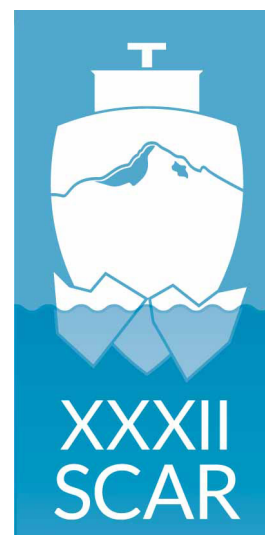


**XXXII SCAR
Open Science Conference**

**Antarctic Science and Policy Advice
in a Changing World**

**16 - 19 July 2012
Portland, Oregon, USA**



**XXXII SCAR
Conference Abstracts**



ISBN: 978-0-948277-29-0

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Differing vertebrate responses to similar magnitude temperature drops during the latest Cretaceous versus the Eocene in the Antarctic Peninsula.

Forename: Judd A. Surname: Case

Authors: Case, Judd A.;

Presentation Allocated: Poster

abstract: The James Ross Basin, northeastern Antarctic Peninsula is the only Antarctic region to exhibit a significant fossil vertebrate record from the Santonian through the Eocene. The latest Cretaceous marine deposits bearing vertebrate remains from the beginning of the Santonian to the end of the Maastrichtian crop out on northern James Ross Island, southern Vega Island to the north and southern Seymour Island to the east. Through this approximately 18 myr time span an 8°C drop in ocean temperature occurs (from 16°C to 8°C) based on changes in oxygen isotope values. The Eocene marine deposits of the La Meseta Formation on northern Seymour Island, also span an approximately 18 myr time frame and likewise exhibit an 8°C drop in ocean temperature, however this time the temperature decline is from 11°C to 3°C. The latest Cretaceous vertebrate faunas show a pattern of stable diversity in teleost fish, neoselachian sharks, non-avian dinosaurs and neornithine birds. Marine reptiles, plesiosaurs and more so of mosasaurs, show a pattern of increasing diversity and abundance through the latest Cretaceous. Thus, the drop in ocean temperature created some taxonomic turnover, but had little effect on overall diversity in the latest Cretaceous, Antarctic vertebrate faunas. In the Eocene La Meseta Fm., in units Telm 3-5 spanning 9 myr from 54.2 Ma to 45.2 Ma, the diversity of neoselachian sharks is very high, nearly equaling the values in the modern tropics today with high levels of abundance as well. Penguin diversity is high with a moderate level of abundance, while cetacean diversity and abundance are low. In units Telm 6 and 7 (41.0 Ma to 34.2 Ma), a significant portion of the 8°C temperature drop occurs and significant changes in vertebrate diversity are seen. Neoselachian sharks are no longer found in units Telm 6 or 7, penguin diversity remains high but abundances dramatically increase, while the cetacean fauna shows only a slight increase in diversity, cetacean abundance shows a substantial increase. Here, the drop the 8°C drop in temperature had dramatic effects on diversity and abundances in the Eocene, Antarctic vertebrate faunas, compared to that seen in the latest Cretaceous.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Establishing a High Resolution Record of the Little Ice Age in Barilari Bay, Graham Land

Forename: Natalie Surname: Elking

Authors: Elking, Natalie; Talaia-Murray, Manique; Christ, Andrew; Domack, Eugene;

Presentation Allocated: Poster

abstract: Barilari Bay, Graham Land, is a northeast-southwest trending fjord along the central Graham Land Coast of the Western Antarctic Peninsula (AP). Multi-proxy analysis of sediment cores collected from the fjord during the January 2010 voyage of the RV Nathaniel B. Palmer suggests Barilari Bay was subject to global climate fluctuations, including the Little Ice Age (LIA) (700-150 cal yr. BP). Establishing a chronology of the LIA along the AP is vital to understanding the area's response to Recent Rapid Regional warming (RRR) (Vaughn, et. Al, 2003). Sampling has yielded the highest resolution proximal record for the LIA event in the Antarctic Peninsula (AP). Cores have been collected at the head of the fjord (Kasten Core 54), from the isolated mid-basin (Jumbo Piston Core 126) and from the mouth of the fjord (Kasten Core 55). The locales of each core and subsequent analyses, allow for the construction of a chronostratigraphic sequence detailing the depositional environment for the entirety of Barilari Bay during the LIA. JPC 126 (21.46 m) contains a series of turbidite sequences that represent a 2.137 cm/yr sediment accumulation rate during the the LIA. KC 55 (425 cm) is a condensed section, with a consistent sedimentation rate of 1.16 mm/yr. The upper section of KC 55 contains 60 cm of hemipelagic mud with decreased diatom content, the LIA signature in the outer fjord. The presence of seasonal ice and IRD are well-documented in Barilari Bay. However, LIA sections in both cores contain evidence for growth and recession of fast ice/ice shelf during this climate event.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Glaci-lacustrine sedimentation within seasonally ice free peri- glacial environments of Schirmacher Oasis and Larsemann Hills, East Antarctica

Forename: Rajesh Surname: Asthana

Authors: Asthana, Rajesh; Shrivastava, Prakash K; Ravindra, Rasik; Beg, Mirza Javed; Mohan, Rahul;

Presentation Allocated: Poster

abstract: Schirmacher Oasis and Larsemann Hills are currently ice-free areas located between the northern edge of the Antarctic Ice Sheet and the Novolazarevskaya Nivl Ice Shelf in Central Dronning Maud Land and on the Ingrid Christensen Coast, Princess Elizabeth Land, approximately midway between the eastern extremity of the Amery ice-shelf and the southern boundary of the Vestfold Hills respectively. The glaci-lacustrine or glaciolimnic sedimentation in these two geographically far off locations shows distinctly different characteristics having diverse sedimentological, geochemical and biological possibilities. Direct deposition from glacier ice, fluvial deposition from glacial melt water streams feeding the lake system, sedimentation from suspension of material in lake water and deposition of sediment particles by strong polar winds characterizes sedimentation milieu as main glacial processes. 3 relatively minor non-glacial processes include lake shore sedimentation, biogenic sedimentation and evaporitic mineral sedimentation which also play important roles in over all sediment characteristics in these peri-glacial environments. Sedimentological studies on glaci-lacustrine sediment cores from Schirmacher as well as Larsemann Hills have revealed that the grain-size varies from 2mm to 0.01 μ m at different depths exhibiting moderate to poor sorting with the dominance of silt size fraction. They also contain a great diversity of biological and physical markers. The upper part has rich content of brownish green algae and the bulk of sediment is generally silty sand having minor amounts of clay - mud and rock fragments. Their textural parameters, diverse biological and physical markers are used to understand and interpret the sedimentation characteristics besides coupling between climatic fluctuations, palaeo-flow regimes and general depositional environment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Glacial extent in the Western Ross Sea during the Early Miocene Climatic Optimum (18-16 Ma): Results from the ANDRILL AND-2A Drillcore, Southern McMurdo Sound Project, Antarctica

Forename: Stephen F. Surname: Pekar

Authors: Pekar, Stephen F.; Passchier, Sandra; Koss, Howard;

Presentation Allocated: Poster

abstract: Litho- and sequence stratigraphic results from the ANDRILL Southern McMurdo Sound AND-2A Project indicate large variations in glacial conditions in the western Ross Sea, between the two isotopic Mi events (i.e., inferred glacioeustasy), Mi1b (17.8 Ma) and Mi2 (16.1 Ma). Most of this interval had not been previously recovered from the Antarctic continental margin providing the first opportunity to develop direct evidence on the evolution of the ice sheet during this time. During the 2007 austral spring/summer, the ANTarctic Geological DRILLing Program (ANDRILL) Southern McMurdo Sound (SMS) AND-2A drill hole cored 1138 meters of sediments, with ~98% recovery. The interval between 780 and 390 mbsf has high sedimentation rates (133-477 m/ my) and excellent age control, based on radiometric ages and magnetostratigraphy, providing an exceptional record of glacial advances and retreats deposited in a shallow water environment in Antarctica between 18 and 16 Ma. Approximately 34 sequences were identified, which contain bounding surfaces characterized by a pronounced shift in lithofacies, with typically more ice distal facies below and more proximal facies above. Lithofacies and grain size analysis suggest that these cycles are controlled by a combination of ice proximity and water depth, ice proximity being dominant in most sections. The timing of the sequence boundaries in the upper 300 meters appear to be controlled by the obliquity cycle, with sequences in the lower 100 meters controlled by the precessional and eccentricity cycles. A surface at 774.94 mbsf contains a hiatus spanning 17.8-18.7 Ma, which encompasses the isotopic events Mi1b (17.8 Ma) and Mi1ab (18.3 Ma). This surface separates a prolonged interval of glacial advance over this site above, based on lithofacies and sediment deformation above and more ice distal environments below. A sharp surface at 398.25 mbsf ($\sim 16.2 \pm 0.2$ Ma) interpreted to represent glacial advance to perhaps near or over the site, contains a possible short hiatus and is correlated to the Mi2 event. In contrast, between 400 and 645 mbsf, little evidence exists for subglacial grounding over the site, with lithology suggesting the presence of deposition of morainal banks associated with smaller tidewater glaciers. This interval correlates to the early Miocene Climatic Optimum (17.3-16.3 Ma).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Glacial history of Prince Gustav Channel and James Ross Island

Forename: Bethan Surname: Davies

Authors: Davies, Bethan; Glasser, Neil; Carrivick, Jonathan; Hambrey, Michael; Smellie, John;

Presentation Allocated: Poster

abstract: During the Last Glacial Maximum (LGM) in Antarctica, circa 18 cal. ka BP, ice draining from northeast Antarctic Peninsula and an ice dome over James Ross Island coalesced in Prince Gustav Channel. These glaciers formed a palaeo-ice stream flowing northwards and southwards to the shelf edge, resulting in an ice divide off northwest James Ross Island. However, this record is largely derived from marine sediment cores and swath bathymetry. The onshore interaction of Antarctic Peninsula-derived ice and an extended Mount Haddington Ice Cap on James Ross Island remains uncertain, and chronostratigraphy is poor, being largely based on radiocarbon dates, which are influenced by the large marine reservoir effect. Holocene glacial activity on Ulu Peninsula is recorded in the Brandy Bay valley, which contains a drift sheet associated with a hyaloclastite boulder train that was deposited by an enlarged, wet based glacier. A lateral moraine parallels the SW edge of Brandy Bay. Molluscs within subglacial tills below the moraine have been radiocarbon dated to 5.3 ka cal. BP, indicating glacial readvance at this time. Lake sedimentation behind this moraine began ~3.8 ka cal. BP (Rabassa, 1987; Björck et al., 1996; Hjort et al., 1997). Cosmogenic nuclide samples were taken from granite boulders on this moraine and from basalt boulders on Ulu Peninsula in order to clarify mid-Holocene glaciations on James Ross Island. Our hypothesis is that following initial deglaciation in the early Holocene, a warmer and wetter climate during the mid-Holocene encouraged the synchronous readvance of glaciers on James Ross Island and the collapse of the Prince Gustav Ice Shelf. These samples will be used, in conjunction with detailed geomorphological and sedimentological descriptions, to answer three key questions: (i) What age is the large moraine flanking Brandy Bay, and was this event synchronous with the deglaciation of Davies Dome? (ii) What was the relationship between terrestrial glacier advance and mid-Holocene ice-shelf collapse in the Prince Gustav Channel, and were these events synchronous? (iii) What were the glaciological conditions that allowed the construction of a large geomorphological feature along Brandy Bay, when the present polythermal glaciers have left little imprint?

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Glacial-interglacial variations in sediment provenance in the southern Drake Passage

Forename: Jae Il Surname: Lee

Authors: Lee, Jae Il; Yoon, Ho Il; Yoo, Kyu-Cheul; Lim, Hyoun Soo; Lee, Yong Il; Bak, Young-Suk; Itaki, Takuya;

Presentation Allocated: Poster

abstract: Trace element, rare earth element, and Nd and Sr isotopic composition of marine sediment from the southern Drake Passage were analyzed to reconstruct variations in sediment provenance and transport paths during the late Quaternary. The 5.95 m gravity core used in this study records paleoenvironmental changes during the last approximately 600 ka. Glacial-interglacial cycles are represented by cyclic variations in magnetic susceptibility, grain size distribution, and sediment facies. Down-core variations in geochemical characteristics reveal that sediment provenance varied according to glacial cycles. During glacial periods, detrital sediments in the southern Drake Passage were mostly derived from the nearby South Shetland Islands and shelf sediments. In contrast, interglacial sediments are composed of mixed sediments, derived from both West Antarctica and East Antarctica. The East Antarctic provenance of the interglacial sediments was inferred to be the Weddell Sea region. Sediment input from the Weddell Sea was reduced during glacial periods by extensive ice sheets and weakened current from the Weddell Sea. Sediment supply from the Weddell Sea increased during interglacial periods, especially those with higher warmth such as MIS 5, 9, and 11. This suggests that the influence of deep water from the Weddell Sea increases during interglacial periods and decreases during glacial periods, with the degree of influence increasing as interglacial intensity increases.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Greenhouse to Icehouse Landscape Evolution in the Gamburtsev Subglacial Mountains of East Antarctica

Forename: Kathryn Surname: Rose

Authors: Rose, Kathryn; Ferraccioli, Fausto; Jamieson, Stewart; Bell, Robin; Corr, Hugh; Creyts, Timothy; Fretwell, Peter; Jordan, Tom;

Presentation Allocated: Oral

abstract: Coupled ice-sheet and climate models predict that the Gamburtsev Subglacial Mountains (GSM) were a key nucleation site for the East Antarctic Ice Sheet (EAIS), 34 million years ago. However, evidence for the scale and shape of the EAIS since its inception is limited and generally restricted towards present-day ice sheet margins. In the IPY, the Antarctica's Gamburtsev Province (AGAP) project completed a major aerogeophysical survey across the Gamburtsev Province in the interior of East Antarctica. We use the airborne radar data to reconstruct the long term history of landscape and climate interactions within the GSM. Bed elevation maps expose the high-relief Alpine-type morphology of the GSM and reveal a network of dendritic valleys incised across the mountain range. Valley geometries and river-long profiles indicate widespread survival of a fluvial landscape that is likely to pre-date ice sheet initiation at ca. 34 Ma. However, the dominant valley cross-sectional morphology (66%) is intermediate (parabolic-glacial) or 'U' shaped (glacial), rather than 'V' shaped (fluvial). This suggests a degree of glacial overprint on the inherited fluvial landscape of the GSM. Similarly, the widespread occurrence of steep semi-circular valley head walls and high elevation overdeepenings provides evidence for local-scale glaciation. A second signal of glacial overdeepening, towards the margins of the GSM, indicates that a regional-scale glacial signal has also been preserved. We suggest that this regional topographic signal, which likely predates a stable EAIS at ca. 14 Ma, may be analogous to the landscapes of the Chilean or Italian lake districts, which are subject to a more temperate climate. In addition, we do not see evidence for glacial breaching or the presence of ice streams, which suggests that not only did today's continental-scale ice sheet form quickly, but also that it has remained relatively stable since its formation ca. 14 Ma. The preservation of these landscape signals also reflects the poor erosive capabilities of the present day ice sheet. As such, the GSM reveal a unique record of four different stages of landscape evolution, possibly representing the oldest glacial geomorphic record ever found. The AGAP data set provides the first direct evidence for ice sheet evolution (at a range of scales) and associated climate variability from the interior of the continent.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Grounding-line processes and stability of ice-sheet margins

Forename: Richard B. Surname: Alley

Authors: Alley, Richard B.; Anandakrishnan, Sridhar; Parizek, Byron R.; Walker, Ryan T.; Christianson, Knut A.; Wilson, Kiya L.; Pollard, David;

Presentation Allocated: Keynote 40 mins

abstract: Stability of the grounding zone is intimately linked to stability of the whole ice sheet. Modern observations show threshold behavior, with stability on topographic highs followed by jumps. If warming produces a sufficiently small ice shelf at a sufficiently deep grounding line, complete ice-shelf calving is possible, as recently occurred in Greenland recently and as suggested by the ice-age Heinrich events of the North Atlantic, favoring faster retreat to the next stabilizing position. Some additional stability may be provided by sedimentation, self-gravitation and isostatic response during retreat, but the record on the Antarctic continental shelf from the last glacial maximum confirms that threshold behavior occurs. Several indirect lines of evidence suggest that the retreat during one or more recent interglacials proceeded past the current configuration in parts of Antarctica, and especially in the deep basins of West Antarctica, raising questions about the near-future stability of the ice sheet.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

1

Title: Holocene climate variability in a maritime permafrost environment (Byers Peninsula, Livingston Island) inferred from lacustrine records: the HOLOANTAR project

Forename:

Marc

Surname:

Oliva

Authors: Oliva, Marc; Vieira, Gonçalo; Mora, Carla; Trindade, Alexandre; Agrela, Joao; Batista, Vanessa; Schaefer, Carlos; Simas, Felipe; Ramos, Miguel; de Pablo, Miguel Ángel; Toro, Manuel; Antoniades, Dermot; Galán, Luis; Giralte, Santiago; Granados, Ignacio; Pla

Presentation Allocated: Poster

abstract: The research carried out by Portuguese teams in Antarctica has increased substantially during the last years. Recently, the Portuguese Science Foundation has approved a new project for undertaking research activities in the Maritime Antarctic between 2012 and 2015. Following former projects focused on permafrost topics (PERMANTAR, PERMANTAR-2), HOLOANTAR project will focus on the South Shetland Islands (SSI). Up to 16 researchers from different international institutions (Portugal, Spain, Brazil and Uruguay) will participate in the HOLOANTAR project. The SSI are an archipelago located near the northern tip of the Antarctic Peninsula where permafrost is mostly continuous even down to sea-level and controls the geomorphodynamics in non-glaciated areas. HOLOANTAR project is focused in Byers Peninsula - the westernmost part of Livingston -, which constitutes the largest ice-free area in the SSI. The relatively flat relief of the plateau and the presence of over-deepened basins have favoured water retention in more than 110 lakes and ponds. HOLOANTAR project is based on two hypotheses: (1) A multi-proxy analysis of lake sediments will provide information about the palaeoecological evolution in Byers (i.e climate variability). Therefore, the role played in it by permafrost and active layer dynamics may be inferred. (2) The detection of activity rates, spatial patterns and geographical controls controlling present-day geomorphic processes and permafrost distribution, will allow defining their limiting climatic conditions that will be used to interpret the sedimentary record. The main purpose of HOLOANTAR is to reconstruct the Holocene environmental evolution and climate variability in Byers Peninsula based on the execution of five main tasks: (1) Geomorphological mapping, (2) Monitoring of geomorphological processes and permafrost regime/distribution, (3) Sedimentological field work, (4) Laboratory analyses, and (5) Palaeoenvironmental reconstruction based on all the data. By comparison with present-day geomorphological processes, we shall derive the role played by permafrost and active layer dynamics in the last millennia controlling the environmental evolution in the area. Results will be published in international journals and widely spread in conferences. Several outreach activities will be conducted in order to collaborate in making aware the people of the uniqueness and the necessity to preserve and protect the Antarctic environment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Impact of the antarctic melting pulses upon the Antarctic Circumpolar Current as derived from the CCSM3/NCAR model

Forename: Ricardo Surname: Acosta

Authors: Acosta, Ricardo; Mata, Mauricio; Wainer, Ilana;

Presentation Allocated: Poster

abstract: It is well established that the climate has been changing throughout history, whereas specific periods are considered key for understanding the changes in the global climate system. Some of these periods are the Last Glacial Maximum (LGM) and the transition Bolling-Allerød (BA). Information extracted from proxy data addressed peculiarities over these key periods, particularly the BA period, when a sudden increase in global temperature occurred in correspondence to the increase rate reported for decades. This work seeks to characterize the variability of the volume transport of the Antarctic Circumpolar Current (ACC). For this, predictions of a transient simulation (21,000 bp until the pre-industrial period) computed from the Ocean-atmosphere Community Climate System Model (CCSM3) of the National Center for Atmospheric Research (NCAR) for the Southern Ocean were analysed. Preliminary results suggest the pulse effects of the antarctic melting upon the CAA volume transport during the BA period. The inflow of "fresh water" in the Southern Ocean is responsible for the deceleration of the ACC and, consequently, for a substantial decrease in the volume transport (<100 Sv). A displacement of its position towards north was also evident. In particular, the total transport volume of the ACC was maximum during LGM, about 220 Sv, whereas the minimum values (~140 Sv) was ascertained at the end of simulated period. These values are in agreement with the current literature. Understanding the mechanisms that control such variability is one of the great challenges for the paleoclimatology, particularly regarding the Southern Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Influence of the reduction in the Antarctic sea ice in the redistribution of the trajectories of extratropical cyclones in a future scenario on the region of Confluence Brazil-Malvinas

Forename: Rose Ane Surname: Freitas

Authors: Freitas, Rose Ane; Souza, Ronald;

Presentation Allocated: Poster

abstract: Sea ice (SI) plays an important role in the climate of polar regions in terms of modifying the radioactive processes, momentum and mass exchange, in addition, modulates the interaction and coupling between the ocean and the atmosphere. So, it becomes very important to study the changes caused in the thickness of the Antarctic SI under the influence of global warming and its relation to the positioning of the preferred range of operation of extratropical cyclones (Storm Tracks, ST) that play an important role to define the global climate. In this context, the influence of reducing the Antarctic sea ice in the redistribution of ST in a future scenario on regions of middle and high latitudes are investigated from the coupled climate model ECHAM5/MPI-OM in this period between 1981 to 2000 and in a future one for the period from 2081 to 2100. Results show that the anomaly observed in the simulations SI has reduced ice thickness up to 0.5 m in regions like the Weddell Sea and up to 2m in the Bellingshausen and Amundsen Seas and the Northern Antarctic Peninsula, which is the most affected region in a scenario under the influence of global warming. This anomaly at the Cryosphere due to a substantial increase in the quantity of oceanic heat transported to the region Antarctica. This retreat of ice from induced heat by the increased CO₂ concentration is decisive to the displacement of the ST in a future scenario. That's why it's reasonable suggest a strong influence in terms of zonal baroclinidade induced by thermal contrast between ice and water and their possible influence on ST. The results showed that SI has a well-defined seasonal cycle and the notable interannual variation, and the anomalies in the extent of the ice field denoted a good consistency with the anomalous position of the ST around five degrees towards the pole. Probably in a future scenario, there will be increased activity of the extratropical cyclones in high latitudes around 60°S due to this repositioning caused by retraction of Antarctic SI, and less activity in regions of middle latitudes directly influencing the region of Confluence Brazil-Malvinas (CBM) where there should be a lower cycle genetic activity, but more intense than the one presented by the current scenario, may have strong influence on precipitation and cloud cover in the region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Interstadial marine deposits in the Fildes Peninsula (King George Island, South Shetland Islands) as indicator for environmental conditions before and during Last Glacial Maximum

Forename: Sergey Surname: Verkulich

Authors: Verkulich, Sergey; Tatur, Andrzej; Pushina, Zinaida; Dorozhkina, Marina; Sukhomlinov, Denis;

Presentation Allocated: Poster

abstract: The interstadial (MIS3) marine deposits stratum was described in the Fildes Peninsula territory (King George Island, South Shetland Islands) due to joint Russian-Polish field and laboratory investigations during 2008-2011. The stratum fragments occur mainly in the north-west part of peninsula in following forms: sections of soft sediments, containing fossil shells or marine algae, and rich marine diatom complexes in situ (9 sites); whale and seal bones in sediment sections in situ (3 sites); fragments of shells and bones on the surface of moraine ridges at the frontal part of the local Collins ice dome (3 sites). According to the obtained values of fourteen AMS radiocarbon dates of algae, shells and bones, these deposits accumulated within the period 21,5–50 ky BP. The section sites lie in the altitude interval 15–32 meters a.s.l., and its upper limit of distribution is well matched to the widely developed marine accumulation-abrasion surface and terraces at 30–40 meters heights. Geographical and altitude settings, age characteristics, taxonomy of fossil flora and fauna, and good safety of the soft marine deposits stratum allow to make five conclusions: during interstadial (MIS3), sea water covered significant part of Fildes Peninsula, which constitute several islands then; the Collins ice dome in the Fildes Peninsula had smaller size (or disappeared) during the interstadial time; the interstadial marine biota in the Fildes Peninsula region inhabited in favorable conditions (maybe even warmer than today); the Fildes Peninsula territory was covered by ice masses of Last glacial maximum not earlier than 21 ky BP; at least, part of the peninsula was under the thin, not mobile field of ice, which contribute to conservation of the soft marine interstadial deposits filled with delicate fossil flora and fauna.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Magnetic and sedimentologic analysis of late Holocene sediment core, Barilari Bay, Antarctica

Forename: Brendan Surname: Reilly

Authors: Reilly, Brendan; Elking, Natalie; Yoo, Kyu-Cheul; Brachfeld, Stefanie; Domack, Eugene; Leventer, Amy; Lavoie, Caroline; Ishman, Scott;

Presentation Allocated: Poster

abstract: Core NBP10-01 JPC126 from a basin in middle Barilari Bay, Western Antarctic Peninsula, recovered a 21.46 meter sedimentary record of the late Holocene. Two shallow submarine ridges on the east and west of this basin are interpreted as grounding lines. Magnetic and sedimentologic analyses were used to study sediment provenance and track ice-covered versus ice free conditions. A mollusk shell at 18.80 meters below seafloor (mbsf) is approximately 840 cal years BP, suggesting JPC126 contains a 1,000 year record. Core lithology between 19.10 - 21.46 mbsf is pebbly sandy mud, containing elevated total organic content (TOC) with respect to the upper 19.10 mbsf. Diatoms are abundant, notably *Chaetoceros*, *Thalassiosira antarctica*, and small *Fragilariopsis*, indicative of productive waters within a zone of variable sea ice. Core lithology between 0 - 19.10 mbsf is terrigenous silty mud, containing turbidites and laminated sections. Laminations indicate absence of bioturbation influence and low TOC suggests a low-productivity environment, possibly a sub-ice shelf environment. Magnetic parameters show two groupings indicative of grain-size and mineralogy sorting within the turbidites. The bases of turbidites are characterized by high low-field magnetic susceptibility (χ_{lf}), coarse multidomain grains, low S-ratios, and low high-field magnetic susceptibility (χ_{hf}). The homogeneous silty muds at the tops of the turbidites are the opposite, with lower χ_{lf} , finer pseudo-single domain grains, and high S-ratios. The turbidites may correspond to grounding line advances. Diatom presence at 6.24 mbsf, 3.28 mbsf and 0 - 0.6 mbsf may represent periods of glacial retreat. Temperature-dependent magnetic susceptibility measurements indicate unique mineralogy in the core between 19.10 and 21.46 mbsf compared to the rest of the core. Curie point measurements in samples between 0 – 19.10 mbsf indicate magnetite and iron sulfides, and occasionally hematite. Curie point measurements from intervals between 19.10 – 21.46 mbsf are variable with a prominent hematite signal, titanomagnetite, and a transition at 300°C interpreted as a magnetic iron sulfide. This suggests the 19.10 – 21.46 mbsf interval was subject to diagenesis due to high TOC and/or to deposition of ice rafted debris derived from outside Barilari Bay. Lithic fragment and Fe-oxide analysis and comparison to inner Barilari Bay diamict will help determine the local or exotic nature of this mineralogy.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Marine record of Holocene climate change in the Antarctic Peninsula to Pine Island Bay: results from Shaldril and other long coring efforts

Forename: Rebecca Surname: Minzoni

Authors: Minzoni, Rebecca; Fernandez, Rodrigo; Anderson, John; Hardin, Laurin; Mead, Kimberly; Munoz, Yuribia; Wellner, Julia; Majewski, Wojciech;

Presentation Allocated: Oral

abstract: Paleoclimate records from eight fjords extending from the South Shetland Islands to Pine Island Bay are being generated from long sediment cores as part of an international study of Holocene climate change. These results are augmented by published records from more open marine settings of the Palmer Deep and the Bransfield Basin, as well as from land-based studies to obtain the spatial sampling needed to examine the timing of climate events and climate forcing mechanisms. The records include SHALDRIL cores acquired from some of the thicker (up to 108 meters) Holocene sections in fjords of the northern Antarctic Peninsula (AP) region. To date, robust radiocarbon chronologies have been obtained for six of the selected sites and a number of paleoclimatic proxies have been applied to identify and characterize climate events. These include grain size, sedimentation rates, magnetic susceptibility, pebble content, TOC, biogenic silica content, and diatom and foraminiferal assemblages. Five previously recognized climate intervals are recorded throughout the AP: an early Holocene deglacial interval, the Mid-Holocene Climate Optimum, a minor cooling event in the mid-Holocene followed by a minor warming event, and the late Holocene Neoglacial. The timing of these events varies widely, up to a few thousand years, across the AP region and reflects differences in local and regional factors such as orography, drainage basin size and altitude, wind patterns, oceanography, and sea-ice coverage. While the study is still ongoing, data collected thus far suggest that the rapid regional warming and glacial retreat observed during the last century is unprecedented in breadth and synchronicity in the Holocene. Current research focuses on the analysis of Kasten cores, including using short-lived isotopes as an age dating tool, aimed at examining the magnitude and temporal variation of late Holocene climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Middle Miocene and more recent coastal valley glaciers activities in the Wood Bay and Lady Newnes Bay, western Ross Sea (Antarctica)

Forename: Chiara Surname: Sauli

Authors: Sauli, Chiara; Geletti, Riccardo; Busetti, Martina; De Santis, Laura; Wardell, Nigel;

Presentation Allocated: Poster

abstract: Revision and integration of past interpretation and isochron maps of the main unconformities in the Ross sea (ANTOSTRAT, 1995) allow to focus the major climatic events that they record and to better constrain their ages, for the purpose of extending their correlations to the whole circum-antarctic shelf and, in a certain order of detail, to reconstruct the behaviour of the antarctic cryospheric elements, in particular the land and marine ice sheets. In the western Ross sea, in the area of the Wood and Lady Newnes bays, relatively new higher resolution seismic data show important clues, in the highlighted glacial valley system, on the dynamics of the activities of the coastal valley glaciers, as coastline grounding linear-type expansion over the continental shelf and successive seaward expansion of single ice tongues carving individual valleys, since about 18 Ma. In the two bays the RSU2 unconformity (ANTOSTRAT, 1995), that is the depositional hiatus of 4.0-14.7 Ma in DSDP 273 (Savage and Ciesielski, 1983), has been recognised on the basis of acoustic facies, geometry and spatial distribution. The integration of the interpretation of these new data and the previous interpretation suggests correlation of the RSU2 unconformity to the Northern basin. Mapping the relative directions of the foreset beds characterising the grounding-line wedges or ice-proximal fan delta sedimentary section, overlying the RSU2 unconformity, shows the influence of the Drygalski outlet glacier and of ice streams coming from the south in the building up of the trough mouth fans of the Northern basin. From the analysed evidence of the prograding wedges, and the successive development of the coastal ridges and valleys system caused by glaciers with melt water at their base, it is possible to infer that, at that time, glaciers were probably in a temperate or sub-polar condition. ANTOSTRAT Project, 1995. Geology and seismic stratigraphy of the Antarctic margin. In: Cooper, A.K., Barker, P.F., Brancolini, G. (Eds.), Antarctic Research Series 68 (22 plates). Savage, M.L., Ciesielski, P.F., 1983. A revised history of glacial sedimentation in the Ross Sea region. In: Oliver, R.L., James, P.R., Jago, J.B. (Eds.), Antarctic Earth Science. Cambridge University Press, New York, pp. 555-559.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Middle Pleistocene evolution of the Antarctic Circumpolar Current

Forename: Minoru Surname: Ikehara

Authors: Ikehara, Minoru; Oiwane, Hisashi; Nakamura, Yasuyuki; Suganuma, Yusuke; Nogi, Yoshifumi; Miura, Hideki;

Presentation Allocated: Poster

abstract: The Antarctic Circumpolar Current (ACC) plays a very important role for the circulation of water mass and materials, because it connects meridian circulations of three major oceans. The ACC is the largest oceanic current, and has the large thermal capacity, its meridional fluctuation of the current axis has been linked to the climate change. However, the Plio-Pleistocene variation of strength and position of the ACC has not been understood. During two survey cruises in 2008 and 2010-2011, we conducted multi-beam bathymetry and multichannel seismic reflection surveys on the Conrad Rise in the Indian sector of the Southern Ocean. According to the detailed bathymetry map, we discovered the mudwave on the Conrad Rise, located in the axis of the modern ACC. Mudwaves are located between 2400 and 3400 m on the southwest slope of the Conrad Rise. Wavelengths of the mudwave are 1-2.5 km, and maximum height of crests is ca. 80 m. We suggested that the mudwave are formed by the ACC flow, because the Conrad Rise is an obstruction to the ACC (Durgadoo et al., 2008). Based on the seismic profiles, the stratigraphy is divided into three units from A to C. Wavy sedimentary structure mudwave are recognized only in the upper unit A. As the sediment thickness of the unit A is ca. 400 m, and as the sedimentary rate of the unit is ca. 30 cm/kyr for a 10 m length piston core, the age of the bottom of the unit A is estimated to be ca. 1.3 Ma. We suggest that the formation of the mudwaves was related with a northward migration of the ACC on the Conrad Rise at the middle Pleistocene, which can be related with the redistribution of the ocean current system in the Southern Ocean. The northward expansion of the ACC and Weddell Gyre system may have altered the poleward heat and moisture transport, sea-ice distribution, and surface stratification in the Southern Ocean, resulting in global cooling at the Mid-Pleistocene Transition (MPT).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Modelling constrained by geophysical data reveals the controls on long-term palaeo-ice-stream retreat in Marguerite Bay, Antarctica.

Forename: Stewart Surname: Jamieson

Authors: Jamieson, Stewart; Vieli, Andreas; Livingstone, Stephen; Stokes, Chris; O'Cofaigh, Colm; Hillenbrand, Claus-Dieter;

Presentation Allocated: Oral

abstract: We aim to understand the controls upon the retreat of Marguerite Bay palaeo-Ice Stream following the Last Glacial Maximum (LGM). High-resolution marine geophysical data record mega-scale glacial lineations and streamlined features which delineate the Marguerite Bay palaeo-Ice Stream. Theory predicts that because of the slope of the bed, which causes water depths to increase inland, the grounding line should have retreated unstably. However, a series of grounding-zone wedges indicate that the grounding line in fact slowed down or paused multiple times on this reverse-sloping bed. We use the lineations and streamlined features to constrain a numerical ice-stream model in order to reconstruct retreat behaviour and understand what controlled the long-term pattern of grounding-line movement. Experiments are carried out using a 1-D ice stream flowband model incorporating basal, lateral and longitudinal stresses and a robust treatment of grounding-line motion. Our multiple working hypotheses invoke a range of controls for initiating, and subsequently controlling patterns of retreat in Marguerite Bay including sea-level change, climatic warming, magnitudes of melting at the ice-ocean interface and ice-shelf buttressing. We systematically test the sensitivity of the grounding-line retreat pattern and timing to these mechanisms by initiating retreat via each process and then analysing the modelled retreat response. We validate our model against the position of the mapped grounding zone wedges and a series of retreat ages on the continental shelf. We reproduce the retreat pattern observed in the offshore record very closely. Our results show that the best fit between the modelled response and geophysical record is generated by driving rapid grounding-line retreat via enhanced melting at the ice-ocean interface. In reproducing the mapped retreat pattern we show that the width of the ice-stream trough is an important control on the pattern of ice-stream behaviour, with topographic narrowing causing significant slowdowns in grounding-line retreat rate at locations where grounding-zone wedges are found. We also infer that the ice shelf remained intact throughout the majority of the retreat from the continental shelf edge before eventually collapsing and enabling a final phase of grounding-line retreat from the mid shelf. Our interpretations agree closely with an independent theoretical model developed using analyses of sediment on the sea floor.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Molecular and hydrogen isotope evidence of Holocene climate and cryosphere variability: results from a 171m, annually laminated, sediment core from the Adélie coast, Antarctica (IODP Expedition 318).

Forename: James Surname: Bendle

Authors: Bendle, James; Toney, Jaime; Seki, Osamu; Kawamura, Kimitaka; Willmott, Veronica; Schouten, Stefan; Sangiorgi, Francesca; Brinkhuis, Henk; McKay, Robert; Riesselman, Christina; Dunbar, Robert;

Presentation Allocated: Oral

abstract: The Southern Ocean remains the least studied region on Earth with respect to Holocene climate variability. The few Antarctic proximal marine sedimentary records available tend to be short, low resolution, and discontinuous. However, sediments recently recovered from the Adélie drift during IODP Expedition 318 present a new opportunity to study East Antarctic Holocene climatic evolution, at a resolution that facilitates direct comparison with ice-cores. Expedition 318 recovered 171m of Holocene laminated diatom ooze from site U1357B. The sediments represent continuous Holocene accumulation up to the present day (based on 89 AMS ^{14}C dates) and are characterised by 2-6cm thick, light/dark laminae couplets, interpreted as seasonal biogenic production and accumulation events. We present the results of initial biomarker analyses: fatty acid δD and TEX86 measurements on lipid extracts from paired light/dark laminae throughout the Holocene. The C18 fatty acid is assumed to represent an integrated signal from the algal precursors and thus surface water conditions. The $\delta\text{DC18-FA}$ values show no consistent offset between the light and dark laminae, and values become isotopically heavier on average through the Holocene (ca. -220 to 140‰), in line with declining insolation at 65°S. Superimposed on this trend are millennial scale isotopic excursions of ca. 20 to 60‰, including a clear excursion coeval with the late Holocene climate 'optimum' between 6 and 3 kyr, inferred from East Antarctic ice-cores (1). $\delta\text{DC18-FA}$ shows no clear relationship with TEX86L sea-surface temperature estimates, which display pronounced early variability and relative warmth from 11.2 to 10.4 ka (0 to 6.5 °C, average ca. 3.5 °C), but almost no change after 10.4 ka, as cold, stable SSTs (average ca. 2 °C) persist through the rest of the Holocene. We explore the potential controls on the $\delta\text{DC18-FA}$ record and suggest the influence of isotopically depleted meltwater from the proximal ice-sheet (additive to a salinity effect) and/or upwelling can account for the millennial scale variability. References: 1. F. Masson et al., Quaternary Research 54, 348 (2000).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Orbital controls on the Plio-pleistocene variability of the Wilkes Land margin of the East Antarctic Ice Sheet

Forename: Rob Surname: McKay

Authors: McKay, Rob; Patterson, Molly; Grant, Georgia; Naish, Tim; N/A, IOPD Expedition 318 Science Party;

Presentation Allocated: Oral

abstract: The Wilkes Land sector of the East Antarctic Ice Sheet is hypothesized to have varied significantly in volume during the Early Pliocene warm period, on account of its marine-based nature and influence by marine mass balance controls. Here, we present a cyclostratigraphy for the Plio-Pleistocene interval of the Integrated Ocean Drilling Program (IODP) Site U1361, located on the Wilkes Land margin continental rise, to investigate the potential sensitivity of this ice sheet to warmer-than-present climates and orbital forcing controls. Using sedimentology (grain size, facies analysis) and physical properties logs, we investigate cyclic variability in sedimentary deposition to interpret relationships between ice sheet dynamics, sea ice variability, and oceanographic changes at the EAIS margin. We present a high-resolution (~3-kyr sample spacing) grain size record of the Pliocene to Early Pleistocene (4.4 to 1.8 Ma) in U1361, with the coarse fraction (>250 μm) of this record allowing for a reconstruction of ice rafting intensity over this site. Facies analysis using visual core descriptions includes the alteration between bioturbated, diatom-bearing silty clays and massive to finely-laminated clays. Periodic oscillations in the fine-fraction grain size, and physical properties logs including magnetic susceptibility, density, natural gamma and colour reflectance data accurately represent distinct lithofacies and have enabled a high resolution cyclostratigraphy to be developed. Using paleomagnetic reversals as age constrain tie points, cyclic variations in physical properties and ice-rafted debris can be visually correlated to the benthic oxygen isotope record of global ice volume throughout the Plio-Pleistocene, and indicate that the cyclic sedimentation is operating at likely Milankovitch frequencies. Spectral analysis on the physical properties was conducted to test the statistical significance of orbital controls on cyclic sedimentation occurring at the Wilkes Land margin during the Late Neogene .

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Paleomagnetic analyses from the SHALDRIL Maxwell Bay Site, South Shetland Islands, Antarctic Peninsula

Forename: Deepa Surname: Shah

Authors: Shah, Deepa; Brachfeld, Stefanie;

Presentation Allocated: Poster

abstract: Core NBP05-02 1B from Maxwell Bay, South Shetland Islands, recovered a 108 m sedimentary record dating between 14.1-14.8 ka. The core has a silty-clay lithology and a calcite based radiocarbon chronology, making this an ideal site to reconstruct an independently dated record of paleosecular variations (PSV) and relative paleointensity (RPI). U-channels were collected for the upper 60 mbsf, and cube samples were collected throughout the core, and exclusively for 60-108 mbsf. Anisotropy of magnetic susceptibility (AMS) was measured to assess the fabric of the core prior to paleomagnetic analyses. The interval 0-72 mbsf displays a normal sedimentary fabric, with K_{min} inclination values nearly vertical and K_{int} , and K_{max} distributed within the bedding plane. Below 72 mbsf, we observed fabrics with shallow K_{min} axes, which may have been caused by deposition on an inclined seafloor. Samples were analyzed for magnetic hysteresis ratios: saturation remanence normalized by saturation magnetization (M_r/M_s) and coercivity of remanence normalized by coercivity (H_{cr}/H_c). The M_r/M_s values range from 0.06 to 1.060 and H_{cr}/H_c values range from 3.40 to 6.10, which fall in the pseudo-single-domain region and upper left corner of the multidomain region of the Day Plot. There were no differences in the hysteresis ratios between normal AMS fabrics and those from below 72 mbsf. Curie point analyses have identified four different features in the heating curve at approximately 150C, 300C, 450C and 550C. These features have been tentatively identified as titanium-rich titanomagnetite, a magnetic iron sulfide and titanium-poor titanomagnetite. Samples were subjected to stepwise alternating field (AF) demagnetization. A low coercivity overprint, likely a drilling or storage overprint was removed at 10-15 mT. The sediments recorded a strong, stable remanent magnetization. Inclinations range from -30 to -80 degrees, with shallow inclinations often correlating with but not limited to AMS fabrics with non-vertical K_{min} values. The maximum angular deviation (MAD) values ranges from 1.3 to 5.6 degrees. The variations in the MAD angles do not correlate with fabric. We ultimately seek to generate PSV and RPI reference curves that can be used to tune and date regional paleoclimate records that lack their own independent chronologic control.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Paleomagnetism in volcanic deposits as a tool to determine paleo-topography; an example from Deception Island (63° S, Antarctica)

Forename: Oliva-Urcia Surname: Belén

Authors: Belén, Oliva-Urcia; Inmaculada, Gil-Peña; Adolfo, Maestro; Ruth, Soto; Andrés, Gil-Imaz; Jerónimo, López-Martínez; Jorge, Rey; Jesús, Galindo Zaldivar;

Presentation Allocated: Poster

abstract: We present a new paleomagnetic investigation carried out in 135 samples from 17 sites in Deception Island. Sites are distributed in: i) dikes (5 sites), ii) lava flows that were emplaced after the caldera collapse (10 sites) and iii) two sites in lava flows and pillow lavas that were emplaced prior to the caldera collapse. Deception Island shows the most recent active volcanism at the western end of the volcanic ridge of the Bransfield Trough. Volcanism in this island evolved from pillow lavas to strombolian and freatomagmatic subaerial eruptions. The stratigraphical successions of the volcanic sequence are divided in pre- and postcaldera formations. According to previous studies the rocks record positive magnetic polarity, what let to infer an age younger than 0.7 my. In the other hand radiometric K-Ar dating on whole rock suggest an age younger than 0.2 my for the subaerial volcanism. The goal of this investigation is to decipher if either the present day topography of the volcanic deposits (lava flows, pyroclastic deposits and pillow lavas) is original or a later process (tectonic deformation, volcanic episodes) has modified the attitude of the volcanic deposits to their present position. The paleomagnetic data provide information of paleomagnetic vectors in a 3-dimensional reference frame, then, it can be used to unravel the paleotopography of a volcanic deposit. The time of the acquisition of the remanent magnetization in such deposits is related to the temperature under which these deposits cool (below 700°C). When the cooling takes place shortly after the emplacement of the volcanic deposits, the magnetic vector can be used as a paleotopographical marker in volcanic edifices. If magnetic vectors from the same volcanic unit group better in the in situ position, then the movements of the volcanic deposits after cooling down below 700°C are minimal. However, when magnetic vectors group better during the restoration of the volcanic deposit to horizontal position, then the emplacement of such deposits was prior to a change in the attitude of the deposits, implying tectonic deformation or just tilting due to the evolution of the volcanic edifice. The information revealed by paleomagnetism (with the so called fold-test) can help to reconstruct the multi-episodic volcanic edifice of this Quaternary island. The preliminary paleomagnetic results suggest that the cooling of the volcanic deposits occur in a position close to their present day attitude.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Pliocene-Pleistocene Antarctic Ice Sheet Evolution

Forename: Tim Surname: Naish

Authors: Naish, Tim;

Presentation Allocated: Keynote 40 mins

abstract: Since humans have not experienced, or been able to measure, the magnitude of climate change projected for the end of this century it has become common practice to hindcast climate during past “warmer-than-present” times using numerical models. Our ability to verify the performance of models used to reconstruct past Earth System responses, such as ice sheet dynamics, to elevated atmospheric CO₂ and global surface temperature rests critically upon the quality of “paleo-observations” derived largely from geological data. Over the last ten years paleo-observations have been acquired through major marine geophysical and geological drilling programs on the Antarctic continental margin, and integrated with an ever increasing global array of high-resolution deep ocean sediment archives. These have provided new insights into the evolution of the Antarctic ice sheet in response to changing climate boundary conditions. Much of this progress has been achieved under the auspices of the SCAR Antarctic Climate Evolution (ACE) Project whose “raison d’être” has been to promote an integrated approach between data and modelling communities. In this talk I will summarise our present understanding of Antarctic ice sheet response during sustained periods of warmth in the Early and “mid”-Pliocene (~5-3Ma), and the warmest interglacials of the last 1Ma. The former provides an equilibrium response for the last time Earth’s atmosphere experienced present day levels of CO₂. The latter provides insights into Antarctic ice sheet sensitivity under relatively small increases in global mean temperature.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Pre-Quaternary Glacial History of the Antarctic Peninsula

Forename: Michael Surname: Hambrey

Authors: Hambrey, Michael; Smellie, John; Davies, Bethan;

Presentation Allocated: Oral

abstract: The Antarctic Peninsula region is currently undergoing rapid environmental change, resulting in the thinning, acceleration and recession of glaciers and the sequential collapse of ice shelves. It is important to view these changes in the context of the long-term palaeoenvironmental record and to understand the key processes controlling ice sheet growth and recession. Specifically, with global temperatures approaching those last experienced during the Pliocene and earlier epochs, the relevance of the older geological record to evaluating ice sheet behaviour is increasing. In addition, numerical ice sheet models require detailed geological data for tuning and testing. Therefore, this contribution systematically and holistically reviews geological evidence for Antarctic Peninsula Ice Sheet variability until the start of the Quaternary Period (which is treated in a separate contribution). Glaciation of Antarctica was initiated around the Eocene/Oligocene transition in East Antarctica, but in the Antarctic Peninsula region, evidence for glaciation this old is equivocal. Oligocene glaciation is primarily restricted to King George Island, where glacial sediments provide a record of early East Antarctic glaciations, but with modification of far-travelled erratics by local South Shetland Island ice caps. Evidence for Neogene glaciation is derived primarily from King George Island and James Ross Island, where glaciogenic strata indicate that ice thicknesses reached 500-850 m during glaciations. This suggests that the Antarctic Peninsula Ice Sheet draped, rather than drowned, the topography. Geophysical and coring investigations on the continental shelf indicate multiple ice sheet advances during this time. A vegetation record in offshore core indicates a transition from forested landscapes to tundra during this interval.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Preliminary Results: Developing Ultra High-Resolution Stable Isotope (d13C and d18O) Records from Planktonic and Benthic Foraminifers from IODP Expedition 318: Wilkes Land, Hole U1357A

Forename: Stephen F. Surname: Pekar

Authors: Pekar, Stephen F.; Dunbar, Robert; Ruppert, Collin; Miller, Kitri; Petito, Julianna;

Presentation Allocated: Poster

abstract: Ultra-high resolution d13C and d18O records from planktonic and benthic foraminifers and foraminiferal assemblage data are being developed from Hole U1357A cored during the IODP Expedition 318: Wilkes Land, to investigate paleoceanographic changes that occurred during the Holocene along Adelie Coast of Antarctica. Site U1357 is located ~50 km off the Adelie coastline of East Antarctica (66°24.8'S, 140°25.7'E) in the Adelie Trough, which is a glacially scoured valley on the continental shelf. An exceptional sedimentary archive of Holocene changes was triple cored during the expedition penetrating nearly 190 mbsf. Carbon-14 age dates from U1357A provide a firm chronology, suggesting an average sedimentation rate of nearly 2 cm/ yr, with the base of the core dated as approximately 11,000 years old. Samples at 10 cm spacing were collected during the expedition for isotopic and foraminiferal studies. Although Antarctic coastal waters are notorious for being corrosive to foraminiferal tests, both planktonic and benthic foraminifers are present in the samples from Site U1357. Results thus far indicate that planktonic foraminifers occur in nearly 70% of the samples below 12 mbsf. Nearly all planktonic foraminifers were dominated (as expected) by *N. pachyderma* (sinistral). The size distribution of *N. pachyderma* specimens were trimodal, with a majority being relatively large (> 250 μ m) and were identified as being morphotype one of Bergami et al. (2009). Very small (63-125 μ m in diameter) specimens represented morphotype four (juvenile form). A third subset ranged in size between 150 and < 250 μ m and were identified as morphotypes 2 and 3 of Bergami et al. (2009). We used morphotypes one and two for isotopic analyses. The calcareous benthic foraminiferal genus *Globocassidulina* occurs in sufficient size and numbers for stable isotopic measurements in about 25 % of the samples below 30 mbsf. Preliminary results from the planktonic d18O record show large isotopic changes (1-2‰), which can be ascribed to mainly a combination of highly depleted d18O melt waters from icebergs and the changes in surface water stratification. Results from foraminiferal assemblages suggest bottom waters hostile for preservation of foraminiferal tests existed during the Late Holocene (0-3.0 kya), with better oxygenated and less corrosive bottom waters existing during the latter part of the hypsithermal (3.5-5.5 kya).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Reconstructing the climate of the southern high latitudes during the early Holocene using data assimilation.

Forename: Pierre Surname: Mathiot

Authors: Mathiot, Pierre; Goose, Hugues; Crosta, Xavier; Stenni, Barbara; Dubinkina, Svetlana; Mairesse, Aurélien; Sallaz-Damaz, Yoann;

Presentation Allocated: Poster

abstract: In this study, we analyse simulations covering the period from 10k BP to 6 kBP performed with the climate model of intermediate complexity LOVECLIM constrained to follow the signal recorded in proxy records through data assimilation. The proxy records selected represent oceanic and atmospheric surface temperature in the Southern Hemisphere derived from various types of archives and proxies. The main goal of our analysis is to understand the causes of the early optimum and the following minimum recorded in several ice cores. The consistency between the derived from the various proxies is investigated and the modifications in oceanic and atmospheric circulation that could potentially explain the observed changes are discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Reconstructing the Holocene trajectory of the Rutford Ice Stream, Antarctica

Forename: Christopher Surname: Fogwill

Authors: Fogwill, Christopher; Turney, Christian; Rood, Dylan;

Presentation Allocated: Poster

abstract: Recent advances in satellite remote sensing have provided real insights into the current behaviour of the West Antarctic Ice Sheet (WAIS). These observations have highlighted some sectors of the WAIS that are thinning considerably faster than originally believed. However, the dynamic processes associated with this are not yet fully included in predictive models of future ice sheet behaviour. It is implied through palaeo studies, though, that similar behaviour occurred in the past; understanding ice sheet dynamics on longer time scales is therefore necessary to place these contemporary observations into context and predict the response of modern ice-sheets to future climate change. Particularly important are recent studies which have used in situ cosmogenic nuclides alongside terrestrial constraints. These have shown that some sectors of the WAIS thinned rapidly during the Holocene, whilst others appear to have achieved their current stable configuration within the past few centuries. Unfortunately, the current paucity of terrestrial field constraints means that the longer-term trajectory of the ice sheet and its contribution to relative sea level throughout the Holocene remains uncertain. Defining this trajectory is critical, both in the provision of boundary conditions for palaeoclimate models and in allowing us to extend the limited observational window available to us from decades to millennia. With this aim in mind, here report initial findings from geomorphological observations and cosmogenic nuclide exposure analysis from the Flower Hills in the Sentinel Range of The Ellsworth Mountains, overlooking the modern grounding line of the Rutford Ice Stream. The results provide an independent test of WAIS deglaciation throughout the Holocene on one of the major ice streams feeding the Ronnie Ice Shelf, which will provide insights into ice sheet dynamics and further improve ice sheet models. These new data are compared with existing regional patterns of deglaciation in the Weddell Sea, revealing a more dynamic pattern of Holocene deglaciation in the Weddell Sea than previously thought.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Reconstruction of changes in the Amundsen Sea and Bellingshausen Sea sectors of the West Antarctic Ice Sheet since the Last Glacial Maximum

Forename: Robert Surname: Larter

Authors: Larter, Robert; Gohl, Karsten; Anderson, John; Bentley, Michael; Dowdeswell, Julian; Graham, Alastair; Hillenbrand, Claus-Dieter; Jakobsson, Martin; Johnson, Joanne; Kirshner, Alexandra; Klages, Johann; Kuhn, Gerhard; Lindow, Julia; Nitsche, Frank; Ó Cofa

Presentation Allocated: Oral

abstract: Observational records of ice sheet change span only a few decades, but ice sheet response times to imposed change extend over millennia. Therefore long-term records are important for calibrating these responses in ice sheet models. New long-term records of ice sheet retreat and thinning are emerging rapidly. An important challenge now is to incorporate these results into a new generation of ice sheet models in order to improve predictions of the Antarctic contribution to sea level rise. As part of an initiative to produce a Community Antarctic Ice Sheet Reconstruction of changes since the Last Glacial Maximum, we have collated available data from the sectors of the West Antarctic Ice Sheet (WAIS) that drain into the Amundsen Sea and Bellingshausen Sea. The drainage basins in these sectors constitute approximately one third of the area of the WAIS, but account for more than half of its surface accumulation. Their mass balance is becoming increasingly negative, and therefore they account for an even larger fraction of current WAIS discharge. Pine Island and Thwaites glaciers alone account for 37% of recent ice discharge from the WAIS. If all of the ice in these sectors of the WAIS was discharged to the ocean, global sea level would rise by nearly 2 m. There is compelling evidence that grounding lines of palaeo-ice streams were at, or close to, the continental shelf edge along the Amundsen Sea and Bellingshausen Sea margins during the last glacial period. Radiocarbon dates from the earliest seasonally open marine sediments in shelf cores indicate different trajectories of palaeo-ice stream recession in the two embayments. The areas were subject to similar atmospheric and eustatic forcing, so this observation suggests that there were differences in oceanic forcing or internal ice-sheet dynamics. Deglacial ages from the Amundsen Sea embayment indicate that the ice sheet had already retreated close to its modern limits by the beginning of the Holocene, which suggests that the rapid flow acceleration, thinning and retreat observed in this sector over recent decades are unusual in the context the past 10,000 years.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Retreat of continental ice sheet in late Quaternary from Schirmacher area of East Antarctica

Forename: Prakash K Surname: Shrivastava

Authors: Shrivastava, Prakash K; Dharwadkar, Amit; Mujtaba, SAI; Asthana, Rajesh; Swain, Ashit K; Roy, Sandip K; Beg, M Javed;

Presentation Allocated: Poster

abstract: During the early Quaternary period, the polar ice sheets showed their characteristic build up of glacial conditions, followed by rapid ice melting and deglaciation. In order to understand Quaternary glaciation / deglaciation in Schirmacher Oasis of East Antarctica, the technique of Thermo-Luminescence (TL) dating of moraines is used. Schirmacher Oasis contains glacial valleys with moraines of different generations. The last glacial submergence of the Oasis is reflected by a sparse coverage of morainic material, fractured rocks, striated surfaces and roches moutonnees at many places in the oasis. The highest point of Schirmacher Oasis (Elevation 212m from msl) also shows glacial striations. The systematic TL dates of glacial sediments from a very prominent valley, situated between Indian Station 'Maitri' and Russian station 'Novolazarevskaya', shows ages between 70.060 ± 5.923 to 89.690 ± 6.323 Ka. These dates indicate different stages of glaciation and warming phases. The TL date 171.001 ± 12.499 Ka from lake sediments at higher level than the present level suggests existence of early warming phenomena in Quaternary. Between 80 and 89 Ka, widespread glacial moraines are found, which is very close to the interglacial period existed at around 100 Ka. Another data from lake sediment gives a date of 70.161 ± 5.106 Ka which also coincides with the terminal moraine age indicating resumption of warming phase. One more moraine sample gave 63 Ka age indicating re-advancement of glacier up to certain extent before recession. There are evidences which show that some parts of the Antarctic oases remain ice free through the Last Glacial Maximum. A relatively warm temperature prevailed in Schirmacher Oasis between ca. 8500 and 5500 cal. yr BP, with a maximum between ~6500 and 5500 yr BP which would have contributed in the present position of ice sheet. **Keywords:** Thermo-Luminescence, Moraine, Striations, Schirmacher Oasis, Lake Sediment

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Sea ice in the Cretaceous greenhouse world 70 million years ago

Forename: Jane Surname: Francis

Authors: Francis, Jane; Bowman, Vanessa; Riding, Jim;

Presentation Allocated: Oral

abstract: The Late Cretaceous climate of Antarctica is considered to have been warm and ice-free, with levels of atmospheric CO₂ up to four times pre-industrial levels. Fossil plants and other climate proxies indicate warm oceans and sub-tropical conditions on land. In contrast, it has been proposed that large ice sheets must have existed on Antarctica to cause the +20m sea level changes recorded in Cretaceous sedimentary records in the Northern Hemisphere, but evidence of Cretaceous ice sheets on Antarctica has been hard to find. We now have new data from the marine palynological record which suggest that sea ice was present in the northern Antarctic Peninsula region during the latest Cretaceous ~70 million years ago. Blooms of small organic-walled cysts, comparable to modern sea ice cysts, have been recorded within the late Maastrichtian to earliest Paleocene López de Bertodano Formation on Seymour Island, Antarctic Peninsula. These blooms imply the presence of drifted seasonal sea ice reaching the tip of the Antarctic Peninsula during cold intervals, probably linked to cold orbital forcing. Computer model simulations of sea ice and ice sheet evolution on Antarctica by DeConto et al. (2007) suggests that sea ice could have formed as far north as 65°S during late winter with 2 x CO₂. Their simulations also showed that seasonal sea ice could have been present with even higher CO₂ levels so long as ice caps were already present in the East Antarctic interior. Our evidence of sea ice along the Antarctic Peninsula therefore implies that significant ice caps were already present in East Antarctica during the latest Cretaceous 'greenhouse' world.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Sedimentary architecture of the Amundsen Sea Embayment shelf, West Antarctica, reveals pre-glacial to glacial processes

Forename: Karsten Surname: Gohl

Authors: Gohl, Karsten; Uenzelmann-Neben, Gabriele; Hochmuth, Katharina; Kuhn, Gerhard; Hillenbrand, Claus-Dieter; Larter, Robert D.;

Presentation Allocated: Oral

abstract: Recent retreat rates of glacier systems in the Amundsen Sea Embayment (ASE) and, in particular, Pine Island Bay have placed this region into focus for predicting the dynamics of the West Antarctic Ice Sheet and sea-level rise. A large dataset of seismic profiles provides new insight into the architecture of the continental shelf, slope and rise and shows stages of sediment deposition, erosion and transport history from pre-glacial times to early glaciation and to the last glacial periods. The data reveal an heterogeneous outer shelf with undulating basement ridges inherited from Cretaceous tectonic breakup. Areas of pronounced progradational deposits exist while other areas lack this depositional configuration almost entirely. In some parts, such as in the Abbot glacial trough of the eastern shelf, sediments deposited across the shelf break enlarged the outer shelf by up to 75 km oceanward. These deep glacial troughs are significant for incursions of Circumpolar Deep Water onto the shelf, which is implicated as the driver of accelerated ice shelf basal melting. A set of glacial unconformities on the middle shelf marks the onset of first advances of a grounded ice sheet and a transition to more frequent glacial advances and retreats. The seismic images show a striking similarity to seismic observations from the Ross Sea shelf. Although chronological control of the strata in the ASE is still lacking, this early seismic horizon-stratigraphic model for the shelf serves as a basis for understanding processes of glacial advance and retreat. The results of this study also support the active Integrated Ocean Drilling Project (IODP) proposal 784 for drilling into shelf sediments with the objective to reconstruct the past dynamics of the central sector of the West Antarctic Ice Sheet.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: SEISMIC STRATIGRAPHIC INVESTIGATION OF THE ANTARCTIC PENINSULA'S PACIFIC MARGIN: TESTING THE OVERDEEPENING HYPOTHESIS

Forename: Logan Surname: Kirst

Authors: Kirst, Logan; Bart, Phil;

Presentation Allocated: Poster

abstract: The oscillations on composite $\delta^{18}O$ records indicate that there were more than 100 climate cycles since TG5, the interglacial oxygen-isotope stage marking the start of the early Pliocene. The relatively small-amplitude oscillations of the low $\delta^{18}O$ values that characterize the early Pliocene are generally taken to indicate relatively small fluctuations of a comparatively reduced ice volume on Antarctica. The larger-amplitude oscillations of the Pleistocene are taken to represent progressive expansion of ice volume associated with northern hemisphere glaciations but presumably also included oscillations of ice volume on Antarctica. Unfortunately, it is not possible to uniquely deconvolve which sector of the Antarctic or Arctic cryosphere participated in any particular $\delta^{18}O$ oscillations and for this reason, site specific direct evidence of glacial advance and retreat is needed. Within this context, ODP Leg 178 drill data and seismic-stratigraphic mapping have been used to show that the Antarctic Peninsula Ice Sheet (APIS) advanced and retreated on the Pacific margin outer shelf as early as the late Miocene and during the early Pliocene. However, the synthesis of data also indicates that the frequency of APIS advance to the outer shelf abruptly decreased in the early Pliocene at ~ 4.25 Ma BP. Bart and Iwai (2011) proposed that the decreased frequency of APIS advances was caused by overdeepening and foredeepening of the Antarctic Peninsula outer shelf in the early Pliocene. The overdeepening permitted perennial intrusion of warm water, which in turn greatly increased ablation at the marine terminus. In our ongoing study of the overdeepening hypothesis, we are using recently acquired data to conduct a detailed seismic-stratigraphic analysis of Pliocene-Pleistocene glacial history. The objective of our analysis is to determine if there is evidence suggesting that APIS advances to the outer shelf were more frequent than has been deduced from previous studies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Small but significant late-Holocene climate change recorded in proxy records from Bransfield Basin sediment core, Antarctic Peninsula

Forename: Alex Surname: Barnard

Authors: Barnard, Alex; Wellner, Julia; Anderson, John;

Presentation Allocated: Poster

abstract: The glacimarine environment of the Antarctic Peninsula region is one of the fastest warming places on earth; however, the locations of late Holocene paleoclimate reconstructions in this region are separated by large distances and thus details of past changes remain uncertain. This study focuses on a marine sediment core collected from ~2000 meters below sea level in the Central Bransfield Strait that provides a central tie for other published studies in this region. The core lithology is dominantly hemipelagic sediment, with some turbidites. An age model has been created using radiocarbon and cesium dates that spans the late Holocene: 3560 cal yr BP to present. This chronostratigraphic framework was used to establish five units, which are grouped into two super-units, based upon: detailed facies descriptions, laser particle-size analysis, x-ray radiograph analysis, multi-sensor core logger data, and weight percentages and isotopic values of total organic carbon and nitrogen. Two super-units have been identified: a lower super-unit (3560 – 1600 cal yr BP) and an upper super-unit (1600 cal yr BP – present). We interpret C and N isotopic data from the upper super-unit as indicating an increase in primary productivity. The two super-units are further subdivided into five individual units that are broadly synchronous with known climatic transitions across the Antarctic Peninsula region: the Mid-Holocene Climatic Optimum, the Neoglacial, the Medieval Warm Period, the Little Ice Age, and recent rapid warming. We interpret the signal contained within the upper super-unit as an increase in surface water temperature and/or shortening of the sea-ice season.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Submarine glacial geomorphology of the South Georgia fjords, sub-Antarctic

Forename: Dominic Surname: HODGSON

Authors: HODGSON, Dominic; Graham, Alastair; Griffiths, Huw; Roberts, Stephen;

Presentation Allocated: Poster

abstract: As part of the ACE Community Antarctic Ice Sheet reconstruction we have been focussing on the glacial history of the Sub-Antarctic Islands. Here we show how multi-beam and single beam swath bathymetric surveys of the major fjords of sub Antarctic South Georgia have been used characterise the glacial geomorphology and to identify the relative timings and extent of glacial advance and retreat. Swath bathymetric surveys revealed a range of glacial features including terminal, retreat and truncated moraines, deep (distal) and shallow (proximal) basins and cross shelf troughs. These provide evidence of advance and retreat through several glacial maxima. A relatively consistent pattern of large scale submarine geomorphological features was observed in the different fjords suggesting a near uniform response of margins of the island ice cap to climate forcing. A relative chronology based on the relationships between the submarine features with their radiocarbon and cosmogenic isotope dated terrestrial counterparts suggests that the inner basin moraines date from the last major glacial advance or Last Glacial Maximum, and the deep basin moraines from MIS6. On the sides of the deep basin troughs a series of truncated moraines show ice advance positions from preceding glacial periods. The cross shelf troughs, and mid-trough moraines are interpreted as the product of much more extensive glaciations that predate MIS6. Sub-bottom topographic parametric sonar data is used to identify marine sediment core sampling locations that could be used to test this hypothesis.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Subsidence and tilting of pre-25 Ma wave-cut platform in Ross Sea, Antarctica

Forename: Christopher Surname: Sorlien

Authors: Sorlien, Christopher; Wilson, Douglas; Luyendyk, Bruce; Wardell, Nigel; De Santis, Laura; Bart, Philip; Sauli, Chiara; Bartek, Louis; Böhm, Gualtiero; Decesari, Robert;

Presentation Allocated: Poster

abstract: Three km of Oligocene and younger subsidence has been proposed for Central Trough and Eastern Basin of Ross Sea. Restoring this subsidence and restoring the volume of offshore sedimentary basin fill back onto West Antarctica results in a larger end Eocene subaerial land mass. An emerged West Antarctica and partly emerged Ross Sea supports an early Oligocene West Antarctic Ice Sheet. We use all available seismic reflection profiles in the Seismic Data Library System, correlated to Deep Sea Drilling Program sites, to interpret the Cenozoic stratigraphy of central and eastern Ross Sea. A planar unconformity interpreted as wave-cut eroded basement rocks before 25 Ma across Central High. Late Oligocene sedimentary rocks aggraded above basement everywhere on Central High as it subsided. The eroded basement surface tilted down into the neighboring sedimentary basins through Oligocene and Miocene time, resulting in a Central High antiform. Glacial erosion cuts Oligocene and younger strata; however, down-cutting tended to be local and a couple hundred meters or less. This changed sometime after deposition of the youngest middle Miocene rocks cored at DSDP Site 272 and before deposition of the oldest Pliocene rocks cored at DSDP Site 271. Early Pliocene or older RSU3 unconformity merges with our underlying middle Miocene or younger "Red" unconformity to cut down through over 1 km of section in the southeast part of Ross Sea, especially near the edge of the Ross Ice Shelf. Tilting suggests that basins continued to subside faster than the Central High basement ridge during Oligocene through Miocene time. At -76.7 degrees latitude, the wave-cut platform antiform crest is below 0.8 km depth, and, 110 km to the east, its eastern edge is near 2 km depth. Subsidence of the crest initiated just before 25 Ma, and initial subsidence of its eastern edge is at an inferred age of ~34 Ma. Planar stratigraphic horizons suggest that the increase in subsidence rate can be projected an additional 60 km east. The post-34 Ma extrapolated subsidence of the edge of deep Eastern Basin would thus be 2.5 km. This supports published interpretations for 3 km of subsidence of the middle of Eastern Basin, and near sea level formation of the RSU6 unconformity, inferred to be earliest Oligocene. Three km of total subsidence supports an end Eocene emergent West Antarctica as well as large land areas within Ross Sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: The last ice-sheet advance and retreat across the Antarctic continental shelf: Current knowledge and uncertainties

Forename: Stewart Surname: Jamieson

Authors: Hillenbrand, Claus-Dieter; Melles, Martin; Kuhn, Gerhard; Smith, James; Livingstone, Stephen; Ó Cofaigh, Colm; Stokes, Chris; Vieli, Andreas; Jamieson, Stewart; Graham, Alastair; Larter, Robert;

Presentation Allocated: Poster

abstract: Over the last few decades, numerous studies from various sectors of the Antarctic continental shelf have reconstructed the spatial extent of grounded ice-sheet advance during the last glacial period and the timing of its retreat. Most reconstructions were based on the bathymetric mapping of subglacial bedforms on the seabed and the palaeoenvironmental interpretation and dating of sub-seafloor sediments in cores. In addition, surface exposure age dating on rocks from the hinterland using cosmogenic isotopes and ice-sheet models were used to constrain the last ice-sheet advance and retreat. Different regional reconstructions provided consistent results for most study areas. In contrast, recent circum-Antarctic reviews that compiled the spatial and temporal information about maximum ice-sheet advance and retreat from these regional studies came to conflicting conclusions regarding i) the maximum extent of grounded ice, and ii) the synchronous/diachronous behaviour of the northern and southern hemispheric ice sheets and the individual drainage sectors within the Antarctic Ice Sheet, respectively. Resolving these conflicts is essential for identifying the main drivers of Antarctic ice-sheet retreat, evaluating the contribution of Antarctic ice-sheet melting to global sea-level rise over the last ~20 ka, understanding the dynamics of individual drainage sectors within the Antarctic Ice Sheet, and locating possible glacial refugia for benthic organisms on the Antarctic shelf. Here we will present examples of circum-Antarctic reconstructions and discuss possible reasons for conflicting conclusions. In some cases, apparent discrepancies can simply be explained by the ambiguity of terms such as “Last Glacial Maximum”, which can refer either to a particular time slice (e.g. 23-19 ka BP) or to the time when grounded ice reached its last maximum extent in a particular area, or “deglaciation”, which can refer either to the time of grounding-line retreat from a core site or to the onset of (seasonal) open-marine conditions at this location. In other instances, specific weaknesses of the techniques applied to reconstruct ice-sheet advance and retreat are likely to be responsible for the apparently conflicting conclusions. These weaknesses include uncertainties in radiocarbon dating of Antarctic marine sediments, cosmogenic isotope exposure age dating and palaeoenvironmental interpretations of sedimentary facies (i.e. subglacial vs. glaciomarine).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: The sedimentary signature of the Antarctic ice sheet during the Miocene Climatic Optimum reconstructed from two drillholes on the Antarctic continental margin

Forename: Sandra Surname: Passchier

Authors: Passchier, Sandra; Hauptvogel, Daniel; Falk, Candice; Henao, Victor; Sangiorgi, Francesca; Florindo, Fabio; Escutia, Carlota;

Presentation Allocated: Oral

abstract: Knowing how large ice masses respond to warming of the planet is of vital importance, because of their role in the Earth's heat balance and sea level variations. The Miocene Climatic Optimum (~17-15 Ma) was characterized by extensive global biotic turnovers, sea level changes, and the most depleted benthic $\delta^{18}O_{\text{seawater}}$ in the past 27 Myrs. Datasets from two drillholes, Antarctic Drilling Program hole AND-2A in the Ross Sea, and IODP Site U1356 on the Wilkes Land continental rise, are indicative of ice sheet retreat coincident with oceanographic changes during the Miocene Climatic Optimum. In contrast to the older and younger intervals, late early Miocene sediments (~17-15 Ma) in IODP Site U1356 are well-bioturbated, have high Ba-excess (productivity, oxygenation), and a general absence of overbank turbidites and ice-rafted debris. Lithofacies and heavy mineral provenance studies on AND-2A, indicate that the Antarctic ice sheet retreated from the Ross Sea continental shelf into the upland regions of the Transantarctic Mountains between ~17.5 and 15.7 Ma, even during glacial maxima. In AND-2A, we also document abrupt changes in paleobathymetry of more than 50 m amplitude, which we attribute to glacio-isostatic and gravitational effects of episodes of ice growth and decay. Overall, the sediment records from two drillholes on the Antarctic continental margin provide evidence of a more dynamic and reduced Antarctic Ice Sheet than present during the Miocene Climatic Optimum.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Tracing Eocene-Miocene Southern Ocean climate and oceanography using dinoflagellate cyst assemblages from the Wilkes Land margin, Antarctica (IODP Leg 318)

Forename: Peter Surname: Bijl

Authors: Bijl, Peter; Houben, Alexander J. P.; Sangiorgi, Francesca; Ebbing, Alexander; Pross, Joerg; Sluijs, Appy; Brinkhuis, Henk;

Presentation Allocated: Oral

abstract: IODP Leg 318 recovered an unprecedented, well-dated Cenozoic sedimentary record from the Wilkes Land Margin of Antarctica. Much of the record lacks carbonate and silicate microfossils, but well-preserved assemblages of organic-walled dinoflagellate cysts (dinocysts) allow for the reconstruction of major climatological and oceanographic changes. Early Eocene (~53-51 Ma) dinocyst assemblages are dominated by cosmopolitan taxa, indicating warm, ice-free conditions, while mid Eocene (49-46 Ma) assemblages are characterized by endemic taxa coevally prevalent in the southwest Pacific Ocean. This suggests that a connection developed between the Australo-Antarctic Gulf and the Pacific Ocean, signifying a shallow-water opening of the Tasmanian Gateway around 50 Ma. In the earliest Oligocene (33.6 Ma), low-diversity assemblages consisting exclusively of heterotrophic taxa replace the typically highly diverse Eocene dinocyst assemblages. The heterotrophic taxa are essentially identical to those dominating modern Antarctic sea-ice systems. Late Oligocene and Miocene dinocyst assemblages show high variability, from oligotrophic to heterotrophic dominance, which may provide information on repetitive changes of Antarctic glacial advance-retreat and/or shifts in oceanic frontal regimes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: U-Pb geochronology of detrital zircons from Cenozoic units from Seymour Island, Western Antarctica

Forename: Matheus Surname: Kuchenbecker

Authors: Kuchenbecker, Matheus; Babinski, Marly; Rocha-Campos, Antônio Carlos; Maciel Canile, Fernanda; Fanning, Mark; dos Santos, Paulo R.;

Presentation Allocated: Poster

abstract: Seymour Island, situated in the Weddell Sea, represents an emerged portion of the back-arc basin of the Antarctic Peninsula magmatic arc. Its sedimentary record includes Cretaceous to Neogene siliciclastic rocks, mainly of marine origin. The northern portion of the island is dominated by the presence of a plateau known as "meseta" sustained by Cenozoic strata. Sediments around the plateau comprise three main units. At the base of the slope, crops out the Eocene La Meseta Formation, a fossil-rich sequence of sandstones and mudstones, unconformably overlain by the Hobbs Glacier Formation. This unit is a glaciomarine, pebble-rich mudstone that passes upward to sandstone with rare clasts. A sharp basal contact separates the underlying units from the pebbly mudstone of the Weddell Sea Formation. Samples of these three units were collected for provenance studies, and U-Pb SHRIMP ages were obtained on seventy zircon grains from each sample. La Meseta Formation has detrital zircons ranging from 83 to 2720 Ma. Zircons from Hobbs Glacier Formation yielded ages between 20 and 2750 Ma, and the Weddell Sea Formation contains zircons with ages varying from 23 to 3320 Ma. The three samples show main age peaks at about 175, 570 and 1050 Ma, but late Neoproterozoic to Cambrian sources are the more expressive. The youngest zircon from Hobbs Glacier sediments, dated at 20.0 ± 0.4 Ma, supports a Miocene age for the deposition of this unit as previously proposed. The U-Pb detrital zircon ages younger than 200 Ma coupled to the clast assemblage of the Neogene units, typical of magmatic arcs, with lithologies such as granites, cataclasites, breccias and pyroclastic rocks, support a source located on the Antarctic Peninsula, as already proposed in the literature on the basis of clast composition. Moreover, at the base of Hobbs Glacier Formation, a boulder pavement shows glacial striae and small stoss and lee structures indicative of a glacier moving grounded toward SE. The zircons with ages ranging between 620 and 500 Ma, which are probably related with Brasiliano/Pan-African event rocks, and also the older detrital populations could be related either to the basement of the arc or to the reworked older sedimentary rocks. It is important to mention that in situ basement older than Silurian, however, has not been reported in the Antarctic Peninsula.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Structure and Debris-Transfer Processes in the McMurdo Ice Shelf (Ross Embayment)

Forename: Michael Surname: Hambrey

Authors: Hambrey, Michael; Fitzsimons, Sean; Koch, Inka;

Presentation Allocated: Poster

abstract: The southern McMurdo Ice Shelf is an offshoot of the much larger Ross Ice Shelf, pinned by various volcanic islands and peninsulas. Its southern reaches are unusual in exposing bare marine ice, along with marine organisms such as shells, sponges, corals and fish, as well as sediment. The aim of this project is to evaluate the dynamics, structure and ice/sediment accretionary characteristics of this ice shelf, and to determine the mode of formation of ice-shelf moraines. Using a combination of ice structural mapping, sedimentology of surface debris and moraines, isotopic studies and radar profiling, we characterize ice and debris facies. The ice comprise three main facies, two of which are marine and one is meteoritic, derived from an accumulation zone up-flow. Ground-penetrating radar data show a series of inclined reflectors, representing accretion layering at the base. With net ablation at the surface, these layers move upwards through the ice mass along with organisms and sediment. The surface sediment forms parallel to this layering and includes both local volcanic and far-travelled (Transantarctic Mountains) debris, the latter evidently accreted when the ice shelf touched down on a bed originally laid down during Late Glacial Maximum expansion. The ice and sediment layering is locally folded and thrust-faulted, with the proportion of debris increasing towards the southern margin where it impinges on Minna Bluff. Here, extensive ice-cored moraines are developed, the internal structure of which reflects the layered structure of the ice shelf. A conceptual model is developed to demonstrate the sequential development of the ice shelf over time, particularly its structural and sedimentological evolution.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

6

Title: Synoptic analysis of high frequency extreme events of sea ice in distinct phases of the El Niño phenomenon: case studies for the Bellingshausen-Amundsen Seas during the austral winter

Forename:

CAMILA

Surname:

CARPENEDO

Authors:

CARPENEDO, CAMILA; BOIASKI, NATHALIE; GANDU, ADILSON; AQUINO, FRANCISCO;

Presentation Allocated: Poster

abstract: Local, regional and remote climate variability influence Antarctic sea ice at different time scales. Many studies suggest a strong association between Antarctic sea ice and the tropical phenomenon El Niño (EN). This study analyzed the relationship between the three distinct phases of the EN and the high frequency extremes of sea ice in the Bellingshausen-Amundsen Seas (BAS) during the austral winter. This work employed BAS sea ice extent data from NSIDC/NASA; atmospheric fields (surface to higher tropospheric levels) from ERA-Interim reanalysis; SSEC IR satellite image composition, and the Oceanic Niño Index CPC/NOAA. High-frequency (2-10 days) anomalies were obtained by applying a fast Fourier transform in the time series (1989-2007). Extremes were defined using the first quartile distribution criterion of the sea ice high frequency anomalies, being these extremes negative of sea ice (ENSI). Each of the EN phases were typified by: El Niño (11-12/SEP/2004), La Niña (14-15/SEP/1999) and Neutral (23-26/SEP/2005). The high frequency anomalies and the synoptic fields were analyzed according to the three days prior to the ENSI events. Results show that in the case of the El Niño phase there is a baroclinic structure over the BAS from three days prior to the ENSI event, with positive anomalies of mean sea level pressure (MSLP) and geopotential heights of 200 hPa (H200) and negative anomalies of geopotential heights of 500 hPa (H500). There is a weakening of the polar jet and a strengthening of the subtropical jet. The synoptic analysis shows a well organized trough-ridge system over BAS. This circulation pattern promotes the spread of relatively warm air over the BAS region, contributing to the ENSI event. In the La Niña case study, an equivalent barotropic structure was observed three days prior to the ENSI event, with positive anomalies of MSLP, H500 and H200. The strengthening of the polar jet was also evident. The northern winds at low levels are associated to the forefront of the active cyclonic systems in the region. In the Neutral phase case study, there is a baroclinic structure, with positive MSLP anomalies over the BAS, negative (positive) H500 (H200) anomalies in the east and positive (negative) anomalies in west of the BAS sector. The polar jet is intensified. The northern circulation is induced by the trough/ridge system as well as by the forefront of the cyclones at surface level.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: The Climate Data Guide for polar climate research and model evaluation: An illustrated case study comparing multiple data sets of Antarctic sea ice concentration to each other and to the NCAR Community Earth System Model

Forename: David Surname: Schneider

Authors: Schneider, David; Shea, Dennis; Deser, Clara; Landrum, Laura;

Presentation Allocated: Poster

abstract: The Climate Data Guide (<http://climatedataguide.ucar.edu>) enables researchers and students to identify and make effective use of climate data sets. It provides a focal point for expert-user guidance, commentary, and questions on the strengths and limitations of selected observational datasets and their applicability to model evaluation. The Climate Data Guide is the only data website where experts from the observational and model evaluation communities are invited to contribute their perspectives on various data sets and variables. Antarctic researchers are encouraged and welcome to contribute, and doing so is an excellent form of outreach and a great way to make your data or model evaluation research more visible. Website users may contribute their own comments, questions, and data set descriptions. In this presentation, the need for understanding the strengths and limitations of individual data sets will be highlighted through an inter-comparison of several different Antarctic sea ice concentration products, all readily accessible via the web. The question of how well we know the mean state and trends in Antarctic sea ice extent and area will be explored, and comparisons will be made with simulations of NCAR's Community Earth System Model (CESM). The CESM can be configured in several ways, some of which reduce biases in simulated sea ice with respect to observations. It is argued that as models improve and more sophisticated data-model comparisons are considered, the choice of observational data set will become more important.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Ecophysiological and molecular study of the bipolar lichen *Umbilicaria decussata*.
Comparison between four populations in a latitudinal gradient from 83°S to 19°N

Forename: Mercedes Surname: Vivas

Authors: Vivas, Mercedes; Sancho, Leopoldo; Perez-Ortega, Sergio; Pintado, Ana;

Presentation Allocated: Poster

abstract: Lichens are an important component of terrestrial Antarctic ecosystems, as they represent the dominant vegetation in many ice free areas of this region, being able to tolerate effectively the harsh climatic conditions which drastically reduce the opportunities for vascular plants to establish and develop. In Antarctica, lichen species diversity decreases with latitude. Indeed, the species abundance is far higher in maritime Antarctica, whose conditions are more favourable for lichen development, than in continental Antarctica, where liquid water availability is very scarce. Several species grow specifically in one of these environments, but some others are able to adapt to both. This is the case of *Umbilicaria decussata* (Vill.) Zahlbr., a lichen whose world distribution is associated with polar regions, as well as high altitudes in both hemispheres. In this study we have compared the ecophysiological behaviour of four populations: Continental Antarctica (Mount Kyffin, 83°S), Maritime Antarctica (Livingston Island, 62°S), los Chilean Andes (Región del Maule, 38°S) and Mexican high mountains (Iztaccihuatl volcano, 19°N). We have specially focused on the photosynthetic yield of these populations through gas exchange measurements, under lab conditions, controlling light intensities and temperatures. We have also compared the chlorophyll content between populations by means of spectrophotometry. Last, we studied the phylogenetic relationships between the mycobiont of these populations, using the ITS region of nuclear DNA, aiming to find out whether there is a geographical pattern in the population structure. Results show a clear increase in photosynthetic productivity towards lower latitudes. This trend is also seen regarding chlorophyll content. In contrast, no differences in productivity were observed between the two Antarctic populations, despite the fact that they are separated by 20° of latitude. Molecular analysis showed that haplotypes tend to be very consistent within populations and clearly different between populations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Effect of root fungal endophytes on physiological performance and fitness traits on *Colobanthus quitensis* and *Deschampsia antarctica*

Forename: Romulo Surname: Oses

Authors: Oses, Romulo; Kozlowski, Jurij; Molina Montenegro, Marco;

Presentation Allocated: Poster

abstract: In the present study the effects of the root fungal endophytes on physiological performance and fitness traits were evaluated. One hand, individuals of both species collected during the growing season 2010-2011 and maintained in growth chambers under controlled environmental conditions were used in this experiment. Individuals of both species were submitted under the following conditions: a) non-sterilized native soil (NS), ii) native soil sterilized (NSS) and sterilized soil plus root endophytes inoculums (NSSI). After 5 months biomass, physiological performance (Fv/Fm) under two watering treatment were recorded. Watering treatments consist in the current water content recorded in field and the water content suggested under global climate change conditions. On the other hand, survival experiment was carried out in King George Island site during one month recording the percentage of survival. Results showed that sterilization pretreatment impact negatively in both species being more evident in *C. quitensis* than *D. antarctica*. On the other hand when root fungal endophytes inoculum was applied to the sterilized soil it was observed an increase of physiological performance and fitness traits in both plants species. Not differences between native soil and inoculation treatment were recorded for all traits measured. These results will help us understand the role of the mycoflora - and symbiosis in the functioning of Antarctic plants and the implications of adaptive symbiosis as a mechanism of tolerance under stressful environmental conditions characteristic of the Antarctic. On the other hand, information obtained in this study will understand the role of endophytes in the reproductive performance of plants under a future scenario of GCC, allowing to understand the degree of dependence on the symbiosis.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Embryos in the cold: Developmental patterns of *Notothenia coriiceps* embryos produced by in vitro fertilization

Forename: John H. Surname: Postlethwait

Authors: Postlethwait, John H.; Yan, Yi-Lin; Titus, Thomas; Allard, Corey; Albertson, R. Craig; Detrich, III, H. William;

Presentation Allocated: Oral

abstract: Loss of skeletal density is an increasing health problem in aging populations. Some Antarctic fish provide a naturally occurring evolutionary mutant model for osteopenic diseases of the elderly. Ancestral notothenioid fish were benthic and lacked a swim bladder, an organ of buoyancy. When the Southern Ocean cooled, notothenioids filled pelagic niches left vacant by local extinction of other species by evolving strategies to reduce body density, including decreases in bone mineral density in several clades, including icefish. To identify genes causing the adaptive evolution of bone loss in Antarctic fish, which may be orthologs of genes responsible for maladaptive bone loss in aging humans, we are comparing the molecular genetics of skeletal development in robustly mineralized and osteopenic Antarctic fish. Furthermore, temperature affects the function of DNA-binding transcription factors that regulate embryonic development and the diffusion of developmental signaling molecules, but mechanisms that drive the development of embryos at the extremes of vertebrate life have been little explored. Here we report on the embryonic development of the yellowbelly rockcod, *Notothenia coriiceps*, a benthic denizen of Antarctic waters that lives at -1.9°C . We collected *N. coriiceps* near the Antarctic Peninsula in early June, obtained gametes by palpitation, and produced embryos by in vitro fertilization. On fertilization lipid droplets in developing embryos reorganized. We cultured embryos for 25 days at Palmer Station, Antarctica, then brought them to the University of Oregon for further culture. The first embryonic cleavage division occurred at 24 h, after which embryos divided at 12-h intervals for the first 10 divisions at an incubation temperature of $\sim -0.5^{\circ}\text{C}$ (compared to 30 min for first cleavage and 15 min for subsequent cleavages for zebrafish at 28.5°C). *N. coriiceps* embryos reached 80% epiboly at 19 days post fertilization (dpf), and at 26 dpf were at about the same stage as a zebrafish embryo at 24 hours postfertilization. By 116 dpf, cartilages had formed, complete with endochondrium and perichondrium. The comparison of cDNAs from *N. coriiceps* and the osteopenic icefish *Chaenocephalus aceratus* will enable us to identify the molecular genetic basis for the evolution of osteopenia in Antarctic fish, and may provide clues to age-related osteopenia in aging humans. Support: U.S. NSF grant ANT-0944517 (HWD); U.S. NIH grant R01AG031922 (JHP, HWD, RCA).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: GPS Scintillations, Ionospheric Imaging and All Sky Images In Antarctica

Forename: Gary Surname: Bust

Authors: Bust, Gary; Mitchell, Cathryn; Kinrade, Joe; Weatherwax, Allan; Deshpande, Kshitija; Ebihara, Yusuke;

Presentation Allocated: Keynote 20 mins

abstract: Over the last three years the University of Bath UK, British Antarctic Survey (BAS), Atmospheric & Space Technology Research Associates (ASTRA), Virginia Tech, Augsburg College and Siena College have collaborated on an extended investigation of the relationships between large scale plasma structuring, small scale GPS scintillations and All Sky Imaging (ASI) over Antarctica. GPS scintillation receivers have been installed at South Pole, McMurdo, at three AGO sites, and at two remote BAS sites. Virginia Tech is currently deploying seven of the new CASES scintillation receivers on the Plateau over the next 3 years. In addition a new funding opportunity will allow for the installation of 2 additional scintillation receivers at McMurdo and South Pole each, to allow for clusters of GPS scintillation arrays. Current investigations include the relationships between large scale tongues of ionization and scintillations during the magnetic storm of April 5-6 2010 and correlations between ASI observations and GPS scintillations on August 9, 2010 and May 20, 2011. Future planned studies include long term statistical analysis of correlations between ASI and GPS scintillations, the use of full three-dimensional (3D) forward electromagnetic (EM) modeling of GPS scintillations to investigate the underlying physical irregularities that cause them, and the use of 3D EM modeling combined with diffraction tomographic techniques and clusters of GPS scintillation receivers to investigate the overall two-dimensional, time-evolving distribution of ionospheric irregularities. This paper will report on recent results of the current scientific investigations as well as some of the new planned studies that will be undertaken over the next three years.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: GPS-derived Precipitable Water Vapour in Antarctica and validation with radiosoundings

Forename: Monia Surname: Negusini

Authors: Negusini, Monia; Sarti, Pierguido; Tomasi, Claudio; Petkov, Boyant;

Presentation Allocated: Oral

abstract: The capability of the GPS in retrieving the precipitable water vapour (PWV) content at low- and mid-latitudes has been amply investigated by several studies. In Polar Regions, beyond the classical positioning application, the use of GPS observations for sensing the atmosphere is of particular interest due to its easy and unmanned operability. It is well known that, in those areas, the atmospheric water vapour content is approximately one third or less than that present at mid latitudes and that on the Antarctic Plateau the atmospheric humidity drops down to less than a few mm. As a consequence, the use of GPS data in sensing the atmosphere can be reliably applied only on coastal areas, where the PWV is large enough to exceed the sensitivity of the method. Radio-soundings are periodically performed at several coastal Antarctic stations, where permanent GPS equipments are also installed. The co-location of GPS and radio-soundings allows a validation of the PWV derived from the geodetic data. In this investigation we present the results of the analysis of continuous long time series of GPS data acquired at Mawson (MAW1), Casey (CAS1), Davis (DAV1), McMurdo (MCM4) and Mario Zucchelli (TNB1) stations during twelve years spanning 1999-2010. Particularly, at each site, the PWV is determined with GPS data and the same parameter derived from the analysis of the radio-sounding is used for validation. The GPS analysis is optimized for Antarctic data, using specific atmospheric models (e.g. the Vienna Mapping Function) and particular care in the data screening and elimination. The sites to be analyzed were selected according to the radiosonde equipment: the Vaisala sensors' readings were corrected specifically with ad hoc models.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: Interhemispheric comparison of GPS phase scintillation and auroral emission observed from the ground and DMSP satellite

Forename: Paul Surname: Prikryl

Authors: Prikryl, Paul; Zhang, Yongliang; Ebihara, Yusuke; Ghoddousi-Fard, Reza; Jayachandran, Periyadan T.; Kinrade, Joe; Mitchell, Cathryn N.; Weatherwax, Allan T.; Cilliers, Pierre J.; Spogli, Luca; Alfonsi, Lucilla; De Franceschi, Giorgiana; Romano, Vincenzo;

Presentation Allocated: Poster

abstract: Rapid fluctuations of the amplitude and phase of transionospheric radio signals degrade positioning accuracy and cause cycle slips, which can lead to complete loss of signal lock and operational outages. High-latitude GPS scintillation is caused by ionospheric irregularities produced by energetic particle precipitation and by patches of enhanced plasma density convecting in the polar cap. Intense phase scintillation was observed with arrays of GPS Ionospheric Scintillation and TEC Monitors (GISTMs) in the Arctic and Antarctica during ionospheric disturbances caused by a high-speed solar wind stream from 29 April to 5 May 2011. One-minute phase scintillation index values derived from data sampled at 50 Hz are complemented by values of a proxy index (delta phase rate) obtained from 1-Hz receivers. The scintillation occurrence was spatially and temporally associated with aurora borealis and aurora australis that were observed by all-sky imagers (ASI) from the ground and by an FUV imager on board DMSP satellites. The GPS receiver at South Pole station that is also equipped with an ASI and an imaging riometer, is approximately conjugate with GPS receivers on Baffin Island, Canada, thus providing an opportunity to examine magnetic conjugacy of scintillation. Interhemispheric comparison of aurora and associated GPS phase scintillation are correlated and collocated.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Recent changes in Wanda Glacier, King George Island, Antarctica

Forename: Kátia Kellem da Surname: Rosa

Authors: Rosa, Kátia Kellem da; Vieira, Rosemary; Fernandez, Guilherme Borges; Mendes JR, Claudio Wilson; Arigony Neto, Jorge; Simões, Jefferson Cardia;

Presentation Allocated: Poster

abstract: This paper investigates changes in Wanda glacier, located in King George Island (KGI), South Shetland Islands ($61^{\circ}54' - 62^{\circ}16'S$ and $57^{\circ}35' - 59^{\circ}02'W$), off the Antarctic Peninsula. This glacier has an extend proglacial front as a consequence of its recent retreat. To monitor recent changes, we determined the glacier flow direction and velocity, internal structure and fluctuations of its terminus. Topography data were used to generate a transverse and longitudinal sections and a three-dimensional model (DSM) of the glacier surface. Wanda Glacier has a small drainage basin, a high retreat rate through fusion processes and reduced ice thickness if compared to others ice masses in KGI. From 1979 to 2011, the glacier lost 0.71 km^2 of its ice front (about 31% of the $1,5 \text{ km}^2$ total surface area). The current continuous and fast retreat phase is attributed to the recent regional warming. Maximum ice surface velocity, measured using a stake network, reached 2.2 cm d^{-1} during the period 2007–2011. Transverse profiles show the influence of the topography on the ice flow. The use of Ground Penetrating Radar (GPR) identified internal reflections that are attributed to water films and intraglacial and subglacial water channels in Wanda Glacier. The abundance of internal diffractions is considered an indication of temperate ice with liquid water content. Similar internal structure is observed in other glaciers in KGI. Due to its small size and thermal conditions, Wanda Glacier responds rapidly to climatic changes and is relevant for environmental studies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: RELATIONSHIPS BETWEEN SEA ICE THICKNESS MEASUREMENTS IN THE NORTHWESTERN WEDDELL SEA AND ENVISAT ASAR BACKSCATTER VALUES

Forename: Vagner da Silva Surname: Duarte

Authors: Duarte, Vagner da Silva; Arigony-Neto, Jorge; Simões, Jefferson Cardia;

Presentation Allocated: Poster

abstract: We investigate the possibility to establishing a relationship between the ASAR backscattering and sea ice thickness, essential to allow the use of that orbital sensor for monitoring permanently this sea ice parameter. Three ASAR images and quasi-time-coincident sea ice thickness and freeboard helicopter-borne measurements were processed, and backscattering values from the pixels corresponding to the trajectory of the northwestern Weddell Sea helicopter flights extracted from the images. We determined statistical parameters for sea ice thickness and freeboard data within corresponding pixel of the images, and calculated correlation coefficients between the sea ice and backscattering values. A flight was performed in midway between Clarence Island and the South Orkney Islands, sampling a uniformly disturbed sea ice regime near the edge of the ice coverage. The correlation coefficient was 7.90% for sea ice thickness, 9.59% for freeboard. The mean ice thickness was $1.76 \text{ m} \pm 1.49 \text{ m}$ and freeboard was $0.27 \text{ m} \pm 0.22 \text{ m}$. Another flight was carried out near the former Larsen A ice shelf coast, over a less disturbed sea ice regime that showed medium correlation with ASAR backscattering: 38.72% for sea ice thickness, and 29.13% for freeboard. In this case the mean sea ice thickness was $2.74 \text{ m} \pm 1.78 \text{ m}$ and freeboard was $0.26 \text{ m} \pm 0.20 \text{ m}$. Finally, a flight in the far east off the coast of Joinville Island sampled a transition area, from strongly to less disturbed ice regimes. The correlation coefficient between backscattering and sea ice was 3.97% for ice thickness, and 4.60% for freeboard. The mean values are: $2.30 \text{ m} \pm 1.54 \text{ m}$ (ice thickness) and $0.21 \text{ m} \pm 0.18 \text{ m}$ (freeboard). The correlation analysis was performed with all the data at pixel level, so results were considered consistent. Sea ice is a complex target for which there is overlapping of different ice thicknesses or freeboards that presenting the same backscattering, as well as different pack ices with the same ice thickness or freeboard can result in distinct backscatter values.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: The Southern Ocean Observing System

Forename: Oscar M.E. Surname: Schofield

Authors: Schofield, Oscar M.E.; Meredith, Michael P.; Newman, Louise;

Presentation Allocated: Oral 20 mins

abstract: The Southern Ocean provides the principal connection between the Earth's ocean basins and the global overturning circulation. Changes in the Southern Ocean therefore have global ramifications. Recent research has demonstrated that the Southern Ocean is changing. The region is warming rapidly; salinity changes have been observed in both the upper and abyssal ocean; the uptake of carbon has caused basin-wide ocean acidification; and ecosystems are reacting to changes in the physical and chemical environment. These results, and their implications, demonstrate the need for sustained Southern Ocean observations. The Southern Ocean Observing System (SOOS) has been developed to establish a multidisciplinary observing system. It will address the following key challenges: 1) Global heat and freshwater balance, 2) Stability of the overturning circulation, 3) Future of the Antarctic Ice Sheet and its contribution to sea-level rise, 4) Ocean uptake of carbon dioxide, 5) Future of Antarctic sea ice, and 6) Impacts of global change on Southern Ocean ecosystems. This presentation will outline the SOOS strategy and provide details on plans towards implementation of the SOOS.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: Effective communication of science: Incorporating the arts into our science culture

Forename: Alan Surname: Cooper

Authors: Cooper, Alan; Stafford, Julianne;

Presentation Allocated: Keynote 40 mins

abstract: The effective communication of science “facts” and concepts is a skill achieved, as in the arts, through years of practice and performance. Science culture dictates how this should be done – currently via objective discourse and visual presentation. Yet, as experience shows science culture is narrowly focused with rigid objective guidelines that disallow telling the complete “science story” in ways that are effectively understood and accepted by audiences. The cultural arts (e.g., narrative, drawing, painting, poetry, music, dance, artistic imagery, etc.) are currently excluded from science culture – being too subjective to be repeatable and therefore credible. Yet, it is these arts, when used thoughtfully by scientists, that provide the human connection to help make science concepts more understandable and acceptable to audiences. Historically, from the time of earliest explorations and science studies of Antarctic regions in the 18th century (e.g., Captain Cook) until the early to mid 20th century, the creative arts were used routinely. The arts were necessary “tools” in conducting and reporting science findings and concepts, to invite and excite interest in science in general and Antarctic science in particular. In that era, cultural arts helped defined science culture. Thereafter, the ascendancy of technology and automation in scientific measurements and analyses has changed science culture to its current focus on “computerized objectivity”. Today, Antarctic scientists, like those elsewhere, acquire and analyze vast computer-generated data sets to create complex models that commonly are not understood and accepted by the general public and sometimes not by colleagues, either. We propose and will briefly demonstrate that the simple introduction of a scientist’s creative arts skills into his/her presentation, adds a “human component” to help open audience minds to listen, to seek to understand and to accept and adopt the science message(s) being presented. Incorporating the arts will reinvigorate our science culture.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: GIS and Printmaking Representations of Mount Murphy and Mount Sidley, Marie Byrd Land Volcanoes, West Antarctica

Forename: Eleanor Surname: Emery

Authors: Emery, Eleanor, Gumper, Jean, Leonard, Kate, Siddoway, Christine

Presentation Allocated: Poster

abstract: Satellite remote sensing techniques have recently identified over a hundred active subglacial lakes under the ice in Antarctica. Water and sediment at the basal interface of glaciers and ice sheets provide the environment that supports microbial life as well as exerting primary control on ice dynamics. Thus a clear understanding of this system is of key importance to scientists from a range of disciplines. Subglacial Lake Whillans and the ice stream grounding zone are being studied as part of a multidisciplinary project called the Whillans Ice Stream Subglacial Access Research Drilling project (WISSARD) that will investigate the physical, geochemical and biological conditions at the base of the ice stream as water and sediment are transported from inland to the grounding line. We present data from ice-penetrating radar, active-source seismic and GPS experiments characterizing basal conditions beneath both Subglacial Lake Whillans and the ice stream grounding zone. The hydropotential map from high-density surface topography and ice thickness measurements reveals a lake basin of approximately 60 square kilometers with water thickness on the order of 5-6 m deep at the time of the survey. The region of high basal reflectivity coincides roughly with the lake boundaries as inferred from ICESat elevation changes but a wet basal interface also exists well beyond the lake boundary to the south. Together with information from satellite remote sensing of the surface, we describe the evolution of the basal hydraulic system from the start of the ICESat era to the present as we prepare for lake access drilling in 2012-13. Grounding zone geophysics reveals a region with highly distorted internal stratigraphy, strong variation in surface slopes across the grounding zone, and a non-uniform basal expression of the grounding line. In most locations, strong folds in the internal stratigraphy occur throughout the ice thickness; these features appear to have been formed upglacier and advected to the grounding line largely unaltered. In contrast, the local, highly variable spatial pattern of basal grounding line expression and changes in basal reflectivity across the grounding line suggests complex, spatially varying interactions at the ice-ocean interface in our survey-area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: NO Expectations: A model for art/science collaboration in Antarctica

Forename: Samuel Surname: Bowser

Authors: Bowser, Samuel; Von Rosk, Laura; Kaiser, Henry; Hudson, Hilary;

Presentation Allocated: Poster

abstract: Art/Science collaboration has become a widely accepted way of communicating the mysteries, discoveries, pitfalls, and potentials of science (e.g., see: www.ASCI.org). The U.S. Antarctic Program has a longstanding tradition of providing logistic support for artists and writers (A&W) interested in experiencing the Antarctic continent to produce a body of work. The paradigm for selecting A&W participants is similar to a research proposal: “tell us what you want to do, tell us how you will do it, tell us where your work will be presented, and justify its significance to your profession.” A panel of experts evaluates each application, and awardees visit field camps and research stations where scientists share their knowledge and logistic expertise. This approach certainly works, but does it nurture or hinder creative processes? Can an expert panel adequately assess the “compatibility” of an A&W project with the science team(s) to be visited? Are there other options to explore? We have produced a short (5 min) film documenting our experience with embedding an artist in a science team as a research assistant. This approach frees both scientist and artist from the necessity of producing a defined product. Instead, such an art/science partnership explores ideas in situ, unhindered, as they work toward their goals of “doing good science” and conveying their shared experiences to better inform the public.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: Paint and Worms: Art of Antarctic Soft-Sediment Communities.

Forename: Andrew Surname: Thurber

Authors: Thurber, Andrew; Simonson, Lily;

Presentation Allocated: Poster

abstract: Paintings can capture the imagination of new audiences and show them the mysterious, beautiful, and unfamiliar life forms that thrive beneath the ice. In addition to Antarctica's "charismatic mega fauna," the polar oceans are filled with minute and amazing animals that have adapted to the extreme seasonality of the high latitudes. Among these groups are dense assemblages of polychaetes that live in an otherworldly habitat bathed in soft-light tempered and colored by the overlying ice and snow. While scientists can use these communities to understand how the world works, only an artist can capture an audience's imagination and transform the way we perceive and understand these organisms and their environment. This collaborative project couples science and art into one. Simonson's expressive large-scale compositions highlight the beauty of these polychaetes and surrounding clams, sea stars, and sponges and provides emotion to the hypotheses tested by Thurber. Combining tropes of zoological illustration, Renaissance glazing techniques, and expressive abstraction, Simonson explores the organisms' otherworldly anatomy and pigmentation, while accentuating the anthropomorphic aspects of their form. By magnifying the subjects to human scale, the paintings delve into their extraordinary morphology and emphasize the affinities between the viewer and subject. The paintings' dramatic shifts in value and color underscore the mystery of this benthic community thriving beneath thick ice, with vibrant blues and greens contrasting against the surrounding darkness. For most of the world's population Antarctica remains an abstraction. These paintings based on Thurber's research aim to transport viewers to a new reality and engage them with this world's rich array of biodiversity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Variation of Biogenic Opal Content from Quaternary to Late Neogene on the Continental Rise of Wilkes Land (Sites U1359 & U1361, IODP Exp 318), East Antarctica

Forename: Buhan Surname: Song

Authors: Song, Buhan; Khim, Boo-Keun; Katsuki, Kota;

Presentation Allocated: Poster

abstract: Variation of Biogenic Opal Content from Quaternary to Late Neogene on the Continental Rise of Wilkes Land (Sites U1359 & U1361, IODP Exp 318), East Antarctica. Buhan Song¹, Boo-Keun Khim¹, Kota Katsuki². ¹Department of Oceanography, Pusan National University, Busan 609-735, Korea; ²Geologic Environment Division, Korea Institute of Geoscience and Mineral Resources, Daejeon 305-350, Korea. A 1216.4 m-long section at Site U1359 and a 350.9 m-long section at Site U1361 were recovered from the eastern levee of the Jussieu submarine channel on the Wilkes Land continental rise through IODP Expedition 318. The drilling purpose at these sites was to obtain the late Neogene to Quaternary glacial history and to test the stability of the East Antarctic Ice Sheet during the extreme warm periods of the middle Miocene to Pleistocene. A total of 760 samples (150 from Site 1359A, 90 from Site 1359B, 240 from Site 1359D, 250 from Site 1361A) were collected to measure the biogenic opal contents using the wet-alkaline sequential extraction method. Opal contents at Site 1359 fluctuate between 3% and 60% and opal contents at Site 1361A fluctuate between 4% and 50%. The variation patterns of both sites are similar with the long-term trends through the Late Neogene and Quaternary. High opal contents in the Wilkes Land continental margin during the early Pliocene indicate strong reduction of sea-ice coverage and relatively warm climatic conditions, because extent and duration of sea-ice coverage seems to be the main controlling factor of biological productivity. Thus, we will discuss the reconstruction of paleoceanographic long-term changes during the Neogene and Quaternary in the Wilkes Land.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: WEATHERED BASALT FLOWS FROM THE MAZUREK POINT FORMATION (EOCENE):
IMPLICATIONS FOR PALEOCLIMATIC CONDITIONS IN THE PALEOGENE OF WEST
ANTARCTICA

Forename: Fernanda Surname: Maciel Canile

Authors: Maciel Canile, Fernanda; Rocha-Campos, Antonio Carlos; dos Santos, Paulo Roberto;

Presentation Allocated: Poster

abstract: Basaltic lava flows from the Mazurek Point Formation (Eocene), 2-7 m thick, exposed in the proglacial area of Wyspianski glacier in Wesele Cove, King George Island, consist of a massive, fresh, brownish gray zone, transitionally overlain by a reddish-brown, upper, saprolithic, argillaceous horizon containing dispersed basalt angular fragments, interpreted as weathering product. The flows compose a 60 m thick tilted sequence of at least 13 units of massive, terrestrial flood and minor pillow basalts and rare agglomerate. Deep weathering on top of a single thick lava flow from the same formation had been previously observed in the area and interpreted as preceding sedimentation of the overlying glacial diamictites of the Krakowiak Glacier Member (Polonez Cove Formation, Middle-Upper Oligocene). Weathering at Wesele Cove seems to occur intraformationally and, thus, offer an opportunity to investigate climatic sensitive processes that operated contemporaneously with the Eocene volcanism. The study involved logging of the basalt section, petrographic, geochemical, and X-Ray diffraction analyses of fresh and weathered zones of flows. Mineralogical alteration of the basalt, a typical island arc tholeiite, involved oxidation of pyroxenes and olivines into iron hydroxide pseudomorphs denoting moderate intensity of weathering processes. This result is compatible with alteration indexes obtained of 61 to 67 (CIA) and 6.6 to 8.6 (IA). Presence of clay minerals of the smectite group indicates predominance of chemical weathering of the Eocene basalts. It seems thus that each lava flow was subject to the action of weathering processes of moderate intensity before being recovered by the next flow. Absence of a precise geochronological framework for the basalt sequence makes it impossible to estimate duration of the interval between successive flows, when weathering took place and of its rate. Occurrence of a 60 cm thick, lenticular, fine, poorly stratified sandstone intercalated between two flows seems to indicate the possibility of occurrence of longer periods of volcanic quiescence separating lava emissions. The above results corroborate previous data derived from fossil plants and oxygen isotopes measured on foram tests, that indicates mild climatic conditions during the Eocene.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: A Preliminary Environmental Magnetic Record of Paleoclimate Variations from Lacustrine Sediments of the Schirmacher Oasis, Antarctica

Forename: Mahesh Surname: Badnal

Authors: Badnal, Mahesh; Warriar, Anish Kumar; Shankar, Rajasekharaiah; Mohan, Rahul; Asthana, Rajesh;

Presentation Allocated: Poster

abstract: Environmental magnetism deals with understanding the intrinsic magnetic properties of natural samples. The data obtained provides information on the concentration, (magnetic) grain size and mineralogy of magnetic minerals which, in turn, may be used to decipher the source and/or processes, both natural and anthropogenic, that may have influenced the sample material. Hitherto not much work has been done to understand the magnetic properties of lake sediments from Antarctica. In this investigation, we have studied the environmental magnetic properties of a ~ 70 cm sediment core (SL) from the Sandy Lake located in the Schirmacher Oasis, Antarctica (70°45'45.9" S; 11°47'34.7" E). Using standard methodology, we measured χ_{fd} , ARM and SIRM, and calculated inter-parametric ratios like χ_{fd} , χ_{fd} %, SIRM/ χ_{fd} , χ_{ARM}/χ_{fd} , χ_{ARM}/χ_{fd} , $\chi_{ARM}/SIRM$, S-ratio and HIRM. AMS 14C dating and studies of other proxies are in progress. The core shows good variations in terms of magnetic susceptibility throughout the core. From the core bottom upwards, χ_{fd} values are high ($\sim 125 \times 10^{-8} \text{m}^3 \text{kg}^{-1}$) up to ~ 55 cm depth, these high values suggests a warmer climate due to which there would have been a higher influx of melt water carrying the sediments including magnetic minerals to the lake basin. From 55 to ~ 48 cm depth, χ_{fd} values are low ($\sim 60 \times 10^{-8} \text{m}^3 \text{kg}^{-1}$) and there onwards exhibits a cycle of high and low values till the core-top. This indicates that a cyclicity of warm and cool climate in the lake catchment. Average χ_{fd} % value is 1.9 % suggesting an insignificant contribution from the ultrafine grained superparamagnetic grains that are associated with weathering and pedogenesis (Maher, 1988; Dearing et al., 1996). A majority of the samples show a mixture of coarse stable single domain (SSD) magnetic grains. The high S-ratio (~ 0.98) suggests a rich presence of magnetically 'soft' minerals like magnetite. HIRM data also indicate low concentrations of magnetically "hard" minerals like hematite and goethite except at a few depth intervals. The presence of greigite and biogenic magnetite can be ruled out in the sediment core as the inter-parametric ratios such as SIRM/ χ_{fd} (indicator of greigite) and χ_{ARM}/χ_{fd} and χ_{ARM}/χ_{fd} (indicators of biogenic magnetite) exhibit low values throughout the core. Magnetic minerals do not seem to have undergone any significant dissolution as indicated by $\chi_{ARM}/SIRM$ and χ_{ARM}/χ_{fd} data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Antarctic climate variability and its tropical linkages

Forename: David Surname: Schneider

Authors: Schneider, David; Deser, Clara; Okumura, Yuko;

Presentation Allocated: Oral

abstract: We review the mechanisms associated with Antarctic-tropical climate linkages and present new analyses of the seasonality and spatial patterns of tropical climate signals in the Antarctic for the late 1950s to present. Tropical climate signals are primarily communicated to the Antarctic via the Pacific-South American (PSA) pattern and the Southern Annular Mode (SAM). The impacts of these circulation patterns and their tropical linkages are evident in regressions of seasonally stratified Antarctic station temperature data and annually resolved ice core records upon global fields of sea surface temperature, sea level pressure and precipitation. Temperature and ice core anomalies in the Peninsula region and adjoining areas of West Antarctica are significantly impacted by the PSA, interpreted as a Rossby wave-train driven by anomalous tropical deep convection during ENSO events. This pattern is most evident in the austral spring, consistent with recent studies suggesting that atmospheric conditions for Rossby wave propagation are most favorable during this season. During austral summer at the peak of the ENSO cycle, temperature anomalies at East Antarctic coastal stations exhibit significant correlations with tropical Pacific anomalies. This linkage reflects the influence of anomalous tropical heating on the position and strength of the subtropical jets and is consistent with changes in eddy momentum fluxes that alter the mean meridional circulation associated with the SAM. Of the ice cores that exhibit tropical linkages, most tend to be associated with the PSA teleconnection. Finally, we discuss the implications of our findings for understanding Antarctic climate variability and climate change from seasonal to decadal timescales. Recent result suggesting a major role for tropical forcing of temperature and sea ice trends in West Antarctica will be highlighted.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Antarctic Humidity Inversions

Forename: Tiina Surname: Kilpeläinen

Authors: Kilpeläinen, Tiina; Valkonen, Teresa; Vihma, Timo;

Presentation Allocated: Poster

abstract: In the Polar areas, humidity inversions, i.e., layers where specific humidity increases with height, are common features in the lower troposphere. They have often been associated with temperature inversions and meridional water vapor transport. Although humidity inversions may have important implications for the climate, they have received little attention until now. In this study, we address climatological characteristics of humidity inversions over Antarctica for the 10-year period 2000-2009. The analysis is based on radiosonde data from an enhanced version of the Integrated Global Radiosonde Archive (IGRA) from 12 locations in Antarctica. Spatial, seasonal and diurnal variability of humidity inversion occurrence, height, depth and strength in Antarctica are presented. We further investigate the dependence of the occurrence and properties of humidity inversions on (a) the temperature control of saturation humidity, (b) mixing of the boundary layer, and (c) meridional and zonal moisture transport, which is affected by large-scale circulation patterns, such as the Zonal Wave 3. The results of this study can be used as a baseline for studies addressing changes in humidity inversion climatology.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Atmospheric synoptic conditions of snow precipitation in East Antarctica using ice core and reanalysis data

Forename: claudio Surname: scarchilli

Authors: scarchilli, claudio; frezzotti, massimo;

Presentation Allocated: Poster

abstract: Snow precipitation is the primary mass input to the Antarctic ice sheet and is one of the most direct climatic indicators, with important implications for Mass Balance and reconstruction of paleoclimate from ice cores. Snow accumulation values obtained at GV7 (70°41' S - 158°51' E), a shallow firn core site in East Antarctica, are connected to the atmospheric synoptic conditions that force precipitation events at site. Provenance and dynamic conditions that force precipitation events in eastern Antarctica were analyzed with data from European Centre Medium Range Weather Forecast for the period from 1980 to 2000. On an annual basis, Model data from ECMWF ERA reanalysis seem to well reproduce accumulation values trend. The analysis showed that Indian ocean represent the main moisture (78% of the total precipitation) path toward the site during winter season, but, South-West Pacific area represents an important secondary air mass path transport especially during summer season. The 500 hPa Geopotential anomaly field show a dipole pattern over Ross Sea/Wilkes Land area with increase (decrease) height anomaly over Ross Sea during year with high (low) accumulation related to atmospheric blocking events developing in the Western Pacific-Eastern Indian Ocean at higher latitudes (60-70°S) than normal. Intermittent blocking-anticyclone events in the Southern Ocean have caused significant precipitation events along the coast and slope of the Antactic Ice Sheet by conveying warm and moist deep air masses into the continental interior. The formation of the blocking ridge is associated with the wave activity propagation of quasi-stationary Rossby waves from the lower latitudes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Climate model simulations of ENSO-SAM teleconnections to Antarctica

Forename: Aaron Surname: Wilson

Authors: Wilson, Aaron; Bromwich, David; Hines, Keith;

Presentation Allocated: Oral

abstract: The observed El Niño-Southern Oscillation (ENSO) teleconnection to Antarctica has been shown to be modulated by the phase of the Southern Annular Mode (SAM). Observations reveal that when ENSO anomalies are "in-phase", that is the Southern Oscillation Index (SOI) and the SAM index have the same sign (La Niña/SAM+, El Niño/SAM-), the ENSO teleconnection to Antarctic latitudes is robust and enhanced. In contrast, when ENSO and SAM are out-of-phase, the teleconnection between the two is weakened. This ENSO-SAM relationship has been demonstrated to vary on decadal time scales as well, possibly related to decadal trends in SAM intensity. Global numerical simulations using the National Center for Atmospheric Research Community Atmosphere Model (CAM4) are shown to capture important features of the observed teleconnection. CAM4 contains convective parameterization modifications that improve the simulation of intraseasonal variability, the related Madden-Julian Oscillation and ENSO teleconnections. Similar to the observed pattern, CAM4 simulates a robust teleconnection with expected ENSO-forced anomalies extending southward and eastward across the Pacific Basin towards the Drake Passage for the in-phase cases. The teleconnection pattern is weaker or less well-defined for the out-of-phase cases. Two different strategies are used to present the in-phase and out-of-phase cases. First, strong SAM or weak SAM cases are encouraged by gentle nudging of the zonal-average circumpolar flow around Antarctica in so-called "Fast SAM" and "Slow SAM" anomaly experiments simulating 1979-2005 with time-varying sea surface temperature, ozone, and carbon dioxide. Second, 15-year simulations with constant boundary conditions representing strong and weak El Niño and La Niña cases from the 1980s and 1990s are chosen to investigate the variability of the SAM modulation of ENSO. Both sets of anomaly experiments are compared to appropriate control simulations in order to detail the physical mechanisms responsible for the ENSO-SAM teleconnection.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Climatological links between the southern annular mode and South America

Forename: Francisco Surname: Aquino

Authors: Aquino, Francisco; Ribeiro Viana, Denilson; Simões, Jefferson; Setzer, Alberto; Carpenedo, Camila;

Presentation Allocated: Oral

abstract: Surface air temperature increases of up to about 3°C in the last 50 years have been recorded in the western coast of the Antarctic Peninsula (AP). Following world-wide tendencies, but to a much smaller extent, the temperatures in continental South America have also increased in the same period. Southern Brazil has shown an increase of 0.5°C for the same half century, amounting to almost 0.3°C, just in the last 30 years. Most studies have focused on global and hemispherical atmospheric circulation patterns and indices, which are averaged over seasons and years, during long-term periods to explain the temperature variations in the AP. In contrast, this work demonstrates that an important regional context, in the scale of months, can have marked effects on the temperatures of both the AP and southeastern South America, more specially, over the southernmost state of Brazil: Rio Grande do Sul (RS). Employing mean monthly 2 m temperature, mean sea level pressure, zonal and meridional wind at 10 m, geopotential, zonal and meridional winds at 850 and 500 hPa of ERA-Interim reanalysis data for the period of 1979-2010 from ECMWF; monthly Southern Hemisphere annular mode (SAM) index from Nan and Li, 2003. We show that cool spells in southeastern South America result from the outflow of Weddell Sea surface air and that increases 10°C inflow from South America are common in the AP. The climatic interactions between sub-Antarctic latitudes and southern South America occur with the lower troposphere air mass exchange, resulting in variations of a few degrees in monthly average air temperatures in both regions, especially in the summer and winter months in RS. Therefore, in addition to a regional warming, temperature changes and variability in these regions can also result from variations in the advection and circulation, coming from thousands of kilometers away induced by SAM.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Connections Between Extratropical Climatic Change and the Tropical-Pacific

Forename: Graham Surname: Simpkins

Authors: Simpkins, Graham; Ciasto, Laura; McGregor, Shayne; England, Matthew;

Presentation Allocated: Poster

abstract: There has recently been an upsurge in the literature attributing contemporary changes in the Antarctic to the tropical-Pacific. Whilst on interannual timescales this relationship is robust, the degree to which trends in the Antarctic climate are related to lower frequency changes in the tropical-Pacific is a matter of contention, largely given the sensitivity of results to the choice of tropical index. Using both observational and modelling results, the authors examine the degree to which trends in the southern hemisphere atmospheric circulation, and thus the consequent impacts on Antarctic climate, can be related to tropical-Pacific variability. Preliminary results suggest that the canonical form of the El Niño-Southern Oscillation (i.e. eastern Pacific variability) is unlikely to have played a dominant role in producing the observed contemporary changes to the southern hemisphere extratropics. Contrastingly, early results indicate that the western tropical-Pacific, perhaps as a result of the substantial SST warming observed there, may be a pivotal region needed to explain the pattern of extratropical change over recent decades.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Current regional climate variations in the Antarctic Peninsula

Forename: Vazira Surname: Martazinova

Authors: Martazinova, Vazira; Tymofeiev, Vladyslav;

Presentation Allocated: Poster

abstract: Antarctic Peninsula (AP) is known to be a region of significant climate variability including low-level warming, recession of glaciers, changes in sea-ice and other components of environment. Regional climate is largely related to global changes however Variety of local climates' response to regional warming is found due to topography, sea-ice. An episode of pronounced warming in the lower troposphere in the late XX century was followed a decade of nearly-stable near-surface air temperatures, although they remain much above the climatic norms especially on western coast stations. Rate of warming has decreased during the Last decade (2001-2010) and Individual stations showed transition to cooling in monthly SAT. Signs of new climate shift are found making difficulties in the interpretation of future climate projections. Methods of statistical classification are applied to identify main synoptic patterns in the atmospheric circulation (AC). It is shown that the regional warming can be explained by the decadal transformation in the AC. Characteristics and frequency of each important synoptic-scale system are described, including typical positions and decadal shifts. High sensitivity of AP weather to large-scale circulation patterns and their regional modifications are shown. Role of Pacific and South Atlantic oscillations is shown in the regional climate. It is also shown that well-known climatic indices like SAM can explain only general variability; Importance of regional indexes is justified. Interdecadal changes in circumpolar vortex (CPV) are shown as well as large coupling between troposphere and stratosphere. Circumpolar flows (westerlies) dominating through the upper tropospheric levels are intensified and associated with increasing thermal latitudinal gradient and with the reduction in the total ozone in CPV area. Role of Earth rotation in CPV intensification is also discussed. Latest decade showed some deceleration in westerlies along with asymmetry in the upper-level air temperature field across Antarctic sector, causing seasonal asymmetry in CPV and ozone hole. Current climate variability in the AP region is presented in comparison to previous decades along with responsible mechanisms in the atmospheric circulation. Changes in the low level AC, weakening westerlies, stabilization of both the surface warming and ozone hole intensity indicate the single-focused changes and may show Transition to some new climate regime.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Decadal and multi-decadal temperature variability of Bransfield Strait Bottom Water from analysis of a deepwater coral proxy

Forename: Ronald Surname: Thresher

Authors: Thresher, Ronald; Rintoul, Stephen;

Presentation Allocated: Oral

abstract: Analysis of sparse hydrographic data indicates AABW has warmed and freshened over the three decades of instrumental records. However, the significance of these trends are difficult to assess in the absence of long-term records for the Southern Ocean in general, and for AABW in particular. To begin to fill this gap, we reconstructed temperature variability over the last two centuries for Bransfield Strait Bottom Water (BSBW) using as a proxy Mg/Ca ratios in the calcite skeleton of a deep-water bamboo coral (Isididae; Gorgonacea), K22, live-collected in 1964 from between 2119 and 2592 m in the eastern basin of Bransfield Strait (61° 57" S; 55° 53" W). Radiocarbon analysis indicated the specimen was about 227 (\pm 42) years old, which is consistent with the ages of other bamboo corals and apparently corroborated by correlations between the temperature proxy and climate records, discussed below. Mg/Ca ratios in K22 varied quasi-periodically throughout the coral's lifetime, with an amplitude of about 2 mmol/mol and a dominant period of 10-12 years, were cyclo-stationary from 1750 to about 1865-70 (trend in Mg/Ca ratios over time, $F_{1,302} = 0.26$, $p = 0.61$), and thereafter declined until the coral's collection ($F_{1,278} = 72.2$, $p < 0.0001$). Three different methods used to calibrate the relationship between temperature and Mg/Ca ratios in bamboo corals all indicate a similar slope for the functional regression, averaging 0.045°C/(mmol/mol). This implies a decline in BSBW temperature since 1867 of about 0.23°C on which is imposed 10-12 year quasi-periodic variability that spans about 0.09°C. Spectral analysis also suggests a weak peak at EN-SO frequencies and possibly at a period of 30-40 years. The mechanisms underpinning this variability are uncertain, but it correlates with reconstructed sea ice extent at multi-decadal time scales and with the Southern Annual Mode at decadal time scales, suggesting links with regional climate dynamics and a possible regime change about 1850-70. The century-long cooling trend suggested by the coral contrasts with indications of recent warming of AABW, and could imply significant changes in the mechanisms and rate of formation, and global biogeochemical role of AABW over the last two centuries.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Decadal Variability in the Southern Hemisphere

Forename: Xiaojun Surname: Yuan

Authors: Yuan, Xiaojun; Yonekura, Emmi;

Presentation Allocated: Keynote 20 mins

abstract: This study reveals that a quasi-decadal variability exists in the climate system of southern high latitudes, particularly in the Southern Annular Mode (SAM) and subpolar to mid latitudes sea surface temperature (SST), based on in-situ observations, reanalysis data, and the 20th Century runs of IPCC AR4 coupled climate models. Spectral analysis reveals that a statistically significant variability with periods of 8-16 years appears in the SAM indices based on about 50 years of reanalysis data and observed SST. Observations of air temperature and sea level pressure from weather stations confirm that the decadal variability is more evident in the mid-latitudes than over Antarctica. Cross-spectral analysis indicates that the SAM index is related to the SST in the subpolar seas of Antarctica and SST gradient at mid-high latitudes at this decadal frequency band. The SAM indices from 20th century runs (longer than 100 years) of eighteen IPCC coupled climate models are also examined for the decadal variability. Sixteen out of the eighteen models exhibit decadal variability in SAM that is significant at least at the 90% of confidence level while eight are significant at the 95% confidence level. Seven models produce significant co-variability between SAM and subpolar SST at this quasi-decadal frequency.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Decadal Variations of the Large-Scale Influences on the Amundsen/Bellingshausen Seas Low and Antarctic Peninsula Climate

Forename: Kyle Surname: Clem

Authors: Clem, Kyle; Fogt, Ryan;

Presentation Allocated: Oral

abstract: The Amundsen-Bellingshausen Seas Low (ABSL), a semi-permanent low pressure in the high latitude South Pacific, may be related to the regional warming across West Antarctica and the Antarctic Peninsula. As a means to understanding this connection, much more knowledge is needed on the variations of the ABSL, especially since this pressure system resides in one of the poorest meteorologically sampled regions globally. This research examines large-scale climate influences on the position (latitude, longitude) and magnitude (central pressure) of the ABSL, and their connections to the regional Antarctic climate on seasonal and decadal timescales. Using data from three global atmospheric reanalyses, we find strong relationships between the El Niño Southern Oscillation (ENSO), Southern Annular Mode (SAM), and the intensity of the ABSL. Interestingly, the relationship varies by season and decade, and with the varying phases of ENSO and SAM. Furthermore, the ENSO-SAM relationship and its decadal variability govern how ENSO and SAM separately influence the ABSL intensity and the Antarctic Peninsula climate. For example, only in winter is there a clear connection between the ENSO-SAM relationship and the SAM influence on the ABSL magnitude, and only during spring do we see the ENSO-SAM relationship control how ENSO influences the ABSL intensity. All of these connections show significant decadal variability. Similar relationships exist between ENSO's influence on the mean sea level pressure, temperature, wind speed and wind direction across the Antarctic Peninsula based on the ENSO-SAM correlation. Surprisingly, little connection is found between the ABSL position and magnitude and the resulting Antarctic Peninsula climate variations. The results suggest that the ENSO-SAM relationship governs much of the climate variability in the region, with marked decadal variations during the last 30 years.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Estimating the Influence of the Stratospheric Processes on the Antarctic Atmospheric Energy Budget

Forename: Karen Surname: Smith

Authors: Smith, Karen; Previdi, Michael; Polvani, Lorenzo;

Presentation Allocated: Oral

abstract: We discuss ongoing work to construct an atmospheric energy budget for the Southern Hemisphere polar region based on observations from the post-1979 period. Satellite measurements and atmospheric reanalyses are synthesized in order to describe the long-term means and variability of radiative, latent and sensible heating, as well as the atmospheric transport of moist static energy into the polar region. We compare estimates of the atmospheric transport of energy determined by direct calculation and as a budget residual. The largest difference occurs in the summer season, when the estimates can vary by over 30%. Decadal trends in energy budget components linked to stratospheric ozone depletion and increases in well-mixed greenhouse gases (GHG) are identified. Trends occur primarily in the summer season when changes in the Southern Hemisphere atmospheric circulation associated with ozone depletion are most pronounced. Comparisons are made between observed trends and general circulation model simulations with individually prescribed transient ozone and GHG forcings. Shorter term interannual variations in the energy budget associated with the El Niño-Southern Oscillation and Southern Annular Mode (SAM) are also examined. We find that large magnitude SAM events such as the sudden stratospheric warming (SSW) of 2002 can have a significant effect on the polar atmospheric energy budget. Similarly, robust differences in the Northern Hemisphere polar energy budget are found when winters with and without SSWs are compared.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Evidences of changes in the Antarctic Peninsula derived from Chilean Weather Stations

Forename: Jorge Surname: Carrasco

Authors: Carrasco, Jorge;

Presentation Allocated: Oral

abstract: It is well known that the Antarctic Peninsula is the region where the increased air temperature is the highest registered on the planet during the last few decades. In contrast, the rest of the Antarctic continent does not show the same rate of warming but rather a slight cooling. However, an analysis of the mid-tropospheric air (above the inversion layer) the whole Antarctica shows an increase in temperature. This behavior has been related with the southward displacement of the westerly winds which allows more relatively warm air to be advected towards the western side of the Antarctic Peninsula. Results from the Chilean stations data show the same overall upward trend in air temperature for the 1970-2010 period, but this warming is driven by the minimum air temperature rather than maximum air temperature. In fact the diurnal temperature range (daily temperature oscillation) shows a decrease over the period. However, one intriguing result is that the air temperature reveals a decrease during the last decade. The same behavior is also observed at Faraday/Vernadsky station but not at Rothera. An indication, that this change is only taking place in the northern tip of the Antarctic Peninsula. Analysis of the foggy days at Frei station reveals an increase in the number of days for which there was a fog event registered in the datalog. Fog usually forms around the time when the minimum air temperature occurs and the water vapor content reaches the saturation point. Fog can also be seen as a proxy for presence of low cloud in the area. Therefore, the upward trend in the minimum temperature can be associated with an increase in cloudy nights. Precipitation results for the 1970-2010 period, show a large interannual variability with an overall positive, however, a filter analysis reveals an upward trend from 1970 to around 1990, then a decline period until around 2000 and then an increase hereafter. Evaluating the daily precipitation type (snow days and rain days), it is found a decrease in the number of snow days and an increase in the number of rain days. The overall increment in precipitation and the increase in liquid precipitation concur with a warmer environment in the Antarctic Peninsula region. Although, results of the last decade still need further analysis.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Export pathways between the Weddell Sea and the Scotia Sea from surface drifter data

Forename: Andrew Surname: Thompson

Authors: Thompson, Andrew; Youngs, Madeleine; Heywood, Karen;

Presentation Allocated: Oral

abstract: The northwestern Weddell Sea is a critical gateway between the unique water masses formed over the continental shelf and slope in the southern Weddell Sea and the greater Southern Ocean. In 2007 40 Lagrangian surface drifters were released along WOCE section SR04 as part of the ADELIE research cruise. These showed for the first time the impact of topography in generating intricate transport pathways that are likely routes for krill, nutrients and other tracers between the Antarctic Peninsula and large bloom sites around South Georgia Island. Variability associated with these strong frontal currents is poorly resolved because of the difficulty in sustaining long-term monitoring programs in this remote region. In January 2012, a second release of 40 surface drifters was carried out in the northwestern Weddell Sea as part of the GENTOO research cruise. This data set will provide the first evidence of how transport pathways vary inter-annually. While in the 2007 experiment drifters largely followed contours of f/h (Coriolis frequency/depth), early results from the latest release suggest that this constraint was considerably weaker in 2012. Immediately following deployment, a large number of drifters moved across isobaths over the steep Joinville Ridge. Conditions were very different between the two studies with sea ice extent much greater in 2012. Furthermore, during the GENTOO deployment the drifters were released behind a large 40 km long iceberg, C19C, being advected along the Antarctic Slope Front (ASF). We will show evidence from the drifter data, complemented by hydrographic observations of the ASF obtained from gliders, that the position and strength of the ASF varied significantly between the two research cruises. We also suggest that large icebergs caught in strong frontal currents in this region may provide a means for rapid cross-front transport.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: High resolution sedimentary records of Maxwell Bay, South Shetland Islands, West Antarctica: A Chronicle of the past 2000 years

Forename: Nina Surname: Wittenberg

Authors: Wittenberg, Nina; Hass, H. Christian; Kuhn, Gerhard;

Presentation Allocated: Oral

abstract: Since 50 years the Antarctic Peninsula experiences an average temperature increase stronger than the global warming trend. As a result, the glaciers are retreating and ice shelves shrink. Our study is a subproject within IMCOAST, a large interdisciplinary research project, dealing with the impact of climate induced glacial melting on marine coastal systems in the Western Antarctic Peninsula region. The South Shetland Islands form the northernmost part of Antarctica. They are separated from the Antarctic Peninsula through the Bransfield Strait. King George Island is the largest of the South Shetland Islands. The study area is Maxwell Bay and its tributary fjords located south of King George Island. We measured grain-size distributions of five radiocarbon-dated marine sediment cores that cover approximately the last 2000 years. The cores were recovered from high-accumulation areas along a seismic transect in Maxwell Bay. The results strongly suggest climate-controlled sedimentation in the area. We identified fluctuations in sediment deposition and grain-size distributions related to minor glacial retreats and advances such as the Medieval Warm Period and the Little Ice Age. The cores show two distinct grain-size compositions that are related to different climate phases. The warmer climate phases appear to be characterized by finer sediments that likely have a meltwater origin. Colder climate phases are depleted in finer sediments, which is most likely the result of reduce supply of turbid meltwaters. High-resolution sub-bottom profiles from the area provide information on the deposited facies and allow the interconnection between the different sediment cores. The seismic data further reveal that well-layered sediments only occur below 200 m, while the acoustic penetration is rather low in Potter Cove, a tributary fjord to Maxwell Bay.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Holocene paleoproductivity change at Site U1357 (IODP Exp 318), Adélie Basin, Wilkes Land, Antarctica

Forename: Jihun Surname: Kim

Authors: Kim, Jihun; Khim, Boo-Keun; Dunbar, Robert;

Presentation Allocated: Poster

abstract: Core U1357A (about 187-m thick) was drilled in the Adélie Basin of the Wilkes Land (East Antarctica) during IODP Expedition 318. Core U1357A consists of laminated diatom ooze sediments. AMS C-14 dates show the high sedimentation rate of about 2 cm/yr. Opal contents of core U1357A were measured at about 10-cm intervals using the wet-alkaline sequential extraction method. Up to now, the biogenic opal data were obtained from sections 1H to 5H (about 50 m thick) covering about 3000 years. Comparison between the 5-points mean of opal data during the late Holocene and the $\delta^{18}O$ of Taylor Dome ice core shows that the variation pattern of both records is similar. The high opal contents indicating the increase of paleoproductivity correspond to the high $\delta^{18}O$ period reflecting the warm climatic condition. Thus, at the first approximation, the opal contents of core U1357A can record the Holocene climatic change in the East Antarctic.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Ice-shelf ripples as a record of seasonal basal melting near the grounding line of Totten Glacier

Forename: Adam Surname: Campbell

Authors: Campbell, Adam; Waddington, Edwin; Smith, Ben;

Presentation Allocated: Poster

abstract: The disintegration of Antarctic ice shelves can trigger rapid changes in upstream glaciers and ice streams, with the potential for rapid sea-level rise. One mechanism for ice-shelf destabilization, of which little is known, is concentrated seasonal melting at the base of the ice shelf near the grounding line. There is evidence that ripples observed on the surface of ice shelves, near their grounding lines, may provide a record of concentrated seasonal basal melting. However this link has been established at only a few locations. We test whether ripples are indicators of seasonal basal melt by comparing the spacing between ripples against the annual displacement of ice across the grounding line of Totten Glacier, using MODIS and Landsat satellite imagery. Ripples formed by concentrated seasonal basal melting near the grounding line could record the amount of seasonal basal melt, the length of the melt season, and a history of transient flow conditions on the ice shelf or upstream glaciers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Influence of the tropics on the Southern Annular Mode

Forename: qinghua Surname: ding

Authors: ding, qinghua; steig, eric; Battisti, David; wallace, john;

Presentation Allocated: Oral

abstract: Perturbations in the Southern Annular Mode (SAM) are shown to be significantly correlated with SST anomalies in the central tropical Pacific during austral winter, and SST anomalies in the eastern tropical Pacific during austral summer. The SAM signature in the Pacific sector resembles a tropically-forced Rossby wave train, the so-called Pacific–South American pattern, while the signature in the Indian Ocean sector is a zonally elongated meridional dipole. Thus, the SAM contains strong zonally asymmetric variability and tends to behave differently in the Eastern and Western Hemispheres, with internal dynamics prevailing in the Indian Ocean sector and the forced response to tropical SST anomalies exerting a strong influence in the Pacific sector. The tropically-forced component of the SAM in the Pacific Sector is related to a geographically fixed active Rossby wave source to the east of Australia within the core of the subtropical jet. In addition to the well-documented positive trend in summer, the SAM also exhibits a significant negative wintertime trend since 1979, characterized by prominent geopotential height increases over the high latitudes. In both seasons, SAM trends are closely linked to long term trends in tropical Pacific SST that are independent of the canonical eastern Pacific ENSO variability. Although the SAM is an intrinsic pattern of high-latitude variability, the SAM index reflects the superposition of both high latitude and tropically forced variability.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Intercomparison of tropical-to-high latitude teleconnection effects on Antarctic precipitation in several atmospheric re-analyses at intraseasonal and longer timescales

Forename: Daria Surname: Halkides

Authors: Halkides, Daria; Schlegel, Nicole-Jeanne; Larour, Eric;

Presentation Allocated: Poster

abstract: Increasing attention is being given to effects of tropical variability on high latitude climate via atmospheric bridges. Many observed relationships are not stable, and some inconsistencies exist in the literature. For instance, studies of intraseasonal variability do not all agree on the role of the Madden Julian Oscillation (MJO) in the southern hemisphere. We will present preliminary results from an intercomparison of several existing atmospheric reanalysis products at key locations over the Antarctic ice sheet. Focus will be on representations in the different re-analyses of total precipitation, accumulated snow, surface wind and pressure patterns linked to the MJO, ENSO, the Indian Ocean Dipole, and (when product lengths allow) decadal variability of these modes. The immediate goal is to identify differences between re-analysis products in how teleconnections patterns are represented, and how they may affect ice sheet surface mass balances (SMB). This work is part of a broader study, in progress, geared at improving simulation of natural variability of ice sheet SMB in a coupled ice-atmosphere system. The later, under development, involves the NASA-Jet Propulsion Laboratory's Ice Sheet System Model (ISSM) and the Goddard Earth Observing System Model 5 (GEOS-5).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Interdecadal non-linearities in the relationships between the tropical Pacific the west Antarctic regions

Forename: Ailie Surname: Gallant

Authors: Gallant, Ailie; Steig, Eric;

Presentation Allocated: Poster

abstract: Variations in the climate of the west Antarctic region, and nearby Southern Ocean, are partially linked to the state of the atmosphere and ocean in the equatorial Pacific on interannual time scales. There is also evidence of a similar relationship on interdecadal time scales; however, we show that this association is non-linear. This is, the strength and spatial structure of the west Antarctic and nearby Southern Ocean climate anomalies during the warm and cool decadal-scale phases of the tropical Pacific Ocean are different. The non-linearities are seasonally dependent and are most evident during the austral winter and spring. During the decadal-scale warm phase of the tropical Pacific Ocean, geopotential height and sea-surface temperature anomalies are often stronger and encompass a larger area compared to a decadal-scale cool phase. There are also statistically significant differences in the strengths of the relationships between interannual climate variations at the two locations. These differences provide evidence that the relationship between El Niño–Southern Oscillation and the west Antarctic climate depends on the interdecadal state of the tropical Pacific Ocean. We demonstrate that during the warm decadal-scale phase of the tropical Pacific Ocean, there is a greater likelihood that the location of the interannual maximum sea-surface temperature anomalies is west of the international dateline. While during the cool decadal-scale phase, the maximum anomalies are more likely to be located east of the dateline. Convection centers, approximated from outgoing long-wave radiation anomalies, show similar interdecadal shifts. Previous work has shown that west Antarctic climate shows a stronger response to tropical forcing stemming from the central and west Pacific Ocean compared to the east Pacific. A warmer decadal-scale state of the tropical Pacific is associated with more central and west Pacific warming events, probably leading to the stronger climate anomalies in west Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Interpreting field observation to assess the causes for glacier retreat on Kerguelen archipelago

Forename: Deborah Surname: Verfaillie

Authors: Verfaillie, Deborah; Favier, Vincent; Jomelli, Vincent; Brunstein, Daniel; Gilbert, Adrien;

Presentation Allocated: Oral

abstract: Understanding the mechanisms of the on-going climate warming is one of the major scientific issues for the XXI century. The evolution of ice mass in the world is one of the main natural indicators selected by the IPCC to scale climate variability and trends of the last and present centuries. The sub-polar areas, are key in the global atmospheric circulation. Due to the high amount of humidity transport, formation of large ice caps is possible despite the low elevation of mountain ridges. Yet, despite a dramatic ice retreat observed, only few glaciological field data exists within the whole latitude range. Indeed, main studies in the area were performed from satellite imagery ; and surface energy and mass balance programs are too scarce to clearly depict which were the main changes of climate during the last century. Located in the Southern Indian Ocean, at low altitude and on islands, the glaciers of Kerguelen archipelago are particularly sensitive to oceanic and atmospheric variations. In pace with important changes in climatic setting during the 20th Century, the Cook ice cap showed a huge and extremely quick retreat, losing 20% of its surface during the last 40 years. Relating directly this acceleration with the important fluctuations of temperature and precipitation is attractive. However, due to the lack of knowledge on the local climate - glacier relationship and ice dynamics in the area, it is currently impossible to depict whether the recent acceleration was due to climatic variations or to a dynamic instability related to complex calving and ice motion processes. As an exploratory step for long term observations on Kerguelen Archipelago, a meteorological, glaciological and hydrological network was set up on and around Ampere Glacier in 2010 to detect, monitor and understand climate and mass balance variability and change in the glacial environment of Cook icecap. In this area, the presence of previous short term mass balance and energy balance studies on Ampere Glacier from 1970 to 1974 (e.g. Vallon et al., 1977) are particularly interesting in order to get comparison data with a 40 years difference. Here, we present our first results on surface mass and energy budgets, and compare our results with those from Vallon et al. (1977) showing that climatic conditions strongly changed during the last 40 years, leading to significantly distinct distribution of surface mass balance value at the glacier scale.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Key role of bromine and first-year sea ice in surface ozone depletion and mercury deposition in the Antarctic

Forename: Karin Surname: Kreher

Authors: Kreher, Karin; Hay, Timothy; Johnston, Paul; Schofield, Robyn;

Presentation Allocated: Poster

abstract: Sudden increases in atmospheric bromine concentrations - so called "bromine explosion" events - are periodically observed at Ross Island in the lowermost layers just above the sea ice. These high levels of bromine have a distinct impact on the atmospheric chemistry, with one of the most obvious effects being the depletion of ozone often close to the surface but sometimes as high as 3-4 km in the atmosphere. Although these events are naturally occurring phenomena, areas covered by strongly elevated bromine levels may have been expanding during the last 2 decades, most likely due to anthropogenic influences on climate. First-year sea ice is seen to be one of the most important pre-requisites for a pronounced bromine release into the atmosphere and changes in the extent of first-year sea ice are expected to impact on the extension and severity of bromine explosion events. Bromine availability in turn also affects the deposition of mercury, a bio-toxin, from the atmosphere to the surface. Therefore, climate-induced changes in sea ice are likely to affect mercury levels in Antarctic ecosystems. The measurements and findings from 2 Antarctic field campaigns supporting this theory are presented here. The observations were made with a mobile measurement platform situated on or near sea ice at Ross Island and are complemented with snow samples to determine the mercury levels and long-term measurements of bromine oxide and surface ozone made at the Arrival Heights laboratory on Ross Island.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Long term variations of the Ice Shelf Water in the Southern Weddell Sea

Forename: Svein Surname: Osterhus

Authors: Osterhus, Svein;

Presentation Allocated: Oral

abstract: Antarctic Bottom Water (AABW) occupies large portions of the deep ocean and is the densest water mass in the world because of its cold temperature. The source water of AABW originating from the Weddell Sea is the cold, low-salinity Weddell Sea Bottom Water (WSBW). The low temperature and salinity of the WSBW is because of the contribution of the Ice Shelf Water (ISW) that got its characteristics by sea ice formation over the continental shelf of the southwestern Weddell Sea and the circulation underneath the Filchner-Ronne Ice Shelf. Water circulating in the ice shelf cavity is cooled by the contact with the ice due to heat conduction through the ice and by melting of the ice shelf itself. Any changes to the ISW properties might therefore result in changes of the AABW, and an increased understanding of variability within the ISW may help us understand the sensitivity of the AABW in the deep ocean. A great effort has been put into monitoring the ISW plume over a long time period in order to gain knowledge of its role in the climate system. This study is focusing on long-term variations of the ISW formed in the southern Weddell Sea and to investigate its sensitivity to external forcing. The main data being used is mooring data from a long-term monitoring site, named S2, located at the Filchner Sill. The first mooring was deployed in 1977, then again in 1985, 1987, 2003, 2009 and 2010-ongoing), all containing at least one year of data. Seasonal and interannual variations are seen from the data set, but no long-term trend is detected.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Multi-decadal warming and shoaling of Antarctic Intermediate Water

Forename: Sunke Surname: Schmidtko

Authors: Schmidtko, Sunke; Johnson, Gregory;

Presentation Allocated: Oral

abstract: Antarctic Intermediate Water (AAIW) is a dominant Southern Hemisphere water mass that spreads from just north of the Antarctic Circumpolar Current (ACC) to at least 20°S in all oceans. This study uses an isopycnal climatology constructed from Argo Conductivity-Temperature-Depth (CTD) profile data to define the current state of the AAIW salinity minimum (its core) and thence compute AAIW core pressure, potential temperature, salinity, and potential density anomalies since the mid 1970s from shipbased CTD profiles. The results are used to calculate maps of temporal property trends at the AAIW core, where statistically significant strong circumpolar shoaling (30 – 40 dbar /decade), warming (0.10 – 0.16°C /decade), and density reductions (up to -0.03 kg /qm /decade) are found. These trends are strongest just north of the ACC in the southeast Pacific and Atlantic oceans and decrease equatorward. Salinity trends are generally small, with their sign varying regionally. Bottle data are used to extend the AAIW core potential temperature anomaly analysis back to the mid 1920s, suggesting a zonally averaged decadal variability of order 0.2°C. The modern warm AAIW core conditions appear unprecedented in the historical record: Biennially and zonally binned median AAIW core potential temperatures in the first half of the 20th Century are 0.2 – 1°C colder than modern values, with even most of their third quartiles colder than modern conditions. Zonally averaged sea surface temperature anomalies around the AAIW formation region and a Southern Annular Mode index are used to put the AAIW core property trends into context.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Multi-proxy ice core evidence for sea ice variability along the western margin of the Ross Sea, Antarctica, 1882-2006

Forename: Kate Surname: Sinclair

Authors: Sinclair, Kate; Bertler, Nancy; Trompetter, William;

Presentation Allocated: Keynote 20 mins

abstract: Seasonal sea ice extent has increased significantly in the Ross Sea since 1995, creating a dipole between the Ross Sea and the Amundsen and Bellinghousen Sea Coasts, which have experienced significant sea ice loss. The reasons for the spatial differences in sea ice anomalies is thought to be primarily related to the phase of the Southern Annular Mode (SAM), the primary climate driver in this sector of Antarctica, and the complex interactions of SAM with the El Niño-Southern Oscillation (ENSO). A positive phase of SAM leads to deeper low pressure anomalies in the Amundsen Sea; cooler and stronger southerly winds in the western Ross Sea, and wind-driven sea ice advance, particularly when it is reinforced by La Nina conditions. An ice core from the Whitehall Glacier (WHG), at the northwest margin of the Ross Sea, provides a highly-resolved record of climate and atmospheric circulation over the time period from 1882 until 2006. Stable isotopes have been measured along the full length of the core, and trace elements and major ions have been analysed for the time period from 1979 onwards. Deuterium excess in the WHG record has mean values of 9.5 per mil from 1979 until 1994 and 5.2 per mil after 1995. This ~5 per mil shift is concurrent with a change from negative to positive sea ice extent anomalies in the Ross Sea and a concurrent decrease in marine trace elements (Na, Mg, V, Rb). We argue that increased southerly winds since 1995 (related to a more positive SAM) have increased the area of the Ross Sea and Terra Nova Bay polynas resulting in increased sea ice extent. Because sea surface temperatures (SST) are very low over these polynas, particularly in the austral autumn and winter, the deuterium excess signal at the Whitehall Glacier is highly sensitive to the amount of local moisture input and the seasonality of this moisture contribution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Spatial and temporal variability of snow accumulation rate and air transports at East Antarctic ice sheet in 1993-2010

Forename: Kazue Surname: Suzuki

Authors: Suzuki, Kazue; Motoyama, Hideaki; Yamanouchi, Takashi; Kawamura, Kenji; Higuchi, Tomoyuki;

Presentation Allocated: Oral

abstract: From the effects by the steep shapes and surrounded by the ocean, Antarctica has a specific spatial distribution of snowfall and humidity. The coastal area has many snowfall and blizzard, whereas the interior area has a few heavy snow events but there are some influences by the diamond dust every day. The high altitudes and low temperature make the less humidity around the interior, the annual accumulation rate is very low. It is important to understand the spatial distribution of the accumulation rate and their interannual variations to estimate the mass balance of the ice sheet for predicting the future climate change, e.g. sea level rise. □ Snow stakes along the traverse routes have been observed for long term monitoring program 'the variation of ice sheet surface mass balance' from the 1960's by the Japanese Antarctic Research Expedition in Shirase glacier drainage basin, East Antarctica. During the traverse route between coastal S16 point (69 02'S, 40 03'E, 580m a.s.l.) to inland Dome Fuji (77 22'S, 39 42'E, 3,810m a.s.l.), the snow stake observations every 2 km have been carried out from 1993. Comparing the annual accumulation rates with AAO-indices (SAM), annual accumulation rate and AAO-index showed the positive correlation. □ We attempted to express the moisture transport using trajectory analysis by assumed that air parcels come from the outside of Antarctica would have rich moisture than the air parcels that traveled around the ice sheet. Air transports are calculated using the NITRAM trajectory model (Tomikawa and Sato, 2005) and ERA-Interim meteorological data set in 1993-2010. The time duration is 5 days from the lifecycle of synoptic disturbances and we suppose the origin of air parcel is the point of trajectory at 5 days ago in this study. The starting points are distributed from 69°S to 78°S per 1 degree along the 39°E and its altitude is 1,300m above the surface. □ The annual (averaged from 69°S to 78°S along 39°E) percentages of air parcels which came from outside of Antarctica have a positive correlation with the annual averaged accumulation deviations in 2000's. However, in the 1990's, there is no significant phase as same as its relationship with AAO-indices. We would indicate the decadal change of air parcel and accumulation rate in detail.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Teleconnections from tropics , Does IOD have a role in sea-ice distribution of Antarctica?

Forename: Nuncio Surname: Murukesh

Authors: Murukesh, Nuncio; YUan, Xiaojun;

Presentation Allocated: Oral

abstract: The study explores the influence of Indian Ocean Dipole(IOD) on southern hemisphere sea-ice. We analyse this by conducting a coupled Singular Value Decomposition of sea-ice concentration anomaly and SST for September- November spanning the time period 1979-2006. The striking feature in the leading mode was the presence of an Indo-Pacific tripole with IOD in the tropical Indian Ocean and ENSO in the Pacific. Teleconnection pattern of the leading mode comprised wave trains from both the Pacific and the Indian Ocean region. Relative importance of IOD in the Pacific is difficult to assess for two reasons, ENSO generates larger anomalies in the eastern Pacific sector and Weddell sea, secondly IOD co-occurs with ENSO. However, in the Indian Ocean Region, south of Australia, IOD correlated positively with 250 hPa geopotential height anomalies that drive warm and moist air southward at about 100E longitude. This is expected to cause a decline in the sea-ice concentration. This did not happen, on the contrary spatial pattern of the leading mode showed positive values. Does this show thermodynamics of warm southward flow is not effective in regulating Indian Ocean sea-ice concentration?. We explore reasons for this in this study.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: TEMPERATURE INTERANNUAL VARIABILITY OVER NORTHERN ANTARCTIC PENINSULA AND SOUTHERN HEMISPHERE LARGE-SCALE CIRCULATION

Forename: Alfredo J Surname: Costa

Authors: Costa, Alfredo J; Agosta, Eduardo A;

Presentation Allocated: Poster

abstract: In the present work the tropospheric circulation in the Southern Hemisphere (SH) associated to anomalously cold (ACS) and anomalously warm summer (AWS) events for the summer season (Dec-Feb), over northernmost Antarctic Peninsula (AP), in the period 1981-2010, is analyzed. The quartile criterion is used to identify the anomalous summers. Additionally, a wave-activity flux for stationary quasi-geostrophic (QG) eddies on a zonally varying basic flow, derived by Takaya and Nakamura (2001), is used as a diagnostic tool to study wave-train propagation. ACSs are characterized by eastward propagation of barotropic quasi-stationary waves (QWSs) across the South Pacific, from a region of anomalous convection near New Zealand. Moreover, positive Sea Surface Temperature (SST) anomalies over the South Pacific during these anomalous summers could reinforce the QSW propagation by favouring positive mean-flow baroclinicity anomalies and the consequent increased transient activity. The eastward propagation reaches southern South America and the AP leading to an anomalous stationary cyclone to the north of the AP. This quasi-stationary cyclone induces anomalous easterlies and negative insolation anomalies favouring the ACS events over northernmost AP. AWSs are characterized by an enhance in barotropic anomalies over Southern South America suggesting circulation anomalies - anticyclonic over the Drake Passage and cyclonic over southern South America - favorable to a blocking of the mean-flow. This is possible related to transient activity blocking, favouring positive insolation anomalies and the consequent AWS events. Moreover, negative SST anomalies over the South Pacific are seen during the AWS events, and also interaction with lower stratosphere could probably be affecting the circulation anomalies since a cold core is observed at those levels. The summer mean conditions over northernmost AP could also be explained by the SH annular mode (SAM)-like pattern throughout the troposphere. ACSs are related with SAM negative phase whereas AWSs with SAM positive phase. The correlation between mean summer temperature over northernmost AP and SAM index is 0.57 ($\alpha < 0.05$).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 2

Title: Validation of atmospheric reanalyses against research aircraft observations in the Antarctic Peninsula region

Forename: Timo Surname: Vihma

Authors: Vihma, Timo; Hartmann, Jörg; Lachlan-Cope, Tom; Lüpkes, Christof; Birnbaum, Gerit; Weiss, Alexandra; Ladkin, Russ; King, John;

Presentation Allocated: Oral

abstract: Atmospheric reanalyses are commonly used to study decadal time-scale variability in the Antarctic and Southern Ocean climate system. In data sparse areas, as the Antarctic, reanalyses are often considered as the best available source of information on the four-dimensional structure of the atmosphere, but the quality of reanalyses is not well known. Although reanalyses have been validated in numerous studies, only a few of them have addresses the Antarctic. In particular, we are not aware of any Antarctic study applying independent (not assimilated into reanalyses) in situ data for the validation of the air temperature, humidity and wind fields in the lower troposphere. In February – March 2010, the British Antarctic Survey (BAS) and Alfred Wegener Institute for Polar and Marine Research (AWI) carried out an aircraft campaign Joint Airborne Study of the Peninsula Region (JASPER) in the Antarctic Peninsula region. The data gathered include vertical profiles of wind, air temperature and humidity (95 profiles measured by BAS and 48 measured by AWI) as well as thousands of kilometres of horizontal profiles of the same quantities. The data were not included in any reanalysis, providing a rare possibility for validation against an independent data set. We validate the following reanalyses: ERA-Interim of the ECMWF, the Japanese Meteorological Agency Climate Data Assimilation System (JCDAS), the NCEP Climate Forecast System Reanalysis (CFSR), and the NASA Modern Era Retrospective-Analysis for Research and Applications (MERRA). We present the validation results separately over sea ice in the Weddell Sea, the open ocean in the Bellingshausen Sea, as well as the Larsen C and Wilkins ice shelves. Weather conditions associated with largest errors in the profiles are identified. We pay particular attention to the temperature and humidity inversions and low-level jets, and evaluate the reasons for and consequences of the errors found.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: A comprehensive look at acidity in ice cores from the East Antarctic Plateau over the last 2000 years

Forename: Daniel Surname: Pasteris

Authors: Pasteris, Daniel; McConnell, Joseph; Anschütz, Helgard; Isaksson, Elisabeth;

Presentation Allocated: Poster

abstract: Ice core acidity is a proxy for acid deposition to the Earth's surface and for the acid content of the atmosphere. It can also affect postdepositional ice core processes such as in situ CO₂ production and the loss of volatile acidic species. Here we present a comprehensive look at acidity in seven ice cores from Dronning Maud Land covering the last 2000 years. The ice cores were collected during the Norwegian-USA scientific traverse during the International Polar Year 2007 – 2009. The measurement was performed with a novel continuous flow analysis (CFA) technique that has provided a degree of accuracy and efficiency not previously achieved in ice core acidity records. Acidity is defined here as the as the hydrogen ion concentration from acids other than dissolved CO₂. The sites range in latitude from 74° S to 82° S, in altitude from 2500 m to 3700 m, and in accumulation rate from 2.6 cm weq/yr to 5.5 cm weq/yr. Records of other major ions (SO₄²⁻, NO₃⁻, Na⁺, Cl⁻, and Ca²⁺) will be examined along with the acidity to quantify their influence on the acidity values.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: A Deglacial Record of Carbon Dioxide from the WAIS Divide Ice Core, Antarctica.

Forename: Shaun Surname: Marcott

Authors: Marcott, Shaun; Brook, Edward; Sowers, Todd; Kalk, Michael;

Presentation Allocated: Oral

abstract: Establishing the role of atmospheric CO₂ during the last deglaciation has important implications for deciphering the mechanisms associated with the transition from glacial to interglacial states. A precise, high-resolution record of atmospheric CO₂ is one essential milestone. Existing Antarctic ice core records have provided insight into both the timing of CO₂ changes and likely sources, but lack the temporal resolution to address some important problems. The WAIS Divide ice core has the potential to produce the highest resolution and most well dated CO₂ record for the last ~60 ka, due to the high accumulation rate at the site (presently 20 cm/yr). This record will be key for understanding the timing and role of CO₂ changes during notable climatic intervals in the past (e.g. Antarctic Cold Reversal, Younger Dryas). Here we present a CO₂ record from WAIS Divide, Antarctica for the period 23,000 – 8,000 years BP. Our initial low pass record (~200 yr resolution) is in general agreement with previous reconstructions of CO₂ during the last 20,000 years, and documents the same general trends at multi-millennial and longer scales. However, several abrupt changes in CO₂ occur within the core that have not been fully documented in other existing ice cores likely due to either the smoothing function for the low accumulation sites or the measurement/sampling precision in others. Several of these changes occur synchronously in both CO₂ and CH₄, which may provide insight into the mechanisms associated with those shifts. Given the small delta-age and excellent chronologic constraints for the WAIS Divide core, the CO₂ record will document variability at the centennial or shorter scale and thus we are currently measuring CO₂ at this resolution over critical transitions in the core (i.e. ACR), which we will also present at the meeting.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: A new high-precision, high-resolution record of the $\delta^{13}\text{C}$ of atmospheric CO_2 from the Taylor Glacier horizontal ice core

Forename: Thomas Surname: Bauska

Authors: Bauska, Thomas; Baggenstos, Daniel; Brook, Edward; Severinghaus, Jeffrey; Petrenko, Vasilii; Mix, Alan; Schaefer, Hinrich; Lee, James;

Presentation Allocated: Oral

abstract: A complete understanding of the mechanisms behind the 80 ppm increase in atmospheric CO_2 during the last deglaciation remains elusive. Changes in the sources and sinks for CO_2 are recorded in the stable isotopic composition of carbon in atmospheric CO_2 ($\delta^{13}\text{C}$ of CO_2), but high-precision measurements from deep Antarctic ice cores have proven difficult to obtain. A new horizontal ice core on the Taylor Glacier in Antarctica allows for the recovery of well-dated, large ice samples spanning the last deglaciation (see Baggenstos, et al, this session). When analyzed with a new ice grater air extraction and dual-inlet mass spectrometry method, this ancient air archive has provided a $\delta^{13}\text{C}$ of CO_2 reconstruction of very high precision (<0.02 per mil) and resolution (50-100 year spacing). Glacial CO_2 (~24-18 kya) was characterized by stable CO_2 concentrations but variable $\delta^{13}\text{C}$ of CO_2 with values averaging around -6.45 per mil (VPDB- CO_2). The Mystery Interval (~17.5-14.5 kya) reveals two distinct modes of variability. An approximately 0.30 per mil depletion accompanied the initial, rapid rise in CO_2 (~2.0 ppm per century). At 16 kya the CO_2 growth rate slowed (~1.0 ppm per century) and atmospheric CO_2 became enriched. A smaller depletion (0.15 per mil), followed by a trend towards enriched values coincided with the resumption of CO_2 growth during the Younger Dryas. Periods of stable CO_2 during the Bolling-Allerod and the early Preboreal were characterized by low variability in $\delta^{13}\text{C}$ with values stabilizing around -6.60 per mil. The varying relationship between CO_2 concentration and isotopic composition suggests that millennial-scale climate-carbon processes played a prominent role in controlling atmospheric CO_2 during the deglaciation. The new high-precision measurements offer the opportunity to determine the source history of CO_2 on the millennial timescale.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Abruptness of climate change in West Antarctica: a 30 ka stable-isotope ice-core record on an annually resolved timescale

Forename: T.J. Surname: Fudge

Authors: Fudge, T.J.; Steig, Eric; Taylor, Kendrick; White, James; Vaughn, Bruce; McGwire, Ken; Neff, Peter; Waddington, Edwin; Conway, Howard; Markle, Brad; Schoeneman, Spruce; Brook, Ed; Sowers, Todd;

Presentation Allocated: Oral

abstract: Drilling of the West Antarctic Ice Sheet (WAIS) Divide ice core has been completed to a depth of 3400 m, approximately 50 meters above the bed. WAIS Divide (79.5°S, 112.1° W) is located approximately 160 km from the location of the well-known Byrd ice core (80°S, 120°W). We present an annually resolved timescale based on electrical measurements; WAIS Divide is the first ice core from Antarctica with annual resolution throughout the glacial-interglacial transition. The annual layer thicknesses are used to infer variations in the accumulation rate.

□

The stable isotopes (δD_{ice} , $\delta^{18}O_{ice}$, deuterium excess of ice) record was measured using both discrete samples and continuous flow. Although the low frequency variations in WAIS Divide $\delta^{18}O_{ice}$ are similar to those from Byrd, there are important differences, owing in part to the non-continuous nature of the Byrd record resulting in aliasing of high frequencies. Furthermore, the significantly higher resolution and more precise dating of the WAIS Divide record reveal a number of interesting and previously unrecognized climatic features. For example, there is an abrupt isotope increase that dates to ~12.9 ka (BP 1950) that marks the end of the cooling associated with the Antarctic Cold Reversal (ACR) and may be related to the beginning of the Younger Dryas cooling. The beginning of Antarctic Isotope Maximum 2 (AIM2) is much more abrupt (2 ‰ $\delta^{18}O_{ice}$ increase in ~150 years) than previously recognized. There is also an abrupt isotope decrease at 8 kyr, which appears to be the West Antarctic expression of the 8.2 kyr abrupt climate change in Greenland. During the transition, the accumulation rate shows a similar increasing trend to that of the $\delta^{18}O_{ice}$, but has significant differences in the timing of changes in slope. The accumulation rate approximately doubled between the last glacial maximum (LGM, ~20ka) and 15 ka, and showed variability during the ACR. The accumulation rate during the LGM was approximately half of the modern value.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: An automated approach for annual layer counting in ice cores

Forename: Mai Surname: Winstrup

Authors: Winstrup, Mai; Svensson, Anders; Olander Rasmussen, Sune; Steig, Eric; Winther, Ole; Axelrod, Amittai;

Presentation Allocated: Oral

abstract: The high temporal resolution of some ice cores (including e.g. the NGRIP ice core, Greenland, and the WAIS Divide ice core, Antarctica) allows for seasonal information being preserved even deep in the ice core records. In such cases, annual layer counting represents one of the most accurate methods to produce a high-resolution chronology for the core. Yet, manual layer counting is a tedious and sometimes ambiguous job. As reliable layer recognition becomes more difficult, a manual approach increasingly relies on human interpretation of the available data. Thus, much may be gained by an automated and therefore objective approach for annual layer identification in ice cores. We have developed a novel method for automated annual layer counting in ice cores. It uses algorithms from the Bayesian statistical framework of Hidden Markov Models (HMMs), which originally was developed for use in machine speech recognition. The strength of this layer detection algorithm lies in the way it is able to imitate the manual procedures for annual layer counting, while being based on purely objective criteria for annual layer identification. The most likely positions of multiple layer boundaries in an entire section of ice core data are determined simultaneously, and an uncertainty estimate of the resulting layer count is provided. Furthermore, multiple data series with an annual signal can be incorporated, hence allowing for a full multi-parameter annual layer counting method similar to a manual approach. As a test case, the automated layer counting algorithm has been applied to the NGRIP ice core, which has the potential to be dated by annual layer counting far back in time [Andersen et al., 2006; Svensson et al., 2008]. A comparison between automated and manual annual layer counts will be presented. Within the estimated uncertainties the two methodologies agree, hence showing the potential of the method for being applied to other ice cores with annually resolved data. References: Andersen, K. K., et al. (2006), The Greenland Ice Core Chronology 2005, 15-42 ka. Part 1: Constructing the time scale, Quaternary Sci Rev, 25(23-24), 3246-3257. Svensson, A., et al. (2008), A 60 000 year Greenland stratigraphic ice core chronology, Clim Past, 4(1), 47-57.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Analysis of Snow and Glaciers in the Himalayan Region using Remotely Sensed Data

Forename: Sunal Surname: Ojha

Authors: Ojha, Sunal;

Presentation Allocated: Poster

abstract: Satellite remote sensing is an effective tool for monitoring snow covered area. However, complex terrain and heterogeneous land cover and the presence of clouds, impose challenges to snow cover mapping. This research analyzes snow cover and glaciers with a perspective of climate change in Himalayan Regions using remote sensing techniques. The remote sensing snow cover data from Moderate Resolution Imaging Spectroradiometer (MODIS) satellite from 2000 to 2008 have been used to analyze some climate change indicators. In particular, the variability in the maximum snow extent with elevations, its temporal variability (8-day, monthly, seasonal and annual), its variation trend and its relation with temperature have been analyzed. The snow products used in this study are the maximum snow extent and fractional snow covers, which come in 8-day temporal and 500m and 0.05 degree spatial resolutions respectively. The results showed a tremendous potential of the MODIS snow product for studying the spatial and temporal variability of snow as well as the study of climate change impact in large and inaccessible regions like the Himalayas. The snow area extent (SAE) (%) time series exhibits similar patterns during seven hydrological years, even though there are some deviations in the accumulation and melt periods. The analysis showed relatively well inverse relation between the daily mean temperature and SAE during the melting period. Some important trends of snow fall are also observed. In particular, the decreasing trend in January and increasing trend in late winter and early spring may be interpreted as a signal of a possible seasonal shift. However, it requires more years of data to verify this conclusion. Significant coverage of lake ice was found in lower elevation zone which is due to flat terrain in this zone.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Atmospheric krypton and xenon from ice cores suggest a two degree deep ocean warming from 18 ka to 16 ka, consistent with deep ocean ventilation cause of atmospheric carbon dioxide increase

Forename: Jeffrey Surname: Severinghaus

Authors: Severinghaus, Jeffrey; Kawamura, Kenji; Bauska, Thomas; Brook, Edward J.; Mix, Alan;

Presentation Allocated: Oral

abstract: Milankovitch theory is broadly successful in explaining the pacing of glacial Terminations, but the detailed mechanistic sequence of events is still poorly understood. In particular, the cause of the atmospheric CO₂ increase remains elusive despite an abundance of proposed mechanisms. Here we show that ice core-based reconstructions of the time histories of atmospheric krypton and xenon burdens add a potential clue. Prior work has shown that these noble gases respond mainly to mean ocean temperature variations, due to their strongly temperature-dependent solubility in liquid water and due to the fact that no significant sources or sinks exist in the ocean-atmosphere system (Headly and Severinghaus, 2007 JGR; Ritz et al., 2011 QSR). Because roughly 80% of the ocean's volume is colder than 4°C, and cold water holds more gas than warm water, the atmospheric noble gases Kr and Xe mainly record changes in deep ocean temperature. Records from the GISP2 ice core show a roughly one per mil increase in the krypton/nitrogen ratio and a three per mil increase in the xenon/nitrogen ratio over the time interval 18 ka to 16 ka, equivalent to a two degree deep ocean warming. During this same interval, our reconstructions of ¹³C of atmospheric CO₂ show a 0.3 per mil decrease (Bauska et al., this session). This time interval is the first half of Heinrich Stadial 1, a time of strong retreat of southern hemisphere mountain glaciers, rapid warming of southern mid-latitude surface waters, and weak northern hemisphere monsoons, all consistent with a southern-shifted thermal equator and weak Atlantic Meridional Overturning Circulation (the "bipolar see-saw" in its warm-south mode). Taken together, these new data support previous suggestions that the initial rise in CO₂ at the last Termination was caused by a strong increase in the rate at which the deep ocean is exposed to the atmosphere around Antarctica (known as "ventilation"), and the concomitant release of respiration-derived CO₂ to the atmosphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Characteristics of correlation between climate and environmental signals with the various time scales from past 700,000 years in Dome Fuji ice core, Antarctica

Forename: HIDEAKI Surname: MOTOYAMA

Authors: MOTOYAMA, HIDEAKI; Project members, Dome Fuji Ice Core;

Presentation Allocated: Poster

abstract: Global climate and environmental changes have occurred on various time-scales in the past million years. A glacial-interglacial cycle occurred on a time-scale of hundred thousand years, and several interstadial and stadial periods occurred on a time-scale of tens of thousands of years during a glacial period. A study on the Greenland ice core revealed that sudden warming and gentle cooling occurred over a time-scale of thousands of years during a glacial period called D–O cycle (Dansgaard–Oeschger cycle). Fluctuations between warm and cool events in Antarctica were not as large as those in Greenland. It is called AIM (Antarctic Isotope Maximum). Warm and cold climates alternated between Greenland and Antarctica. In recent years, medieval warm period and little ice age occurred on a time-scale of hundreds of years. These fluctuations in the global climate system should be studied in detail. What could be the implications of the present global warming scenario on the global climate of future? Two deep ice cores (DF1: 2,503m and DF2: 3,035m) at Dome Fuji, Antarctica have the in-depth information of global environmental change from present to the past 700,000 years. We made the data set of ion concentration, dust concentration and stable isotope ratio which were analyzed 10cm sample every 50cm from 2,400m to 3,035m using the DF2 core. The age of this depth was covered from 300,000 to 700,000 years before. Using the DF1 core, major chemical species were carried out using 7-10cm ice samples cut out of the 50 cm-long spaced from 0.5 to 2.5m. All data was averaged by every 5 m or every 1,000 years. The Correlations between climate and environmental signals with various time scales were calculated. The indexes of climate and environment are the following elements; MSA^- , Cl^- , NO_3^- , SO_4^{2-} , H^+ (calculated from pH), Na^+ , NH_4^+ , K^+ , Mg^{2+} , Ca^{2+} , ss-Na^+ , nss-Cl^- , nss-SO_4^{2-} , nss-K^+ , nss-Mg^{2+} , nss-Ca^{2+} , δD , $\delta^{18}\text{O}$, δ -excess, dust, pH and electrical conductivity. There is a feature in correlation respectively by the climatic stage. δD or $\delta^{18}\text{O}$ which becomes the index of the temperature and the environmental elements (for example, Na^+ and Mg^{2+}) indicate the strong negative correlation, but its degree is different depending on the climatic stages. In particular, environmental changes around Mid-Brunhes event (i.e. 430kyrBP), Glacial and Interglacial Stage, AIM event were examined.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Characterization of Dissolved Organic Matter in the West Antarctic Ice Sheet (WAIS) Divide Ice Core

Forename: Juliana Surname: D'Andrilli

Authors: D'Andrilli, Juliana; Foreman, Christine; McConnell, Joe; Priscu, John;

Presentation Allocated: Poster

abstract: WAIS Divide is a collaborative, multi-investigator US deep ice coring project focused on developing interrelated climate, ice dynamics, and biogeochemical records at high resolution. Our preliminary data indicate that the WAIS Divide ice contains a temporal record of both dissolved and particulate organic carbon. We measured temporal trends in the quantity and quality of dissolved organic matter (DOM) in early Holocene ice (1300-1700m) of the WAIS Divide core using a flow-through dissolved organic carbon analyzer, excitation emission matrices (EEMS), and deep ultraviolet fluorescence spectroscopy. Despite dissolved organic carbon concentrations in the WAIS Divide ice core that are typically less than 50 ppb, sufficient fluorescing material was present to characterize the different fluorophores present in the ice core DOM. Approximately 90% of the DOM in these ice cores was dominated by the presence of both tyrosine-like and tryptophan-like protein fluorescence signatures. Proteinaceous fluorophores are believed to reflect the production of amino acids during microbial metabolism and are typically more labile than DOM with significant humic signatures. Humic-like components were detected by EEMS in regions of the ice core which represents the most commonly detected fluorescing material in terrestrial and marine environments. However, fluorescence in those regions was far less prevalent than the protein-like fluorescent contributions. We will compare the EEMS of the DOM collected from 1300-1700m of the WAIS Divide ice core with the co-registered geochemical datasets to determine the role of DOM in the southern hemisphere climate record.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Continuous, high resolution halogen records from Western Antarctica

Forename: Olivia Surname: Maselli

Authors: Maselli, Olivia; McConnell, Joseph; Layman, Lawrence; Sigl, Michael; Pasteris, Daniel; Vigliotti, Lauren; D'Andrilli, Juliana; Grieman, Mackenzie;

Presentation Allocated: Poster

abstract: High temporal resolution halogen records from Western Antarctica will be presented which cover the transition from the Pleistocene into the Holocene (25,000 to 6,000 years B.P.). The WAIS Divide Ice Core was analysed for Chlorine, Bromine and Iodine at annual resolution using a continuous melt system and ICP-MS analysis technique developed at the Desert Research Institute in Reno, Nevada. Major changes in Iodine concentrations are observed over the period whilst Bromine remains comparatively constant. Major natural sources of the halogens are oceanic and they are also often observed in volcanic plume, both of which aid in the dating of the ice core. The involvement of bromine in stratospheric ozone destruction is well established and the measurements performed here may help in the establishment of background atmospheric halogen concentrations required for modeling of the ozone destruction process.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Continuous gas measurements along the NEEM S1 core: new insights into ice core methane signals

Forename: Rachael Surname: Rhodes

Authors: Rhodes, Rachael; Fäin, Xavier; Chappellaz, Jérôme ; Blunier, Thomas; McConnell, Joseph; Brook, Edward; Stowasser, Christopher;

Presentation Allocated: Oral

abstract: Mixing ratios of ancient methane preserved inside ice core bubbles can now be determined efficiently, precisely, and at ultra-high resolution, utilizing a laser spectrometer coupled to a continuous melter system. Here we present results of a 4-week laboratory-based campaign to measure methane mixing ratios in the North Greenland Eemian (NEEM) S1 ice core (400 m depth) using a SARA instrument (Floralis, France). The system of continual gas extraction via a hydrophobic membrane, developed over several field seasons at NEEM, was further modified to allow quantification of the negative bias on the methane mixing ratio, primarily resulting from methane dissolution in the melt water stream. Our results faithfully replicate the multi-decadal cycles in atmospheric methane levels over the last millennium recently recognised in discrete methane measurements on the Greenland Ice Sheet Project 2 (GISP2) ice core (Mitchell et al., unpublished). Furthermore, we report evidence of previously unobserved high frequency methane signals, possibly resulting from in situ production. Quasi-annual cycles of 5 ppbv mean amplitude are prevalent throughout the record from 175 m (1482 AD gas age) onwards. At this fine scale, the methane record shows good correspondence in depth with organic-rich black carbon supporting the hypothesis of in situ production. An additional interesting aspect of the NEEM S1 record is that it extends into the lock-in zone and records methane mixing ratios of the closed porosity comparable to firn air measurement results. ☐

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Firn layering and its effects on ice core gas records

Forename: Julia Surname: Rosen

Authors: Rosen, Julia; Brook, Edward; Severinghaus, Jeffrey;

Presentation Allocated: Poster

abstract: New high-resolution gas records from polar ice cores contain many features which have never before been observed. These include abrupt changes over very short depth scales that tend to occur during periods of changing atmospheric concentration or climate, but seem to happen too fast to be atmospheric in origin. One possible explanation for these anomalies is the occurrence of age reversals in the ice due to firn layering. In this scenario, an abnormally dense layer could trap air at a significantly shallower depth in the firn column than the lock-in depth, where most air is sealed into bubbles in the ice. If horizontal permeability in the firn allows air to continue to diffuse below this closed off layer, an age inversion could result in which younger air becomes trapped below older air. Such heterogeneity is supported by recent observations of the physical properties of polar firn (e.g. Fujita et al., 2009; Hörhold et al., 2009). However, the effects of these layers on ice core gas records have yet to be quantified. Firn air modeling provides an important means to address this question by illustrating the possible effects of a given type of layer and constraining the nature of layers required to produce observed results. We present new results using the OSU Firn Air Model (Buizert et al., 2011), improved to include layer parameterizations, which show the effect of such layering on ice core gases and the importance of accounting for layers to correctly interpret these records.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: High-precision measurements of in-situ cosmogenic ^{14}C in natural glacier ice from Greenland and Antarctica

Forename: Vasilii Surname: Petrenko

Authors: Petrenko, Vasilii; Severinghaus, Jeffrey; Smith, Andrew; Schaefer, Hinrich; Riedel, Katja; Bagginstos, Daniel; Harth, Christina; Orsi, Anais; Hua, Quan; Bauska, Thomas; Brook, Edward; Emanuele, Guy; Franz, Peter; Takeshita, Yui; Lee, James; Brailsford, Go

Presentation Allocated: poster

abstract: We present measurements of in-situ cosmogenic ^{14}C (in the forms of $^{14}\text{CO}_2$, ^{14}CO and $^{14}\text{CH}_4$) in natural glacier ice from Greenland and Antarctica. Very large (~ 1000 kg per sample) amounts of ice were sampled, allowing for unprecedented precision and detection limits for in-situ ^{14}C . The first set of measurements is from shallow (3 - 6 m) firn (consolidated snow) at Summit, Greenland. Most prior measurements from Summit ice and firn have found large amounts of in-situ cosmogenic ^{14}C , suggesting that this ^{14}C is well retained in the ventilated porous firn. Our results, on the contrary, suggest that very little ($<1\%$) in-situ cosmogenic ^{14}C is retained in Summit shallow firn. This very low retention rate of in-situ cosmogenic ^{14}C in the upper firn suggests that $^{14}\text{CO}_2$ can be used as an absolute dating tool for ice cores. The second set of measurements is from shallow (2 – 20 m), ~ 50 kyr old ablating ice at Taylor Glacier, Antarctica. ^{14}CO was quantified to $\sim 2\%$ relative uncertainty and showed the quasi-exponential decrease with depth that is expected from ablation-zone ^{14}C production. Both sets of measurements succeeded for the first time in detecting a small in-situ cosmogenic $^{14}\text{CH}_4$ component, which was quantified with a precision as low as 0.01 molecules / gram ice. The Taylor Glacier measurements suggest a constant $^{14}\text{CH}_4$ / ^{14}CO partitioning of 0.0078 for ^{14}C production by muons, and a higher value for production by neutrons. These measurements demonstrate that a reliable correction for the in-situ cosmogenic component of $^{14}\text{CH}_4$ in ice is possible, allowing for accurate reconstructions of paleoatmospheric $^{14}\text{CH}_4$. Paleoatmospheric $^{14}\text{CH}_4$ measurements would allow to determine the fossil component of the past atmospheric CH_4 budget as well as to test the hypothesis that marine methane clathrates release CH_4 to the atmosphere during times of warming. Our melt-extraction technique is not well suited for precise $^{14}\text{CO}_2$ determinations, mainly because of interfering CO_2 produced from carbonates and organics in the ice upon melting. More approximate determinations, however, are possible and allow for constraints on the total in-situ ^{14}C content in Taylor Glacier ice. These estimates suggest that the currently used muon ^{14}C production rates may be overestimated by a factor of 2 or more.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: High-resolution trace element analysis of the "Old Faithful" layer from the WAIS Divide ice core

Forename: Michael Surname: Sigl

Authors: Sigl, Michael; McConnell, Joseph R.; Maselli, Olivia; Pasteris, Daniel; Layman, Lawrence; Brook, Edward J.; Rhodes, Rachael; Winckler, Gisela; Dunbar, Nelia;

Presentation Allocated: Oral

abstract: In central West Antarctica a continuous layer (named "Old Faithful") has been traced over large areas by deep radar soundings (Neumann et al. 2008). It corresponds to multiple strong acid-depositional events lasting 170 years, between 1279.5 and 1283.5m in the Byrd core (Hammer et al. 1997), with a corresponding age of 17,400 yrs BP (Blunier & Brook 2001). The event is positioned at the beginning of the warming trend that ended the last ice age and it could serve as a potential time marker for the synchronization of deep ice cores within West Antarctica. Chemical analysis of this event showed a 20-fold increase in acidity, mostly due to HF and HCl with no apparent rise in H₂SO₄, which is the most common volcanic tracer in ice cores for historic eruptions. The origin of the acid deposition is still unknown. One hypothesis is a sub-glacial local eruption where a substantial fraction of the sulfur remained within the magma. A second hypothesis suggests a distant volcanic eruption, taking into account the absence of high particle concentrations, typical for local volcanic eruptions (Hammer et al. 1997). A third hypothesis is based on the regular spacing of the acidity peaks within the event and proposes interstellar dust particles rich in HF and HCl as possible source for the acidity signals in Byrd ice core (LaViolette 2005). Until now a similar event has not been reported from any other ice core in Antarctica or Greenland. We take advantage of a new deep ice core drilled at Western Antarctic Ice Sheet (WAIS) Divide, that allows reconstructing Pleistocene climate at an unprecedented time resolution for West Antarctica. The event created a chemical fingerprint between 2422 and 2427m in the WAIS core that is similar to the signal described for the Byrd ice core. This corresponds to an age of 18,190 to 18,040 yrs BP on the current timescale WDC06A-5. Here we present annually dated and highly resolved concentration records of 30 elements determined by ICPMS. Elemental concentration records between 2420 and 2500m are analyzed using Positive Matrix Factorization (PMF) to identify unique source factors representative of volcanoes, sea salt, dust and other potential sources. Blunier, T. & E. J. Brook (2001), *Science*, 291, 109-112. Hammer, C. U., et al. (1997), *Clim. Change*, 35, 1-15. LaViolette, P. A. (2005), *Planet Space Sci*, 53, 385-393. Neumann, T. A., et al. (2008), *JGR-Earth*, 113, 9.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Horizontal ice coring on Taylor Glacier: high resolution gas records

Forename: Daniel Surname: Baggenstos

Authors: Baggenstos, Daniel; Severinghaus, Jeffrey; Bauska, Thomas; Lee, James; Schaefer, Hinrich; Brook, Edward;

Presentation Allocated: Poster

abstract: Ice formed on the northern flank of Taylor Dome descends eastwards through the Transantarctic Mountains as Taylor Glacier and terminates in Taylor Valley, exposing a surface outcrop of old ice. We present measurements of methane concentrations, O-18 of atmospheric oxygen, and N-15 of N₂ from the ablation zone of Taylor Glacier. Close to the surface the gases are compromised by modern air contamination or other processes, but they are not adversely affected below 4m depth. The sampling transect consists of an array of 140 shallow cores drilled to 5m depth over a distance of 500m. The combination of methane concentrations and air oxygen isotope data allows us to cross-date our record to gas histories from other ice cores, and shows a minimally disturbed, continuous record from 8 kyr to 50 kyr BP. This work on Taylor Glacier has produced for the community a well dated, easy to access record of atmospheric gases and paleoclimatic proxies with virtually unlimited sample size, enabling measurements that are precluded by the sample size restrictions of conventional ice cores. A comparison with Taylor Dome ice core gas records highlights some interesting differences: During the Last Glacial Maximum, gravitational enrichment as seen in N-15 almost ceases at Taylor Dome, suggesting deep air convection and an extremely low accumulation rate. At Taylor Glacier N-15 also decreases but never falls below 0.065‰ indicating distinctly different firn characteristics during this climate period. Marginal ice typically undergoes some form of deformation on its path through the ice sheet. The deformation manifests itself in the form of large scale folding which can be clearly identified visually on satellite imagery as well as geochemically in the gas records. Although we can find folding on a variety of scales on the glacier, there is no indication of small scale folding in our transect that would disturb the sequence.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: How fast is West Antarctica warming? Results from borehole temperature combined with noble gas isotopic measurements at WAIS Divide

Forename: Anais Surname: Orsi

Authors: Orsi, Anais; Severinghaus, Jeffrey;

Presentation Allocated: Poster

abstract: The instrumental record of temperature in Antarctica started in 1957, and was complemented by satellite measurements in the 1980's. This record is short and discontinuous, and it has been difficult to establish a warming rate precisely. We present here a temperature reconstruction at the West Antarctic Ice Sheet (WAIS) Divide for the last hundred years, based on a joint inversion of both borehole temperature measurements and the noble gas isotopic composition of the firn and ice. Borehole temperature measurements provide information on the absolute temperature and long term changes, while isotopes of N₂, Ar and Kr record fast changes in temperature, making them a good complement. This reconstruction confirms that West Antarctica has been warming for the last 50 years by at least 0.2°C/decade, and gives a broader temporal context to this trend.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: ION CROMATOGRAPHY OF A SHALLOW ANTARCTIC ICE CORE

Forename: Magdalena Surname: de Mello Marques

Authors: de Mello Marques, Magdalena; Ruaro Peralba, Maria do Carmo; Cardia Simões, Jefferson; Torma Bernardo, Ronaldo;

Presentation Allocated: Poster

abstract: During the Austral summer of 2004/2005, several shallow cores were recovered by a Chilean-Brazilian traverse from the Geographic South Pole to the Parodi Chilean Station (80°18'S, 81°23'W). This work discusses ion chromatography results of one of these cores, IC3 (85°59'S, 81°35'W), which was melted into discrete samples at 2-3 cm resolution using the Climate Change Institute, CCI, University of Maine (USA), continuous melting system (Osterberg et al., 2006) and analyzed using a Dionex DX-500 Ion Chromatograph. The mean ionic concentrations in the upper 25 m of the core are 37.79 ng g⁻¹ (Cl⁻); 81.33 ng g⁻¹ (NO₃⁻); 43.41 ng g⁻¹ (SO₄²⁻), 19.47 ng g⁻¹ (MSA, methanesulfonate, CH₃SO₃⁻); 15.63 ng g⁻¹ (Na⁺); 0.87 ng g⁻¹ (K⁺); 2.59 ng g⁻¹ (Mg²⁺) and 3.22 ng g⁻¹ (Ca²⁺), which are in agreement with values cited for the area by Bertler et al. (2005). Cl⁻ variability exhibits a similar pattern to Na⁺, and the mean Cl⁻/Na⁺ ratio of 2.97, is higher than the seawater ratio of 1.8 (Bertler et al., 2005), suggesting an additional source of Cl⁻ from HCl (De Angelis and Legrand, 1995). As expected for central Antarctica, the MSA record shows no seasonality (Legrand and Mayewski, 1997) this is also the behavior of NO₃⁻. The core is estimated to represent 46±3 years of accumulation (a 32.3 cm year⁻¹ in water equivalent).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Isotopic investigation of the integrity of environmental records at the Allan Hills Blue Ice Area, Antarctica

Forename: Nicole Surname: Spaulding

Authors: Spaulding, Nicole; Kurbatov, Andrei; Mayewski, Paul; Higgins, John; Bender, Michael; Introne, Douglas;

Presentation Allocated: Oral

abstract: A major limitation of deep ice core records is the availability of large volumes of ice for detailed investigation. Horizontal ice cores from blue ice areas (BIA), where ancient ice outcrops at the surface, provide an opportunity for resolving that problem. The development of environmental records from these areas is therefore desirable. The Allan Hills BIA, located on the western flanks of the Convoy Range of the Transantarctic Mountains is of particular interest as cosmogenic radionuclide dating of meteorites indicates the presence of ice as old as ~2 Ma and its localized accumulation area makes its record relevant to changes in the Ross Embayment. Ideally the stable water isotope record from a surface transect through a BIA would reveal the climatic history of its accumulation area. However, as a result of the interaction between the ice and bedrock topography that forms BIAs, a record of deformation may be imprinted upon the climatic history. Here we present a deuterium isotopic record from the main icefield (MIF) of the Allan Hills BIA, which tests for disruption of the environmental record at the surface. This record consists of measurements from samples collected every 10 m from 5-7 cm depth along an ~ 5.5 km transect through the MIF and from a 225 m core intersecting the surface transect 2.67 km from its northern extent (15 cm resolution). The transect was selected using measurements of ice flow from a 14 year precision GPS study. A continuous tephra layer cross-cutting the transect provides a rigid match point between the surface record and the core and rules out the occurrence of off-setting of layers through brittle deformation. δD values in both records range from -264 to -363 per mil. The two records are nearly identical from their point of intersection to their downstream and downcore limit, verifying that the environmental signal at the surface has not been altered. These records exhibit variability consistent with the glacial/interglacial signals of deep ice cores. The pattern of variability can be used to place these records on the EPICA Dome C (EDC) age scale. Preliminary comparison suggests these records from the Allan Hills MIF contain 20 meters of surface ice for each meter in the EDC record from the same time period. The preliminary chronology will be verified by forthcoming data including ages from trapped gas and tephra layers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Modeled MSA and sulfate deposition fluxes in East Antarctica: difference between modern and LGM

Forename: Paul Surname: Hezel

Authors: Hezel, Paul; Alexander, Becky; Bitz, Cecilia; Steig, Eric;

Presentation Allocated: Oral

abstract: Methanesulfonic acid (MSA) in ice cores has been interpreted as an indicator of both local sea ice extent (via modulation of dimethylsulfide (DMS) emissions) and regional circulation on interannual-decadal time scales, but there has been no assessment of the importance of these or other processes in determining MSA concentrations on glacial-interglacial time scales. Both MSA and sulfate concentrations measured in ice cores on the East Antarctic Plateau for the last glacial maximum (LGM) are higher than modern day concentrations. In low accumulation environments like the Plateau however, it is deposition flux, not snow/ice concentrations, of a chemical species that should be most closely related to atmospheric concentrations. Sulfate deposition fluxes between the modern and last glacial maximum (LGM) are roughly constant, though MSA deposition fluxes are still higher in the LGM than modern period. Since Antarctic MSA and sulfate originate primarily from oxidation of oceanic DMS emissions that are particularly high in the sea ice zone around Antarctica, we seek to understand the divergent behavior between these two species. Here we explore modern/LGM differences in MSA and sulfate deposition in the GEOS-Chem chemical transport model. We force the model with GISS-ModelE meteorology using modern and LGM boundary conditions to simulate Antarctic MSA and sulfate deposition. We estimate the contribution of transport, precipitation, oxidant concentrations, and temperature-related chemistry to the higher MSA fluxes and roughly equivalent sulfate fluxes in the LGM. We investigate the possibility of higher DMS emissions during the LGM as an explanation for the difference.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Modeling the isotopic composition of snow for synoptic storm events at Roosevelt Island, Antarctica

Forename: Lana Surname: Cohen

Authors: Cohen, Lana; Sinclair, Kate; Bertler, Nancy;

Presentation Allocated: Poster

abstract: Understanding the stable isotope-temperature relationship in snow is critical for reliable use of ice core isotope records as temperature proxies. Changes in moisture trajectories and source regions and post-depositional effects such as diffusion and windblown snow can have significant effects on the isotopic composition of snow. This study investigates stable isotopes from three distinct storm events at Roosevelt Island, a coastal ice-core site on the western side of the Ross Ice Shelf. Measured values of $\delta^{18}\text{O}$ and δD are compared to modeled isotopic values in order to better understand the role of moisture trajectories on isotopic fractionation for the Roosevelt Island site. Three storm events that represent common moisture-delivery pathways to Roosevelt Island were sampled during November-December 2010. For each of the three storm events, freshly precipitated snow was sampled throughout the duration of the storm (lasting between 48 to 72 hours). Measured isotope values show high intra-storm variability (δD ranges between -268 to -137‰ within one storm) and the isotope-temperature relationship differs significantly between the storms. A Rayleigh fractionation model is used to calculate the isotopic fractionation for each storm along average air-mass pathways derived from the NOAA HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) model. We use ECMWF ERA-Interim reanalysis data as input for the HYSPLIT model. An assessment of ERA-Interim meteorological parameters at the Roosevelt Island site shows good correlation with observed conditions giving confidence that the back-trajectories are producing realistic air-mass pathways. Specific humidity from reanalysis data along each trajectory are employed to estimate the loss of moisture along each storm pathway, and hence the degree of fractionation that occurs prior to deposition at the site. Results of the isotope modeling show good agreement with measured values both for air-mass trajectories that cross the West Antarctic Ice Sheet and for the more locally sourced storm.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Multi-millennial-scale climatic variations in Antarctica for the last eight glacial periods

Forename: Kenji Surname: Kawamura

Authors: Kawamura, Kenji;

Presentation Allocated: Keynote 20 mins

abstract: Climatic variability on millennial timescales, characterized by abrupt temperature changes in the Northern Hemisphere and inter-hemispheric seesaw, have been well documented for the last glacial period by many paleoclimatic records. The cause for these variations is thought to be the variations of freshwater flux into North Atlantic ocean from surrounding ice sheets, which affects the strength of meridional overturning circulation and associated poleward heat transports. Therefore, millennial-scale variations in Antarctica or elsewhere may tell us about ice sheet variability in the Northern Hemisphere. However, the frequency and magnitude of such events are uncertain for older glacial periods and terminations because of the lack of suitable climatic records. Here we present a 720,000-yr ice-core isotopic record from the second Dome Fuji ice core, East Antarctica. Synchronizing and stacking this record with existing Dome C ice-core record permits robust identification of multi-millennial-scale Antarctic warming events. Dust proxies in Marine Isotope Stage 16 in the Dome Fuji core (oldest glacial period in this core) show that the millennial-scale variations of dust flux are negatively correlated with Antarctic temperature for all 9 identified events. This demonstrates that changes of aridity in the dust source region, presumably Patagonia, occurred in concert with Antarctic climate changes. A bandpass filter (3,000 - 15,000 yr periodicities) was applied to the stacked isotope record to homogenize the resolution throughout the record. This allows us to identify large Antarctic warming events with a consistent criteria through time. We find a positive relationship between repetition period of multi-millennial-scale events and Antarctic temperature, with exceptions in glacial maxima. The data suggests instability of Northern Hemisphere ice sheets in intermediate glacial condition. Multi-millennial-scale events also becomes infrequent in concert with large precession variations in early parts of glacial periods, implicating long freshwater release due to strongly rising summer insolation. Very large multi-millennial-scale events are identified at glacial terminations, suggesting that all terminations involve millennial-scale variability overlaying on orbital-scale changes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Oxygen stable isotopic ratios variability from Patriot Hills to the Geographic South Pole

Forename: Luciano Surname: Marquette

Authors: Marquette, Luciano; Cardia Simões, Jefferson; Introne, Douglas; Casassa, Gino;

Presentation Allocated: Poster

abstract: In the summer of 2004-2005, a Chilean-Brazilian Antarctic Traverse, travelling from the Chilean station Parodi in Patriot Hills (80°18'S, 081°21'W) to the Geographic South Pole (GSP), collected 103 superficial snow samples, and 6 shallow firn cores of up to 49 m long. Those samples were analyzed for O18/O16 ratios determination. Sampling altitude varied from 700 m (Patriot Hills) to 2830 m (South Pole). Our results may be interpreted in terms of variation in the condensation temperature of the precipitation, source area of moisture and orographic effect. The superficial snow samples were analyzed by IRMS - Isotope Ratio Mass Spectrometry, using GSMS - a Gas Source Mass Spectrometer (Osterberg et al., 2006) at the Climate Change Institute, University of Maine, Orono, USA. The oxygen isotope ratios were measured with a Micromass Multiprep device coupled to a mass spectrometer with 0.05‰ of precision. Data are presented in delta (δ), notation relative to SMOW - Standard Mean Ocean Water. As expected, there is clear linear trend to smaller oxygen isotope ratios as the sample site approximates to the GSP, decreasing from -32‰ (Patriot Hills, mean temperature -25°C) to -50‰ (GSP, mean temperature -49°C). Our results are in agreement with spatial distribution maps derived by Dahe and others (1990) and Masson-Delmotte and others (2008), who registered isotopic ratios of -33‰ and -30‰ at Patriot Hills, -51‰ and -50‰ at the GSP. On the other hand, It is also clear from our traverse profile the Transantarctic Mountains orographic effect where in less than 20 km, approximately at 86°45'S, the $\delta^{18}O$ increases rapidly from -45 to -34.5‰, and then after about 100 km goes back to the general decreasing trend.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Physical Properties in the Service of Ice-Core Paleoclimatology

Forename: Richard B. Surname: Alley

Authors: Alley, Richard B.; Fitzpatrick, Joan J.; Fegyveresi, John M.; Stevens, Nathan T.; Sowers, Todd A.; Spencer, Matthew K.;

Presentation Allocated: Keynote 20 mins

abstract: Study of ice-core physical properties often addresses ice-flow problems, but also reveals much of paleoclimatic interest. Bubble number-density is proving a useful tool for paleothermometry, complementing melt-layer occurrence, and frequency of occurrence of crusts may offer additional information. Total-gas content has proven much more complex than initially hoped, but may contain important signals. Much work on physical properties is related to demonstrating that ice-flow processes have not distorted paleoclimatic records. We will discuss some of these key issues, with examples from the WAIS Divide Deep Core.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: SAM associated dust and trace metal fluxes in coastal East Antarctica during the last 250 years

Forename: Laluraj Surname: C M

Authors: C M, Laluraj; Meloth, Thamban; K, Satheesan; Ravindra, Rasik;

Presentation Allocated: Poster

abstract: Southern Annular Mode (SAM) is the major factor for the variation of the climate in the Southern Hemisphere and a positive SAM is associated with an increase in the westerly winds in the main belt of subpolar regions, the arid Patagonia region being situated under this belt. Previous studies suggested that Patagonia remained an important source of dust to the East Antarctic region, as the westerly winds favored its transfer to Antarctica in the recent past. Dust fluxes in a high resolution ice core (IND-25/B5) revealed that dust deposition was two-fold higher after 1985, compared to the earlier records in the coastal Dronning Maud Land (cDML) region. It is observed that there is a general shift in the SAM towards positive values since the 1980 and increased easterlies over the cDML region, which could sink air and aerosols to the East Antarctica carried by the westerlies by mass compensation. This confirms that the dust fall in Antarctica is modulated by the Southern Hemispheric climate modes like SAM. A strong negative correlation between $\delta^{18}\text{O}$ records and dust flux suggested that enhanced dust flux in the ice core represents periods of colder atmospheric temperature. Back trajectory studies suggested that the seasonal increase in the dust deposition is associated with a transport of air from the north and west of cDML especially during winter. Further, the trace metal flux measured in the Antarctic snow was strongly associated with the dust flux confirming that these chemical species transported /scavenged by the aeolian dust. Our study corroborate the view that trace metal accumulation in the ice sheets of Antarctica are closely linked to the aeolian depositions originating from South America, that are modulated by the climatic variability associated with SAM.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: South Pole paleoclimate record from borehole laser particulate stratigraphy in IceCube

Forename: Ryan Surname: Bay

Authors: Bay, Ryan;

Presentation Allocated: poster

abstract: The IceCube Neutrino Observatory and the prototype AMANDA have enabled explorations of South Pole ice which were previously not possible. These telescopes have been constructed using powerful hot-water drills, which provided clean repeated access to the deep ice sheet through multiple boreholes at a single location. The massive construction projects afforded us unique opportunities for studies of the ice, including precision measurements of optical properties, acoustic properties, and glaciology including flow, shear and temperature. As part of our calibration program to map scattering and absorption of Cerenkov light emitted in the ice by neutrino interactions, we made eight high resolution laser borehole dust logs over the course of detector commissioning in 2004-2010. The laser borehole profiles we obtained are the best resolved measurement of last glacial period Antarctic dust and can be used to reconstruct detailed paleoclimate records. We will present analyses of chronology, accumulation, flow, and surface roughness as a proxy for cyclone activity. Through visual inspection and automated stratigraphic matching, we have synchronized our South Pole history with ice core data from Dome C and identified widespread volcanic ash depositions useful for dating Antarctic ice cores. This technique has become an essential tool for rapidly determining age and evaluating the stratigraphic integrity of potential new coring sites. South Pole is the likely site for the next deep or intermediate Antarctic ice core.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Stable isotope records for the past 2000 years from ice cores in central Dronning Maud Land, Antarctica

Forename: Hans Surname: Oerter

Authors: Oerter, Hans; Wilhelms, Frank; Kipfstuhl, Sepp;

Presentation Allocated: Poster

abstract: Ice coring on the plateau of the inland ice of Dronning Maud Land, Antarctica, took place in the period 1998 through 2006. The central ice core is the EDML ice core (75.0017 S, 0.0678 E, 2882 m a.s.l.) drilled adjacent to the German Kohnen station in the frame of the European Project for Ice Coring in Antarctica (EPICA). It covers more than 150 kyrs in time and can also serve as a reference core for the complete Holocene. In this paper the focus is on the past 2 kyrs of 18-O data. During the EPICA period several firn-core studies were performed, resulting in stacked data sets for the past 50 years (reference horizon Agung 1963), 200 years (reference horizon Tambora 1815) and 2000 years (4 cores). The paper compares the 18-O records, which are converted to temperature with the local isotope-temperature relationship as well as accumulation rates. None of the cores shows an increase of the 18-O content indicating a stable temperature regime during the past 2 kyrs. However, decadal and centennial variations are detectable. Thus, a slight increase of 18-O content in the 20th century can be observed. It peaks around 1985 AD and does not continue afterwards. The cores are used to construct stacked isotope/ temperature records for central Dronning Maud Land.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Surface mass balance and stable oxygen isotope ratios from shallow firn cores on Fimbulisen, East Antarctica

Forename: Elisabeth Surname: Schlosser

Authors: Schlosser, Elisabeth; Anschuetz, Helgard; Isaksson, Elisabeth; Martma, Tonu; Divine, Dmitry;

Presentation Allocated: Oral

abstract: Monitoring of recent changes in the mass balance of Antarctic ice shelves is important since, being situated in the marginal zones of the continent, they react most sensitive to climate change. Apart from that they also strongly influence ice-sheet dynamics and glacier outflow, especially in West Antarctica. Fimbulisen is one of the smaller ice shelves bounding Dronning Maud Land (DML), East Antarctica. The central part of the ice shelf is fed by Jutulstraumen, the largest outlet glacier in DML that drains an area of about 124000km² and causes the buildup of a fast-moving tongue within the ice shelf. During the Austral summer 2009/2010 an extensive glaciological field campaign was carried out on Fimbulisen to investigate the recent surface mass balance (SMB) of the ice shelf. Eight shallow firn cores (10-18m depth) were taken and ground-penetrating radar surveys were conducted to link drilling sites. The firn cores were dated using dielectric profiling (DEP) and seasonal variations of stable oxygen isotope ratios ($\delta^{18}O$), cross-checked by the identification of the volcanic eruptions of Mount Pinatubo (1991) and El Chichón (1982). DEP data were fairly noisy in most cores, however, the dating results were consistent within the error bounds of the methods. Accumulation rates show a weak decreasing trend during the past 20-30 years, which is not for all cores statistically significant. Stable-isotope ratios were compared to the snowfall temperatures of Neumayer Station. Neither the temperatures nor the $\delta^{18}O$ values show any trend for the investigated time period.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: The comparison of trends of snow accumulation based on different observational data for West Antarctica Ice sheet

Forename: Alexander Surname: Semenov

Authors: Semenov, Alexander;

Presentation Allocated: Poster

abstract: This work is directed to investigate and analyze the problem of existing multiple observational datasets and the confusion for the modelling purposes to find out which of the datasets is more accurate and which is less to initialize. In this work there's been an attempt to accumulate the snow accumulation data for West Antarctica Ice sheet. In particular there were considered following datasets: the derived snow accumulation rates based on ice core data from ITASE expedition, gridded reanalysis data NCEP-NCAR, ERA-40, ERA-Interim, CFSR, and station observational data. The scientific approach that has been implemented for this problem included the analysis of trends of snow accumulation rate based on each dataset, Kenn-Mandell test, correlation between the time series. In addition to that, it has been known from previous papers that the West Antarctic Ice Sheet in terms of sources of precipitation has been divided into 3 basic regions: Ross sector, Amundsen sector, and Ice divide between the Amundsen and Ross sector. So, in this research it was particularly interesting to investigate how the values of trends differ corresponding for a particular sector.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Total Air Content Constraints on Past West Antarctic Ice Sheet Elevation: Preliminary Results from WAIS Divide and Siple Dome

Forename: Edward Surname: Brook

Authors: Brook, Edward; Mitchell, Logan; Lee, James; Edwards, Jon; Steig, Eric; Fudge, TJ;

Presentation Allocated: Poster

abstract: Understanding past ice sheet elevation is important for understanding ice sheet impacts on sea level and climate. In interior regions of present ice sheets, geological indicators of ice sheet height (trimlines, moraines, or similar) are rare if present at all, thus indirect means of constraining past elevation are required. In principle the total air content of polar ice reflects past elevation through the elevation-atmospheric pressure relationship, although in practice factors other than elevation affect air content, including local variations in atmospheric pressure and variations in pore volume closed off at the firn-ice transition. Here we explore air content records from the Siple Dome and WAIS Divide ice cores from the West Antarctic ice sheet, a critical region with respect to past and future sea level change. Air content is determined at OSU by measuring air pressure in a known volume after a melt-refreeze extraction, as part of our measurements of atmospheric methane. We focus on the last 25,000 years, the period where we have data from both cores. We use the pore close off volume parameterization of Delmotte et al., 1999 (*J. Glaciology*, v. 45), and temperature estimates based on stable isotopes to calculate air pressure at the time of pore close off. These calculations are preliminary and do not account for cut bubble effects or other influences on air content. Taken at face value our results suggest little to no change in air pressure between glacial and Holocene time at WAIS Divide. For Siple Dome, data are more scattered, but may allow a few hundred meters of thinning since the glacial maximum.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 3

Title: Variations of stable isotopes in East Antarctic Ice Sheet in different altitudinal zones and its significance to ice core interpreting

Forename: Minghu Surname: Ding

Authors: Ding, Minghu; Xiao, Cunde;

Presentation Allocated: Poster

abstract: Samples of surface snow were collected for stable isotope analysis along the traverse route from Zhongshan to Dome A in east Antarctica . The results of the analysis showed a linear relationship between $\delta^{18}\text{O}$ and δD in terms of $\delta\text{D} = 7.49\delta^{18}\text{O} + 6.21$, and a relationship between δD and annual mean temperature (T) in terms of $\delta\text{D} = 6.412T + 69.99$; these two basic environmental equations could be used to interpret climatic records. Spatial distributions of δ and deuterium excess were also analyzed, and three different patterns were found. Thus, we examined the slope S and intercept D in the δD - $\delta^{18}\text{O}$ equation using a sliding window with a width of 5 samples, which suggested that this sub-Rayleigh model may determine three different climatic zones with different ratios. The boundary between these areas occurred at altitudes of 1,900 m a.s.l. (approximately 185 km from the coast) and 2,850 m a.s.l. (approximately 830 km from the coast), suggesting three sources of summer moisture. This is a guide to interpret ice core isotopic records in east Antarctic ice sheet, at least for shallow ice cores.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Antarctic Climate Change Caused by Ozone Depletion in a Fine Resolution Ocean Climate Model

Forename: Cecilia Surname: Bitz

Authors: Bitz, Cecilia; Polvani, Lorenzo;

Presentation Allocated: Keynote 20 mins

abstract: The surface westerlies in the Southern Ocean sped up and shifted southward with ozone depletion in the late 20th century. We investigate the influence of resolving ocean eddies in the response of a modern climate model to these surface wind anomalies. Ocean models at typical resolutions of 1 degree must parameterize eddies and the models do not resolve polynyas in the sea ice. It is not clear if parameterized eddies and coarsely resolved sea ice respond correctly to a large wind increase. We explore this problem with the Community Climate System Model version 3.5 with pairs of simulations at high (pre 1960s) and low (1990s) ozone forcing run at 1 degree ocean and sea ice resolution and 1/10 degree ocean and sea ice resolution. The atmosphere resolution is 1/2 degree in all cases. The sea ice declines and surface air and ocean warm with ozone depletion, in agreement with Spence and Fyfe (2010), but the magnitude is much smaller in the eddy-resolving case compared to runs at typical resolution. Surprisingly the surface wind stress anomalies are significantly suppressed in the eddy resolving case, which is a partial cause for the muted response. Another factor is the increase in southward ocean heat transport by parameterized eddies at coarse resolution that is absent when eddies are parameterized.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Anthropogenic heat and carbon uptake by the Southern Ocean in CMIP5 Earth System Models

Forename: Thomas Surname: Froelicher

Authors: Froelicher, Thomas; Sarmiento, Jorge; Downes, Stephanie; Dunne, John; Stouffer, Ron; Griffies, Stephen;

Presentation Allocated: Poster

abstract: A new set of Earth System Models (ESM) show that the Southern Ocean (SO) south of 30°S absorbs on average 70% of anthropogenic heat and 42% of anthropogenic carbon, indicating that the SO thus plays a central role in determining the rate of climate change. However, the exact processes governing the magnitude and regional distribution of heat and carbon uptake remain poorly understood with models showing the largest disagreement in the SO due to their widely divergent representation of physical circulation and atmosphere-ocean interactions. Indeed, the fraction of the simulated uptake within the SO ranges between 30 to 160% for excess heat and between 38 to 47% for anthropogenic carbon. Natural unforced variability in models and observations further complicates the detection and attribution of changes. Firstly, we compare heat and carbon uptake in CMIP5 ESMs using an analysis framework that includes both novel skill-score metrics and investigations in density spaces. Secondly, we assess the contribution of internal variability to model-model and model-data differences by using an ensemble of six simulations with different initial conditions of a single ESM. Finally, recent studies suggest that stratospheric ozone recovery and increased greenhouse gases will be the dominant driver in changing Southern Ocean winds. We use stratospheric ozone sensitivity simulations, where ozone and greenhouse gases are individually varied, to separate the impact of changing greenhouse gases and ozone on atmospheric circulation in the Southern Hemisphere and its effect on past and future ocean heat and carbon uptake and ocean acidification. Ultimately, the results of this study allow us to pin down one of the greatest uncertainties in predictions of future climate change: the fate of anthropogenic carbon and heat.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Assessing simulations of Southern Hemisphere tropospheric jet, meridional overturning circulation of the Southern Ocean and carbon uptake

Forename: Thomas Surname: Bracegirdle

Authors: Bracegirdle, Thomas; Shuckburgh, Emily; Sallee, Jean-Baptiste; Zhaomin, Wang; Bruneau, Nicolas;

Presentation Allocated: Poster

abstract: The motivation for our analysis is the question: will the Southern Ocean sink of carbon become less effective in the future, providing a positive climate change feedback? Central to this is a pathway of dynamical responses to anthropogenic change from the stratosphere to the ocean. Our aim is to evaluate how well the CMIP5 models represent the key physical processes in this pathway. A number of studies have highlighted the limitations of CMIP3 models in their representation of the Southern Hemisphere atmospheric and oceanic processes. CMIP5 models have been improved in a number of ways. Several models have improved representation of the stratosphere, many models have increased horizontal resolution in the ocean component to permit or even partly resolve the mesoscale eddies that are critical to the oceanic response and some models now have a coupled carbon cycle. We are in the process of evaluating whether improvements implemented in the CMIP5 models enable us to now make robust predictions concerning the future of the Southern Ocean carbon sink. This involves a careful analysis of the aspects that are critical for the coupled system, for example the wind-stress curl at the surface of key regions of the Southern Ocean. Preliminary assessment of the Southern Hemisphere atmospheric circulation in 15 of the CMIP5 models shows that, similar to the CMIP3 simulations, historical runs have an equator-ward bias of the time-mean tropospheric westerly jet over southern mid-latitudes. However, current results indicate that compared to CMIP3 the predicted future changes in the jet position are less consistently poleward. Preliminary multi-model analysis of the ocean component shows that the surface layer representation and vertical flux are tightly controlled by the position of atmospheric jet and that most have an excessively shallow mixed layer depth, possibly due to overly strong basin-scale stratification.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Climate impact on interannual variability of Weddell Sea Bottom Water

Forename: Xiaojun Surname: Yuan

Authors: McKee, Darren; Yuan, Xiaojun; Gordon, Arnold; Huber, Bruce; Dong, Zhaoqian;

Presentation Allocated: Oral

abstract: Bottom water formed in the Weddell Sea plays a significant role in ventilating the global abyssal ocean, forming a central component of the global overturning circulation. To place Weddell Sea Bottom Water in the context of larger scale climate fluctuations, we analyze the temporal variability of an 8-year (April 1999 through January 2007) time series of bottom water temperature relative to the El Niño/Southern Oscillation (ENSO), Southern Annular Mode (SAM), and Antarctic Dipole (ADP). In addition to a pronounced seasonal cycle, the temperature record reveals clear interannual variability with anomalously cold pulses in 1999 and 2002 and no cold event in 2000. Correlations of the time series with ENSO, SAM, and ADP indices peak with the indices leading by 14–20 months. Secondary weaker correlations with the SAM index exist at 1–6 month lead time. A multivariate EOF analysis of surface variables shows that the leading mode represents characteristic traits of out-of-phase SAM and ENSO impact patterns and is well separated from other modes in terms of variance explained. The leading principal component correlates with the bottom water temperature at similar time scales as did the climate indices, implying impact from large-scale climate. Two physical mechanisms could link the climate forcing to the bottom water variability. First, anomalous winds may alter production of dense shelf water by modulating open-water area over the shelf. Second, surface winds may alter the volume of dense water exported from the shelf by governing the Weddell Gyre's cyclonic vigor.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Downslope flows in the Prydz Bay area: observations and modeling

Forename: Alexander Surname: Klepikov

Authors: Klepikov, Alexander; Antipov, Nick; Kazko, Gena; Golovin, Pavel;

Presentation Allocated: Poster

abstract: During the last several years the processes at the continental slope were investigated in the region to the west of Prydz Bay, Antarctica. CTD soundings were made with the spatial resolution 2 - 3 miles at the meridional sections. Sections begin on the shelf near the shelf break, cross the continental slope and reach the deep ocean area. Some stations were made at section along the front of the Amery Ice Shelf in Prydz Bay. Data show that Antarctic Shelf Water and its modification, Ice Shelf Water, goes to the north along western border of Amery Depression and then flows down the continental slope in the region to the west of Prydz Channel ($\sim 72^\circ$ E). High spatial resolution of the section along 70° E at the shelf break and above the upper steep part of the slope has allowed detailing of mesoscale peculiarities of the near-slope convective plumes. Sections along 70° E were repeated six times from the r/v Akademik Fedorov during the period 2004 – 2012. Sinking of dense water plumes along continental slope was not found in the region to the east of 72° E. Descending water in the region to the west of Prydz Channel results in deep water ventilation and bottom water formation. Prydz Bay Bottom Water (PBBW) with the potential temperature -0.3 – -1.6°C and salinity 34.54 psu – 34.62 psu is found between 62° E and 72° E at the depth 1300 – 2000 m. PBBW is colder and less saline than Antarctic Bottom Water observed in this region. To get the solution of ocean near continental slope convective circulation problem the two- and three-dimensional non-hydrostatic hydrodynamic models in terms vorticity–vectorial potential were developed. The results of convection modeling show that sinking of cooled water along the continental slope at thermal convection is significantly three-dimensional. The scale of process of the slope of convection does not exceed a few tens of meters in space and a few tens of minutes time. Model shows intense convective mixing can prevent freezing of open water within a few days. Even with fixed boundary conditions the convective process may be substantially transient. The thickness of the modeled plume is about 100 m. The modeled vertical speed at the slope convection is about 1 cm/s. Given the extent of the continental shelf and slope where the processes of downslope convection have been found, we can estimate the production rate of bottom water of about 1.5 Sv.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Higher precision estimates of Antarctic warming by ensemble regression of climate model projections

Forename: Thomas Surname: Bracegirdle

Authors: Bracegirdle, Thomas; Stephenson, David;

Presentation Allocated: Oral

abstract: This study presents predictions of 21st century wintertime surface temperature changes over Antarctica and the surrounding ocean based on the Coupled Model Inter-comparison Project number 5 (CMIP5) multi-model ensemble. The state-dependence of the climate change response on the present-day mean state is captured using a simple yet robust ensemble linear regression model. The ensemble regression approach gives different and more precise mean predictions than ensemble mean predictions. For the Antarctic in winter (July) the ensemble regression method gives 2°C more warming over the Southern Ocean close to the Greenwich Meridian (~7 °C compared to ~5 °C). Prediction uncertainty was almost half that of the ensemble mean uncertainty over the Southern Ocean between 0- 90°E and 30% less over the northern Antarctic Peninsula. The ensemble regression model avoids the need for explicit ad hoc weighting of models and exploits the whole ensemble to objectively identify overly influential outlier models. Bootstrap resampling shows that maximum precision over the Southern Ocean can be obtained with ensembles having as few as only 6 climate models.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Highly resolved sea ice-ocean interactions and their effect on Southern Ocean stratification in a fully coupled climate model

Forename: Emily Surname: Newsom

Authors: Newsom, Emily; Singh, Hansi; Bitz, Cecilia;

Presentation Allocated: Poster

abstract: Rates of water mass production and stratification in the Southern Ocean are compared between standard (1 degree) and high (1/10 degree) resolution of ocean and sea ice in 150-year integrations of the Community Climate Model Version 3.5 (CCSM 3.5). The atmosphere and land components are at 0.5 degree resolution in both cases. High resolution generally improves the agreement in temperature and salinity between simulation and observations in the Southern Ocean, as several key features emerge in the eddy-resolving integration that are not captured at coarser resolution. At high resolution, a water mass similar in salinity and temperature to Antarctic Bottom Water (AABW) is formed and sinks along steep isopycnals. The formation of this water is linked to the well-resolved polynyas that form along the coastline. Additionally, pronounced differences in the transport of warm, saline water comparable to Circumpolar Deep Water (CDW) are evident between resolutions. The physical processes regulating the organization of these water masses are poorly understood in nature and important to global climate: the production of AABW is important in moderating the global meridional circulation; the rate of transport of CDW onto the continental shelf is important in regulating the mass balance of the Antarctic Ice Sheet. Here, plausible mechanisms controlling the inter-model deviations in water mass organization are explored to elucidate production mechanisms, specifically the relative importance of resolving localized sea ice formation regions versus the importance of the ocean mean state in controlling how isopycnal mixing alters stratification.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Holocene changes in the Antarctic Circumpolar Current and sea ice extent in the Antarctic Peninsula

Forename: Amy Surname: Leventer

Authors: Leventer, Amy; Domack, Eugene; Freccia, Sam; Jeong, Sunmi; Ishman, Scott; Brachfeld, Stefanie; Prentice, Mike;

Presentation Allocated: Keynote 20 mins

abstract: Two critical components of atmosphere-ocean-climate dynamics of the Southern Ocean are the position and strength of the Antarctic circumpolar current and the distribution and extent of annual sea ice. We reconstructed variability in these parameters for the Holocene based on proxies from geographically widespread marine sediment cores from the Antarctic Peninsula shelf. The cores extend along the western margin of the Peninsula from Lallemand Fjord at $\sim 67^{\circ}\text{S}$, northeastward to Barilari Bay, the Hugo Island Trough, the Palmer Deep, and Kayak Bay and then around the tip of the Peninsula to a core in the Erebus and Terror Gulf. The core sites include both inner shelf fjords, and more open regions of the inner- to mid-shelf. Multi-proxy data, including sedimentologic, geochemical and micropaleontologic data, were used to support the clues held by a diatom proxy, based on changes in the distribution of different morphologies of *Eucampia antarctica*, a common Southern Ocean diatom. The data suggest that for a period of time during the mid Holocene, from $\sim 7,500 - 5,500$ ybp, and peaking at about 6,500 ybp, the shelf was characterized by the influx of "sub-polar" waters, suggesting a more proximal influence of the Antarctic Circumpolar Current. Oxygen isotopic data on planktic foraminifera from the Hugo Island Trough core indicate warmer surface waters, while the foraminiferal assemblage data document the persistent occurrence of UCDW on the shelf, at this time. In addition to this large scale change in oceanographic circulation, winter sea ice extent was uniformly low from throughout the early Holocene, from $\sim 11,000 - 6,000$ ybp; from 6,000 ybp to the present, sea ice extent was generally higher and more variable.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Mineral dust variability in Central-West Antarctica associated with ozone depletion

Forename: Marcio Surname: Cataldo

Authors: Cataldo, Marcio; Evangelista, Heitor; Simões, Jefferson; Godoi, Ricardo; Simmonds, Ian; Hollanda, Maria Helena; Wainer, Ilana; Aquino, Francisco; Van Grieken, René;

Presentation Allocated: Poster

abstract: Here we show that mineral dust retrieved from an ice core at the Central-West Antarctic Sector, spanning the last five decades, provides evidence that northerly air mass incursions into Antarctica, tracked by dust microparticles, have slightly declined. This result contrasts with dust in ice core records reported to Western/coastal Antarctica, that show significant increases to the present day. We attribute that difference, in part, to changes in the regional climate regime triggered by the ozone depletion with consequences to the polar vortex intensity that maintains the Antarctic central region relatively isolated from mid latitude air mass incursions with implications to the intensification of the westerlies and to a persistent positive phase of the Southern Annular Mode. We also show that variability of diameter of insoluble microparticles in Central-West Antarctica can be modeled by linear/quadratic functions of both cyclone depth (energy) and wind intensity around Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: OCEAN-ICE SHELF INTERACTIONS IN THE ROSS SEA AND THE CHANGING MODES OF DEEP OCEAN VENTILATION

Forename: Alejandro Surname: Orsi

Authors: Orsi, Alejandro;

Presentation Allocated: Poster

abstract: The active year-round Southern Ocean exchange of heat and freshwater with the polar atmosphere and cryosphere facilitates the rapid propagation of ongoing climate changes in Antarctica. The documented warming and freshening of bottom waters in the Pacific sector are traced back to their Ross Sea origins. Shallow and deep boundary currents carry these signals to the abyssal layers farther north. The narrow shelf between the Amundsen and Ross Seas shows nearly freezing and low salinity surface water carried westward by the Antarctic Slope and Coastal Currents. Around Cape Colbeck the coastal flow turns south and subsurface waters offshore have direct access to the Ross Ice Shelf along the Little America Trough. Year-long transport along this path is studied with an array of moored subsurface temperature, salinity and current recorders deployed near the outer and mid portions of that Trough. They reveal active ocean-ice interactions, with intermediate meltwater outflow in early winter, preceded by relatively warm subsurface influences throughout the summer, and followed by a weakly stratified water column that persisted during the rest of the year. Transformation and redistribution of northern and Antarctic waters around cyclonic circulations in the subpolar Pacific also have significant influences on global meridional overturning and inter-basin exchange, and are highly sensitive to global change. Observations from the CLIVAR Repeat Hydrography program show evidence of decadal scale changes in water mass properties, circulation patterns and transports in the southern Pacific. Regional types of Antarctic surface and bottom waters have become lighter in the past two decades, primarily due to the lower salinities of source waters. The densest Ross Sea outflow is no longer distinguishable by its high salt content from other sources. Its present substitutes are warmer but far-reaching, as documented by progressive and widespread warming of the abyssal ocean. The bulk of deep northern source waters entering the subpolar gyres has also warmed. The observed evolution of the southern Pacific points to the relatively rapid Antarctic response to global change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Ozone and Greenhouse Gas Influences on the Amundsen - Bellingshausen Seas Low

Forename: Ryan Surname: Fogt

Authors: Fogt, Ryan; Zbacnik, Elizabeth;

Presentation Allocated: Oral

abstract: The Amundsen-Bellingshausen Seas Low (ABSL), a semi-permanent low pressure off the coast of West Antarctica, has important monthly and seasonal variations that are not yet fully understood. Since the presence of the ABSL contributes to the marked warming and sea ice loss occurring in the region, it is necessary to further characterize these variations. A recent study suggested some of the ABSL variations are due to stratospheric polar ozone depletion. With this in mind, this study seeks to determine the sensitivity of the ABSL to ozone depletion and changes in greenhouse gas concentrations using chemistry-climate models (CCM), which more accurately depict the stratosphere where ozone-depleting processes occur. Our analysis is done using CCM data from the Stratospheric Processes and their Role in Climate (SPARC) Chemistry-Climate Model Validation project phase 2 (CCMVal2), focusing on the region of the ABSL [45°-75°S; 180°-60°W]. Temperature, wind, and geopotential height at various pressure levels are examined for the period of 1979-2001. Comparisons are made with two sensitivity runs: one with constant ozone and one with constant greenhouse gas levels. The same variables are also compared to the NNR, ERA-40 and JRA-25 reanalysis datasets for model validation. While there are some intermodel differences, we note that both ozone depletion and changing greenhouse gas levels have an impact on the ABSL, but only during certain months. Results from this study can increase our understanding of how the ABSL might respond to changes in ozone and increasing greenhouse gas concentrations, and therefore the future impact it will have on the climate of the region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Recent decadal-scale freshening of the Antarctic Bottom Water exported from the Weddell Sea

Forename: Alberto Surname: Naveira Garabato

Authors: Naveira Garabato, Alberto; Jullion, Loic; Meredith, Michael; Holland, Paul; Courtois, Peggy; King, Brian;

Presentation Allocated: Oral

abstract: On the Antarctic continental shelf, the intricate interplay between the ocean, the atmosphere and the cryosphere, leading to the formation of Antarctic Bottom Water (AABW), makes the water mass potentially very sensitive to the significant climatic changes observed in Antarctica. The recent observations of a rapid freshening of the AABW in the Indian and Pacific sectors of the Southern Ocean and a widespread warming in the Atlantic highlight this sensitivity. The driving mechanisms of this variability are still an open question. Here, we will report the first observational evidence of a recent decadal-scale freshening of the AABW exported from the Weddell Sea, based on the analysis of 17 occupations (1993 - 2011) of the SR1b hydrographic section in eastern Drake Passage. We will present evidence suggesting that the breaking of the Larsen B ice shelf and changes in the atmospheric conditions near the Antarctic Peninsula linked to the Southern Annular Mode are the most likely causes of the observed freshening. Recent interdecadal changes in the SAM have been linked to greenhouse gas emissions and ozone depletion, raising the possibility of a partially anthropogenic cause for the observed AABW freshening.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Recent West Antarctic warming caused by central tropical Pacific warming

Forename: qinghua Surname: ding

Authors: ding, qinghua; steig, eric; battisti, david; kuttel, marcel;

Presentation Allocated: Poster

abstract: The Pacific sector of Antarctica, including both the Antarctic Peninsula and continental West Antarctica, has experienced substantial warming in the last 30 years. An increase in the circumpolar westerlies, due in part to the decline in stratospheric ozone since the late 1970s, may account for warming trends in the peninsula region in austral summer and autumn. The more widespread warming in continental West Antarctica occurs primarily in austral winter and spring, and remains unexplained. Here, we use observations of Antarctic surface temperature and global sea surface temperature, and atmospheric circulation data to show that recent warming in continental West Antarctica is linked to sea surface temperature changes in the tropical Pacific. Over the last 30 years, anomalous sea surface temperatures in the central tropical Pacific have generated an atmospheric Rossby wave response that influences atmospheric circulation over the Amundsen Sea, bringing increased warm air advection to the Antarctic continent. General circulation modeling experiments show that the central tropical Pacific is a critical region for producing the observed high latitude response. Forcing of high latitude Southern Hemisphere circulation by increasing tropical sea surface temperatures may account for West Antarctic warming through most of the 20th century.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: The ACCIMA project

Forename: David Surname: Bromwich

Authors: Bromwich, David; Hines, Keith; Bai, Le-sheng; Nicolas, Julien; Holland, David; Klinck, John; Dinniman, Michael; Yoo, Changhyun; Gerber, Edwin;

Presentation Allocated: Poster

abstract: The West Antarctic Ice Sheet (WAIS) is currently losing mass via several of its outlet glaciers draining into the Amundsen Sea. Recent studies project accelerated retreat for the Thwaites Glacier and Pine Island Glacier. Warm ocean currents appear to be a factor in glacier and ice shelf retreat on the mesoscale. While recent work in the climate modelling community has emphasized coupling of multiple components so as to achieve flexible, quantitative, multi-disciplinary tools to address the various critical climate questions, global models are not ideal to treat driving processes on the mesoscale. Consequently, we adopt a high-resolution regional climate approach to modelling the key coupled atmosphere-ocean-ice processes for the WAIS that represents about 10% of the volume of the entire Antarctic ice sheet. The Atmosphere-Ocean Coupling Causing Ice Shelf Melt in Antarctica (ACCIMA) project combines a team of researchers from The Ohio State University, Old Dominion University and New York University to develop and couple components of an earth system model for the Southern Ocean with a regional emphasis on the West Antarctic. The component system models to be coupled include the polar-optimized version of the Weather Research and Forecasting model (Polar WRF) for the atmosphere. The ocean component is the Regional Ocean Modeling System (ROMS), and the sea ice component is the Los Alamos sea ice model (CICE). Retrospective decadal simulations will be performed to understand recent past variability. Downscaled future projections for Antarctica will be driven by the global National Center for Atmospheric Research (NCAR) Community Climate Model (CCSM or its equivalent). Resulting simulations will explore the possibility that increased basal melt of the seaward floating ice shelves of the region's terminal glaciers is increasing ice mass loss from West Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: The Characteristic Variability and Connection to the Underlying Synoptic Activity of the Amundsen-Bellingshausen Seas Low

Forename: Alex Surname: Wovrosh

Authors: Wovrosh, Alex; Fogt, Ryan; Simmonds, Ian;

Presentation Allocated: Poster

abstract: Recent studies have noted an asymmetrical climate change across Antarctica, with significant warming in West Antarctica and the Antarctica Peninsula, and primarily insignificant trends in East Antarctica. Due to its proximity, variations in the position and intensity of the Amundsen-Bellingshausen Seas Low (ABSL) are a suspected atmospheric mechanism. Here, we investigate the ABSL to understand its characteristic variability and underlying synoptic-scale influences, based on three reanalysis datasets. The ABSL is defined as the minimum monthly pressure in the $45^{\circ} - 75^{\circ}\text{S}$, $180^{\circ} - 60^{\circ}\text{W}$ domain. Using this criterion, a significant north-south and east-west progression is noted in the climatological (1979-2001 average) ABSL, which is strongly tied to the location of the maximum cyclone system density and minimum cyclone central pressures. More than 550 cyclones a year were identified in the vicinity of the ABSL; during spring, significant trends in their central pressures are noted in the Ross Sea. The implied changes in temperature advection by these stronger systems are consistent with the warming in West Antarctica. The strongest cyclone events (i.e., the ten with the deepest central pressures) also demonstrate a connection to the climatological ABSL, albeit weaker. Moreover, these strong cyclone events are significantly linked to the Southern Annular Mode (SAM), particularly in their annual frequency and location/steering in the summer. This shows that large-scale forcing, such as from the SAM, may influence the strongest cyclones in the region and could allow for the prediction of such events.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: The Role of Stratospheric Ozone Recovery in Mitigating Future Antarctic Sea Ice Loss

Forename: Karen L Surname: Smith

Authors: Smith, Karen L; Polvani, Lorenzo M;

Presentation Allocated: Poster

abstract: While Arctic sea ice extent has experienced a marked decline over the past several decades, Antarctic sea ice extent has exhibited a weak yet statistically significant positive trend. The advance of Antarctic sea ice is most pronounced in the Ross Sea region, while sea ice extent (SIE) in the Amudsen-Bellingshausen has declined. Recent studies have argued that the observed positive trend in SIE in the Ross Sea is related to the contemporary positive trend in the Southern Annular Mode (SAM) associated with stratospheric ozone depletion. Here, we investigate the effect of stratospheric ozone recovery on Antarctic sea ice by comparing two simulations from the year 2000 to the year 2065 of the Whole Atmosphere Community Climate Model (WACCM) that is coupled to an ocean. In the first simulation, ozone-depleting substances are held fixed at year 2000 levels (FixODS) and in the second, ozone recovery is predicted (RCP4.5). We find that SIE declines in both simulations; however, the negative trend in SIE is significantly greater in the FixODS simulation in all seasons and in all ocean regions. The largest percentage difference in the SIE trend between FixODS and RCP4.5 occurs in austral spring/summer when enhanced Ekman pumping due to the poleward shifted westerly jet in the FixODS simulation leads to sea ice export and a thinning of the sea ice. The largest absolute difference in SIE trend occurs in austral fall/winter involving complementary effects of enhanced Ekman pumping in the FixODS simulation and advection of warm, maritime air from the north in the RCP4.5 simulation. In all seasons we observe a greater trend in first year ice fraction near the coast and reduced first year ice fraction near the ice edge in the FixODS simulation relative to the RCP4.5 simulation illustrating equatorward export of sea ice. Our model results suggest that ozone recovery, rather than depletion, acts to mitigate future Antarctic sea ice loss due to anthropogenic climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: The seasonal characteristics of mixed layer depth and stratification in the southern ocean using in situ observations

Forename: Sebastiaan Surname: Swart

Authors: Swart, Sebastiaan; Chang, Nicolette; Joubert, Warren; Tagliabue, Alessandro; Thomalla, Sandy; Monteiro, Pedro;

Presentation Allocated: Poster

abstract: The changing balance between buoyancy forcing and wind mixing is one of the factors that could alter the long term trends in the Southern Ocean's role in the climate – carbon feedback. The physical conditions of the surface ocean is crucial to the biological carbon pump, and in the Southern Ocean this may be exhibited as a bottom-up control on primary production mediated through properties of the mixed layer. The mixed layer variability is strongly influenced by the seasonal cycle of both buoyancy (heat, freshwater) and momentum (winds) forcing. We investigate the seasonal cycle of stratification (Brunt-Väisälä frequency) and mixed layer depth (MLD) in the Southern Ocean, with particular focus on the oceanic processes that contribute to their observed regionality and variability. In large areas of the Southern Ocean the variability of MLD is closely constrained by its seasonal cycle, while in other regions, particularly the Subantarctic Zone, less than 20% of the variance of the MLD can be explained by the seasonal cycle. These domains experience high degrees of intra-seasonal variability and we show that this can drive different biogeochemical responses by modulating light and iron concentrations in the euphotic zone.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: The Southern Ocean and its Climate in CCSM4

Forename: Wilbert Surname: Weijer

Authors: Weijer, Wilbert; Sloyan, Bernadette; Maltrud, Mathew; Jeffery, Nicole; Hecht, Matthew; Hartin, Corinne; van Sebille, Erik; Wainer, Ilana; Landrum, Laura;

Presentation Allocated: Poster

abstract: The Southern Ocean is a key area in the climate system for many reasons, and good representation of its mean state, internal variability, and response to external forcing is essential for the fidelity of coupled climate simulations. Here we present results of our evaluation of the Southern Ocean in the Community Climate System Model v4 (CCSM4). The CCSM4 is a state-of-the-art coupled climate model, and a suite of simulations have been performed following the protocol of the Coupled Model Intercomparison Project, phase 5 (CMIP5). We discuss the surface climatology and interannual variability, evaluate the representation of the major water masses of the Southern Ocean (Antarctic Bottom Water, Subantarctic Mode Water, and Antarctic Intermediate Water), compare water mass properties and tracer distributions to observations, and address the representation of the Antarctic Circumpolar Current and the interocean exchanges that take place along the northern edge of the Southern Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 4

Title: Understanding the Southern Ocean CO₂ uptake region: biological and physical controls

Forename: Jennifer Surname: Ayers

Authors: Ayers, Jennifer; Strutton, Peter;

Presentation Allocated: Poster

abstract: Based on sparse data, the Southern Ocean region between ~30 and 50°S is a strong sink for atmospheric CO₂ on a mean annual basis. Unlike some annual sink regions found at similar latitudes in other basins, the Southern Ocean sink uptakes atmospheric CO₂ year-round by maintaining a sea surface pCO₂ consistently below that of the atmosphere. This work aims to quantify the roles of temperature effects, biological drawdown, and physical ocean circulation in maintaining low pCO₂ in the region throughout an annual cycle. We compare seasonal and annual controls on the carbon sink of the Indian, Atlantic, and Pacific sectors of the Southern Ocean with our previous quantification of controls on the North Pacific carbon sink. Both sink regions are found between ~30 and 50° latitude in their respective hemispheres in deep western boundary current extension regions, suggesting that the location of the Southern Ocean carbon sink, like the North Pacific carbon sink, may be determined by the large-scale ocean circulation. However, while the North Pacific sink region exhibits the largest seasonal seawater pCO₂ cycle globally, the Southern Ocean sink region exhibits nearly no seasonal cycle, suggesting that seasonal and annual controls on the two carbon sinks may differ considerably. This work seeks to identify and quantify dominant seasonal and annual controls on the strong annual CO₂ uptake region of the Southern Ocean. Understanding controls on air-sea CO₂ flux on these short time scales will provide a foundation for understanding how it may evolve with global climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Changes in the Southern Hemisphere Atmospheric Jets over the Twenty First Century from the CMIP5 models

Forename: Sheeba Surname: Nettukandy Chen

Authors: Nettukandy Chenoli, Sheeba; Turner, John; Abu Samah, Azizan;

Presentation Allocated: Oral

abstract: The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC/AR4) models suggested there would be a poleward shift of the Southern Hemispherical jets as well as an intensification of them during the next 100 years if greenhouse gas concentrations coupled. In this presentation, predictions of 19 World Climate Research Programme Coupled Model Inter-comparison Project Phase 5 (CMIP5) of the coupled models from the IPCC fifth assessment report (AR5) archive are examined to predict changes in the Southern Hemisphere jets over the twenty first century. The first part of the study was carried out to assess how the historical runs of the CMIP5 model represented the strength, position and variability of the Southern Hemispheric jet streams. To explore this issue, we compared the historical runs of CMIP5 model with the ERA interim data from 1981 – 2010. Here, we compared the location of the jets, climatology of zonal wind, its annual cycle and trends in the wind speed from the ERA-interim with the model run. We investigated further the role of broadscale climate and Southern Annular Mode (SAM) on the variability of the jet streams. In the second part of the study, we have examined the future trends in the wind speed, location and variability of jets based on the future prediction from CMIP5 models.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Constraining the modern environment for Holocene climate reconstruction in Southern Patagonia

Forename: Sverre Surname: LeRoy

Authors: LeRoy, Sverre; Vizcaino i Marti, Alexis; Stadnyk, Alex; Mucciarone, David; Dunbar, Robert;

Presentation Allocated: Oral

abstract: One of the largest uncertainties in the Holocene ocean-atmosphere carbon cycle is the role of the Southern Ocean in driving atmospheric CO₂. The strength and position of the westerly winds is thought to control CO₂ exchange, however, little is known about westerly wind variability over the Holocene. Southern Patagonia is an ideal locality for addressing this uncertainty, as it is the only major landmass that extends into the southern wind field. In particular, fjord and lake environments in this region hold potential for reconstructing precipitation, which is closely correlated with westerly wind strength. Sediments in these fjords and lakes may record precipitation signals, which therefore allow us to reconstruct large-scale climate forcings. Characterizing the modern environment allows for selection of ideal sediment core sampling sites and provides a framework from which to place sediment data into context. During August 2011, we collected seismic profiles, water samples, and sediment samples from fjords and Lago Sarmiento, a large, closed-basin lake, near Puerto Natales, Chile (51°45'S, 72°15'W). Here, we show results from CTD casts and dissolved oxygen, which elucidate water circulation between Seino Ultimo Esperanza (SUE), Golfo Almirante Montt (GAM), and Canal Valdes (CV). Additionally, we show $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and C:N values of sediment samples from gravity cores and grab samples from GAM and CV. We discovered that modern surface bulk sediment $\delta^{13}\text{C}$ values range from -22.24 to -19.26 ‰, $\delta^{15}\text{N}$ from 8.23 to 9.22‰, and C:N values from 8.80 to 11.89. Among our sample sites, we identified one area of special interest due to its anoxic bottom waters ([O]=1.98 μM), and elevated C:N (11.5) and $\delta^{13}\text{C}$ (-19.3‰) values relative to other GAM and CV sites. This site may prove to be an ideal coring location because it could offer a high-resolution record. Beyond improving our understanding of the modern environment, these data will help us constrain regional paleoclimate records. This work represents an important first step for future coring in this key region of the climate system.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: COUPLED OCEAN ATMOPHERE IN THE BRAZIL-MALVINAS CONFLUENCE REGION
ESTIMATED FROM GLOBAL DATABASES

Forename: Ronald Surname: Souza

Authors: Souza, Ronald; Pezzi, Luciano; Casagrande, Fernanda;

Presentation Allocated: Oral

abstract: The Brazil-Malvinas Confluence (BMC) region in the South Atlantic Ocean is characterized by the thermal gradients of the meeting between the warm Brazil Current (BC) and the cold Malvinas Current (MC). The region is considered a key region for understanding the linkage between Antarctica and South America. This paper aims to describe the atmospheric wind modulation forced by the thermal contrasts of the BMC region and estimate the variation of heat flux (latent and sensible heat) over the study area. Data were available from the QuikScat satellite, NCEP/NCAR reanalysis, HiRAC (High-resolution, Regionally Analyzed COADS -Tokinaga et al., 2005), and from the AMSR sensor onboard the Aqua satellite. Analysis of the data demonstrated that wind and heat flux intensity fields were directly related to the SST fields attesting the coupling between the ocean and the atmosphere at the BMC region. The satellite data confirms former evidence (Pezzi et al., 2009; Acevedo et al., 2010) that wind and heat flux intensity increases over the warm waters of BC and decreases over the cold waters of the MC. The reanalysis data was not as able as the satellite data to represent the atmospheric modulation in terms of wind intensity. This work suggests that the use of satellite data is important when studying ocean-atmosphere coupling over regions of intense oceanic mesoscale activity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Dense shelf water formation at coastal polynyas in the Weddell Sea

Forename: Verena Surname: Haid

Authors: Haid, Verena; Timmermann, Ralph; Heinemann, Günther; Ebner, Lars;

Presentation Allocated: Poster

abstract: For any climate signal to leave an imprint on the Antarctic Bottom Water (AABW) that fills the World Ocean abyss, it has to pass through the process of bottom water formation in the marginal seas of the Southern Ocean. An indispensable component of AABW is the dense shelf waters created on the continental shelves around Antarctica, particularly in the Ross and Weddell Seas. At coastal polynyas we find strong atmospheric cooling and high freezing rates that lead to a strong salinification of the water column. Here the bulk of High Salinity Shelf Water (HSSW) is formed. The impact of coastal polynyas on ice production and water mass formation in the southwestern Weddell Sea was studied employing the Finite Element Sea ice-Ocean Model (FESOM) of Alfred Wegener Institute, Bremerhaven. FESOM is a coupled system of a primitive-equation, hydrostatic ocean model and a dynamic-thermodynamic sea ice model. Simulations were conducted on a global unstructured mesh with a strong focus on the southwestern Weddell Sea coastline (up to 3 km resolution). The model runs were initialised in 1980 and forced with NCEP reanalysis data (daily resolution). For 2008 also higher-resolution GME data and results from the regional COSMO atmosphere model of University Trier were applied as atmospheric forcing data. The period 1990-2009 is used for data analysis. Our simulations indicate that mean winter sea ice production within the coastal polynyas exceeds the surrounding area's ice production by a factor of 7, giving a polynya contribution to total sea ice formation of 3 %. This small percentage is due to their even smaller areal percentage (0.4 %), and also the existence of leads and small polynyas in the 'ice-covered' ocean. The latter contribute substantially to sea ice production, but not to bottom water formation since they are transient elements that open, move and close dependent on the ice drift, whereas coastal polynyas are fixed in space and often open for days, enabling the salinification necessary for HSSW formation. From our simulations we derive a mean HSSW-formation of $4.2 \cdot 10^5$ km³/winter, but only 0.5 Sv thereof are exported over the shelf break, the rest stays on the shelf and is warmed and diluted during the following summer. The WSBW formation rate for the southwestern Weddell Sea continental shelf in our simulation is about $6.3 \cdot 10^4$ km³/yr (2 Sv), which is on the low side but still reasonable compared to independent estimates.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Diagnosing the role of the Weddell Gyre in the global ocean circulation

Forename: Alberto Surname: Naveira Garabato

Authors: Naveira Garabato, Alberto; Jullion, Loic; Bacon, Sheldon; Meredith, Mike; Brown, Peter; Venables, Hugh; Speer, Kevin; Bakker, Dorothee; Watson, Andrew; Sanders, Richard; Jenkins, William; Ballentine, Christopher;

Presentation Allocated: Oral

abstract: Bottom water formation in the Southern Ocean plays an important role in the lower cell of the Meridional Overturning Circulation and in marine biogeochemical cycling, by ventilating and cooling the ocean abyss and sequestering carbon and nutrients there. The lack of adequate observations has to date hindered the quantification of exchanges of mass and physical and biogeochemical tracers between the Weddell gyre and the global ocean. The Antarctic Deep Water Rate of Export (ANDREX) project seeks to determine these exchanges through the analysis of the first systematic hydrographic and tracer survey along the gyre's outer rim. These measurements (including temperature, salinity, oxygen, nutrients, carbon system parameters, chlorofluorocarbons, sulphur hexafluoride, oxygen isotopes, noble gases and radiocarbon) are combined with velocity observations in an inverse model to obtain a self-consistent estimate of the physical and biogeochemical transports across the edge of the Weddell gyre and of the rate at which the deep ocean is ventilated from the region. Of particular interest to the analysis are the quantification of bottom water formation and the density profile of ventilation in the gyre, as well as an assessment of the region's role in biogeochemical cycling and anthropogenic carbon sequestration. In this presentation, we will discuss the initial results of the inverse model, focusing on the physical circulation and water mass transformations in the Weddell gyre.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Evidence for increased Southern Ocean waters in the tropical intermediate Indian Ocean during the last deglaciation

Forename: Harunur Surname: Rashid

Authors: Rashid, Harunur; Gourlan, Alexandra; Smith, Mary;

Presentation Allocated: Poster

abstract: Oxygen isotopes and Mg/Ca ratios in the planktonic foraminifera *Globigerinoides ruber* (white) were analyzed from the marine sediments of the Bay of Bengal and Andaman Sea. Mg/Ca, Cd/Ca and B/Ca ratios are also determined in benthic foraminifers *Cibicidoides wuellerstorfi* and *Uvigerina peregrina* in two cores from the Andaman Sea and western Arabian Sea. Furthermore, neodymium isotopic ratios (ϵNd) of seawater in two sediment cores are determined. Our results show that seawater oxygen isotope values were most enriched between 17.8 and 14.6 ka. We also find coincidence between the onset of intermediate water warming at 17.8 ka, and the onset of increase in atmospheric CO₂. In the tropical Indian Ocean, the deep water (>2200 m) warmed after the surface, in sharp contrast with the warming found in the intermediate water which occurs earlier. Furthermore, an inverse relationship between the intermediate and surface waters is also found during the Bolling-Allerod and Younger Dryas periods in which surface water warmed (cooled) and intermediate water cooled (warmed). We hypothesize that the cause of warming of the northern tropical Indian Ocean intermediate water does not lie within the tropics, rather an increase in Southern Hemisphere spring insolation combined with sea-ice albedo feedbacks, consistent with the hypothesis suggested earlier (Stott et al., 2007). The hypothesized mechanism involves an increase in upper circumpolar deep-water (UCPDW) circulation into the Indian Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Freshwater fluxes in the Weddell Gyre: Results from $\delta^{18}O$

Forename: Peter Surname: Brown

Authors: Brown, Peter; Meredith, Michael; Naveira Garabato, Alberto; Jullion, Loic; Venables, Hugh; Speer, Kevin;

Presentation Allocated: Oral

abstract: Freshwater Molluscs; A tool for Biomonitoring. 1Zahoor Pir, 2Imtiyaz Tali, 3Shailendra Sharma, 1L. K. Mudgal, 2Anis Seddique, 1. Department of Zoology, Govt P. G. girls college Motitabela Indore MP- 452001. 2. Department of Zoology, Govt holkar Science College Indore MP- 452001. 3. Department of zoology, Shri Omya College Mandleshwar Indore MP- 452001

Abstract:- The molluscs contribute second largest invertebrate group on earth. The Molluscan Fauna are absent in strong currents, but appear when the current is slowed down. The Molluscs are helpful in purification of water in their capacity to act as scavengers. The Molluscs play an important role in the assessment of water quality that is they are used as Bio indicators. The rivers are always selected as the sites for drinking purposes. The biodiversity of Narmada river is quite varied, rich and needs regular monitoring and conservation as the river is subjected to various sources of point and non point pollution which are posing threat to these biota. Molluscan species were collected from specific stations of Narmada River from July 2009 to June 2010. During the present investigation carried out, about eight species of class gastropoda and eight species of class pelecypoda were recorded through out the year. Among the gastropoda group, *Vivipara bengalensis* was most dominant followed by *Bellamya bengalensis*, *Indoplanorbis*, *Unio* species, *Thiara scabra*, *Pila globosa*, *Thiara lineata*, and *Thiara tuberculata*. Among pelecypoda the dominant species was *Lymnaea acuminata*, followed by *Lymnaea auricularia*, *Corbicula striatella*, *Pissidium clarkeanum*, *Melanoides tuberculata*, *Musculium indicum*, *Parreysia favidens*, *Corbicula striatella* and *Perreysia caerulea*. *Vivipara bengalensis* and *Bellamya bengalensis* dominated the Molluscs fauna and are distributed from the shore line to 3 m depth in all types of sediments. Some species of Molluscs like *Lymnaea* lives in only highly polluted environment. The species like *Thiara* and *Indoplanorbis* live in slightly polluted environment, while the species like *Pseudomillieria delyi* is highly sensitive to pollution and can survive in pollution free environment. On the presence these species we can know the water quality of river.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Interannual variability and long term trends in the north-western Weddell Sea CDW and the impact on AABW

Forename: Sunke Surname: Schmidtko

Authors: Schmidtko, Sunke; Thompson, Andrew; Heywood, Karen;

Presentation Allocated: Oral

abstract: The January 2012 hydrographic cruise JR255A within the GENTOO project, repeated the Antarctic Peninsula shelf and shelf break part of the SR04 section and collected the most recent hydrographic data from the northwestern Weddell Sea up to the 2500m isobath. This section covers 4 distinct water masses: cold boundary current waters on the shelf from various sources, very fresh, cold central Weddell Sea summer surface waters, warm Circumpolar Deep Water (CDW) and the cold Antarctic Bottom Water (AABW) along the shelf break. This part of the Weddell Sea has been visited more regularly than any other part south of the Antarctic Circumpolar Current since the beginning of WOCE, making this an ideal location for inter annual variability studies. We analyse the variability and long term changes of the hydrographic properties of the theta maximum associated with the CDW in the Powell Basin in the north western Weddell Sea and just south of this basin over the past two decades. The CDW core variability has direct influence on AABW properties via virulent entrainment and mixing along its export pathway along the Antarctic Peninsula. We discuss the importance and impact of CDW changes on observed AABW changes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Intrusion of Circumpolar Deep Water over the continental shelf in the central Amundsen Sea

Forename: Ho Kyung Surname: Ha

Authors: Ha, Ho Kyung; Kim, Tae Wan; Wahlin, Anna; Lee, Jae Hak; Lee, Sang Hoon;

Presentation Allocated: Poster

abstract: The Amundsen Sea sector is the most rapidly changing region of the Antarctic ice sheets. It has been claimed that the rapid retreat of the glaciers (or ice sheets) is primarily related to the intrusion of warm Circumpolar Deep Water (CDW) which acts as an oceanic heat source. The Amundsen shelf troughs were suspected to be main conduits supplying warm CDW onto the continental shelf, eroding the underside of the ice sheets and glaciers. Despite the critical role of CDW in the continental shelf of the Amundsen Sea, vital information is still lacking concerning the spatial-temporal variability of CDW. This is mainly because the Amundsen Sea is remotely located and the harsh weather and sea conditions limit the access to its inner shelf. This pronounced lack of data hinders the evaluation and prediction of physical processes and associated biogeochemical processes in the Amundsen Sea. Using the icebreaker R/V Araon, a multi-disciplinary scientific cruise was conducted between December, 2010 and January, 2011 to reveal the spatial distribution of CDW on the Amundsen shelf. During the expedition, total 30 CTD stations were visited. Warm CDW occupied a large volume seaward of the continental slope. During the transport onto the continental shelf it is modified by subsurface melting processes and interaction with Antarctic Surface Water into a fresher and colder water mass, Modified CDW (MCDW). Two cross-trough transects clearly show the intruding tongue of MCDW. The core of warm, denser water was mostly confined to the deeper part of shelf trough. The temperature of the surface water varied spatially. The warmest surface water, $-0.8\sim-0.4^{\circ}\text{C}$, was found in the open polynya, and the coldest water was found below sea ice. In order to understand the temporal variation of the flow of CDW, the shipborne measurements were combined with a mooring measuring temperature, salinity and velocity every hour during 2010. During the observation period, the average water and heat transport were $2.5\text{ m}^2/\text{s}$ and $26\text{ MW}/\text{m}$ along the western channel, respectively. The velocity of the CDW along the western channel showed a good correlation with the variation of eastward wind speed. Preliminary results collected during the upcoming Araon cruise during austral summer 2012 will be also presented in terms of CDW intrusion and its synoptic circulation on the Amundsen shelf.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Numerical Investigation of Dense Water Formation Under the Ross Sea Ice Shelf

Forename: Marcos Surname: Tonelli

Authors: Tonelli, Marcos; Wainer, Ilana;

Presentation Allocated: Poster

abstract: Dense water formation around Antarctica is recognized as one of the most important processes to climate modulation, since that's where the linkage between the upper and lower limbs of Global Thermohaline Circulation takes place. Assessing whether these processes may be affected by rapid climate changes and all the eventual feedbacks may be crucial to fully understand the ocean heat transport and to provide quality projections. Applying the Coordinated Ocean-Ice Reference (CORE) interannual forcing we have run a 50-year simulation (1958-2007) using ROMS with the sea-ice/ice-shelf thermodynamics module. Another 100-year simulation forced with CORE normal year was previously run to provide stable starting fields. The normal year consists of single annual cycle of all the data that are representative of climatological conditions over decades and can be applied repeatedly for as many years of model integration as necessary. The 50-year forcing has interannually varying data from 1958 to 2007, which allows validation of model output with ocean observations. Both experiments employed a variable high resolution grid reaching less than 5km over the inner continental shelf. Performing OMP water masses separating scheme, we were able to identify the main Ross sea water masses: Antarctic Surface Water (AASW), Circumpolar Deep Water (CDW), Antarctic Bottom Water (AABW) and Shelf Water (SW), further separated into Ice Shelf Water (ISW) and High Salinity Shelf Water (HSSW). Results are consistent with previous observational studies and the capability to represent ISW and HSSW is an relevant contribution to climate studies, since IPCC class models seem unable to provide reliable representations of such important processes which may lead projections to more realistic scenarios.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Rapid freshening and contraction of Antarctic Bottom Water south of Australia

Forename: Esmee Surname: van Wijk

Authors: van Wijk, Esmee; Rintoul, Steve;

Presentation Allocated: Oral

abstract: Dense waters formed in the polar regions supply the lower limb of the global overturning circulation, which largely controls the ocean and transport of heat and carbon dioxide. Bottom water formed around the margin of Antarctica provides the coldest and densest waters found in the world's oceans. Recent studies show strong evidence that changes in the Southern Ocean are underway but the magnitude and drivers for these changes are unclear. We used repeat hydrographic sections to investigate changes in the Antarctic Bottom Water in the Australian Antarctic Basin. WOCE/CLIVAR repeat lines SR3 (140E) and I9S (115E) have each been occupied several times between 1994 and 2012; nearby stations from the pre-WOCE period were used to extend the time series back to the late 1960s where possible. Dense waters sinking along the Antarctic continental slope have become significantly fresher and less dense over the last 40 years at both 140E and 115E. The potential temperature – salinity (T-S) relationship has shifted towards fresher and lighter bottom waters throughout the basin. The T-S curves diverge at potential temperatures warmer than 0C, corresponding to a layer more than 1000 m thick. The bottom water layer has also thinned and contracted: the area below the 28.3 kg/m³ neutral density surface has reduced by about 30% at each section between the mid-1990s and the present. Comparing recent data to nearby stations occupied in 1970, we find a 65% reduction in the area of the layer over this time period. The thickness and area of the layer below the 28.25 kg/m³ neutral surface has not changed. The observed changes in AABW could be caused by a change in the formation rate or the properties of the source waters. Changes in the production rate of dense shelf waters would likely be associated with changes in oxygen, which are not observed. Basin-wide changes in the potential temperature – salinity (T-S) relationship, on the other hand, are consistent with formation of fresher, lighter shelf waters. Vertical and isopycnal mixing of the fresh, dense shelf waters with surrounding waters can explain the changes in water properties observed in the 1000-m thick abyssal layer. We conclude that freshening of dense waters descending the Antarctic continental slope is the most likely cause of the rapid and widespread changes observed south of Australia and in basins further north.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Role of Southern Annular Mode (SAM) on Antarctic Climate Change and Its Signal in the North Pacific

Forename: Seong-Joong Surname: Kim

Authors: Kim, Seong-Joong; Choi, Hye-Sun; Kim, Baek-Min;

Presentation Allocated: Oral

abstract: This study investigates the role of the Southern Annular Mode (SAM) on the recent Antarctic climate change and the influence of the SAM on the climate change in the North Pacific. We analyzed the seasonal-mean surface temperature trends over Antarctica from 1957 to 2006 using CRUTEM3 data. During the analyzed period, the most common feature found in all seasons is the marked warming in the Antarctic peninsula by more than 0.6°C per decade and little warming or even slight cooling in east Antarctica, especially in austral fall season. The former is called WAP-LEA pattern and the latter is named WAP-CEA pattern. The surface temperature trends is overall consistent with the change in sea surface temperature (SST), which shows the substantial warming in the Bellingshausen and Amundsen Sea, but a slight warming in the coast off east Antarctica. A substantial cooling is observed in the open ocean of the Ross Sea sector. The change in SST is associated with the change in sea ice extent. We examined the role of the change in SAM index, which has been suggested to be the most important driver in Antarctic climate change, on the surface temperature trends. From a regression analysis, we found that the WAP-CEA pattern shown in austral fall is largely illustrated by the change in SAM, especially in east Antarctica. Overall, the change in the SAM illustrates the warming over the Antarctic peninsula by about 50% in austral winter and fall and in east Antarctica the change in the SAM leads to the slight cooling trends. The little temperature change in east Antarctica in spite of greenhouse gas increase seems to be due to the change in the SAM index. The SAM also influences the SST in the North Pacific. When the SAM is in positive phase during August, a marked cooling is found in the northeastern Pacific, whereas a marked warming is observed over the north-western Pacific. The warming feature found in the north-western Pacific is becoming stronger with time until several subsequent months with strongest warming in October against August SAM index. Regression analysis of wind anomaly with the August SAM index indicates that after August the advection of cold air from the Asian continent toward the northwestern Pacific is suppressed that seems to play the role in warming the area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: SENSITIVITY OF A FULLY COUPLED MODEL TO AN EXTREME INCREASE IN THE THICKNESS AND CONCENTRATION OF THE ANTARCTIC SEA ICE

Forename: Claudia Surname: Klose Parise

Authors: Klose Parise, Claudia; Ponzi Pezzi, Luciano;

Presentation Allocated: Oral

abstract: The sea ice due to its high albedo and by act as an efficient insulator preventing the exchange of heat, mass and momentum between the ocean and the atmosphere is an important factor in global climate. In this work was investigated the sensitivity of the climate system to an extreme condition of the Antarctic sea ice using the coupled atmosphere-ocean-ice model (CM2.1p1). Two experiments were conducted and initialized with different boundary conditions of concentration and thickness of the Antarctic sea ice: I.Control experiment (CTL) performed with climatological sea ice provide by the Atmospheric Model Intercomparison Project and II.Forced experiment (FRC) performed with the modified boundary condition of sea ice. From the latitude 60°S to 90°S was applied a mask of sea ice thickness of 4m, sea ice concentration of 80% and sea surface temperature of -2°C. The model was integrated during one year (from Jan to Dec) for both experiments. The maximum sea ice boundary condition in the experiment FRC was set for the summer. At the beginning of the experiment CTL, the climatological sea ice thickness and concentration were very small and were gradually increasing during the autumn and winter when then had a peak during the spring (Sep). In the experiment FRC, however, the maxima thickness and concentration started in the first month (Jan) and as the integration was freely evolving it was revealed a remarkable melting sea ice reducing its thickness and concentration. The data from the National Snow and Ice Data Center shows that the concentration and extent of sea ice is maximum in Sep and minimum in Feb. These same data show that the Weddell Sea (Bellingshausen Sea and Amundsen Sea) at east (west) of the Antarctic Peninsula (AP) has the highest (lowest) sea ice concentration/extent throughout the year. Thus, in order to analyze how the coupled model responded to the perturbed boundary condition of sea ice, we have calculated the time series of sea ice thickness at 40°W (Weddell Sea) and 90°W (at Bellingshausen Sea and Amundsen Sea) for both experiments CTL and FRC. In both experiments, the sea ice thickness was higher in the east of the AP and occurred in spring, showing that the coupled model used was sensitive to extreme sea ice forcing and showed results consistent with climatology. This study suggests that the dynamics and physics present in the coupled model CM2.1 are able to respond to an extreme forcing of Antarctic sea ice in a consistent manner.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Sensitivity of Antarctic Bottom Water export and overturning circulation to polar easterlies

Forename: Andrew Surname: Stewart

Authors: Stewart, Andrew; Thompson, Andrew;

Presentation Allocated: Oral

abstract: The formation of AABW, which occurs through a combination of ice-shelf melt, brine rejection and mixing with Circumpolar Deep Water, is a key component of the ocean's meridional overturning circulation (MOC). The AABW downwells over the continental slope to the deep Southern Ocean, then spreads and ventilates the deep ocean. Modern theories for the meridional transport in the Southern Ocean invoke a near-balance between a wind-driven Ekman overturning circulation and a counter-acting "eddy" circulation, sustained by the bolus velocities of baroclinically-generated eddies. The "residual" of these circulations describes the net latitudinal and vertical mass transport. This circulation is almost entirely adiabatic in the interior, but it is closed by strong diapycnal mixing in the surface and bottom boundary layers. Much work has focused on how westerly winds over the Antarctic Circumpolar Current modulate the MOC. In this study we find that the MOC is also sensitive to the strength and position of easterly winds over the continental margins, which are typically associated with the formation of the Antarctic Slope Front current. We perform eddy-resolving simulations using the MIT Ocean General Circulation model of an idealized periodic zonal channel with a continental shelf and slope at the southern boundary. We impose idealized patterns of surface wind forcing and heat fluxes, and we parametrize bottom water formation by providing a source of dense water on the shelf. This yields a pair of overturning cells in the meridional/vertical plane, which correspond qualitatively to the upwelling of NADW and downwelling of AAIW and AABW observed in the Southern Ocean. The lower overturning cell is characterized by eddy transport of dense water down the continental slope and then northward across the ocean bed. As the continental slope inhibits baroclinic instability, the export of AABW depends sensitively on the strength of the wind over the slope. A stronger westward wind over the slope increases the rate of deep overturning, and leads to a larger export of bottom water from the continental shelf. Our simulation results agree closely with solutions of the time- and zonal-averaged residual-mean equations with a modified eddy parametrization that reflects the stabilizing effect of the slope.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 5

Title: Surface residence times in the Southern Ocean mixed layer

Forename: Andrew Surname: Thompson

Authors: Thompson, Andrew; Mazloff, Matthew;

Presentation Allocated: Oral

abstract: Ventilation is the process by which climatically important trace gases, such as carbon dioxide, move from the surface mixed layer, where they can actively exchange with the atmosphere, and the ocean's interior where they are isolated. Transit time distributions of tracers, which take the form of probability distributions that partition fluid parcels according to the time and location of their last surface contact, have provided important insight into how the deep ocean is ventilated. A common technique for arriving at these residence times is to assume a model in which water masses that rise to the surface are tagged with atmospheric concentrations, implying an instantaneous equilibration. In reality, though, various trace gases require a range of equilibration periods spanning a few weeks to many years. Thus an important value to quantify is not only the deep ocean residence times, but also surface residence times. If these are short, gases may only partially equilibrate before being subducted. To explore the distribution of surface residence times in the Southern Ocean we have introduced 20 different tracer patches in the Southern Ocean State Estimation (SOSE) model within the mixed layer and advected it with an eddy-resolving circulation for a period of ten years. The surface residence time of different tracer patches shows remarkable spatial variability. Removal of the tracer from the surface mixed layer occurs in large pulses that vary from year to year. Choice of a mixed layer definition does not qualitatively alter this picture. We will discuss the mechanisms, largely linked to topographic interactions, that lead to enhanced subduction and we will present a map of surface residence times for the Southern Ocean. Implications for the interpretation of tracer distributions in the deep ocean will be discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: A century of ice shelf-ocean-sea ice interaction in McMurdo Sound, Antarctica

Forename: Pat Surname: Langhorne

Authors: Langhorne, Pat; Williams, Mike; Stevens, Craig; Smith, Inga; Robinson, Natalie; Purdie, Craig; Mahoney, Andy; Leonard, Greg; Hughes, Ken; Haskell, Tim; Gough, Alex; Dempsey, David;

Presentation Allocated: Poster

abstract: It is 100 years since Scott's ill-fated expedition to the South Pole. His scientific team produced remarkable observations of the formation of the sea ice in coastal Antarctica, complemented by ocean temperature measurements. Since these early visits, McMurdo Sound and Ice Shelf have been the site of intense investigation, producing as long a record as exists in any region of Antarctica. Close to an ice shelf, sea ice often grows in water that has been supercooled due to proximity to the ice shelf. The sea ice therefore not only loses heat to the atmosphere, but also to the ocean. In McMurdo Sound this oceanic heat flux modifies the growth of the sea ice, leaving its signature in the sea ice cover. It can also produce crystals in the water column that accumulate and grow under the sea ice or attached to any object dangling in the near-surface ocean. Over the past decade we have used our sea ice and oceanographic observations, and those of others, along with modeling to understand the interaction between the supercooled ocean and the growing sea ice. Using this information we now attempt to merge the collected wisdom of the past century to construct a historical record of ocean heat flux in McMurdo Sound. This involves placing the following measurements in a coherent framework: (i) Crystallographic records from sea ice cores, (ii) Observations of platelet ice in the near-surface ocean and on objects, (iii) Measurements of the thickness of the layer of crystals that accumulates under the sea ice (sub-ice platelet layer) and (iv) Near-surface oceanographic observations. While the record has significant shortcomings, it has the potential to hint at the "health" of the ice shelf.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: A first evaluation of the role of wave-ice interactions on the global mass balance

Forename: Martin Surname: Vancoppenolle

Authors: Vancoppenolle, Martin; Fichfet, Thierry; Mathiot, Pierre; Ackley, Steve; Shen, Hayley; Massonnet, François; Lecomte, Olivier;

Presentation Allocated: Oral

abstract: Sea ice frequently forms in wavy waters. Wave motion packs forming ice crystals into small floes, while the ice attenuates the waves as the ice floes increase in diameter and thickness. Swell has been reported up to a few hundred kilometres inside the ice pack. Because of ocean waves, young ice floes take a rounded shape that led hungry early explorers to give them the name of pancake ice. Observations suggest that pancake ice thickness grows up to twice as fast as for ice forming in quiet seas. In this work we try to evaluate whether future large-scale sea ice models should include wave-ice interactions to properly simulate large-scale distributions of ice concentration and thickness. In the large-scale 3D ice-ocean modelling system NEMO-LIM, a representation of pancake ice formation is included. First, the ERA-40 ocean wave climatology is extrapolated in the sea ice zone as if the ocean was ice-free. After diagnosing the simulated ice edge, ocean waves are propagated from the ice edge further inside the ice pack assuming exponential decay of amplitude. Finally, the thickness of newly forming ice is computed as a function of wave amplitude, as given by the equilibrium pancake ice theory. Wavelength is prescribed, which is a strong limitation of the model. Pancake ice formation is found important in regions located in the vicinity of open ocean, namely the Southern Ocean and, in the Arctic, the Bering, Okhotsk and Greenland Seas. Pancake ice formation accelerates the ice edge progression, reduce winter ice concentration and, in turn, enhance ice production and thickness, in particular in the Southern Ocean. In some regions, the ocean responds to changes in ice production and modifies the location of the ice edge, as in East Antarctica. Wave-ice interaction parameters (wave attenuation, equilibrium pancake thickness, ...) have a key impact on the simulated response of the model. Given the uncertainty in the model parameters, we conclude that more work is required to couple ocean waves and sea ice in large-scale models.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: About the impact of Sea Surface Temperature variations on ice shelf front retreat: Case study at George VI ice shelf

Forename: Guido Surname: Staub

Authors: Staub, Guido; Buchroithner, Manfred;

Presentation Allocated: Oral

abstract: Several ice shelves (e.g. Wilkins, Larsen B) have shown ongoing thinning and even disintegration during the last couple of years. These processes are caused in general by abnormal ocean and/or atmosphere variations, a fact that is widely recognized and often linked to an anthropogenic climate change. Every ice shelf interacts differently with either the ocean and/or the atmosphere and therefore has to be studied separately. The development of the northern George VI ice shelf front is mainly influenced by oceanographic parameters like upwelling deep water, ocean currents and sea surface temperature (SST). In order to monitor both, the ice shelf and the surrounding ocean in Marguerite Bay, remotely sensed data is taken into account. This data is acquired by the ASAR (Advanced Synthetic Aperture Radar) sensor on-board the ENVISAT satellite and MODIS (Moderate-resolution Imaging Spectroradiometer) on-board the Aqua satellite. An analysis of the ASAR data shows, that two notable horizontal rifts of about 5,96km and 16,73km length have developed during antarctic summer 2008/09. During antarctic fall 2009 two more rifts (length of about 8,93km and 5,6km) are detectable. A total area of about 60sqkm was lost during a break-up event along these rifts during summer 2009/10. In antarctic summer 2010/11 a second, but clearly smaller break-up event started at the western part of the northern ice shelf front. It caused a loss of about 10,18sqkm until late winter 2011. During that time no new rifts have formed. With respect to seasonal SST, information obtained from MODIS observations, in George VI Sound and Marguerite Bay the following values have been observed: 272K; 271,5K; 273,5K; 272K (values are in chronological order and correspond to the events mentioned earlier). The main break-up event in antarctic summer 2009/2010 was a result of new rift formation during previous summer and fall. Their development occurred while SST was relatively constant. However, the break-up events themselves have to be related to abnormal high sea surface temperature in Marguerite Bay and close to the northern George VI ice shelf front. Break-up events are therefore mainly caused by positive SST anomalies. Nevertheless, they only occur in case of rift existence. Furthermore, the magnitude of a break-up event depends on the extent of rifts formed in an earlier stage.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Antarctic ice sheet loss driven by basal melting of ice shelves

Forename: Hamish Surname: Pritchard

Authors: Pritchard, Hamish; Ligtenberg, Stefan; Fricker, Helen; Vaughan, David; Van den Broeke, Michiel; Padman, Laurie;

Presentation Allocated: Keynote 40 mins

abstract: Accurate prediction of global sea-level rise requires that we understand the cause of recent, widespread and intensifying glacier acceleration along Antarctic ice-sheet coastal margins. Floating ice shelves buttress the flow of grounded tributary glaciers and their thickness and extent are particularly susceptible to changes in both climate and ocean forcing. Recent ice-shelf collapse led to retreat and acceleration of several glaciers on the Antarctic Peninsula. However, the extent and magnitude of ice-shelf thickness change, its causes and its link to glacier flow rate are so poorly understood that its influence on the future of the ice sheets cannot yet be predicted. Here we use satellite laser altimetry and modelling of the surface firn layer to reveal for the first time the circum-Antarctic pattern of ice-shelf thinning through increased basal melt. We deduce that this increased melt is the primary driver of Antarctic ice-sheet loss, through a reduction in buttressing of the adjacent ice sheet that has led to accelerated glacier flow. The highest thinning rates occur where warm water at depth can access thick ice shelves via submarine troughs crossing the continental shelf. Wind forcing could explain the dominant patterns of both basal melting and the surface melting and collapse of Antarctic ice shelves, through ocean upwelling in the Amundsen and Bellingshausen Seas and atmospheric warming on the Antarctic Peninsula. This implies that climate forcing through changing winds influences Antarctic Ice Sheet mass balance, and hence global sea-level, on annual to decadal timescales.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Antarctic sea ice climatology, variability and late 20th- Century change in CCSM4

Forename: Laura Surname: Landrum

Authors: Landrum, Laura; Holland, Marika M.; Schneider, David P.; Hunke, Elizabeth;

Presentation Allocated: Poster

abstract: A preindustrial control run and an ensemble of 20th-Century integrations of the Community Climate System Model version 4 (CCSM4) are evaluated for Antarctic sea ice climatology, modes of variability, trends and covariance with related physical variables such as surface temperature and sea level pressure. Compared to observations, the mean ice cover is too extensive in all months. This is in part related to excessively strong Southern Ocean westerly winds, which drive a large equatorward meridional ice transport, and also connected with a cold bias in the Southern Ocean. In spite of these biases, the model's sea ice variability compares well to observations. The leading mode of austral winter sea ice concentration exhibits a dipole structure with anomalies of opposite sign in the Atlantic and Pacific sectors. Both the El Niño-Southern Oscillation and the Southern Annular Mode (SAM) project onto this mode. In 20th-Century integrations, Antarctic sea ice area exhibits significant decreasing annual trends in all six ensemble members from 1950-2005, in contrast to observations. Two ensemble members show insignificant changes when restricted to 1979-2005 suggesting a large imprint of natural variability. The ensemble mean shows a significant increase in the austral summer SAM index over 1960-2005 and 1979-2005 that compares well to the observed SAM trend. However, Antarctic warming and sea ice loss in the model are closely connected to each other and not to the trend in the SAM.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Antarctic sea ice response to global climate variability from 1979 to 2011

Forename: Newton Surname: Magalhães

Authors: Magalhães, Newton; Evangelista, Heitor; Simões, Margareth;

Presentation Allocated: Poster

abstract: Since 1979 the Antarctic sea ice has been monitored by orbital sensors that have provided consistent daily sea ice concentration and extent data. Recent analyses (considering the 1979-2007 period) have indicated notable trends in Antarctic sea ice extent specially in Bellingshausen-Amundsen sea (decline of 19,88%) and Ross Sea (an increase of 19,75%). In these regions the sea ice has been recognized as a multivariate parameter related to El Niño / La Niña events, solar irradiance, positive and negative phases of the Antarctic Oscillation, stratospheric ozone depletion, and the increase in atmospheric CO₂ concentrations and global surface air temperature (GAST). Despite the multivariate nature in the sea ice variability, GAST and ozone depletion have been pointed out as major causes of the observed trends. In the present study we extended the time analysis of the Bellingshausen-Amundsen Seas and the Ross Sea Regions with respect to the above climate parameters/forcings. We constructed time series of correlation values between sea ice and each climate forcings. Our analyses allowed determining from what period the correlation became statistically significant. The results indicate that Bellingshausen-Amundsen and Ross sea ice have been impacted by the increasing global temperature and the ozone depletion since the period between 1997 and 2000. We have also updated the sea ice extent trends for the period from 1979 to 2011 by dividing the Antarctic sea ice in radial sectors of 15 degrees. The most notable negative trend was found for the Antarctic Peninsula region, a reduction of 27.78%, while the positive trend was more pronounced in the Ross Sea region, an increase of 27.2% (period from 1979-2011), this is, an approximate dipole response.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Antarctic sea-ice motion derived from (A)SAR imagery

Forename: Petra Surname: Heil

Authors: Heil, Petra; Massom, Robert;

Presentation Allocated: Oral

abstract: While important for its active role within the polar climate system, routine data of sea-ice motion have not been available for most of the Antarctic region. The recent development of the semi-automated IPADS system based on feature tracking across two temporally separated images of Antarctic sea ice allows us to review ESA's Envisat ASAR data base for information on Antarctic sea-ice motion. Availability of relevant ASAR images went from few in 2007, ramped up during the International Polar Year before dropping off again in 2010. Using images from those years and supplementing IPADS results with in situ data of ice drift, we explore the effect of sea-ice dynamics on the anomalously high summer extent of Antarctic sea ice of austral summer 2007/08 and its anomalously low winter extent of austral winter 2008. Due to the sparse nature of the ASAR image archive we focus on a few regions, including near the Mertz Glacier (East Antarctica), for which sufficient high-frequency image cover is available. Our results reveal a series of small-scale near-stationary cyclonic ice eddies during austral spring 2007, which affected the net regional ice transport by producing a southerly ice motion on their eastern flank. In consequence of the southward ice flow, regional ice extent swiftly retracted towards the coast. Furthermore this flow resulted in the compaction of the near coastal ice pack. In situ observations confirming unusually thick near-coastal sea ice along the East Antarctic during austral summer 2007/08.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Change detection of the Amery Ice Shelf front in the past 10 years using Envisat-1 ASAR data

Forename: ZHAO Surname: Chen

Authors: Chen, ZHAO; Xiao, CHENG; Fengming, HUI; Yan, LIU;

Presentation Allocated: Oral

abstract: Abstract: Antarctic ice shelves are key regions to understand the climate change mechanism in Antarctica, as well as to predict the global climate changes in the future. Most of Antarctic ice sheets are drained off through the ice shelf, being lost in the form of ice shelf crumbing and bottom ablation. So, it's very important to study the complex process of ice shelf mass balance, monitor the changes and study the interrelationship between ice shelves and environment changes. As a key part of the Antarctic ice shelf system, the Amery Ice Shelf has already become a significant content of the global changes research. In this dissertation, the changes of the Amery Ice Shelf during the past 10 years were investigated through geometric correction, image registration and filtering processing of Envisat-1 ASAR. The data were acquired by the ENVISAT-1 using C-band (5.6 cm wavelength) SAR sensor at a 75-m resolution from September, 2002 to September, 2011. Firstly, we choose the Polar Stereographic projection as the standard map projection for the geometric correction. Secondly, it's the image clipping and image registration for the ASAR images of the same scene acquired at different times. Thirdly, it's the noise suppression with the Gamma filter under the window of 7. After the data preprocessing, coastlines of the Amery Ice Shelf were extracted automatically. On this basis, get the corresponding image points through the intersection operation between the coastlines and the ice flow lines. Then track the corresponding point changes and summarize the inter-annual changes of the Amery Ice Shelf front in the past 10 years. In conclusion, the Amery Ice Shelf front has been expanding during the past 10 years in the four major factors. After the change analysis, the advances in researches on the Amery Ice Shelf are also introduced.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Comparative analysis between variations in wet snow zone and the main break-up and retreat events in Wilkins Ice Shelf – Antarctic Peninsula

Forename: Adriano Surname: Lemos

Authors: Lemos, Adriano; Mendes, Claudio; Arigony-Neto, Jorge;

Presentation Allocated: Poster

abstract: The Antarctic Peninsula (AP) is one of the most dynamic in the southern hemisphere and presented a surface air temperature rise of about 3°C over the past 50 years. The Wilkins Ice Shelf (WIS - 70° 20' S and 72° 20' W), for example, is undergoing great loss of mass through basal and superficial melting. This work consisted in a comparative analysis between these events and variations in Wet Snow Zone (WSZ) extension in this region during the austral summers from 1978 to 2008. The total area of WSZ on the WIS in those summers was estimated with a Spectral Linear Mixing Model (SLMM), which allowed a subpixel analysis of satellite images acquired by the Scanning Multichannel Microwave Radiometer (Nimbus-7 SMMR) and the Special Sensor Microwave Imager (DMSP SSM/I). The studied area includes the WIS and Alexander, Latady, Charcot and Rothschild Islands. The WSZ on WIS had a high annual variability during the period 1978-2008, explained by a seasonal and interannual variability of surface air temperature on the western AP, influenced by continental and sea air masses of different characteristics. In the austral summers of 1984-1985 and 1989-1990 were observed the largest extension of WSZ in the study area. This sequence of extreme melting events could have contributed to the retreat of part of the WIS, in the late 80's and early 90's. In the mid-austral summer of 1992-1993, the largest melting season on the AP, there were other break-up events that can be related to significant extension of WSZ, approximately 36.145 km². A significant break-up of part of the WIS occurred in 1997-1998 summer, such as on the Larsen A and B ice shelves. An additional loss of ice occurred in 2007-2008, when 1.400 km² was lost. In this last years, there was great extension of WSZ (about 43.500 km²), more than other summers of the period 1994-1999. Insignificant areas of WSZ (i.e., less than 10.000 km²) occurred in the summer 2003-2004, compared to 2002-2003 (about 37.800 km²). An increase in melt extension area occurred in the 2004-2005 summer compared to previous years. In 2007-2008, WIS broke-up in response to basal melting, and due to greater extent and duration of WSZ in this region. The median WSZ total area had a declining trend over the period 1978-2008. However, the estimated linear trend were not statistically significant, as indicated by a small correlation coefficient, that can be explained by the high interannual variability of the WSZ total area of the study area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Continuous monitoring of Antarctic sub-ice shelf dynamics and ocean temperatures

Forename: Scott Surname: Kobs

Authors: Holland, David; Tyler, Scott; Zagorodnov, Victor; Stern, Alon; Taylor, Kendrick; Sladek, Chris; Kobs, Scott;

Presentation Allocated: Poster

abstract: Measuring the dynamics of sub-ice shelf melting and ocean circulation represents an important step in understanding ice sheet stability. Continuous monitoring is challenging, due to difficult surface access, the need to penetrate through the ice shelf, and long term operation of non recoverable sensors. During the Austral spring of 2011, two instrumented boreholes were completed through the McMurdo Ice Shelf (MIS) at Windless Bight to test rapid drilling and continuous monitoring methods. The boreholes were drilled using an approach combining ice coring for the upper portion of the borehole, with a new hot-point method for the final penetration through the ice-ocean interface. Each borehole was drilled through 190 m of ice to the ocean using two-person drilling team. The core drilling provided a 130mm diameter open borehole that remained dry through the drilling period. A hot point drill was used to penetrate into the ocean, and provided a 40 mm diameter borehole. The boreholes were instrumented with distributed temperature sensing (DTS) fiber-optic cables temperature measurements within the ~190m thick ice shelf and into the ocean below. The boreholes were also instrumented with traditional thermistors both in the ice shelf and in the ocean column and pressure transducers all attached to the armored DTS cables. Borehole BH1 is instrumented with fiber optic temperature sensing cable through the ice shelf and extending 30m into the ocean below. BH2, located 40m north of BH1, was used to test measurements to depths of 800m and also to demonstrate the potential for multiple independent installations through the same borehole. BH2 is completed with one DTS cable extending 600m below the ice/ocean interface, a logging pressure transducer and thermister located 450m below the ice/ocean interface and four additional logging thermistors. Temperature measurements are made every 1 meter along each optical fiber. The measurements are repeated hourly through the summer, and 4 times per day in winter months to conserve power. Data are transmitted off site via satellite link. This provides unprecedented space and time resolution for an over winter measurement. After 3months of operation (February 2012) there has been warming trend (~0.5 oC) in the upper ocean column that began in late December, consistent with previous measurements in the vicinity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Diurnal tidal effects on sea ice concentration in the Ross Sea from AMSR-E satellite data and a regional ocean model

Forename: Stefanie Surname: Mack

Authors: Mack, Stefanie; Springer, Scott; Dinniman, Mike; Padman, Laurence; Klinck, John;

Presentation Allocated: Oral

abstract: The northwest corner of the Ross Sea experiences strong diurnal tidal currents, up to ~ 1 m/s, which are known to vary over short spatial scales. We hypothesize that the associated periodic divergence of stress acting on the base of the pack ice influences the time-averaged characteristics of sea ice in this region. We use ice concentration data extracted from individual swaths of the AMSR-E passive microwave sensor (3-4 passes per day) during austral winter 2004 to show that tides cause ice concentration to vary periodically between 60% and 100% over the shelf break, where estimated tidal-band stress divergence is greatest. Despite the non-uniform time sampling by AMSR-E, we were able to extract the amplitude and phase of ice concentration variability at the frequencies of the principal tidal constituents (O1 and K1). The observed variability agrees well with results from a regional ocean model, forced by the atmosphere and tides, which includes sea ice. Comparison with a model run with no tidal forcing indicates that tides reduce the time-averaged winter ice concentration in this region from ~ 90 -100% to ~ 75 -85% .

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: DMSP IN HOLOCENE SEDIMENTS AS A PROXY FOR OCEANIC PALEOPRODUCTIVITY

Forename: Maria Surname: Vernet

Authors: Vernet, Maria; Cape, Mattias; Matrai, Patricia; Gle, Corine; Leventer, Amy; Jeong, Sun Mi; Domack, Eugene; Brachfeld, Stefanie; McCormick, Michael; Rauschenberg, Carlton;

Presentation Allocated: Poster

abstract: DMSP (DiMethylSulfonioPropionate) is an organic sulfur compound produced by phytoplankton, precursor to DMS (DiMethylSulfide), a climate-relevant gas that, after atmospheric oxidation, produces MSA (MethylSulfonic Acid), a commonly used biogenic proxy in ice cores. DMSP measured in surface sediments has been used to study phytoplankton export from the euphotic zone or the cycling and metabolism of DMS in sediments. An 850 cm jumbo piston sediment core, spanning approximately 7500 years, was collected during a cruise to Barilari Bay in the western Antarctic Peninsula as part of the LARsen Ice Shelf (LARISSA) project. Significant DMSP concentrations were observed throughout the core (> 2 nmole/g dry weight), suggesting high preservation at depths > 30 cm, with highest concentrations at the sediment surface. Low DMSP concentrations correlated with abundant diatom valves, as expected from published water column relationships. We discuss DMSP variability in relation to other measured paleoproductivity indices. Assuming sedimentation processes in the water column are the main source of DMSP in sediments, we are proposing DMSP as a new paleoceanographic proxy of phytoplankton abundance.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Dynamics of surface flooding of Antarctic sea ice in summer

Forename: Stephen Surname: Ackley

Authors: Ackley, Stephen; Perovich, Donald; Weissling, Blake;

Presentation Allocated: Oral

abstract: The surface flooding of Antarctic sea ice in summer is estimated to cover 50% or more of the sea ice area in the two major summer ice packs, the western Weddell Sea and the Bellingshausen-Amundsen Seas. Sea water flooding at the snow-ice interface impacts growth of sea ice biological communities both in summer and in the fall freeze-up, the remote sensing characteristics of Antarctic sea ice, and the composition of the ice cover as snow ice forms during freezing of the flooded layer. Mechanisms discussed for surface flooding have concentrated on sudden winter increases in snow depth, causing the ice surface to be pushed below sea level and sea water to intrude and the depth of flooding on summer sea ice, without new snowfall, was relatively constant from the beginning until the end of summer. Two ice mass balance buoys were deployed on the Amundsen Sea pack ice at distances of ~ 100m from floe edges in late December 2010 from the icebreaker Oden. Temperature records from thermistors mounted on a rod at 10cm intervals embedded in the snow and ice vertically showed progressive increases in the depth of the flooded layer on the ice cover during January and February 2011 by 30-40cm at each of the two sites. Snow depth and ice thickness changes were also recorded during this time. While the snow depth was relatively unchanged, ice thickness decreased by up to a meter from bottom melting during this period. The mechanism for increasing the depth of flooding was therefore caused by the decrease in ice thickness which progressively raised the sea level into the snow cover to maintain isostatic balance in the floe. The process to increase the depth of the flooded layer is therefore vertical in nature, does not require additional snow depth and is apparently independent of the horizontal distance to floe edges. High biological production can therefore be maintained in these flooded layers throughout summer since nutrients are recharged as the flooded layer increases in depth as ice bottom melting occurs. Estimates of the nutrient recharging and conversion to snow ice on refreezing are also presented. Both relatively high snowfall in winter and the summer dynamics, where bottom melting results in less snow freeboard above sea level, can increase the depth of flooded snow. The high proportion of snow ice found for Amundsen Sea pack ice in previous survey cruises therefore results from both winter snowfall and summer bottom melt.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Estimation of average sea ice cover using geostatistic techniques

Forename: Ingrid Surname: Linck Rosenhaim

Authors: Linck Rosenhaim, Ingrid; Sanches, Ana Maria; Cardia Simões, Jefferson;

Presentation Allocated: Poster

abstract: Sea ice is spatially and temporally one of the most variable substances found on the earth's surface. It occupies vast areas of world's oceans and modifies their fundamental character by influencing the global climate. The area covered by sea ice in the Bellingshausen-Amundsen (BA) Seas was highly correlated with air temperature recorded by the Faraday/Vernadsky station. Therefore, it is possible to determine a regression function between them, and then estimate the area of sea ice from temperature completing the monthly data set of 1951-2007. Given the relationship between these variables it was possible to estimate the sea ice cover using the Simple Kriging with local mean (SKlm). In this methodology the mean value needed for the kriging estimator is not stationary, but determined by the residues obtained from the differences between true values and those obtained from the regression function. This residual component, that is the local average, is kriged (ordinary kriging), and its output re-added to all values regressed from the data set, thus resulting in the estimator of values at grid points where the ice surface was not known. From the SKlm, it was possible to estimate the average of sea ice coverage in the BA Seas in the previous years to satellite cover, launched in 1979. The sea ice data used correspond to monthly averages from the algorithm NASA Team for the period 1979-2007, and air temperature data used were recorded at Faraday/Vernadsky station for the period 1951-2007. After that, the actual and estimated data were confronted (cross validation), resulting in a correlation index of 0.70. The correlation index between the actual sea ice area and the final estimate obtained by SKlm for the BA Seas was 0.92 for the period 1951-2007. The results show that the temperature is a good estimator for the sea ice coverage, because various tests and variograms inferences showed a strong correlation between the results. However, other tests should be performed to verify the influence of other factors in the sea ice coverage, such as sodium and chlorine content in ice cores, wind speed and direction, among other parameters, as well as the same methodology should be applied in other southern seas.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Evidence for deposition within a pre-Holocene sub-glacial aquatic environment in the Greenpeace Trough, Antarctic Peninsula

Forename: Alex Surname: Crawford

Authors: Crawford, Alex; Domack, Eugene; Leventer, Amy;

Presentation Allocated: Poster

abstract: During research cruise NBP0003 of the Nathaniel B. Palmer, a suite of sediment cores were recovered from the Greenpeace Trough, an inner shelf feature reaching depths > 1000 meters. The trough is located within the northernmost embayment along the eastern side of the Antarctic Peninsula, a region that developed into an open marine setting following the 1995 disintegration of the Larsen A Ice Shelf. Two kasten cores have been studied, NBP0003 KC20 and KC23. Each has a complementary jumbo gravity core, JGC20 and JGC23, respectively, which over-penetrated the surface, but recovered deeper sediments and added to the stratigraphic record. The two kasten cores share a common stratigraphy that records the progression from grounded ice, to ice liftoff, to a subaqueous setting. The greater penetration of the gravity cores revealed a deeper stratigraphic unit, underlying the diamict recovered at the base of the kasten cores and within the upper part of the gravity cores. This unit is distinguished by several characteristics, including the presence of laminated bedforms and dropstones that deform the laminae, which suggests deposition in a quiescent, sub-aqueous setting. The sediments have a relatively high organic carbon content; microscopic examination reveals the presence of common, fine-grained, golden colored organic material, coupled to the complete absence of diatom valves or fragments. The complete absence of marine microfossils indicates isolation from both an oceanic source of material and from rock units containing marine diatoms that could be eroded and introduced into the sediments. We attribute the observable organic debris, high total organic carbon content, distinct isotopic composition and black color of these sediments to the contribution of debris eroded by the over-riding ice sheet from sub-cropping Jurassic black shales. Together, these observations support the interpretation that the lower laminated unit with dropstones was deposited subaqueously, most likely in a subglacial pond or water filled cavity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: A Barrier to Flow through Drake Passage at the Onset of Antarctic Glaciation

Forename: Ian Surname: Dalziel

Authors: Dalziel, Ian; Lawver, Lawrence; Pearce, Julian; Barker, Peter; Hastie, Alan;

Presentation Allocated: Oral

abstract: Seafloor spreading between the Andean cordillera of Tierra del Fuego and the 'Antarctandes' of the Antarctic Peninsula created the Drake Passage oceanic gateway, essential to completion of the globe-encircling Antarctic Circumpolar Current (ACC). This event has long been noted as closely associated in time with a major, abrupt drop in global temperatures and the rapid expansion of Antarctic ice sheets at ~33-34 Ma, the Eocene-Oligocene boundary. Although some computer models downplay the significance of deep ocean gateways in the change from 'greenhouse' to 'icehouse' conditions and point instead to the importance of declining atmospheric CO², other models do indicate Antarctic cooling after ACC onset under high CO² conditions and the debate has therefore continued. We have obtained new evidence on the nature and age of the floor of the central Scotia Sea, critical to eastward flow of deep water within the Scotia arc. This demonstrates that a now submerged volcanic arc would have formed a barrier to oceanic circulation eastward even as oceanic lithosphere formed in the western Scotia Sea between ~28 and 6 Ma opening the Drake Passage deep oceanic gateway. The Antarctic continent could not have been thermally isolated by a complete and deep ACC until significantly later than the onset of glaciation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: A unique paleoceanographic record from the Antarctic Peninsula shelf: merging stable isotopic results with multiproxy diatom, IRD, and organic geochemical indices.

Forename: Scott Surname: Ishman

Authors: Ishman, Scott; Leventer, Amy; Prentice, Michael; Domack, Eugene; Brachfeld, Stefanie; Vernet, Maria; Cape, Mattias; Rosenheim, Brad; Gunter, Madeleine; Vadman, Kara; Santoro, Jennifer;

Presentation Allocated: Oral

abstract: The Holocene climatic record of the western Antarctic Peninsula (WAP) is complex. Kasten core KC 11, a 4.2 meter sediment core was collected from 636 mbsl in the Hugo Island Trough, western Antarctic Peninsula continental shelf. It represents the last ~11,000 cal. Yrs, determined from radiocarbon ages on ramped pyrolysis splits of organic carbon, bulk organic matter, and foraminiferal calcite. Sedimentation rates are variable, with the highest rates in the early Holocene, decreasing through the mid-Holocene and slightly increasing over the last 2500 yrs. Sedimentologic, magnetic susceptibility, micropaleontologic, and geochemical data reveal a fundamental change in paleoceanographic conditions on the WAP shelf through the Holocene. The base of KC 11 captures the final phase of deglaciation with high organic carbon, peak diatom abundance dominated by *Chaetoceros*, dominance of the opportunistic benthic foraminifera *Fursenkoina*, and high photosynthetic pigment concentration indicating high surface water productivity. These sediments resemble calving bay re-entrant sediments of the Palmer Deep. The early Holocene is characterized by a decrease in organic carbon, increase in ice rafted debris (IRD), and diatoms indicating uniform warm surface water and low sea ice conditions. Benthic $\delta^{18}\text{O}$ is variable but overall light indicating lowered salinities associated with a retreating ice margin. The mid-Holocene shows a decrease in IRD coupled with increased concentrations of the "sub-polar" form of the diatom *Eucampia antarctica* and long *Eucampia* chain length, indicating low sea ice extent. Light planktic $\delta^{18}\text{O}$ values and negative benthic $\delta^{13}\text{C}$ indicate lowered salinities/higher temperature associated with distally retreating ice margins and source water temperature increase. The mid-Holocene is also marked by the increased relative abundance of a diatom indicative of the Antarctic Circumpolar Current, and changes in benthic foraminiferal abundances and $\delta^{18}\text{O}$ values indicating increased flux of Upper Circumpolar Deep Water. Late Holocene diatom data and surface $\delta^{18}\text{O}$ indicate increased sea ice extent and lower surface water temperatures. Benthic foraminiferal and $\delta^{18}\text{O}$ data indicate the establishment of persistent UCDW. Also, benthic and planktic $\delta^{13}\text{C}$ are clearly separated indicating persistent water-column stratification. These paleo-reconstructions of significant oceanographic changes throughout the Holocene are consistent with other Southern Ocean records.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Age Estimates of Holocene Glacial Retreat in Lapeyrère Bay, Anvers Island: How Reliable are Down-core Radiocarbon Dates?

Forename: Kimberly Surname: Mead

Authors: Mead, Kimberly; Wellner, Julia; Rosenheim, Brad;

Presentation Allocated: Poster

abstract: Lapeyrère is a fjord on the eastern side of Anvers Island, located off the Western Antarctic Peninsula. Though a large amount of data has been gathered in Lapeyrère Bay, very little has been published on the fjord's glacial retreat history. The primary purpose of this study is to reconstruct glacial retreat from Lapeyrère Bay using cores for chronology and facies analysis, shallow seismic for mapping facies, and multibeam swath bathymetry for identifying seafloor morphological features. Multibeam data show seafloor features including grounding zone wedges and a glacial outwash fan. Core data, representing both the proximal and distal settings, has documented five sediment facies. These facies were interpreted as open marine, glacial outwash fan, and proximal glacial marine deposits. Timing of these deposits has been constrained using two methods of radiocarbon (^{14}C) dating: ramped pyrolysis ^{14}C dating and carbonate ^{14}C dating. This study seeks to assess the effectiveness the novel ramped pyrolysis ^{14}C method, which dates individual fractions of organic material combusted at successively higher temperatures. Antarctic sediment cores often lack sufficient calcareous material for carbonate ^{14}C dating yet bulk acid insoluble organic material (AIOM) dating frequently yields anomalously old ages. Performing ramped pyrolysis ^{14}C dating and carbonate ^{14}C dating on the same cores and comparing the resulting ages will address this conundrum. Ramped pyrolysis results are not consistent with previous studies. Dates from five aliquots produced by each sediment sample are less dispersed than expected and not always in age/temperature order. The true age of each sample is the aliquot with the youngest age, as it is more likely organic material has been contaminated by older carbon than younger carbon. Eight carbonate ^{14}C dates and ramped pyrolysis ^{14}C dates from six depths in a proximal 20.3m drill core yield discordant ages. Ramped pyrolysis ages are significantly younger than carbonate ages, and the difference between both methods increases down-core. Ramped pyrolysis estimates the maximum age of the core as ~4000 years younger than carbonate ^{14}C ages and yields a significantly higher average sedimentation rate, 2.6mm/yr, when compared to carbonate ^{14}C ages, 1.7mm/yr. Similar results were found for a 10.6m distal core. These ramped pyrolysis results suggest carbonate ^{14}C dating may not always accurately represent the true ages of down-core sediment samples.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Amundsen Sea deep sea sediments: Archives of modifications in oceanographic and climatic conditions

Forename: Gabriele Surname: Uenzelmann-Neb

Authors: Uenzelmann-Neben, Gabriele; Gohl, Karsten;

Presentation Allocated: Oral

abstract: Deep sea deposits document stages of particular material input, dynamic bottom-currents and associated sedimentary transport activities. The analysis of seismic reflection data from the Amundsen Sea, southern Pacific Ocean, reveals different stages in sediment input from the continent and sediment drift formation. Sediment was input from the continent via three troughs in Eocene/Oligocene times, but we also observe sediment drift formation for this period in the northwestern Amundsen Sea. This observation indicates bottom current activity and hence a cold climate for the late Paleogene in an area, which today lies under the influence of Antarctic Bottom Water (AABW) originating in the Ross Sea. The main depot centre shifted to the northeastern Amundsen Sea with a increased input via the Abbot Trough for the period 21-14.1 Ma, There the material was shaped into sediment drifts, which points towards a SW setting slope-parallel bottom current. This bottom current is also responsible for the formation of sediment drifts in the central Amundsen Sea as the result of a shift in main material input to the Western Pine Island Bay Trough during 14.1.-4 Ma. This was followed by less material input due to a change from wet- to dry-based ice conditions, but maintenance of the sediment drifts, during the last 4 Ma.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: ANDRILL Coulman High Project: Drilling Beneath the Ross Ice Shelf to Uncover the Tectonic, Climatic, and Glacial History of Antarctica in a Warmer World

Forename: Richard Surname: Levy

Authors: Levy, Richard; Luyendyk, Bruce; DeConto, Robert; Rack, Frank; Harwood, David; Naish, Tim; Wilson, Doug;

Presentation Allocated: Oral

abstract: The international ANDRILL (ANTarctic DRILLing) program proposes to drill two ~900 m holes into Paleogene to lowest Miocene sediments beneath the Ross Ice Shelf, at an extensively surveyed location on the Coulman High (CH). Recovery of the targeted strata will provide a new, high-quality stratigraphic record from a period when atmospheric CO₂ was comparable to concentrations projected for the next century. Of particular relevance is the response of the polar regions to elevated levels of greenhouse gases and the impact that regional amplification of surface temperatures have on the cryosphere. Examination of sediments deposited during the targeted time intervals offers a window into the range of environments and ecosystems that existed in the Ross Sea region during warm, high-CO₂ "greenhouse" conditions that dominated the Eocene and cooler moderate- to low-CO₂ conditions that developed in the Oligocene. Direct information on physical, biological, and ecological conditions at the drill sites will allow new constraints to be placed on estimates of ice volume variability, marine and terrestrial temperatures, timing and nature of major tectonic episodes, development of Antarctica's marine, terrestrial, and sea-ice biota, and model simulations of past and future climates and ice sheets. The Coulman High drill sites are located 120 km northeast of Scott Base and McMurdo Station on the Ross Ice Shelf where it is ~ 260 m thick and moving north at ~ 2m/day in ~810 m of water. Technical advances will allow the recovery of high-quality sediment cores below this fast moving shelf ice. During the 2010-11 Antarctic field season a multinational team of scientists, engineers and drillers used the ANDRILL hot water drilling system to access the sub-ice shelf environment. A suite of data and samples were collected to characterise the water column (current velocity, conductivity, temperature, and pressure), survey the ice-shelf boundary layer and sea-floor (video), and examine Holocene ice shelf calving history (sediment cores). Geophysical experiments were conducted at the ice shelf surface to enhance seismic velocity models (seismic refraction survey) and examine crustal structure (gravity survey). GPS instruments were deployed to collect data to constrain vertical and lateral movement of the ice shelf. The international ANDRILL team is working to establish formal partnerships and aims to drill during the 2014-16 austral field seasons.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Antarctic contribution to meltwater pulses during the last deglaciation

Forename: Michael E. Surname: Weber

Authors: Weber, Michael E.; Kuhn, Gerhard; Clark, Peter U.; Spreng, Daniela;

Presentation Allocated: Oral

abstract: The timing of the last maximum extent of the Antarctic ice sheets relative to those in the Northern Hemisphere remains poorly understood because only a few findings with robust chronologies exist for Antarctic ice sheets. We developed a chronology for the Weddell Sea sector of the East Antarctic ice sheet (EAIS) that, combined with ages from other Antarctic ice-sheets, indicates that the advance to (at 29–28 ka) and retreat from their maximum extent (at 19 ka) was nearly synchronous with Northern Hemisphere ice sheets (Weber, M.E., Clark, P. U., Ricken, W., Mitrovica, J. X., Hostetler, S. W., and Kuhn, G. (2011): Interhemispheric ice-sheet synchronicity during the Last Glacial Maximum. – *Science*, 334, 1265-1269, doi: 10.1126/science.1209299). Using an atmospheric general circulation model we conclude that surface climate forcing of Antarctic ice mass balance would likely cause an opposite response, whereby a warming climate would increase accumulation but not surface melting. Furthermore, our new data support teleconnections involving a sea-level fingerprint forced from Northern Hemisphere ice sheets as indicated by gravitational modeling. Also, changes in North Atlantic Deepwater formation and attendant heat flux to Antarctic grounding lines may have contributed to synchronizing the hemispheric ice sheets. With respect to the deglaciation, our study contradicts a late ice-sheet retreat (from ca. 14–7 ka) with a large impact of an unstable West Antarctic Ice Sheet (WAIS) and a small impact of a stable EAIS. Instead, the Weddell Sea sites indicate that specifically the EAIS responded much earlier (first retreat at 19 ka and, again, at ca. 16–16.5 ka), probably provided a significant contribution to the last sea-level rise, and was much more dynamic than previously thought. Well-dated deep-sea sites from the Scotia Sea (Weber, M.E., Kuhn, G., Spreng, D., Rolf, C., Ohlwein, C., and Wicken, W. (in press): Dust transport from Patagonia to Antarctica – a new stratigraphic approach from the Scotia Sea and its implications for the last glacial cycle. *Quaternary Science Reviews*, doi: 10.1016/j.quascirev.2012.01.016) confirm these ice-sheet instabilities at 19 and ca. 16.5 ka, as inferred from the amount of ice-rafted detritus (IRD) that was transported along the “iceberg alley”. There is also a major IRD pulse at ca. 15–14 ka, indicative for a substantial contribution of the Antarctic ice sheets to meltwater pulse 1a.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Antarctic hydrology during the late Eocene as deduced from carbon isotopic analysis of pollen grains from Southern beech (*Nothofagus*)

Forename: Kathryn Surname: Griener

Authors: Griener, Kathryn; Nelson, David M.; Warny, Sophie;

Presentation Allocated: Poster

abstract: The Antarctic landscape was mostly ice-free and vegetated with mean temperatures above freezing prior to the E-O boundary (~34 Mya; Barrett, 1996). Cooling and ice sheet growth in the late Eocene led to conditions that have generally prevailed to the present. Recent palynological data obtained from the SHALDRIL II cores indicate that a significant decrease in plant diversity and abundance already occurred at ~37 Ma, prior to the boundary (Anderson et al., 2011; Warny & Askin, 2011). Several theories exist as to why cooling and subsequent changes in vegetation occurred, e.g. development of the Antarctic Circumpolar Current and consequential thermal isolation of Antarctica (e.g. Kennett, 1977) and/or declining levels of CO₂ (e.g. DeConto and Pollard, 2003). To assess late Eocene changes in Antarctic hydrology, we performed carbon isotopic analysis on modern and late Eocene fossil pollen of the genus *Nothofagus* (the Southern beech), which occurs in relatively high abundance in SHALDRIL cores (Warny and Askin, 2011). Today, *Nothofagus* occurs throughout the Southern Hemisphere in regions like Patagonia. Small quantities of modern and fossil *Nothofagus* pollen (20-60 per sample) were isolated using a micromanipulator. Their $\delta^{13}\text{C}$ values were measured using a spooling-wire device interfaced with an isotope-ratio mass spectrometer (Nelson et al., 2008). We first compare $\delta^{13}\text{C}$ values from modern leaf and pollen tissues to aid interpretation of $\delta^{13}\text{C}$ data from fossil grains. We then use $\delta^{13}\text{C}$ data obtained from fossil *Nothofagus* pollen to reconstruct variations in plant water-use efficiency (WUE; Seibt et al., 2008) and assess factors controlling vegetation changes during Antarctic climate deterioration. Pollen from 32 herbarium specimens of 16 *Nothofagus* species from across the Southern Hemisphere show a range of $\delta^{13}\text{C}$ values from -31.0 to -23.1‰. There is a strong positive correlation between leaf and pollen $\delta^{13}\text{C}$ values ($R^2=0.65$). This indicates that $\delta^{13}\text{C}$ of *Nothofagus* pollen is useful for assessing potential shifts in WUE as many studies have shown the correlation between leaf $\delta^{13}\text{C}$ and WUE (e.g. Farquhar et al., 1982; Farquhar & Richards, 1984). Results from 10 SHALDRIL Eocene samples show a trend towards more positive $\delta^{13}\text{C}$ values in *Nothofagus* in younger sections of the Antarctic core, with an overall range of -25.7‰ to -23.6‰ (uncorrected), suggesting a gradual increase in aridity through this interval.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Antarctic Peninsula Ice Sheet dynamics during the LGM and Holocene

Forename: Bethan Surname: Davies

Authors: Davies, Bethan; Hambrey, Michael; Smellie, John; Glasser, Neil; Carrivick, Jonathan;

Presentation Allocated: Oral

abstract: The Antarctic Peninsula region is currently undergoing rapid environmental change, resulting in the thinning, acceleration and recession of glaciers and the sequential collapse of ice shelves. It is important to view these changes in the context of long-term palaeoenvironmental complexity and to understand the key processes controlling ice sheet growth and recession. In addition, numerical ice sheet models require detailed geological data for tuning and testing. Therefore, this paper systematically and holistically reviews published geological evidence for Antarctic Peninsula Ice Sheet variability for each key locality throughout the last glaciation and Holocene, and brings together the prevailing consensus of the extent, character and behaviour of the glaciations of the Antarctic Peninsula region. Major contributions include a downloadable database of 186 terrestrial and marine calibrated dates; an original reconstruction of the LGM ice sheet; and a new series of isochrones detailing ice sheet retreat following the LGM. During the Late Pleistocene, repeated glacials reached the shelf edge, but ice shelves inhibited iceberg rafting. The Last Glacial Maximum (LGM) occurred at 18 ka BP, after which transitional glaciomarine sediments on the continental shelf indicate ice-sheet retreat. The continental shelf contains large bathymetric troughs, which were repeatedly occupied by large ice streams during Pleistocene glaciations. Retreat after the LGM was episodic in the Weddell Sea, with multiple readvances and changes in ice-flow direction, but rapid in the Bellingshausen Sea. The late Holocene Epoch was characterised by repeated fluctuations in palaeoenvironmental conditions, with associated glacial readvances. However, this has been subsumed by rapid warming and ice-shelf collapse during the twentieth century.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Cold and glacial events in the Late Paleogene and Neogene of Seymour Island, West Antarctica: A Review

Forename: Antônio Carlos Surname: Rocha-Campos

Authors: Rocha-Campos, Antônio Carlos; Kuchenbecker, Matheus; Maciel Canile, Fernanda; dos Santos, Paulo R.;

Presentation Allocated: Poster

abstract: We present here results of a recent study of the sedimentary section comprising the interval from the top of the La Meseta Formation (LMF; Eocene-earliest Oligocene) and overlying units cropping out around the Meseta plateau, on Seymour Island. Here we present and discuss field work results of stratigraphic distribution of features interpreted as indicative of cold to glacial paleoclimatic conditions. Names and ages of units above the LMF follow present practice. Uppermost strata of LMF are usually marked by presence of diffuse zones and thin condensed, horizontal beds of fine, green sandstone disconformably overlain by the Hobbs Glacier Formation, HGF (Miocene/Pliocene). Contact varies from plane, sharp to slightly undulated, erosive. HGF is a sequence of sandy-silty pebbly massive mudstone with small (grain to cobble) polymictic clasts, some striated, dispersed in the matrix. Locally it may include a fine, sandy lower portion or pass upward to sandstone with rare clasts. Small features (reverse faults and interfingering lithologies) found at the top of LMF may indicate subglacial shear stress. Possible sand wedges and pseudomorphs of ice veins point to permafrost conditions preceding deposition of HGF. Rare diamictite-like sediments found consists of discontinuous or relatively extensive pebbly, dark gray clayey bed intercalated in the mudstone with irregular boundaries. A restrictly exposed boulder pavement pressed into the underlying LMF sandstone at the base of HGF is so far the only concrete evidence of a glacier advance on Seymour Island in the Miocene/Pliocene, moving toward SE. Contact of HGF with the overlying Weddell Sea Formation (WSF) pebbly mudstone is generally sharp and may occasionally be associated with a green silt/clay bed. Our data concur with characterizing the WSF as a homogeneous sequence of very fine to fine, sandy matrix mudstone, bearing dispersed polymictic, pebble to boulder size clasts, some striated. The apparent dropstone nature of clasts of the units studied is still debatable, but cannot be excluded, since soft nature of the mud matrix is unfavorable to preservation of deformation under the clasts. Except for the basal Hobbs Glacier Formation, sediments that correspond to typical diamictite/tillite were not clearly identified in the area. Results concur with the concept of marine, glacially influenced depositional settings fed by settling from suspension plumes and rainout for the Neogene formations studied.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Comparison of Antarctic total water vapour from measurements, reanalyses and regional climate simulations

Forename: Christoph Surname: Knöfel

Authors: Knöfel, Christoph; Walther, Connie; Rinke, Annette; Dethloff, Klaus; Dietrich, Reinhard;

Presentation Allocated: Poster

abstract: The global weather and climate processes are significantly influenced by the atmospheric water vapor. Therefore, the profound knowledge of the distribution of the water vapor in the atmosphere and its temporally changes is essential for understanding and modeling the Earth's weather and climate processes. Due to rare total water vapor measurements in Antarctica, our knowledge about the spatial and temporal water vapor variability is very limited. Model simulations can help to close this gap and to understand the driving factors like storm strength and variability. Atmospheric humidity is traditionally available from radiosondes but also GPS observations provide a sound base for the estimation of water vapor. A comparison of Antarctic total water vapor derived from measurements (radiosounding and GPS), reanalysis data (NCEP, ERA40 and ERA Interim) and HIRHAM4 simulations is presented. The regional climate model HIRHAM4 is used to get a better insight on the Antarctic climate in the last four decades. This model is driven at its boundaries by ERA40 reanalysis data. Due to the distribution of Antarctic stations, most of the measured data is bound to the coastal regions of Antarctica. For the comparison, we additionally consider the total water vapor derived from ground-based GPS observations of two inner Antarctic stations. In addition the uncertainties in both measurements and simulations are quantified. We also expand on the influence of using different mapping functions to estimate the zenith tropospheric delay of the GPS signals which is convertible into precipitable water. As a first result, the different data sets show a high correlation on the Antarctic Peninsula. Contrary, HIRHAM4 tends to be too dry for continental stations. To explain the differences of the results based on different data sets, the synoptic activity and the wind directions have been analysed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: CONSTRAINTS ON WEST ANTARCTIC ICE SHEET VOLUME CHANGES BASED ON COSMOGENIC EXPOSURE AGES IN THE DARWIN-HATHERTON GLACIAL SYSTEM OF THE TRANSANTARCTIC MOUNTAINS

Forename: Bryan Surname: Storey

Authors: Storey, Bryan; Joy, Kurt; Fink, David; Shulmeister, James;

Presentation Allocated: Oral

abstract: Quantitative assessment of the spatial and temporal scale of ice volume change of the West Antarctic ice sheet (WAIS) is essential to accurately predict ice sheet response to current and future climate change. Although global sea level rose by approximately 120 metres since the Last Glacial Maximum (LGM), the contribution of the West Antarctic Ice Sheet is uncertain and the timing of such contribution is controversial. Mountain ranges flanking the Darwin-Hatherton glacial system (79.5° S, 158° E) exhibit well-defined moraines, weathering signatures, boulder rich plateaus and glacial tills, which preserve evidence of the advance and retreat of the ice sheet during earlier glacial cycles. Previous geomorphic studies, based on limiting radiocarbon dating, relative weathering rates and degree of soil pedogenesis have been used to estimate the timing and magnitude of LGM ice sheet advances suggesting a WAIS at the LGM to be at least 1,000 metres thicker than today. Vertical transects in the flanking mountain ranges from four key sites within the Darwin Hatherton glacial system were sampled for in-situ cosmogenic dating from catchment to drainage, with an aim to quantify the timing and volume of ice thickness changes through the system. All sites (Dubris Valley, Lake Wellman, Roadend Nunatak, and Diamond Hill) contain evidence of Quaternary ice fluctuations (moraines, striated bedrock, perched erratics, extensive boulder laden drift sheets). From a total of 77 samples, ^{10}Be exposure ages range from 2.2 Ma to 1.0 ka from 1600 to 80 metres above sea level. ^{10}Be and ^{26}Al paired dates show significant ice thickening of up to ~800 metres above present glacier ice surface at ~1.6 - 2.2 Ma along the length of the glacier profile. In contrast the Darwin Hatherton glacial system shows minor advance since global LGM with ice thickness being no more than 50-100 m above that today. The data consistently indicate that the greatest ice volume was much earlier than LGM, and that LGM ice volume was not as large as previously estimated. LGM ice elevation is constrained to be at most 50-100 m above current ice surface elevation - effectively little different from what is observed today. These results raise serious questions about the implications of a reduced West Antarctic ice Sheet at the LGM, and how the Antarctic ice sheets respond to global warming.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 1

Title: Coupled ice sheet-climate modeling of Antarctic ice volumes in the earliest Oligocene and middle Miocene

Forename: David Surname: Pollard

Authors: Pollard, David; Wilson, Douglas; DeConto, Robert; Luyendyk, Bruce;

Presentation Allocated: Poster

abstract: The first sustained growth of land ice in the Cenozoic occurred on Antarctica within a few hundred thousand years at the Eocene-Oligocene (E-O) Transition (~34 Ma). The general consensus from deep sea core $\delta^{18}O$ records, other proxy data, and climate modeling is that ice volume increased to values as large or larger than modern observed (~26 M km³), and deep-ocean temperatures cooled by 2 to 4 C. However, numerical modeling of Antarctic ice-sheet growth to date has simulated substantially smaller volumes. One possible reason is the use of modern ice-free rebounded bed topography, which ignores any bedrock elevation changes since the E-O. Wilson and Luyendyk (GRL, 2009) and Wilson et al. (Palaeo3, 2011) have produced reconstructions of Antarctic bed topography allowing for glacial erosion, lithosphere extension, and thermal subsidence, which restore substantial areas of West Antarctic bedrock to above sea level at the E-O. A 3-D hybrid ice sheet-ice shelf model using the reconstructed E-O topography is coupled asynchronously to a Global Climate Model (GCM), and applied to the earliest Oligocene. The ice sheet is run to equilibrium, with 30-year GCM snapshots performed at intervals of 5000 years to provide surface mass balance for the ice sheet model. Additional ice is accommodated on subaerial West Antarctica; simulated ice volumes are ~33.4 M km³ and 37.7 M km³ for minimum and maximum topographic reconstructions, substantially greater than using modern rebounded topography (22.7 M km³), and in better accord with proxy data. Ice-sheet results are also shown for bed elevations that are weighted means between the E-O and modern bed topography, crudely representing a time later in the Cenozoic (possibly middle Miocene) when West Antarctic bedrock elevations had subsided just below sea level. This raises the possibility of a marine West Antarctic ice sheet, surviving in warm waters due to the relatively shallow bathymetry, and fluctuating between that state and open ocean with little or no ice. Preliminary simulations using the coupled sheet-shelf capability of the ice model are presented for these scenarios.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: HIGH-FREQUENCY VARIABILITY OF SEA ICE, IN THE WEDDELL SEA, MODULATED BY ATMOSPHERIC CIRCULATION DURING THE AUSTRAL WINTER

Forename: CAMILA Surname: CARPENEDO

Authors: CARPENEDO, CAMILA; BOIASKI, NATHALIE; GANDU, ADILSON; AQUINO, FRANCISCO; SIMÕES, JEFFERSON;

Presentation Allocated: Poster

abstract: The sea ice distribution can affect and be affected by synoptic disturbances, and a single synoptic event alone can dramatically change the coverage of sea ice in a region. The objective of this study is to analyze the patterns of high-frequency atmospheric circulation in the Southern Hemisphere that may induce the extremes events of sea ice in the Weddell Sea (WS) in the same timescale. We used sea ice extent data for the sector of the WS, from NSIDC/NASA; mean sea level pressure, zonal and meridional wind at 10 m and mean air temperature at 2 m from ERA-Interim reanalysis (ECMWF). Anomalies of high-frequency (2-10 days) were obtained by applying a fast Fourier transform in the time series (1989-2007). The extremes were defined using the first (q25) and third (q75) quartile of the distribution of synoptic sea ice anomalies. Below the q25 were considered extremes negative of sea ice (ENSI) and above the q75 extremes positive (EPSI). Lastly composites were lagged in time for the anomalies of synoptic atmospheric fields, given 25 days prior to the events ENSI/EPSI (lag = -25) and 25 days after the beginning (lag = +25). The statistical significance of the anomalies was obtained with the Student t test, at 95%. Events ENSI and EPSI are associated with the anomalies of atmospheric fields occurred from three days before of the extreme event. The westerly winds anomalies in the north and east winds in the south are associated with cyclonic anomaly in the west of WS, and east winds anomalies in the north and west winds in the south are associated with anticyclonic configuration in east of WS. This pattern results an anomaly of winds of north and hence a positive anomaly air temperature. This configuration contributes to the events ENSI by melting sea ice and its own transport toward higher latitudes. Synoptic atmospheric fields anomalies in all cases event ENSI show opposite phases to the events EPSI. Therefore, different phases of the circumpolar wave train induced modulation concurrent extremes of sea ice.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Hydroacoustic detection of Ice-tremor and Ice-quakes from the grounding and calving of Iceberg A53a

Forename: Robert Surname: Dziak

Authors: Dziak, Robert; Fowler, Matthew; Park, Minkyu; Bohnenstiehl, Delwayne; Matsumoto, Haru; Haxel, Joseph; Lau, T-K; Lee, Wong Sang;

Presentation Allocated: Poster

abstract: An array of underwater hydrophones (250 or 1000 Hz sample rate) deployed in the Scotia Sea and Bransfield Strait off Antarctica recorded the full life-cycle sounds of an iceberg, from grounding harmonic tremor (HT) near its source to the large-scale calving icequakes as it melted and broke apart. During April-June 2007, the massive Iceberg A53a (60x35 km), drifted out of the Weddell Sea and through the Bransfield Strait. Hydrophones first detected HT from A53a when it impacted a 124 m deep shoal causing the berg to rotate 192 degrees and began generating six days of continuous HT as it ground across the seafloor. The mega-iceberg then entered the Bransfield Strait where it became fixed and began to pinwheel over a 265 m deep shoal, generating impulsive, short duration HT and establishing the iceberg's minimum keel depths, and that they vary over the 60 km length of A53a. In both cases, the iceberg tremors are generated through periodic, discrete stick-slip bursts caused by contact of the moving iceberg with the seafloor rather than resonant vibration

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Mass loss in ice shelf frontal zones determined from satellite laser altimetry

Forename: Geir Surname: Moholdt

Authors: Moholdt, Geir; Fricker, Helen Amanda; Padman, Laurie;

Presentation Allocated: Oral

abstract: Calving and basal melting of ice shelves are the principal processes by which mass is lost from the Antarctic Ice Sheet. Basal melt rates are typically highest near the grounding zones where the ice draft is deepest, but they can also be elevated in the most seaward 10-30 km of the ice shelf, denoted the ice shelf frontal zone (ISFZ). Thinning through basal melting in this region may lead to further mass loss by calving, and reduce buttressing of the remainder of the ice shelf. We have investigated basal melt rates of the larger ISFZs around the Antarctic continent using satellite laser altimetry from the Ice, Cloud and land Elevation Satellite (ICESat). Elevation change rates dh/dt are derived from repeat-track ICESat data and evaluated in a "Lagrangian" sense (following a specific location on the advancing ice shelf): because of ice front advance, these rates can be much higher than those evaluated relative to fixed geographic coordinates. We convert measured rates of Lagrangian dh/dt into ice thickness changes and basal melt rates. The results show large differences in ISFZ mass loss between ice shelves, and we interpret these differences in terms of key ice shelf parameters (thickness and extent) and ocean conditions (temperature and circulation) using available ocean data and models. Although the two largest ice shelves, Ross and Filchner-Ronne, seem to be relatively stable under current conditions, we postulate that warming of the upper ocean along the ice fronts may lead to a gradual ice-front retreat through increased basal thinning and calving.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Modeling Atmosphere-Ice-Ocean Coupling in the Southern Ocean: The Impact of Model Resolution

Forename: Hansi Surname: Singh

Authors: Singh, Hansi; Newsome, Emily; Bitz, Cecilia; Bryan, Frank;

Presentation Allocated: Oral

abstract: We investigate couplings between the atmosphere, ocean, and sea ice in the Southern Ocean using the Community Climate System Model version 3.5 (CCSM3.5), and compare surface ocean processes and sea ice evolution with a high-resolution 0.1-degree (eddy-resolving) ocean and sea ice components versus the standard 1.0-degree (eddy-parameterizing) resolution. The atmosphere and land components are 0.5 degree in both cases. Results from these experiments show that increasing model resolution has a significant impact on patterns of sea ice growth and melt, as well as the evolution of properties of the surface ocean, including mixed layer depth, sea surface temperatures, and sea surface salinities. Lead and lag correlation studies suggest that these discrepancies affect ocean circulation at the gyre scale and mixing processes in the upper ocean. Spatial filtering is used to isolate relationships across scales. We will discuss the implications of modeling resolution on sea ice-ocean interactions in the Southern Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Modeling mass loss through basal melting in the Ross Ice Shelf frontal zone

Forename: Scott Surname: Springer

Authors: Springer, Scott; Padman, Laurence; Dinniman, Michael;

Presentation Allocated: Oral

abstract: The Ross Ice Shelf (RIS), the largest ice shelf in Antarctica, experiences a net mass loss of ~30-50 Gt/yr through basal melting averaging ~0.1 m/yr. Recent observations suggest that much of this mass loss occurs in the 20 km band of the ice shelf frontal zone (ISFZ). While the RIS is presently close to mass balance, the rapid basal melting in the ISFZ suggests that ice-shelf retreat could occur through relatively modest increases in ocean heat provided to the ice-shelf front. We use a numerical ocean and sea-ice model, with thermodynamic coupling to an ice shelf model, to investigate the processes causing elevated basal melt in the ISFZ. Basal melting for ice drafts of less than 250 m experiences a strong seasonal cycle, with greatly enhanced rates in summer. The elevated flux of ocean heat to the ISFZ at this time is correlated with sea-ice-free conditions along the ice front, a positive surface radiation balance, and increased advection of Modified Circumpolar Deep Water southward across the continental shelf. The amplitude and duration of the seasonal cycle are only weakly dependent on whether the model is forced with winds of high or low spatial resolution. The addition of tidal forcing increases net mass loss slightly in the ISFZ. We hypothesize that warming of upper-ocean waters along the ice front could lead to a gradual ice-front retreat through a feedback cycle of thinning and calving: this is in contrast to recent observations and models that emphasize the role of enhanced Circumpolar Deep Water inflows penetrating to the deep grounding lines of smaller ice shelves along the Antarctic Peninsula and Amundsen Sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Motion Estimation of Lambert Glacier-Amery Ice Shelf System, East Antarctica Using Feature-Tracking

Forename: Zhaohui Surname: Chi

Authors: Chi, Zhaohui; Klein, Andrew;

Presentation Allocated: Oral

abstract: The Lambert Glacier-Amery Ice Shelf (LAS) system is the largest outlet glacier system of the eastern portion of the Antarctic Ice Sheet (AIS). Therefore, long-term accurate ice motion measurements are important to assess the possible variability in the mass flux of the LAS. However, it is very difficult to constrain the distribution of ice motion from field observations. Feature tracking method is explored to derive ice motion estimation for the LAS from remotely sensed satellite images, including optical images and Synthetic Aperture Radar (SAR) images. The velocity fields of the LAS were analyzed using Landsat ETM+ and MODIS images from 1999-2004 and ENVISAT ASAR images from 2009-present. These estimates are compared to the widely available Interferometric SAR (InSAR) measurements of velocity derived from images acquired during the 1997-2000 period. Velocities were derived from optical images and SAR images of 1-3 year intervals. Using Landsat images, approximately 50,000 motion vectors met the quality control criteria and densely distributed across the LAS. Due to severely lacking cloud-free Landsat image pairs in the large area of the northern LAS, four substitute MODIS image pairs were utilized to derive the contemporary surface velocity measurements. A comparison analysis between the optical image derived and InSAR derived measurements suggests that feature-tracking derive motion fields from optical images achieving similar accuracy as InSAR measurements. The velocity field of the LAS for more recent periods is being derived from feature tracking of ENVISAT ASAR images.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Multi-scale deformation of the 'Loose Tooth' of the Amery Ice Shelf, East Antarctica

Forename: David Surname: Heeszel

Authors: Heeszel, David; Fricker, Helen; Walter, Fabian; Bassis, Jeremy; O'Neel, Shad;

Presentation Allocated: Poster

abstract: Despite its important role in the mass balance and dynamics of ice sheets and tidewater glaciers, iceberg calving is still poorly understood. Since it is episodic, the process is challenging to observe in situ; however, recent progress has been made by examining seismic signals emitted from propagating rifts. Understanding seismic source processes associated with rift propagation and calving within ice shelves will allow us to develop better models of calving and ice shelf breakup, which will provide constraints on ice sheet models. To this end, we have reprocessed data from a quasi-continuous, three season (2004-2007) deployment of seismographs around the propagating tip of the 'Loose Tooth' of the Amery Ice Shelf, a nascent iceberg 30km by 30km at the ice front, to better constrain seismic sources associated with rift propagation. We analyze seismic data at a number of timescales from weeks to seconds to locate and characterize seismicity associated with rift propagation. We confirm that at longer time scales of days to weeks, seismicity is episodic in nature with intense 'swarms' of seismicity occurring at intervals of 10-20 days. High resolution relocation of individual events indicates that icequake locations during these swarms are associated with rift propagation. By utilizing time-dependent frequency-wave number (fk) analysis we refine locations further and find that bursts of seismicity occur at the propagating rift tip followed closely by icequakes on the transverse crevasses, indicating an effective mechanism of stress transfer within the rift system. Additionally, we invert waveforms from individual events for moment tensor solutions in order to characterize the stress release that occurs on a time scale of less than a second. Initial results suggest a strong extensional component, consistent with an opening crack. Moment magnitudes (M_w), an estimate of energy release, are in the range of M_w -1.0 – 0.5.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: OCEAN HEAT TRANSPORT TO THE ANTARCTIC COASTAL CRYOSPHERE

Forename: Robin Surname: Muench

Authors: Muench, Robin;

Presentation Allocated: Oral

abstract: The onshore flow of heat from the deep circumpolar ocean has a profound effect on Antarctic ice shelves and coastal sea ice. This heat flow is highly variable in time and space, being influenced by seasonal and longer-term changes and by topographic variability along the continental shelf break, proximity of the Antarctic Circumpolar Current (ACC) to the continental slope, and orientation of mean winds and characteristics of synoptic weather systems. Onshore flow is also influenced by circulation induced by offshore flows of dense shelf water produced by sea ice formation and ice shelf basal melting. The complexity of the system is a major challenge for projecting Antarctic coastal response to global climate change. This presentation reviews the mechanisms responsible for warm water intrusions onto Antarctic coastal regions. Perhaps the simplest is the shoreward flow of heat in topographic depressions where the ACC impinges on a cyclonically curving slope. Such regimes, typified by the West Antarctic Peninsula, lack a shelf break frontal system. In contrast, the Ross Sea and Weddell Sea slopes are defined by well-defined oceanic frontal structures with strong associated currents. Cross-slope flow in these regions is dominated by dense, deep outflows balanced by onshore flow of warmer waters from offshore. Conditions along the Amundsen Sea slope fall between these two extremes, and mechanisms driving onshelf flow of warm water there include meteorological pumping by migrating weather systems and onshelf pumping of warm deep water up the slope and onto the shelf by frictional bottom boundary layer effects where filaments of the ACC impinge on the slope. Additional cross-slope transports can be driven, either onshelf or offshore, through dynamical instabilities either where strong shelf break frontal currents are present or where the ACC impinges on the slope. Finally, locally steep and complex seafloor topography can impact cross-slope transports.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: On the Temporal Variability of Antarctic Sea-Ice

Forename: Graham Surname: Simpkins

Authors: Simpkins, Graham; Ciasto, Laura; England, Matthew;

Presentation Allocated: Poster

abstract: To date, the characterisation of Antarctic sea-ice trends has largely been through understanding the spatial patterns of change, an expected response given the robust dichotomy of sea-ice growth and decline between the Ross and Amundsen-Bellingshausen Seas, respectively. Presently, however, there has been little research characterising sea-ice trends in a temporal sense. Here, therefore, the authors provide a preliminary assessment of the observed changes to the Antarctic sea-ice system using Bootstrap sea-ice concentration data from 1979-2007. Past studies are used as “markers” to track changes through time, and thus gain knowledge of the evolution of sea-ice trends. In the Bellingshausen Sea region, it is found that much of the “long-term” trend in sea-ice is dominated by a strong consistent perturbation that occurred over the first ~12 years of the record. Relatively subtle variations subsequently follow this predominant early change, and consequently the trend signal is diluted with each extra year of data; as such, the magnitude of sea-ice trends are observed to diminish as the literature “markers” are tracked through time. Similar to the Bellingshausen Sea, much of the “long-term” trend in the Ross Sea region is primarily accountable by changes that occurred over the early record, but over a slightly longer time period. Contemporary trends in Antarctic sea-ice thus appear to be influenced by changes that occurred over one relatively short time period, and do not seemingly represent a consistent pattern of change like that which is observed in the Arctic.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Polynya formation and air/sea-ice/ocean interaction in the Weddell Sea region

Forename: Guenther Surname: Heinemann

Authors: Heinemann, Guenther; Ebner, Lars; Timmermann, Ralph; Haid, Verena;

Presentation Allocated: Oral

abstract: Coastal polynyas are frequent in the Weddell Sea Region even in winter and have a strong impact on ice-ocean-atmosphere interactions. Coastal polynyas are primarily forced by strong offshore winds which shift the sea ice away from the shoreline. Through the enhanced energy exchange between ocean and atmosphere, these areas are known as strong sea ice producers. In consequence, polynyas have a substantial impact on bottom water formation through the production of new cold and saline water masses during the whole winter season. To investigate the polynya dynamics for the freeze-up and winter season, a high-resolution atmospheric dataset has been produced for 6 months for the Weddell Sea Region, comprising the autumn and winter season in 2008. Daily simulations have been carried out using the non-hydrostatic numerical weather prediction model COSMO (Consortium for Small-scale modeling) of the DWD (German weather service). In a first nesting step, simulations were performed with a spatial resolution 15km, using GME (Global model extended) analysis from the DWD for atmospheric forcing. Daily sea ice coverage was provided from AMSR-E (Advanced Microwave Scanning Radiometer - EOS) data and a thermodynamic sea ice model was used to simulate the sea ice surface temperatures in the COSMO model. In a second nesting step, these model outputs were used for forcing atmospheric simulations with a horizontal resolution of 5kms. This high-resolution atmospheric dataset was then provided for forcing the sea ice ocean model FESOM (Finite element sea ice ocean model). On the other hand, we use the atmospheric model output to investigate polynya dynamics and ice production in association with synoptic and mesoscale phenomena, like cyclones, katabatic and barrier winds.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Recent Changes in the Larsen B Ice Shelf Remnant and its Tributary Glaciers: An imminent break-up?

Forename: Ted Surname: Scambos

Authors: Scambos, Ted; Bohlander, Jennifer; Pettit, Erin; Truffer, Martin; Shuman, Christopher; Haran, Terry; Ross, Ronald;

Presentation Allocated: Oral

abstract: The southern 30% of the Larsen B Ice Shelf (the SCAR Inlet area) persisted after the dramatic February-March 2002 disintegration event. Climate and other indications suggest that this section, too, is near the limit of ice shelf stability, although recent years have seen a slight cooling trend relative to the period 2002-2006. Two large glaciers, Flask and Leppard, flow into the southern shelf margin. We document several structural changes to the shelf in the aftermath of the loss, including several icebergs, new large rifts, and changes to the northwestern shear margin as recorded by a time-series of satellite images. Ice velocity on the SCAR Inlet has increased since 2002, and by a significant amount since 2006. In situ observations from stations installed in January-February 2010 verify the satellite-based ice flow speed mapping, indicate the tidal range, and provide weather data that shows intense foehn/chinook wind patterns and a distinct accumulation shadow effect for the Scar Inlet shelf (near-zero accumulation over 24 months). The presence of a very deep trough on Flask (>1500 m?, inferred from shelf-front bathymetry and partial results from radar profiling), and moderately deep trough on Leppard (~700 m, from airborne and ground radar profiles) implies that very significant mass balance changes are likely to occur if the SCAR Inlet shelf breaks up. We discuss two conceptual models for break-up: melt ponding / hydrofracture / wave action; and shelf thinning / shear margin detachment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Recent trends in Antarctic sea ice and their simulation by the IPCC/CMIP5 models

Forename: John Surname: Turner

Authors: Turner, John; Phillips, Tony; Bracegirdle, Tom;

Presentation Allocated: Keynote 40 mins

abstract: Passive microwave satellite data indicate that over 1979 – 2005 the annual mean Antarctic sea ice extent (SIE) increased by 1.1%/decade ($0.13 \times 10^{16} \text{ km}^2 / \text{decade}$) (significant at <5% level). This talk will focus on the representation of the annual cycle and recent SIE trends in 18 Coupled Model Intercomparison Project 5 models that were run with historical forcing for the 1850s to 2005. Many of the models have an annual SIE cycle that differs markedly from that observed over the last 30 years. The majority of models have too little SIE at the minimum in February, while several of the models have less than two thirds of the observed SIE at the September maximum. In contrast to the satellite data, the mean SIE of the models over 1979 - 2005 show a decrease of SIE in each month, with the greatest percentage monthly decline of 13.6%/decade in February and the greatest absolute loss of ice of $0.40 \times 10^{16} \text{ km}^2 / \text{decade}$ in September. The models have very large differences in SIE in the pre-satellite era and all have a negative trend in SIE since the mid-Nineteenth Century. This is consistent with a response to increasing greenhouse gases, with the largest changes in February - April likely being a result of the ice-albedo feedback mechanism. The negative SIE trends in most of the model runs over 1979 - 2005 are a continuation of an earlier decline, suggesting that the processes responsible for the observed increase over the last 30 years are not being simulated correctly.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Roughness of Amundsen Sea Pack Ice and Estimates of Air-Ice Drag Coefficient

Forename: Stephen Surname: Ackley

Authors: Ackley, Stephen; Weissling, Blake;

Presentation Allocated: Poster

abstract: The Oden Southern Ocean 2010-11 expedition to the Amundsen and Ross Seas, Antarctica, provided the opportunity to assess an innovative imaging technology for sea ice physical properties research – the application of terrestrial laser scanning (TLS) or LiDAR technology for topographic sea ice surface characterization. A Riegl Z620 scanning LiDAR system, on loan from UNAVCO, was deployed during the Oden's transit through the Amundsen and Ross Seas to McMurdo Station. Three mixed first-year/multi-year ice floes, representative of the deformed ice regime prevalent in the Amundsen just prior to the onset of summer melt, were selected for scanning of snow/ice surface topography. Each site was scanned with multiple scanner positions providing overlapping coverage of the ice field to minimize shadowing and range effects. Co-registered LiDAR point clouds at a single site never exceeded 1.5 cm rms registration error. The final point clouds were then registered to a sea level datum utilizing standard transit surveying to water levels in adjacent auger holes and then rasterized to a 10 cm resolution, 400 x 400 m digital elevation model (DEM) image. The last LiDAR survey of the project, a 7 scan position survey in the shape of a hexagon of diameter ~ 250 m, was selected for a topographic roughness analysis utilizing variance of elevation and the power spectral density (PSD) computed from a Fourier transformation of snow surface elevation profiles along the 3 internal diameters of the hexagon. These diameters were also co-located with snow depth measurements and electromagnetic induction (EMI) sounding for ice thickness at a 2 m sample spacing. The roughness of an ice sheet (top and bottom) has previously been demonstrated to encode its deformational history and to determine its frictional coupling with the atmosphere and ocean. Snow and ice surface (topside and draft) power spectra from multiple sets of 100 m ice profiles, collected during the Winter Weddell Gyre Study of 1989, provides the point of comparison for this study. The air-ice drag coefficient, wavenumber dependency, and an evaluation of PSD sampling considerations for snow surface and ice surface (topside and draft) are presented for Amundsen sea ice conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Sea ice growth rates near Antarctic ice shelves

Forename: Inga Surname: Smith

Authors: Smith, Inga; Langhorne, Patricia; Leonard, Gregory; Trodahl, Joe; Gough, Alex; Frew, Russell; Van Hale, Robert; Mahoney, Andy; Haskell, Tim;

Presentation Allocated: Oral

abstract: Ice shelves lie along approximately half of the Antarctic coastline, and melting/dissolving of the base of ice shelves affects sea ice structure and growth rates. The input of this ice shelf meltwater leads to faster sea ice growth rates, and thicker sea ice, a result that might seem counter-intuitive at first. This is due to the formation of platelet ice crystals in supercooled water at or near the sea ice lower surface. However, measuring such changes is challenging. Determining the thickness of sea ice using satellite sensors is difficult due to snow cover and the presence of brine inclusions in the ice. Consequently, changes in sea ice thickness over time are not well known. Direct measurements through drilling, extracting cores, or the use of temperature (thermistor) probes are resource intensive to collect, and are therefore limited to a few sites. An ideal methodology would allow retrospective reconstruction of sea ice growth rates from the analysis of ice cores taken at the end of the growth season. This presentation compares measurements of bulk sea ice growth rates with (i) salinity-based growth rates models, (ii) isotope-based growth rates models, and (iii) growth history deductions from thick section structural analysis. Measurements of hydrogen and oxygen isotope ratios in sea ice and sea water samples taken at a site in McMurdo Sound, Antarctica during the winter of 2010 form the basis of this comparison. To accurately predict sea ice growth rates in McMurdo Sound, near the McMurdo and Ross Ice Shelves, modifications to existing growth rate models are necessary. The role that platelet ice plays in the growth process will be discussed in relation to this. The promise that hydrogen isotope measurements hold will be also be discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Sea ice records and some limited ocean measurements from a small Antarctic coastal embayment; trends and implications

Forename: HYOUNG CHUL Surname: SHIN

Authors: SHIN, HYOUNG CHUL; LA, HYOUNGSUL; KANG, SUNG-HO;

Presentation Allocated: Poster

abstract: We attempted to describe sea ice cycles in the northern part of Maxwell Bay and Marian Cove, King George Island, Antarctica, examining the weather logbook and limited ocean measurements from a coastal year-round research station, King Sejong. Sea ice duration and the coverage differed widely year to year, reflecting its low latitude maritime Antarctic locality. The onset of sea ice formation, the development and its break-up were strongly affected by local weather, the air temperature as well as the wind field. However, the sea ice formation and duration in this small bay appear to be governed by a much wider geographical scale trend. The sea ice forms in open waters further south of the bay, and enters and advances into the bay. The autumn decline of sea water temperature might be a coarse predictor of sea ice dynamics in the upcoming winter. Melt sea ice tends to induce either a short-lived or longer lasting algal bloom. Examination of near 20 year record shows that the sea ice tends to form later and for a shorter length recently, although the trend is weak and not necessarily unidirectional. This tendency should have an implication for this site of enhanced biological activity and glacial retreat.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Sea ice variability and trends in the Weddell Sea for 1979 - 2006

Forename: Sandra Surname: Schwegmann

Authors: Schwegmann, Sandra; Timmermann, Ralph; Gerdes, Rüdiger; Lemke, Peter;

Presentation Allocated: Oral

abstract: Sea ice concentration in the Weddell Sea is subject to regional climate variability. The magnitude and origin of local trends in the sea ice coverage were studied using the bootstrap algorithm sea ice concentration data from the NSIDC for 1979-2006. The impact of atmospheric forcing such as air temperature, wind speed, and cloud coverage, gained from NCEP/NCAR reanalysis, on sea ice was assessed by analyzing correlation coefficients between the respective atmospheric component and the satellite-observed sea ice concentrations. It was found that sea ice concentrations increased in the eastern and decreased in the western Weddell Sea, predominantly in the marginal sea ice zone. There, and in coastal regions, temperature variability is strongly anti-correlated to the variability of sea ice concentration. In the central Weddell Sea, warmer air masses and the redistribution of sea ice, induced by an observed shift of the prevailing westerly winds towards the south, are suggested as reasons for the positive correlation between air temperatures and sea ice concentration in this region. Sea ice concentration trends are well connected to trends in the air temperature and wind fields, but sea ice drift trends, analyzed using the Polar Pathfinder sea ice motion vectors, differ from those in the wind field. These differences are to some extent interpretable when considering sea ice deformation changes. Modelling the state and trends of the sea ice cover with the Finite Element Sea ice - Ocean Model (FESOM) showed that sea ice thicknesses predominantly indicate the same tendencies as the simulated sea ice concentrations, which results in an increase of the total sea ice volume by 1 % per decade in the Weddell Sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Sedimentary environments beneath the Amery Ice Shelf, East Antarctica throughout the Holocene

Forename: Alix Surname: Post

Authors: Post, Alix; O'Brien, Phil; McMinn, Andrew; Craven, Mike;

Presentation Allocated: Poster

abstract: The sediments deposited beneath the floating ice shelves around the Antarctic margin provide important clues regarding the nature of sub-ice shelf circulation and the imprint of ice sheet dynamics and marine incursions on the sedimentary record. Understanding the nature of sedimentary deposits beneath ice shelves is important for reconstructing the icesheet history from shelf sediments. In addition, down core records from beneath ice shelves can be used to understand the past dynamics of the ice sheet. Six sediment cores have been collected from beneath the Amery Ice Shelf in East Antarctica, at distances from the ice edge of between 100 and 220 km. The sediment cores collected beneath this ice shelf provide a record of deglaciation on the Prydz Bay shelf following the last glaciation. Diatoms and other microfossils preserved in the cores reveal the occurrence and strength of marine incursions beneath the ice shelf, and indicate the varying marine influence between regions of the sub-ice shelf environment. Variations in diatom species also reveal changes in sea ice conditions in Prydz Bay during the deglaciation. Grain size analysis indicates the varying proximity to the grounding line through the deglaciation, and the timing of ice sheet retreat across the shelf based on ^{14}C dating of the cores. Two of the cores contain evidence of cross-bedding towards the base of the core. These cross-beds most likely reflect tidal pumping at the base of the ice shelf at a time when these sites were close to the grounding line of the Lambert Glacier.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Sensitivity of Modified Circumpolar Deep Water in the Ross Sea to Changes in the Winds and Atmospheric Temperatures

Forename: Michael Surname: Dinniman

Authors: Dinniman, Michael; Klinck, John; Smith, Jr., Walker;

Presentation Allocated: Oral

abstract: Transport of relatively warm, nutrient-rich Modified Circumpolar Deep Water (MCDW) onto the Ross Sea continental shelf has important consequences for physical and biological processes. Strengthening of the cold southerly winds over the Ross Sea is thought to be one of the causes for the observed increases in sea-ice extent in this area and may have significant effects on other aspects of the circulation. A high resolution (5 km) regional ocean/sea-ice/ice shelf model of the Ross Sea is used to examine the effects of changes in the winds on the transport of MCDW onto the shelf, vertical mixing of MCDW and basal melt of the Ross Ice Shelf (RIS). Simple increases in the wind speed with no other atmospheric changes actually reduced the sea-ice, opposite of what has been observed. Increases in the winds combined with spatially uniform decreases in the air temperature led to realistic increases in sea-ice concentrations. Stronger winds and cooler air temperatures both led to increases in the quantity of MCDW advected onto the continental shelf and increases in the vertical mixing of MCDW into the upper water column, possibly increasing nutrient transport into the euphotic zone. The increased winds worked against the cooler air temperatures in changing the basal melt rate of the RIS and the slight change (4% increase) in the basal melt makes it difficult to tell from these experiments which effect dominates. R4 future scenario simulations typically show atmospheric warming and changes in wind speed (increases and decreases) and direction over the Ross Sea. One would expect from the idealized forcing simulations that warmer temperatures would reduce the MCDW that gets to the upper shelf waters, although this could be balanced out by changes in the winds. Preliminary results from simulations forced with winds and air temperatures from the SRES A1B scenario simulations from the MPI ECHAM5 model do show lower transport of MCDW onto the continental shelf and decreased mixing of MCDW into the upper waters for 2046-2050 compared to the end of the 20th century. The MCDW concentrations on the shelf are about the same for 2096-2100 compared to the end of the 20th century, although many other aspects of the circulation are different. The basal melt rate of the RIS increased slightly for 2046-2050 (6% increase) and 2096-2100 (9% increase) compared to the end of the 20th century.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Snow Depths on Antarctic Sea Ice in the Bellingshausen and Amundsen Seas

Forename: David Surname: Prado

Authors: Prado, David; Ackley, Stephen F.; Xie, Hongjie; Lewis, Micheal; Weissling, Blake;

Presentation Allocated: Poster

abstract: Snow on sea is typically thought to control ice growth by modulating the conduction of heat through the ice and into the atmosphere as ice forms on the bottom and thickens the existing layer. An additional mechanism for Antarctic sea ice is that the accumulation of snow on the sea ice surface depresses it and causes flooding which can refreeze to snow ice, and thicken the sea ice from the top instead. In Situ measurements from two vessel expeditions in the Bellingshausen- and Amundsen Seas, J.C. Ross (Nov. 2010) and Oden (Dec. 2010 – Jan. 2011), showed that the majority of the sea ice surfaces were flooded during the period through ice stations and underway ASPeCt observations, and therefore identified the flooding-snow ice formation behavior as a principle source of ice thickening in these regions. A further consequence of widespread flooding is that the snow surface elevation is 90 to 100% of the snow depth on most of the sea ice cover. From in situ measurements, therefore, snow surface elevation has been determined to be an effective proxy for snow depth on Antarctic sea ice. In the same regions, airborne lidar was conducted from NASA's IceBridge aircraft in flights during Oct-Nov in 2009, 2010 and 2011. The same track lines were flown each year. Snow surface elevation will be determined from airborne lidar with correction to local sea level made by returned signal intensity to locate leads which can then be used as a local sea level reference for elevation. Ship based measurements, near the same regions as portions of the flight lines will be compared to snow depths determined from airborne snow elevation as validation data. Interannual changes in snow depth will then be determined over selected portions of the flights and used to examine regional variations in ice formation and precipitation processes over the period from 2009-2011 in the Bellingshausen and Amundsen Seas.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Sound of Climate Change: Anthropogenic Impact to the World Ocean

Forename: Haru Surname: Matsumoto

Authors: Matsumoto, Haru; Bohnenstiehl, DelWayne; Dziak, Robert; Park, Minkyu; Lee, Won-Sang;

Presentation Allocated: Poster

abstract: Another sign of climate change is found in the low-frequency ocean sound observed in the Bransfield Strait off Western Antarctic Peninsula (WAP), where most rapid rise of air temperature and retreat of glacier has been reported in the last 50 years. Interestingly during the same period, the low frequency ocean noise level in the coastal water off California has been found risen at rate of 3dB/decade, and increased ship traffic noise was suggested as a leading cause. In the WAP, the regional ambient noise level may be also on the rise due to decreasing sea ice as a result of the temperature rise. Since many marine organisms, from fish larva to the great cetaceans, use sound both for directional sensory cues as well as in breeding behavior, a rise in ocean ambient noise may have a direct effect on marine ecosystems. Here we show that a seasonal pattern of ocean ambient noise level coincided with the regional climate including air temperature, wind speed, and seasonal ice coverage from the 2-year long underwater acoustic monitoring. We show that the lower noise level of 2007 winter was a direct consequence of the longer and colder winter of that year than previous year. The region's warming trend and known effects of decreasing sea-ice extent to the acoustic environment lead us to believe that the noise level in the WAP may be on the rise and may be contributing to the ocean acoustic noise budget in the southern hemisphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: The land-fast sea ice in Atka Bay, west Antarctica: a monitoring initiative

Forename: Mario Surname: Hoppmann

Authors: Hoppmann, Mario; Nicolaus, Marcel;

Presentation Allocated: Poster

abstract: Sea ice fastened to coasts, icebergs and ice shelves is of crucial importance for climate- and ecosystems. Near Antarctic ice shelves, land-fast sea ice exhibits some unique characteristics that distinguish it from other sea ice: a significant fraction of incorporated ice platelets and a thick snow cover, leading to surface flooding and snow-ice formation. In order to investigate the spatial and temporal variability of sea-ice and snow thicknesses, we have initiated a regular observation program on the land-fast sea ice of Atka Bay as part of the international Antarctic Fast Ice Network (AFIN). Here we describe our monitoring activities and present first results of 2010 and 2011. Manual measurements of sea-ice and snow thicknesses and freeboard were performed at 6 locations along an east-west profile, every 3 weeks from June to December 2010 and from May 2011 to January 2012. Starting in November 2011, over 200 km of high-resolution, electromagnetic (EM31) thickness data were acquired. A mass balance buoy frozen into the sea-ice since August 2011 provides time-series of thickness data of high temporal resolution and allows us to investigate thermodynamic properties of sea ice and its snow cover. At the same time, an automatic weather station was deployed on the land-fast sea ice to provide model forcing data and to compare the atmospheric conditions to the Neumayer III station on the nearby Ekström ice shelf. First results show that sea-ice thickness is lowest in the eastern part of the Bay, where a thick snow cover leads to extensive surface flooding. In the West, dynamic conditions lead to high sea-ice thickness and high local variability. Snow is heavily redistributed by wind, leading to high snow thickness variability over the entire Bay. Ice platelets were observed regularly in the boreholes. Upcoming texture analysis of ice-cores taken at each of the stations at the end of the respective growth season will reveal the contribution of incorporated platelet ice and snow ice to the total sea-ice thickness. During our field campaign in November 2012, the monitoring will be intensified. The regular measurements will be extended by under-ice CTD profiles to detect super-cooled water masses. In addition, the prototype of a portable under-ice camera system will be tested to detect loose ice platelets and a radiation station will shed light on the variability of surface albedo and reveal the differences in light regimes in and under the ice.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: The Relationship Between Surface Meteorological Observations, Modes Of Climate Variability, And Sea Ice In The Larsen Ice Shelf System, Antarctica

Forename: Mattias Surname: Cape

Authors: Cape, Mattias; Vernet, Maria; Scambos, Ted; Domack, Eugene;

Presentation Allocated: Oral

abstract: Rapid regional warming over the northeast Antarctic Peninsula in the last fifty years is thought to have contributed to the retreat and disintegration of the Larsen A and B ice shelves. While recent laboratory and modeling studies have linked increases in summer temperatures to the positive trend in the Southern Annular Mode (SAM) climate index via the strengthening of the circumpolar westerlies, field data to test these hypotheses have generally been lacking. As part of the LARISSA (LARSen Ice Shelf System, Antarctica) project, we analyzed data from long-term weather stations as well as additional ground stations adjacent to the Larsen B embayment to explore the response of near-surface meteorological conditions to changes in climate indices. Preliminary field results indicate that increases in SAM are indeed associated with increased wind velocity and temperature as well as decreased surface air pressure leading to favorable melt conditions, as proposed by models. Foehn (downslope, warm) wind events were also significantly more frequent during periods of positive SAM, with sustained events associated with decreases in sea ice cover in the coastal regions. Such conditions may have large effects upon sea ice dynamics in the newly opened Larsen B embayment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: The role of the upper Southern Ocean in modulating Antarctic sea ice extent

Forename: Sally Surname: Close

Authors: Close, Sally; Goosse, Hugues; Massonnet, François; Zunz, Violette; Dubinkina, Svetlana;

Presentation Allocated: Oral

abstract: The variability in Antarctic sea ice extent on timescales ranging from interannual to interdecadal is, at present, poorly understood. The response appears to be highly regionalised, with increases in sea ice coverage being reported in the Ross and Weddell Seas, in contrast to the reported reduction in extent in the Amundsen-Bellingshausen sector. The contributions of the various processes responsible for driving Antarctic sea ice variability are not well quantified, and consensus has not yet been achieved in the literature regarding the likely primary forcing(s). Previous studies have focussed primarily on the role of the atmosphere and the major climatic modes. In contrast, the role of the ocean has received comparably little attention, despite its potentially critical role in modulating sea ice coverage via the supply of upwelled heat at the ocean-ice interface. In this work, two sea ice-ocean models, NEMO-LIM and LOVECLIM, are used to study upper-ocean salinity variability in the Southern Ocean, with the aim of evaluating the role of upper-ocean freshwater changes in driving variability in Antarctic sea ice. Circumpolar upper-ocean salinity variability is quantified over interdecadal timescales (1950-2010) and evaluated in the context of available observational studies. Links between the ocean, atmosphere and sea ice variability are then explored. Comparisons are made between both the model representation of sea ice over this period and the satellite observational record, and the feasibility of stratification as a primary driving mechanism of sea ice variability discussed. Stratification changes may be effected by changes in the hydrological cycle and, in addition to bringing about changes in sea ice, may also occur via the sea ice formation cycle of brine rejection and freshwater input. Both precipitation and sea ice thickness are currently poorly quantified by observational data, and thus the application of model data to this problem affords the opportunity to better understand the role of these influences in driving large-scale climatic changes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: The seasonal arrival of ice shelf water in coastal Antarctica and its effect on sea ice growth

Forename: Andrew Surname: Mahoney

Authors: Mahoney, Andrew; Gough, Alex; Langhorne, Patricia; Robinson, Natalie; Stevens, Craig; Williams, Michael; Haskell, Tim;

Presentation Allocated: Oral

abstract: In this paper we report measurements from the first year-round mooring underneath sea ice in McMurdo Sound, Antarctica, which provided temperature, salinity and current data from a complete annual cycle. We merge these data with full-depth ocean profiles, as well as continuous a record of sea ice growth, crystallographic observations and under-ice photography to identify the incremental arrival of ice shelf water (ISW) and its influence on sea ice growth. We find that ISW acts as a heat sink to the growing sea ice and we identify the conditions necessary for persistent growth enhancement and the incorporation of platelet crystals into the sea ice. In doing so we demonstrate the possibility of inferring the presence of ISW beneath sea ice through crystallographic analysis of cores. In addition, we found that the local growth of first year landfast sea ice only accounted for half of the observed increase in salinity over the water column, which indicates that polynyas are responsible for approximately half of the salt flux into McMurdo Sound.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Thermal Melt Probes for Clean, Extensive Observations in Subglacial Waters

Forename: Dale Surname: Winebrenner

Authors: Winebrenner, Dale; Elam, W.T.;

Presentation Allocated: Poster

abstract: All studies to date beneath glaciers, ice sheets and ice shelves have been limited by a paucity of in situ measurements, due to practical limitations on deploying instruments beneath hundreds to thousands of meters of ice. Existing ice drilling and coring rigs capable of reaching km-depths comprise tons of equipment and fuel, and are operated by crews of several (or more) people over periods of days to months. Moreover, current methods risk forward contamination of subglacial habitats, not only by organisms present at the ice surface, but also by organisms found within the ice that are foreign to the sub-ice environment. This situation can be improved greatly through modernization of thermal melt probes, which were pioneered in the 1960s and last used widely in the 1970s. Thermal probes melt their way autonomously, vertically down through ice at speeds of meters per hour. Advances in miniaturized instrumentation, solid-state power-control electronics, and high-voltage cabling now enable reliable, robust and sophisticated observations with small, logistically light melt probes. Moreover, melt probes offer significant advantages in preventing contamination, because they use no drilling fluid and could use ultraviolet light to decimate organisms continuously along the path of the probe, from the surface all the way to the subglacial environment. We have developed a sub-scale prototype melt probe as a basis new probes to penetrate kilometers of ice. We have field tested the sub-scale prototype on Arctic sea ice and on Easton Glacier on Mount Baker, WA. Here we review the development of thermal melt probes from the 1960s up to and including our own experience. We present a model that inform the design of probes to reach depths of 1 and 4 kilometers through polar ice. We find that probes of diameter 7 cm and length 150 cm can be used to reach depths of 1 km using 5 kW of electrical power at 3000 VDC. A probe to reach 4 km depth requires a diameter of approximately 12 cm and length 250 cm, and 18 kW electrical power transmitted to the probe at 8000 VDC. Finally, we investigate possibilities for continuous decimation of even spore-forming organisms during passage of a probe through ice using UVC illumination, based on published dose-response data and optical properties of ice.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Thirty years of elevation change on Antarctic Peninsula ice shelves from multi-mission satellite radar altimetry

Forename: Helen Surname: Fricker

Authors: Fricker, Helen; Padman, Laurence;

Presentation Allocated: Oral

abstract: We use data acquired between 1978 and 2008 by four satellite radar altimeter missions (Seasat, ERS-1, ERS-2 and Envisat) to determine multi-decadal elevation change rates (dhi/dt) for six large Antarctic Peninsula (AP) ice shelves. In areas covered by the Seasat orbit (to 72.16°S), regionally averaged 30-year trends were negative (surface lowering), with rates between ~ 0.03 and ~ 0.16 m a $^{-1}$. Surface lowering preceded the start of near-continuous radar altimeter operations that began with ERS-1 in 1992. The average rate of lowering for the last 16 years of the period was typically larger than the 30-year average; the exception was the southern Wilkins Ice Shelf, which experienced negligible lowering between 2000 and 2008, when a series of large calving events began. Analyses of the continuous ERS/Envisat time series (to 81.5°) for 1992–2008 show that large changes in dhi/dt can occur on interannual time scales, reinforcing the importance of long time series altimetry to separate long-term trends associated with climate change from inter-annual to inter-decadal natural variability. Most AP ice shelf regions experienced a period of strong negative dhi/dt between 1992 and 1995. Based on prior studies of regional atmospheric and oceanic conditions, we hypothesize that elevation decline on Larsen C Ice Shelf is driven primarily by firn compaction while the western AP ice shelves are responding to changes in both surface mass balance and basal melt rates. We examine the negligible lowering for Wilkins in the period 2000–2008 and conclude that there was a sudden reduction in basal melt rate around the year 2000. We associate this reduction with prior thinning and, possibly, changes in local upper-ocean processes, which raised the ice base relative to the interface between the warm thermocline and the upper-ocean layer of cold Winter Water. We conclude that basal melting of thin ice shelves like WIS is very sensitive to upper-ocean and coastal processes that act on shorter time and space scales than those affecting basal melting of thicker West Antarctic ice shelves such as George VI and Pine Island Glacier.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 6

Title: Variability of Antarctic ice shelf elevations from multi-mission satellite radar altimetry:
Results from Filchner-Ronne Ice Shelf

Forename: Fernando Surname: Paolo

Authors: Paolo, Fernando; Fricker, Helen; Padman, Laurence;

Presentation Allocated: Poster

abstract: It is now recognized that ice shelves exert a significant dynamic constraint on the offshore flow of ice from the large ice sheets. Recent observations of ice shelf retreat, collapse and thinning along the Antarctic Peninsula and Amundsen Sea coasts indicate that ice shelves can respond rapidly to changing atmospheric and oceanic conditions. However, it is still uncertain whether the driving forcing is related to long-term trends in climate or decadal variability in oceanic and atmospheric circulation. Continuous observations over long time periods are required to determine stability, monitor change, and identify general relationships between observed changes on the ice shelves and ocean variability. We have developed a new data set of elevation change for all of Antarctica's ice shelves spanning more than two decades, by combining data from multiple satellite radar altimeter (RA) missions (Geosat, ERS-1, ERS-2, GFO, Envisat). We show that multi-mission RA records provide reliable long-term, continuous time series in a high-resolution grid for consistent trend and variability analysis. After clear separation of short- and long-term oscillations, we derive maps of ice shelf elevation change rates based on a >20-year time span. This allows us to characterize the time and space patterns of change towards determining relationships with modes of climate variability. Here we present results from the Filchner-Ronne Ice Shelf in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: A new interpretation of Antarctic Ice Sheet flow process

Forename: Alexey Surname: Markov

Authors: Markov, Alexey; Talalay, Pavel;

Presentation Allocated: Poster

abstract: Typically the interpretation of ice mass transfer of Antarctic Ice Sheet is based on the geodetic measurements of the surface flow and extrapolation of the surface parameters down to the ice sheet interior. This scientific approach does not account the flow features inside ice sheet. In fact, according to the data from geophysical survey in deep boreholes, geodetic measurements of the surface flow, radar sounding, petrographic ice core studies, the flow inside East Antarctic Ice Sheet is changed layer by layer. The absolute velocity of flow is increased with depth. Data processing allows identifying four main layers at the profile Gamburtsev subglacial mountains – Dome B – Vostok – Mirny. The upper snow-firn layer up to the depth of 100-120 m undergoes elastic stress state. The flow direction of the snow-firn cover is differed from underlying ice on the 30-80° in azimuth. The ice sheet flow under snow-firn cover is divided into three layers according to their behavior. The middle layer is stronger than the upper and lower layers, and the lower layer is the most plastic. The flow structure of the each layer is differed. Independently of the ice thickness, the ratio between layers width is $1/4 : 2/4 : 1/4$. At Vostok region the total ice thickness is near 3700 m and the depths of layers bottom are 920 and 2700 meters, respectively. The long-term (25 years) monitoring of the axes boreholes brings the stratification of the additional four stratum within second layer (105-920 m). The flow direction of each stratum is changed with depth up to 920 m in the ‘fan’ manner within 17 degrees. The parameters of Glen’s Law are differed from stratum to stratum. We connect this feature with cyclical conditions of the snow-firn-ice forming and individual evolution of these stratum in time (slope and direction of the surface flow, metamorphic processes, anisotropy properties, etc.). Thus, the flow of the East Antarctic Ice Sheet has layered structure, and the lower layer is squeezed out by the upper layers. This process is the same as geological processes in the Earth crust.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Antarctica surveying at latitude 84 using GPR method

Forename: Saulo Surname: Martins

Authors: Martins, Saulo; Travassos, Jandyr; Cardia Simões, Jefferson;

Presentation Allocated: Poster

abstract: A total of 10 km geophysical data set were collected with a Sensors & Software GPR, fitted with 1 kV 100 MHz antennae in broadside parallel configuration around an ice core site (83°59'57"S, 79°29'59"W and 1253 m a.s.l.) in the West Antarctic Sheet during the 2011/2012 summer. We use two methods with different spatial and temporal scale and resolution: firn and ice cores and GPR. We concentrate our study in the first 100 m, enough to probe past the firn-ice transition in the region. Our geophysical data is georeferenced using a differential post-processed GPS to a local base. That base in turn is referenced to a remote base about 480 km to the north in Union Glacier (Ellsworth Mountains). Part of that geophysical data set was acquired with a man-hauled acquisition train of 5 sledges thus yielding a finer lateral resolution, which is comparable to the vertical one. That time-consuming data collection strategy paid itself through a data quality that allowed a very good correlation with the ice core borehole data. The proximity of the local GPS base yielded a positioning accuracy of the geophysical data at a centimeter level. We have done the depth conversion with the best velocity estimation as determined by the CMP measurements. Notwithstanding the depth limit of interest for this work, our geophysical data revealed the rocky basement lying 900 m deep.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Basal water sasuke: The water ninja's journey

Forename: Justin Surname: Hiester

Authors: Hiester, Justin; Sergienko, Olga; Hulbe, Christina;

Presentation Allocated: Poster

abstract: Short, inter-annual timescale elevation anomalies observed in a number of locations along west Antarctic ice streams are interpreted as being subglacial ponds filling or draining in response to subglacial hydrologic conditions. Ponds may form due to local variations in basal traction that produce and focus basal meltwater or due to ponding of water created elsewhere (upstream) in topographic lows at the ice stream base. In either case, ponds are both sources and sinks for water in the through-going basal water drainage system, making the relationship of ponds to the overall system of interest. Here, the "steering" effects of the subglacial bed and pond system on water transport are examined using a numerical model. The numerical model solves a two dimensional system of coupled steady state equations describing ice and water. Idealized basal topographies with features having dimensions that match observations are varied to investigate the "steering" effects.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Decelerated mass loss of Hurd Peninsula glaciers, Livingston Island, Antarctic Peninsula, in spite of continued regional warming

Forename: Francisco Surname: Navarro

Authors: Navarro, Francisco; Jonsell, Ulf; Corcuera, María Isabel; Martín-Español, Alba; Lapazaran, Javier; Otero, Jaime;

Presentation Allocated: Poster

abstract: Hurd Peninsula ice cap spans an area of ca. 13.5 km². Its two main basins are Johnsons, a tidewater glacier, and Hurd Glacier, ending on land, both with areas about 5 km². Maximum annual ice velocities of 65 m/a are reached at Johnsons calving front, while those of Hurd Glacier rarely surpass 5 m/a. Hurd Peninsula shows the polar maritime climate typical of the Western Antarctic Peninsula, dominated by the warm Bellingshausen Sea, though with certain peculiarities due to local factors. In particular, the prevailing winds on the glacier are from SW, followed by those from NNE and ENE-E, though the latter are the strongest. We present in this contribution the winter, summer and annual surface mass balances of Johnsons and Hurd glaciers, for the hydrological years (southern hemisphere) 2002-2011, computed from: 1) accumulation and ablation measurements at a net of ca. 50 stakes; 2) snow thickness measurements at some 50 additional points; and 3) snow density and stratigraphy measurements in snow pits dug at several locations on the accumulation zone. These mass balance measurements are complemented by meteorological measurements at an automatic weather station installed on Johnsons Glacier in December 2006, as well as those recorded at Juan Carlos I Spanish Station during the entire mass balance measurement period. The annual surface mass balances, averaged over the 10-year period, are slightly negative (-0.15 +/- 0.10 m/a w.e.) for Hurd Glacier, and very slightly positive (0.05 +/- 0.10 m/a w.e.) for Johnsons Glacier. However, if we add to the latter the calving losses (volumetric calving flux is estimated as 0.823×10^{-3} km³/a), it results an equivalent geodetic mass balance of -0.15 +/- 0.10 m/a w.e. for Johnsons Glacier. These mass losses are, however, smaller (almost by half) than the average geodetic mass balances estimated for the period 1956-2000 (-0.27 and -0.16 m/a w.e., for Hurd and Johnsons glaciers, respectively), showing that the rate of mass loss has decelerated in spite of continued regional warming. Interestingly, this seems to be due not just to the observed increase in accumulation in the region, but, at least in the case of Hurd and Johnsons glaciers, also to a decrease of surface melt associated to the smaller amount of energy available at the glacier surface as a result of increased cloud cover.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Development and Applications of the Community Ice Sheet Model

Forename: Matthew Surname: Hoffman

Authors: Hoffman, Matthew; Price, Stephen; Lipscomb, William; Johnson, Jesse; Sacks, William;

Presentation Allocated: Oral

abstract: The Community Ice Sheet Model (CISM), part of the Community Earth System Model (CESM), has been under active development by the Land Ice Working Group (LIWG) for the past ~5 years, with an overall goal of improving the representation of land ice in Earth System Models (ESMs). Specific areas of model development reported on here include improved dynamical cores, improved coupling to ESMs, and improvements in model physics. We report on the status of two new dynamical cores in CISM, which solve the mass, energy, and momentum conservation equations for ice flow in a scalable and robust manner. We will also discuss the status of efforts towards coupling CISM to the atmosphere, ocean, and land model components of CESM, and the status of collaborative efforts towards improving important physical processes, which are currently missing or poorly represented in CISM. Preliminary results from these same areas of model development will be presented and discussed. Finally, we summarize community involvement in CISM, future development plans for CISM and CESM, and anticipated upcoming model releases.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Evolution of Antarctic surface mass balance by high-resolution downscaling and impact on sea-level change for the next centuries

Forename: Cécile Surname: Agosta

Authors: Agosta, Cécile; Favier, Vincent; Genthon, Christophe; Gallée, Hubert; Krinner, Gerhard;

Presentation Allocated: Oral

abstract: Most of the IPCC-AR4 Atmospheric Global Circulation Models (AGCM) predict an increase of the Antarctic Surface Mass Balance (SMB) during the 21st century that would mitigate global sea level rise. Present accumulation and predicted change are largest at the ice sheet margins because they are driven by snowfall, which mostly comes from warm, moist air arising over the land slopes. The coastal belt is also where complex processes of sublimation, melt and refreezing occur. Thus, high-resolution modelling is necessary to adequately capture the effects of small-scale variations in topography on the atmospheric variables in this area, but limitations in computing resources prevent such resolution at the scale of Antarctica in full climate models. We present here a downscaling method leading to 15-km SMB resolution for century time-scales over Antarctica. We compute the effect of the fine topography on orographic precipitation and on boundary layer processes that lead to sublimation, melt and refreezing. We first display the SMB downscaled from ERA-Interim and show that the downscaling improves the agreement between modelled and observed SMB for the end of the 20th century. We then present hi-resolution features of the Antarctic SMB evolution during the 21st century downscaled from LMDZ4 for different scenarios. We show that a higher resolution induce at the same time more run-off but a significantly higher mitigation of sea level rise.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Evolution of fine-scale elevation change on Pine Island Glacier, 2003-2011

Forename: Benjamin Surname: Smith

Authors: Smith, Benjamin; Hofton, Michelle; Joughin, Ian; Morin, Paul; Porter, Claire; Shean, David;

Presentation Allocated: Oral

abstract: In the last two decades, Antarctica's Pine Island Glacier has seen some of the largest mass losses of any glacier in Antarctica. Between 1992 and 2007, the ice in the trunk of the glacier has accelerated by around 60%, leaving the glacier with a substantially negative mass balance, and leading to several meters per year drawdown in the lower trunk region. As surface elevation and longitudinal stress gradients have steepened, accelerated ice flow has been increasingly observed in the upper trunk and glacier catchment, and the thinning has spread inland. More recently, in the last 2-3 years, the speed in the lower trunk has become nearly constant in time, while the upper trunk has continued to flow progressively faster; absent other effects near the grounding line, this should lead to reduced thinning in the trunk even as the catchment continues to thin. Recent observations by NASA's IceBridge laser altimetry campaign and Worldview satellite stereophotogrammetry maps, combined with older ICESat laser altimetry data, show that the thinning on the lower trunk has indeed slowed over the last 1-2 years. This change in the thinning rate is most pronounced on the western side of the trunk, where the grounding line had its largest retreat in the late 2000s, and suggests that more recent recession of the grounding line on the east side of the trunk may still be driving thinning. These observations set the scene for a competition between two processes over the next 1-2 years: Increased flow from upstream will tend to stabilize the grounding-line position, while potential increases in sub-ice-shelf melt would tend to produce further grounding-line retreat. Further planned observations by altimetry, imaging satellite radar, and optical feature tracking will help constrain these patterns and the mechanisms behind them.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Fracture Propagation as a Function of Tide Height at the Kamb Ice Stream Grounding Line, West Antarctica

Forename: Andrea Surname: Bugni

Authors: Bugni, Andrea; Hulbe, Christina; Cruikshank, Kenneth;

Presentation Allocated: Poster

abstract: Scientific work in Antarctica and its logistical support relies on a consistent geographic framework. The SCAR Standing Committee on Antarctic Geographic Information (SCAGI) manages and seeks to improve the geographic framework for activities in Antarctica by delivering a range of freely available Geographic Information products: The Antarctic Digital Database (ADD) is a seamless topographic map compiled from the best available international data, and includes other selected information sources such as a bedrock and surface DEM from BEDMAP and coastal change over time information for the Antarctic Peninsula. The data can be downloaded in a range of formats. The SCAR Composite Gazetteer of Antarctica (CGA) integrates place-names information received from National Antarctic Programmes into a universal database of names. Many topographic features in Antarctica have multiple names, applied by different countries. The Composite Gazetteer reduces confusion by allocating a Unique Identifier to each feature, which links together the various names for it. The SCAR Map Catalogue provides information about international published maps of Antarctica and enables free download of digital versions of maps where available. This paper summarises the current status, recent developments and future plans for these geographic information products, including accessing the data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Glacier Change in the McMurdo Dry Valleys, Beginning of the End?

Forename: Andrew G. Surname: Fountain

Authors: Fountain, Andrew G.; Basagic, Hassan; Hoffman, Matthew;

Presentation Allocated: Oral

abstract: The McMurdo Dry Valleys are the largest expanse of ice-free landscape in Antarctica and we report here on our efforts to integrate remote sensed measurements with ground-based measurements to synthesize glacier change in the Valleys. We have been monitoring glacier mass balance in the Valleys since 1993 and tracking changes in glacier area from historic hand-held photographs dating to Scott's first expedition in 1903, and again starting in the 1970s with the New Zealand program. From the 1950s onward we have included aerial photographs in our glacier monitoring and since the 1970s satellite imagery has been included. Within the uncertainty of the measurements, we observed little to no change in glacier area over the past 100+ years. Certainly some portions of the glacier perimeter have advanced or retreated slightly, but overall the glacier area had not changed. We note that handheld photographs of a point change on the perimeter, the most accurate because of ice flow parallel to the plane of the image, to be deceptive compared to compensating changes elsewhere around the perimeter. Annual mass balance measurements over the first decade of measurements showed the glaciers to be in balance within our measurement uncertainty with no significant trend. Since the 2002-03 season, a significant trend has emerged showing a negative mass loss. Summer rather than winter losses drive this trend. The summer losses are not due to summer air temperatures, which continue to cool or have remained cool. Instead we attribute the losses to the trend of increasing solar radiation and increased eolian sediment deposition on the glaciers, which reduces the albedo. At a few unmeasured glaciers, photographic evidence suggests sediment to cause a dramatic mass loss. The lack of observed change in glacier area from satellite imagery over the past decade despite measured mass losses is consistent with the slow time-scale response of these polar glaciers. The trend of recent glacier mass loss is reflected in other ice-related landscape changes where sediment is a mediating factor.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Ice mechanics and the stagnation of Kamb Ice Stream, Antarctica

Forename: Mason Surname: Fried

Authors: Fried, Mason; Hulbe, Christina;

Presentation Allocated: Poster

abstract: Century-scale stagnation and reactivation events have been documented for several large ice streams in the Ross Sea sector of West Antarctica. Here, I explore how changes in ice thickness and surface slope near the marine margin may affect basal water routing in ways that may have in the past produced variations in ice flow at the downstream ends of Whillans and Kamb Ice Streams (WIS and KIS, respectively). In particular, I am interested in how a discharge event on one ice stream produces transients that propagate laterally across the grounding zone and, in turn, drives changes in the adjacent outlet. Temporal evidence shows that the timing and behavior of KIS grounding line migration is linked to WIS discharge events via rapid ungrounding and grounding across a broad, low slope region of the sea floor. A mechanical analysis of high resolution surface elevation and ice velocity data sets is used to create a framework in which past events may be understood. For example, shear margins produce mechanical thinning of the ice that in turn affects local gradients (and probably local basal water routing). Events like margin jumps and rapid grounding events, as have been documented at the KIS outlet, were likely accompanied by changes in basal water routing. The goal of the present work is to gain insight into changing water routing at the time of KIS stagnation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Improving estimates of the englacial and basal Antarctic temperature field using combined interferometric velocity data and ice sheet modelling

Forename: Frank Surname: Pattyn

Authors: Pattyn, Frank; Van Liefferinge, Brice;

Presentation Allocated: Keynote 40 mins

abstract: Sharing data collected in polar regions and thus maximizing their use requires knowledge of what and where data exists as well as the ability to quickly evaluate these data. GeoMapApp is an application that was designed to allow users to interact and visualize different data sets without major knowledge of data formats or software. It is a tool to integrate different data types using one interface and perform basic analyses. User can interact and visualize different data quickly but can also obtain links to the underlying data if needed. Originally designed as a tool for marine geophysical data, especially multibeam bathymetry, it now integrates many different global and regional datasets. GeoMapApp has a special Antarctic interface that is configured specifically with data of interest for the Antarctic community, e.g. sea ice extent, snow accumulation, airborne gravity data. Additional datasets from other sites can be linked via standard web services or directly imported by the user. For several data types including multi-channel seismic, multibeam bathymetry, ocean drilling and earthquakes particular portals have been integrated into GeoMapApp that enable the user to perform basic analysis functions including the extraction of depth profiles, and analysis of seismic and ground penetrating radar profiles. We will present examples of basic features, improved functions and recent data additions of GeoMapApp including new multibeam bathymetry, marine seismic, and airborne radar data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Mass balance investigations at Bellingshausen Dome in 2007-2012, King George Island, Antarctica

Forename: Bulat Surname: Mavlyudov

Authors: Mavlyudov, Bulat;

Presentation Allocated: Poster

abstract: Bellingshausen Dome is located in the western part of King George Island in archipelago Southern Shetland Islands and has the sizes about 3x3,5 km, the area is about 10 км². The height of the dome changes from 0 up to 250 m asl, slopes are flat. Ended at the land boundary of glacier is located at height about 40 m asl. Mass balance researches on Bellingshausen Dome were spent during five summer seasons in 2007-1012 and one winter in 2011. For researches the standard technique of studying of accumulation and ablation has been used. For an estimation of accumulation during a maximum of snow accumulation (in November) were spent: 1) net snow surveys with cells 250x250 m, 2) measurements of snow density of a in holes (from 8 up to 12 in different years). Ablation measurements was spent 2-4 times during month on a network of 29 ablation stakes on slopes of different exposition. Each measurement was accompanied by measurement of density of a snow in 2-3 holes located on different heights. The analysis of the received data has shown that in 2007/2008 and 2008/2009 ice mass balance on Bellingshausen Dome was almost closed to zero, in 2009/2010, 2010/2011 and 2011/2012 it was positive. ELA in 2007/2008 and 2008/2009 was situated a little below top of a glacial dome (about 225 m asl), in 2009/2010, ELA has lowered practically up to a sea level, in 2010/2011 and 2011/2012 ELA was equal 180 m asl. It was shown that for the observation period vertical gradients of air temperature have increased. Therefore, despite of approximately identical intensity of ice melting at the lower part of the dome during the period of researches, snow and ice melting at the top part of Dome last years was decreased. It has led to that continuous retreating glacier boundary (up to 2 m/year) is accompanied by mass accumulation at the top of a glacial dome. If the outlined tendency will be kept it is necessary to expect the beginning of growth of a glacial cover on island in future.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Mass-balance and surface elevation changes of outlet glaciers on northeastern Antarctic Peninsula

Forename: Pedro Surname: Skvarca

Authors: Skvarca, Pedro; Marinsek, Sebastián;

Presentation Allocated: Oral

abstract: As a consequence of increased atmospheric warming the glaciers on northeastern Antarctic Peninsula (NEAP) are suffering drastic changes. During the last four decades the surface air temperature on NEAP augmented significantly as reveal the long term temperature records of stations Orcadas (+0.26 °C d-1), Esperanza (+0.31 °C d-1) and Marambio (+0.47 °C d-1). Few glaciers terminating on land and tidewater calving glaciers are analyzed in response to either climatic or dynamic forcing. Two glaciers with termini on land namely "Glaciar Bahía del Diablo" (GBD) and "Glaciar Cabo Lamb" on Vega Island have been subject to consistent surface lowering of 1.0 m a⁻¹ since 1984. Detailed mass-balance carried out on GBD from 1999 to 2011 show high interannual contrast in response to the regional climatic variability. Ten of the twelve balance years were negative with an average net balance of -0.22 m w.e. The GBD net mass-balance shows a strong correlation with the mean summer temperature (MST) recorded glacier terminus. According to Marambio record, the MST in this region increased +2.1 °C since 1971.

☐

However, major changes are occurring at few tributary glaciers still after 16 years of the Larsen ice-shelf sections removal due to dynamic factors. Satellite images in combination with ASTER DEMs allowed us to derive frontal variations and thinning rates of major glaciers draining NEAP. For instance, the surface of Dinsmoor, Bombardier and Edgeworth (DBE) glaciers lowered from Oct. 2003 to Dec. 2008 more than 40 m, implying a loss of 5.6 km³ of ice over the lower 138 km². These glaciers oscillated from surging in 2001 to strong retreat-advance from 2006 until early 2012. According to available DEMs Hektoría, Green and Evans glaciers thinned ~120 m between late 2001 and early 2011, losing in total 46 km³. A large area loss of ~32 km² took place in only 73 days from late 2010 to early 2011, but from then to early 2012 Hektoría and Green glaciers advanced again in surging mode ~2.0-2.4 km at centerlines, gaining 24 km². The Crane Glacier thinned ~126 m at a rate of ~25 m a⁻¹ from late 2001 to late 2006, slowing down considerably until late 2010 to ~21 m at a rate of 5 m a⁻¹ and slightly advance from early 2011 to early 2012. New satellite mission to provide repeated DEMs will improve measurements of ice loss in this critical region and allow assessing more reliably their contribution to sea-level rise.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Multi-Frequency Airborne Radar Measurements of Outlet Glaciers and Ice Streams

Forename: David Surname: Braaten

Authors: Gogineni, Prasad; Braaten, David; Rodriguez-Morales, Fernando; Li, Jilu; Leuschen, Carl; Paden, John; Hale, Richard; Arnold, Emily; Panzer, Ben; Gomez, Daniel; Crowe, Reid; Patel, Aqsa; Yan, Steven;

Presentation Allocated: Oral

abstract: Outlet glaciers and ice streams in Greenland and Antarctica are important delivery systems of inland ice to the oceans. Satellite observations are showing that parts of the Antarctic and Greenland ice sheets are undergoing rapid changes, including both the speed-up of several glaciers in Greenland and erratic behavior of Antarctic glaciers buttressed by ice shelves. While satellite sensors provide data on the surface flow speed and document the rapid changes the ice sheets are undergoing, they do not provide essential information needed to understand the ice dynamics driving these changes and a detailed assessment of mass balance. In particular, a more complete knowledge of ice thickness, bed topography, and basal conditions are needed to better understand the dynamic processes causing rapid changes and assess outlet glacier discharge. Simultaneous measurements of snow accumulation from internal layering over the glacier catchment provide an assessment of temporally varying surface mass balance. An airborne radar instrumentation package with four radars operating over the frequency range from about 180 MHz to 18 GHz has been developed, including (1) a wideband radar depth sounder with a center frequency of 195 MHz to sound and image ice; (2) an ultra-wideband (accumulation) radar that operates from 600 to 900 MHz to map near-surface internal layers in polar firn and ice; (3) an ultra-wideband microwave radar that operates from about 2 to 8 GHz to measure thickness of snow cover over sea ice and map near-surface internal layers in polar firn with fine resolution (5 cm); and (4) a radar altimeter that operates from 12 to 18 GHz for high-precision surface elevation measurements. The complete radar package or parts have been flown on long-range aircraft (NASA DC-8 and P-3), and on a short-range Twin Otter during the last 3 years over the Greenland and Antarctic ice sheets. We used these data sets to produce first generation bed maps for key glaciers and results are already being used in improved ice-sheet models. We will present results from several changing glaciers, including Byrd Glacier in Antarctica that have altered our understanding of these glaciers in significant ways. We have located a deep sub-glacial trench at the Byrd glacier that is at least -2.7 km MSL. The accumulation radar has also allowed us to not only map near-surface internal layers with fine resolution, but also sound low-loss ice and ice shelves with fine resolution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Origin of the surface undulations at Kamb Ice Stream Grounding line, West Antarctica

Forename: Fiona Surname: Seifert

Authors: Seifert, Fiona; Hulbe, Christina;

Presentation Allocated: Poster

abstract: A combination of mathematical models and observational data are used to investigate the role of ice properties in the creation of long wavelength, low amplitude surface undulations at the grounding line of Kamb Ice Stream, West Antarctica. The undulations, unique to this location, provide an opportunity to investigate elastic and viscous properties of glacier ice in a relatively simple setting. Repeat surveying using kinematic and continuous GPS show the longitudinal strain rates across the grounding line to be extensional on the order of 10^{-3} . Ground penetrating radar profiles taken across the grounding line show no easy correlation of surface undulations to basal crevassing. Repeat track analysis using laser altimetry from the Ice, Cloud and land Elevation Satellite (ICESat) data shows no obvious advection of traveling waves progressing downstream. Models used to analyze these data include necking in a viscous layer and bending of an elastic plate. The West Antarctic Ice Sheet is drained primarily by five major ice streams, which control the volume of ice discharged into the ocean at the grounding line. Understanding the dynamics of this transition is essential for predicting future discharge rates and their influence on global sea level.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Preliminary estimation on the evolution and mass balance for a portion of Quito Glacier ,
Shetland Southern Islands

Forename: Bolívar Surname: Cáceres

Authors: Cáceres, Bolívar;

Presentation Allocated: Poster

abstract: An Ecuadorean- Swiss team set up a new observation system to determine the mass balance over a part of Quito Glacier, Greenwich Island, South Shetland Islands, during the Austral summer in 2010. This glacier was measured over a two year period during the Austral summer (January-February) in 2011 and 2012 , a set of data to determine the preliminary evolution and the year mass balance over this small glacier was obtained. During the two years of study a moderate ablation was observed, which has been supported by measurements carried out using a small net of stakes. In addition, measurements over a selected segment of the glacier front were performed. It was observed a small reduction in the aerial cover of it. The results of this study will show if the response of small glaciers located at the Greenwich island have the same response as the small glaciers monitored at the Shetland island zone

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Quantifying ice-sheet dynamics and variability with meter-scale DEM and velocity data

Forename: David Surname: Shean

Authors: Shean, David; Joughin, Ian; Morin, Paul; Moratto, Zachary; Porter, Claire; Smith, Ben;

Presentation Allocated: Poster

abstract: Both the Antarctic and Greenland ice sheets are losing mass at an increasing rate, although loss due to accelerating flow and dynamic thinning remains poorly understood. We are using complementary data from repeat satellite/airborne observations to investigate the relationship between ice-sheet dynamics and geometry on seasonal to interannual timescales. High-resolution along-track stereo imagery from commercial satellite vendors DigitalGlobe and GeoEye provide unprecedented spatial (~ 0.5 m/px with ~ 17 km swath width) and temporal (weekly/monthly) resolution for these efforts. We are developing an automated pipeline using open-source software to generate image, DEM, and surface velocity products. All mapping and image manipulation is performed using the Geospatial Data Abstraction Library (GDAL), with image correlation, triangulation and DEM generation by the NASA Ames Stereo Pipeline (ASP). Efforts to develop custom camera models and triangulation routines for the commercial data are underway. Surface flow velocity measurements at sub-meter resolution will be derived from the high-resolution image data using optical feature-tracking methods. Preliminary tests of ASP using Worldview 2 image data produce high-quality disparity maps with 99% correlation success. These excellent correlation results will directly translate to contiguous, ~ 1 -2 m/px DEMs after implementation of the necessary ASP modifications. Preliminary comparisons of WorldView 1/2 DEMs (generated using commercial software) with IceBridge ATM and ICESat GLAS data show median elevation differences of -1.4 to 3.7 m ($1-\sigma = 0.5$ to 5.5 m) [Porter et al., 2011, AGU]. We are also developing a comprehensive database of ATM and GLAS data with tools to perform automated spatial/temporal queries and DEM correction. We will use these data to produce detailed time series of velocity and surface elevation variations for rapidly changing outlet glaciers in Greenland and Antarctica. Stereo data acquisition began in 2009, with greatly improved spatial/temporal coverage from repeat observations in 2010 and 2011. We will analyze these timeseries to characterize contemporary change and evaluate any deviations from recent acceleration/thinning trends. Our results will complement ongoing IceBridge efforts to obtain future estimates for ice-sheet mass balance and contributions to sea level rise.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Role of winter accumulation in annual mass balance of Chhota Shigri glacier Lahaul-Spiti valley, Himachal Pradesh, India

Forename: PARMANAND Surname: SHARMA

Authors: SHARMA, PARMANAND; RAMANATHAN, ALAGAPPAN; LINDA, ANURAG; RAVINDRA, RASIK;

Presentation Allocated: Poster

abstract: Chhota Shigri glacier has been investigated for mass balance by using glaciological method from 2002 to 2011. Initially, till 2008, this study was focused on annual mass balance and then from 2008 to 2011 winter mass balance has been integrated with ongoing study. Overall, the glacier experienced a negative glacier wide mass balance of -0.58 ± 0.4 mweq a⁻¹ with cumulative balance of -5.27 mweq during 2002-11. Last three consecutive year from 2009 to 2011 including 2005, glacier experienced positive mass balance among the studied period. Specific winter balance of the chhota Shigri in year 2008-09, 2009-10 and 2010-11 are $+0.42 \text{ mweq} \pm 0.1$ mweq, $+1.19 \text{ mweq} \pm 0.1$ mweq and $+0.39 \text{ mweq} \pm 0.1$ mweq respectively. In the same studied year overall specific annual mass balances in Chhota Shigri shown $+0.11$ mweq, $+0.33$ mweq and $+0.10$ mweq respectively. In 2009-10 overall 3m average snow accumulation found throughout the glacier while rest of the year it was less than 2m. Mean vertical gradient of accumulation is $0.33 \text{ m } 100\text{m}^{-1}$ in term of snow depth between 4300m 5200m altitude in 2010. This gradient ($>0.5 \text{ m } 100\text{m}^{-1}$) is sharp above 4900 m altitude while there is no vertical gradient ($0 \text{ m } 100\text{m}^{-1}$) between 4600-4900m. Results revealed that in Chhota Shigri glacier positive annual mass balance is mostly controlled by high winter accumulation. There is positive relation between specific winter balance and specific annual mass balance while this relation may or may not be linear. High accumulation of snow during winter increase albedo as well prevents melting of ice for longer period, to effectively reduce the ELA and enhance AAR of the glacier. Apart from winter accumulation, solar radiation, summer accumulation, shading effect in lower portion of ablation zone, debris cover and liquid precipitation are major controlling factor that influences annual mass balance.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Snow grain size measurements in Dronning Maud Land, Antarctica

Forename: Roberta Surname: Pirazzini

Authors: Pirazzini, Roberta; Vihma, Timo; Johansson, Milla; Tastula, Esa-Matti; Räisänen, Petri;

Presentation Allocated: Poster

abstract: The snow grain size controls the radiative properties of the snowpack and indicates the state of the snow metamorphism. A detailed characterization of the snow grain size distribution and stratigraphy is needed to accurately model the radiative transfer over snow covered areas and the snowpack thermodynamics and mechanics, and to validate inversion methods used to retrieve snow surface properties from reflected radiances measured by satellites. Traditional manual measurements of snow grain size are subjective and not repeatable, while the quantitative and repeatable estimations proposed in the literature are based on delicate and laborious stereological techniques (Shi et al., *Ann. Glaciol.*, 17, 1993), gas absorption techniques (Dominé et al., *Cold Reg. Sci. Technol.*, 46, 2006) or near-infrared photographic techniques (Matzl and Schneebeli, *J. Glaciol.*, 52, 2006) that are in many cases impracticable. Another recently proposed technique uses a tested model to retrieve the optical-equivalent grain radius from the measured snow reflectance at the 1.03 micrometre wavelength (Painter et al, *J. Glaciol.*, 53, 2007). However, uncertainty remains on how to relate physical features of the snow grains to the optical properties, and it is questionable whether the same optical-equivalent grain size is applicable to all visible and near-infrared wavelengths. We present here the size distributions of various snow grain dimensions at several layers obtained from image processing of macro-photographs. The photos were taken in a cold and dark "laboratory" (a cave inside the Antarctic snowpack), and the technique is completely repeatable and straightforward to apply. The spectral reflectance measured at the snow surface is then applied to derive the optical-equivalent grain size at various wavelengths by inverting a radiative transfer model. The direct relationship between measured grain dimensions and optically-equivalent grain size is finally obtained.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Surface melt and runoff on the northern Antarctic Peninsula

Forename: Juliana Surname: Costi

Authors: Costi, Juliana; Arigony-Neto, Jorge; Mendes Jr, Claudio Wilson; Cardia Simões, Jefferson;

Presentation Allocated: Poster

abstract: Surface melt and subsequent runoff supply coastal waters with freshwater, changing its salinity, sediment concentration, nutrients availability and transparency, with several impacts on the coastal ecosystem. At time scales longer than 100 years, it can affect sea level. Besides their direct contribution to glacier mass balance, liquid water percolates into crevasses and can lubricate glacier's contact with basement, accelerating its flow. The extreme warming trend that the Antarctic Peninsula has been subjected for the last three decades requires a good understanding of how these processes are spatially and temporal distributed. The present work reconstructed a 21-year time series of glacier surface melt (SM) and surface runoff (SR) for the northern Antarctic Peninsula and adjacent islands (i.e. 60°S–65°S). A SM estimative was performed through a positive-degree day (PDD) based model, using surface air temperature obtained from the ERA-Interim reanalysis project. SR was considered the difference between SM and the amount of water retained in the snowpack by porosity, capillarity and refreezing processes. By counting grid elements where $M > 0$ was found, we estimated surface melt area, which was compared with the Wet Snow Area derived from 18 Envisat ASAR wide-swath images acquired in 2006/2007 austral summer. These remote sensing derived data were considered ground truth, thereby we adjusted a function between them and a model-derived melt area, which was used as a correction method for both SM and SR. This approach was considered reasonable once SM and SR series are well correlated with surface melt area ($R^2 > 0.82$). Corrected values ranged between 1.5Gt to 5Gt (SM) and 0.2Gt to 1.4Gt (SR). Pronounced positive peaks occurred in 1989/1990, 1998/1999, 2005/2006 and 2008/2009. Low estimates were found in 1990/1991, 2000/2001, 2006/2007 and 2009/2010. Both SM and SR showed high interannual variability, as did summer mean temperatures (SMT) acquired by meteorological stations. Maximum and minimum SM and SR also agree with peaks in SMT. Spatially, it was clear that the former Larsen A and B and Prince Gustav ice shelves and their vicinity were the most continuous and largest SM and SR producer areas observed. In the western Antarctic Peninsula, they were restricted to coastal areas and islands, indicating a close relationship with topography.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: The Antarctic Ice Sheet and future sea level rise: Projections with a simple Antarctic Ice Sheet model calibrated with last interglacial reconstructions

Forename: Gary Surname: Shaffer

Authors: Shaffer, Gary;

Presentation Allocated: Oral

abstract: At present the Antarctic Ice Sheet (AIS) contains enough ice to raise global mean sea level by about 60 m. Given this potential, the response of the AIS to ongoing, man-made global warming is one of the largest sources of uncertainty for sea level rise projections. Although most coupled climate-ice sheet models predict initial growth of the AIS in response to this warming, the AIS has in fact been losing mass in recent years as documented by a variety of observational techniques. We have developed a simple, mass balance model of an axi-symmetric AIS, based on earlier modeling work and on observations showing that ice stream flow increases when buttressing ice shelves disintegrate. Model parameters are calibrated such as to 1. reproduce ice volume, area, mean surface elevation and mass throughput of the present AIS and 2. reproduce the implied size and timing of the AIS contribution to sea level rise across the last interglacial period when the model is forced by reconstructed temperatures and sea level rise from and before this period. With this calibration, the model reproduces observations of ongoing AIS mass loss when forced by reconstructed temperatures and sea level across the last glacial termination and up to the present. Projections of the AIS contribution to future sea level rise are made by forcing the calibrated AIS model with temperature projections from the DCESS Earth System Model in response to different CO₂ emission scenarios. This contribution is in the range of 10-20 cm by AD 2100 but increases significantly in the subsequent century for the A2, "business-as-usual" emission scenario. For this scenario, projected sea level rise from AIS melting exceeds 10 m over time scales of thousands of years. On the other hand, this rise can be limited to several meters over these long time scales for an emission scenario with emission reductions of 20% by 2020 and 60% by AD 2050 (compared with AD 1990).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: The contribution of the Antarctic Ice Sheet to present-day sea-level change

Forename: Matt Surname: King

Authors: King, Matt; Moore, Philip; Whitehouse, Pippa; Bentley, Mike; Milne, Glenn; Bingham, Rory; Le Brocq, Anne;

Presentation Allocated: Keynote 40 mins

abstract: We present a new estimate of the contribution of the Antarctic Ice Sheet to sea-level rise during the GRACE era. We correct the GRACE data for the ongoing effects of Glacial Isostatic Adjustment (GIA) by employing a new model that has been developed using a numerical ice-sheet model constrained by glaciological and geological data, and Earth viscosity models that optimise the fit to relative sea-level data and GPS observations of present-day uplift. Error bars provided with the GIA model, which reflect uncertainty in both the Earth model and ice history, enable us to place bounds on the contribution of present-day ice-mass change to the observed GRACE signal. We forward model the magnitude and spatial distribution of ice-mass change throughout Antarctica during the last decade required to reproduce the GIA-corrected GRACE rates, and use our estimates to predict the spatial distribution of the resulting relative sea-level change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: The Dynamic Instability of Thwaites Glacier, West Antarctica

Forename: Knut Surname: Christianson

Authors: Christianson, Knut; Parizek, Byron; Horgan, Huw; Anandakrishnan, Sridhar; Alley, Richard; Walker, Ryan; Edwards, Rebecca; Wolfe, Derek; Bertini, Gabriel; Reinhart, Samantha;

Presentation Allocated: Poster

abstract: Thwaites Glacier, West Antarctica has the potential to directly contribute approximately 1 m to sea level, and is currently losing mass and thinning rapidly. Due to the geometry of the geometry of the glacier's bed, which is below sea level and deepens inland, it is also subject to the marine ice sheet instability, and thus, possibly, to rapid deglaciation. Here we integrate recent kinematic GPS, GLAS ICESat laser altimetry, and aerogeophysical data (collected by Operation IceBridge) to present a comprehensive geophysical picture of both the grounding zone of Thwaites Glacier and highlight recent changes in inland dynamics, which include acceleration of inland thinning up to 100 km from the current grounding line-. These data are used in a coupled ice-stream/ice-shelf/ocean-plume model that includes oceanic influences across a several-kilometers-wide grounding zone (a possible interpretation of the geophysical data). Our results suggest that ice-stream stabilization on grounding-line highs may be ephemeral, and that Thwaites Glacier has the potential to retreat on the order of a hundred kilometers on century to millennial timescales. Thus, accurate projections of future sea-level change will require both improved grounding-zone data and important revisions to ice-sheet models, which now consider ice-sheet grounding to occur at a single point along flow.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

7

Title: Union Glacier (Ellsworth Mountains) remote sensing studies during the 2011/2012 austral summer

Forename: Jorge

Surname: Arigony-Neto

Authors: Arigony-Neto, Jorge; Jaña, Ricardo; Borges Fernandez, Guilherme; Vieira, Rosemary; Medeiros, Cristiano; Rivera, Andrés; Cardia Simões, Jefferson;

Presentation Allocated: Poster

abstract: The spatial distribution of the snow accumulation on the West Antarctic Ice Sheet (WAIS) and the dynamics of its outlet glaciers still remain partly unknown. Satellite based studies are one of the most appropriated ways to estimate accurately these mass balance parameters and to validate models on the WAIS stability. In order to evaluate the potential of the COSMO-SkyMed X-band Synthetic Aperture Radar (SAR) to identify spatial patterns of snowpack characteristics related to snow accumulation (e.g., snow stratigraphy, snow density, crystal size and morphology) and glacier velocity, a remote sensing survey was carried out at Union Glacier (79°46'S, 83°16'W) simultaneously with glaciological measurements on the glacier surface in the 2011/2012 austral summer. COSMO-SkyMed data acquired consisted of 04 Spotlight-2, 07 Stripmap Himage, 02 Stripmap PingPong, and 02 ScanSAR Wide Region images. Seven snow pits were dug in Union Glacier areas with different backscattering patterns observed in COSMO-SkyMed images acquired in July 2011, and seven 100-m long profiles with Ground Penetrating Radar (GPR) using a 400 MHz antenna with common offset procedures were carried out centered in each snow pit. Furthermore, 27 stakes deployed in previous campaigns by the Centro de Estudios Científicos (CECS) were surveyed with differential GPS and 06 new stakes placed in the glacier for calibration of the glacier flow velocities methods. First results indicate that the X-band backscattering on the Union Glacier surface is affected by the surface roughness and snowpack characteristics, giving important information on the spatial patterns of snow accumulation related parameters (i.e., snow stratigraphy and snow density). Additional studies are planned to investigate the relationship between small-scale snow stratigraphy variations as detected by the GPR survey and the signal measured by the X-band SAR sensor, and to adjust algorithms used for tracking of features on the surface of Union Glacier.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 7

Title: Whillans Ice Stream flow speed insensitive to subglacial lake flood, West Antarctica

Forename: Lucas Surname: Beem

Authors: Beem, Lucas; Tulaczyk, Slawek; King, Matt;

Presentation Allocated: Oral

abstract: It is now believed that networks of rivers and lakes exist below the Antarctic Ice Sheet and experience significant variations in flux and geometry on the time scales of years. Recent observations has shown subglacial hydrology to be more dynamic, of greater volume and more spatially correlated with fast ice flow regions than previously understood. Numerous lakes below the Antarctic Ice Sheet have been identified to fluctuate between periods of water storage and drainage. It has been hypothesized that subglacial lake activity may influence glacier flow and cause speed ups during times of flooding. Here we investigate, through the use of geodetic GPS, how subglacial lake activity influences glacier flow of the Whillans Ice Stream Ice Plain on temporal time scales of weeks to months. Ten continuous GPS stations were placed above or around four active subglacial lakes to measure 3-dimensional ice surface displacement. We find that Subglacial Lake Whillans goes through a full filling and draining cycle, but has limited influence on temporal variations in glacier flow. We show that there is no unique local velocity anomaly near Subglacial Lake Whillans during draining and that all GPS measurements of lateral ice surface displacement are highly coherent for all times during the period of observation. We hypothesize that Subglacial Lake Whillans responds to systemic variations in subglacial hydrology and is therefore indicative of those changes. We also show that hypothesized interconnectivity of lakes is not observed. Previous work has estimated the location of probable drainage pathways that connect instrumented lakes. In our observations we see no coincident filling and draining between multiple lakes. We hypothesize that drainage pathways may be more complex than than can be currently resolved or that subglacial lakes variability includes the ability to store water.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: A synthesis of one-dimensional experiments with a bio-physical sea ice model

Forename: Martin Surname: Vancoppenolle

Authors: Vancoppenolle, Martin; Moreau, Sébastien; Tedesco, Letizia; Goose, Hugues; Bitz, Cecilia; Fichfet, Thierry; Lancelot, Christiane; Tison, Jean-Louis;

Presentation Allocated: Oral

abstract: Sea ice is characterized by a dynamic biogeochemistry, which is not represented in present Earth System Models. Micro-algae grow in brine inclusions in sea ice. Previous sea ice micro-algal models neglect brine-biogeochemistry interactions, prescribing the location of the microbial communities. Here, a one-dimensional sea ice model is introduced, with explicit brine dynamics coupled to a simple nutrient-phytoplankton (N-P) module, with one group of ice algae (diatoms) and two limiting nutrients (nitrogen and silicon). The model is tested over one year at Point Barrow (AK), in the coastal Beaufort Sea (Arctic) and at the Ice Station Polarstern (ISPOL), Weddell Sea (Antarctic). The model naturally predicts bottom micro-algal populations, with abundance, seasonality and vertical distribution in agreement with observations. In fall, brine convection supplies nutrients, which favors micro-algal growth as long as light is sufficient. In spring, rising light levels promote algal growth and in late spring, the vertical brine density profile stabilizes due to warming, nutrient supply shuts off, which prevents further biomass building. A series of sensitivity tests to model structure and parameters are performed. We successively test the role of physical and physiological parameters, the role of bio-physical interactions, of numerical vertical discretization and of ecosystem model complexity, to which the simulated ice algal production is strongly sensitive.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: EFFECT OF EXPERIMENTAL WARMING ON SECONDARY METABOLITES IN ANTARCTIC LICHENS

Forename: Angelica Surname: Casanova-Katny

Authors: Casanova-Katny, Angelica; ZUÑIGA-LIBANO, Gustavo; Pizarro, Marisol; Zuñiga, Gustavo;

Presentation Allocated: Poster

abstract: The vegetation of the Antarctic tundra is dominated by lichens, which occur under all microclimatic conditions. Currently, the Antarctic Peninsula is one of the fastest warming regions on the world. Previous reports suggest that lichens grow faster in response to global warming. It has been also suggested, that warming would reduce secondary metabolites in plants and other species as a trade-off for increased growth. However, there is still deficient knowledge about lichen metabolism under the new climate conditions. Our study was focused on the effect of passive warming on secondary metabolites and biological activity of two lichens, *Usnea aurantiaco-atra* and *Himantormia lugubris* on Fildes Peninsula, King George Island. We installed open-top chambers (OTC) in 2008 and after two years we collected samples of both lichen species for metabolite analysis. Antioxidant activity of extracts of both species measured as DPPH* scavenging or FRAP power did not show differences under the treatments. However, phenolic content profile and compounds were different between both species. In *U. aurantiaco-atra*, an increase in Usnic acid was found under warming. Concordantly, a significant increase of total phenolic compounds was observed in *H. lugubris*, characterized as p-Coumaric acid, Ferulic acid, Gallic acid and Sinapic acid. Total content of phenolic compounds and the amount of individual compounds were higher in *H. lugubris* than in *U. aurantiaco-atra* and higher in *H. lugubris* inside than outside the OTC. Our results suggest that global warming is affecting the metabolism of phenolic compounds in *H. lugubris*.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Estimates of Potential New Production (PNP) for the waters off of the Western Antarctic Peninsula (WAP) Region

Forename: Marco Surname: Pedulli

Authors: Pedulli, Marco; Bisagni, James;

Presentation Allocated: Poster

abstract: The Western Antarctic Peninsula (WAP) region has been characterized by many as one of the most productive areas which supports a large biomass of higher trophic levels. A number of previous studies have been carried out from direct (e.g. incubation studies) to indirect measurements (e.g. satellites) and numerical models in order to quantify the amount of primary production that sustains WAP's foodweb. For the current study, a first attempt to estimate Potential New Production (PNP) – used here as proxy for new primary production - was made by employing a one dimensional analytical model using in situ and model data for the waters off of the Western Antarctica Peninsula (WAP) for January (mid summer). Field observations were made during the US Palmer LTER Program and a decade long Time-series (1998-2007) was used for the computations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Limnological response of Lake Hoare to the 2001-2002 flood in the McMurdo Dry Valleys

Forename: Devin Surname: Castendyk

Authors: Castendyk, Devin; Gallagher, Hugh; Lyons, W. Berry; Priscu, John;

Presentation Allocated: Oral

abstract: The lakes of the McMurdo Dry Valleys contain one of the coldest freshwater ecosystems known on Earth, and the physical processes that sustain or modify these lakes are of great interest. These lakes are considered to be very stable over time. However, unusually warm air temperatures between December 2001 and January 2002 caused record discharge from meltwater streams feeding the lakes which increased lake levels and disrupted the shallow density profile of at least one lake. Annual Conductivity, Temperature, and Depth (CTD) profiles from Lake Hoare collected between 1996 and 2005 suggest that this event added a new layer of low density water immediately below the lake ice and caused vertical mixing in the shallow portion of the water column. Prior to 2002, a step-increase in water density occurred immediately below the lake ice followed by a small increase in density over the next several meters. After 2002, water density still increased but at a slower rate over a 2 meter interval below the lake ice, and thereafter, increased rapidly with depth. We hypothesize that flood year stream discharge caused sub-ice currents which created sheer velocity and dynamic instability between water layers resulting in vertical mixing in the shallow water column. To investigate the presence of sub-ice currents, an Acoustic Doppler Current Profiler (ADCP) was deployed in Lake Hoare during the 2009-2010 field seasons and pressure transducers were deployed during the 2011-2012 field season. Average longitudinal velocities of 23.8 cm/sec were observed by the ADCP and independently validated using a hand-held Acoustic Doppler Velocity meter (ADV). The density of meltwater discharge was equal to the density of shallow lake water above the density transition suggesting that discharge creates a thin interflow lens below the lake ice. The magnitude of longitudinal currents oscillated with a 5-13 min period which corresponds to the theoretical first-mode surface seiche for the lake. Seiche frequencies intensified during peak meltwater discharge suggesting that diurnal stream discharge triggers seiche motion. Other possible causes include wind energy impinging upon lake ice and temperature-drive convection currents generated by melting lake ice. Relationships between stream discharge, seiche intensity, and horizontal velocities warrant further investigation as they may link meteorological and hydrological events to limnological changes in the Dry Valley.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Long term in situ experimental warming improves survival and growth of *Deschampsia antarctica* in the maritime Antarctic.

Forename: Angelica Surname: Casanova-Katny

Authors: Casanova-Katny, Angelica; Torres-Mellado, Gustavo;

Presentation Allocated: Oral

abstract: *D. antarctica* (antarctic hairgrass) is the dominant of both native vascular plant species which are known to have successfully colonized the maritime Antarctic. Moreover, many of its populations have increased during the past decades, supposedly as a consequence of global climatic change. In fact, the local temperature rise at the Antarctic Peninsula is the highest observed during the last 50 yrs on Earth and is still continuing. Antarctic hairgrass is a pioneer species that colonizes recently deglaciated terrains, but little is known about its regeneration ecology, particularly recruitment. Our study was focused on the effect of passive warming on *D. antarctica* recruitment and growth parameters. We transplanted individual tillers inside and outside open top chambers (OTC) on Fildes Peninsula (King George Island) during three growing seasons. Survival and growth parameters were measured after one and three years. After the first year, between 90-100% of *D. antarctica* plants had survived under both, ambient and warming conditions. Three years later the responses were markedly different, with a strong decrease of survival in ambient vs. OTC plants (up to 33% and 85%, respectively). Plant size, tiller and spike number were also significantly higher in the OTC plants. These are the first assays providing experimental evidence that the observed expansion of *D. antarctica* populations is dependent on warming. Moreover, our results contrast other studies carried out on the Antarctic Peninsula where plant biomass decreased after long-term warming, suggesting that Antarctic plant responses to global warming can be locally different, probably due to particular microclimatic and soil conditions. Grant INACH T0307

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Modeling argon dynamics in first-year sea ice

Forename: Martin Surname: Vancoppenolle

Authors: Moreau, Sebastien; Vancoppenolle, Martin; Zhou, Jiayun; Tison, Jean-Louis; Delille, Bruno; Gooze, Hugues;

Presentation Allocated: Oral

abstract: Recent studies suggest an active role of sea ice as a source or sink for climatically significant gases such as CO₂ and DMS. However, the dynamics of such biogeochemically active gases within sea ice are still not well understood. Modeling can help to understand and upscale the physical and biogeochemical processes that affect gas diffusion, production, consumption and transport within sea ice and through the brine network. Argon (Ar), which is a biogeochemically inert gas, can be used, as a first step, to constrain the physical processes that determine gas dynamics within sea ice. To accomplish this goal, in this study, we aim at constraining the dynamics of Ar within sea ice using observation data and a one-dimensional halo-thermodynamic sea ice model, including gas physics. The incorporation and transport of dissolved Ar within sea ice, as well as its rejection via gas-enriched brine drainage to the ocean, are modeled following fluid transport equations through sea ice. In addition, gas bubbles nucleate within sea ice when Ar concentration is above saturation. The uplift of gas bubbles due to buoyancy is allowed when the brine volume fraction is above a prescribed threshold. Ice-atmosphere Ar fluxes are formulated as a function of wind speed, the differential partial pressure of Ar between sea ice brine and the atmosphere, the sea ice brine aspect ratio and the presence or absence of snow. Two simulations corresponding to two case studies were run, the first one covering the seasonal growth of first-year ice at Point Barrow, Alaska, and the second corresponding to the growth and melt of artificial sea ice in an ice-tank experiment (INTERICE IV). Modeled snow depth and ice thickness, ice temperature and bulk salinity realistically reproduce the observations. Basal entrapment and vertical transport due to brine motion enable a qualitatively sound representation of the vertical profile of Ar. Sensitivity analyses suggest that bubble nucleation should account for more than half of the observed Ar concentrations. Gas bubbles uplift improves simulation performances when the brine volume fraction threshold is set to 10%. Finally, the near-surface concentration of Ar in sea ice depends critically on ice-atmosphere gas exchanges. The choice of model parameters, among which some are highly uncertain, is also critical. How specific the gas processes affect O₂ and CO₂ dynamics within Antarctic sea ice will be discussed using preliminary results.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Photosynthetic response and pigment ratios of Antarctic marine benthic diatoms exposed to different light intensities

Forename: Paulina Surname: Uribe

Authors: Uribe, Paulina; Petrou, Katherina; Zbinden, Marlene; Molina, Ernesto;

Presentation Allocated: Poster

abstract: Antarctic benthic diatom communities account for 40% of the primary production in shallow coastal areas. They are exposed to wide variations in light intensity and duration over an annual cycle. In particular, they persist in these coastal areas during the austral winter under the sea-ice cover in very low light conditions. They play a vital role in the winter food web, providing “winter forage” crucial for a diversity of marine organisms such as small crustaceans and krill. Despite their ecological importance, community composition, physiology and their acclimation to low light remain poorly understood. This study investigated photophysiological responses in eight benthic diatom species collected from different depths of Covadonga Bay O’Higgins Station (63°19’15”S, 57°53’55”W) in January 2009. Diatoms were grown in low light and exposed to six different irradiances for five hours. Physiological responses were assessed by measuring the photosynthetic parameters: Quantum Yield (ϕ PSII); relative Electron Transport Rate (rETR); and light utilization efficiency (α), following the 5-hour exposure to light and again after 30 min of darkness. Pigment composition of each species was analyzed by HPLC before and after light treatment. Our results show low-light acclimation in all eight species with photoinhibition occurring at 100-200 μ mol photons $m^{-2} s^{-1}$. Species from the genus *Nitzschia* showed higher tolerance to greater light intensities than those from the genus *Navicula*. Important questions arise regarding the mechanisms involved in photoprotection among benthic diatoms, as well as the role light plays in determining their spatial and temporal distribution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Potential climate driven changes to the summer habitat of Antarctic krill

Forename: Tony Surname: Phillips

Authors: Hill, Simeon; Phillips, Tony; Atkinson, Angus; Wang, Zhaomin;

Presentation Allocated: Oral

abstract: The Southern Ocean has experienced rapid regional warming over recent decades and climate models project more widespread warming by 2100. Water temperature is one of the major defining characteristics of the habitats of Southern Ocean species. A well known example is Antarctic krill, *Euphausia superba*, one of the most abundant wild animals on Earth which is nevertheless restricted to the cold waters South of the Antarctic Polar Front. The abundance of Antarctic krill exhibits strong climate-related variability in the Northern parts of its habitat where temperatures fluctuate between suitable and stressful. A recent larger-scale decline in krill abundance might also be climate related. We examined the response of a krill summer growth habitat model, based on temperature and chlorophyll, to Coupled Model Intercomparison Project Phase 5 sea surface temperature projections for the 0° to 90°W sector of the Southern Ocean, where 70% of the Antarctic krill stock occurs. The model ensemble projected a diverse range of conditions at the end of the 21st century, from a severe contraction to a modest increase in suitable krill habitat. In the northern part of the sector there was agreement amongst most models that, under all radiative forcing scenarios, there would be a reduction in the availability of suitable krill habitat within the foraging ranges of most land-based predators (penguins, seals, albatrosses). Discrepancies between ensemble members were greater for the middle latitudes of the Southern Ocean where representation of current day sea ice cover varies greatly. Our results indicate the potential for dramatic changes in krill habitat and for the effects of such changes to propagate through the ecosystem. They also highlight some of the major uncertainty issues including the inconsistent performance of climate models in replicating the current day state of physical characteristics that drive Southern Ocean ecology and the sparse spatial and temporal coverage of ecological data. These uncertainty issues must be addressed to improve forecasting of the state of the Southern Ocean ecosystem and the significant services it provides.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: PROJECTING LAKE-LEVEL RISE FROM AIRBORNE LIDAR AND CLIMATE MODELS IN TAYLOR VALLEY, ANTARCTICA

Forename: Spencer Surname: Niebuhr

Authors: Niebuhr, Spencer; Herried, Brad; Obryk, Maciej; Doran, Peter;

Presentation Allocated: Poster

abstract: The McMurdo Dry Valleys (approximately 77°45'S, 162°E) is the largest ice-free valley system in Antarctica with a cold, hyper-arid climate. Despite extreme polar conditions, isolated biological communities are present in valley soils, lakes, and streams and are sensitive to even small changes in climate and environmental conditions. Taylor Valley is the southernmost of three large east-west valleys and it contains three large, adjacent, closed basins with perennially ice-covered lakes (Lake Bonney, Lake Hoare, and Lake Fryxell). Lake levels are rising due to an imbalance in ablation (sublimation and evaporation) rates and input of liquid water. We merged a LiDAR-derived digital elevation model (DEM) of Taylor Valley (2 meter resolution) with a bathymetric grid of each lake (2 meter resolution), resulting in a hydrologically-sound elevation model of the Taylor Valley floor. Water volumes were then calculated at one meter elevation intervals to produce a hypsometric curve for each lake basin. We used the hypsometric curve to derive a function which projects yearly water volumes for each basin. Our model allows the user to input annual volumetric change for each basin to predict shoreline migration and year of possible spill event. The output allows users to determine when the basins will merge and spill into the adjacent Ross Sea using multiple simulations visually. Basin spill events have implications on the fragile, isolated biological communities as well as the geologic landscape. A web application was developed to prompt input values and display water volume and surface area changes over time spatially and numerically. The high spatial resolution of the DEM resulted in more accurate calculations of future shoreline migration and water volume than ever previously measured. This study, more generally, shows an application of LiDAR data, bathymetric data, and climate models to understand closed-basin processes in unique climatic environments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 8

Title: Radiocarbon bomb spike reveals climate change is stunting growth of century old Antarctic moss shoots

Forename: Sharon Surname: Robinson

Authors: Robinson, Sharon; Clarke, Laurence; Waterman, Melinda; Bramley-Alves, Jessica; Hua, Quan; Wanek, Wolfgang; Fink, David;

Presentation Allocated: Oral

abstract: The Antarctic has experienced major changes in temperature, wind speed and stratospheric ozone levels over the last 50 years. However until recently continental Antarctica appeared to be little impacted by climate warming, thus biological changes were predicted to be relatively slow. Detecting the biological effects of Antarctic climate change has been hindered by the paucity of long-term data sets, particularly for organisms that have been exposed to these changes throughout their lives. We have shown that radiocarbon signals preserved along shoots of the dominant Antarctic moss flora can be used to determine accurate growth rates over a period of several decades, allowing us to explore the influence of environmental variables on growth and providing a dramatic demonstration of the effects of climate change. Detailed 60-year growth records have been generated for *Ceratodon purpureus* and three other East Antarctic moss species using the 1960s radiocarbon bomb spike. Growth rate and stable carbon isotope ($\delta^{13}C$) data show that *C. purpureus*' growth rates are correlated with key climatic variables, and furthermore that the observed effects of climate variation on growth are mediated through changes in water availability. Many of the sites investigated showed evidence of drying over recent decades and this was associated with reductions in moss growth rate. The most likely cause of this drying is increased wind speeds around the coast of Antarctica linked to depletion of the ozone layer. The finding that stable isotope signals laid down as the mosses grow can be used to determine changes in microhabitat water availability over recent decades means that in future, Antarctic mosses could be used as proxies for past coastal climate. Changes in water availability during the growing season may determine the fate of these mosses and the associated communities that form oases of Antarctic biodiversity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Abiotic versus biotic drivers of high-frequency pH variation under fast sea ice in McMurdo Sound, Antarctica

Forename: Paul G. Surname: Matson

Authors: Matson, Paul G.; Washburn, Libe; Martz, Todd R. ; Hofmann, Gretchen E. ;

Presentation Allocated: Poster

abstract: Ocean acidification (OA) – the decrease in oceanic pH driven by the absorption of anthropogenic atmospheric carbon dioxide (CO₂) into surface oceans – is expected to have a major effect on the marine carbonate system over the next century, particularly in high latitude seas. Many experimental studies have begun to explore the impact of OA on the physiological performance of Antarctic calcifiers by using future predicted atmospheric CO₂ levels (e.g., IPCC emission scenarios) to parameterize laboratory experiments. Less appreciated is the natural environmental variation within these systems, particularly in terms of pH, and further how this natural variation may inform laboratory experiments. In this study, we deployed sensor-equipped moorings at 20 m depths at three locations in McMurdo Sound, comprising deep (bottom depth > 200 m: Hut Point Peninsula) and shallow environments (bottom depth ~25 m: Cape Evans and New Harbor). Our sensors recorded high-frequency variation in pH (Hut Point and Cape Evans only), tide (Cape Evans and New Harbor), and water mass properties (temperature and salinity) during austral spring and early summer 2011. These collective observations showed that (1) pH differed spatially both in terms of mean pH (Cape Evans: 8.009 ± 0.015; Hut Point: 8.020 ± 0.007) and range of pH (Cape Evans: 0.090; Hut Point: 0.036), and (2) pH was not related to the mixing of two water masses, suggesting that the observed pH variation is likely not driven by this abiotic process. Given the large daily fluctuation in pH at Cape Evans, we developed a simple mechanistic model to explore the potential for biotic processes – in this case algal photosynthesis – to increase pH by fixing carbon from the water column. For this model, we incorporated published photosynthetic parameters for the three dominant algal functional groups found at Cape Evans (benthic fleshy red macroalgae, crustose coralline algae, and sea ice algal communities) to estimate the amount of oxygen produced/carbon fixed from the water column underneath fast sea ice and the resulting pH change. These results suggest that biotic processes may be the primary driver of pH variation observed under fast sea ice at Cape Evans and potentially at other shallow sites in McMurdo Sound. Identifying the drivers of observed pH variation will help to better predict how global climate change may impact Antarctic marine ecosystems and provide better information to parameterize manipulative laboratory experiments investigating physiological thresholds of response to future OA.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: An investigation of the sub-lethal impacts of elevated carbon dioxide induced seawater acidity and temperature on two Antarctic molluscan mesograzers from the western Antarctic Peninsula

Forename: Julie Surname: Schram

Authors: Schram, Julie; Schoenrock, Kathryn; McClintock, James; Amsler, Charles; Amsler, Margaret; Angus, Robert;

Presentation Allocated: Poster

abstract: Current changes in anthropogenic atmospheric carbon dioxide concentrations are increasing at unprecedented rates and altering ocean carbonate chemistry (ocean acidification). These conditions will especially challenge calcifying marine organisms living in the Southern Ocean, a region where calcite and aragonite will first become undersaturated and temperatures are rapidly rising. The present study examines the sub-lethal effects of decreased seawater pH and increased temperature on growth, biochemical composition and energy content of whole animal tissue, calcification, shell dissolution, right responses and predator escape responses in the common Antarctic limpet *Nacella concinna* and mesogastropod *Margarella antarctica*. Experimental animals were collected by hand using SCUBA within 3.5 km of Palmer Station, on Anvers Island off the central western Antarctic Peninsula. We used a 2 x 3 factorial experimental with two temperatures and three pH levels (12 replicates per pH-temperature treatment) to measure sub-lethal impacts in both species over a two-month time period. The pH levels selected represent current ambient seawater pH in the vicinity of Palmer Station, Antarctica (pH 8.1), a pH predicted to occur by year 2100 (pH 7.7), and for comparative purposes, a more aggressive seawater pH used in many published studies (pH 7.4). All seawater for decreased pH treatments were adjusted by bubbling an appropriate carbon dioxide-air mixture. Temperature treatments reflect the current summer ambient seawater temperature of the central western Antarctic Peninsula (1.5 degrees C) and a temperature predicted to occur by year 2100 (3.5 degrees C). This study was supported by NSF grant ANT-1041022.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Antarctic acidification: Is there room for acclimation and adaptation in the foreseeable future?

Forename: Coleen Surname: Suckling

Authors: Suckling, Coleen; Clark, Melody; Peck, Lloyd; Harper, Elizabeth;

Presentation Allocated: Oral

abstract: Our oceans have become progressively more acidic over recent decades, yet we still know little about how this will affect marine biota, or the differences between species from different global regions. Organisms in high latitude areas may be particularly vulnerable due to cold temperatures naturally absorbing more CO₂ compared to lower latitudinal areas, thus exacerbating carbonate saturations levels. Additionally, in the Southern Ocean, the rates of growth, reproduction and development are up to ten-fold slower than warmer global regions and abilities to acclimate to small rises in temperature are poor. Thus their ability to survive is potentially limited if they are to acclimate and adapt towards predicted saturation states within the real timescales of ocean acidification. Experimental studies striving to predict Antarctic organismal responses to forecasted saturation levels are limited. This is largely due to the timescales required to conduct long term assessments (years) on organisms with such slow growth and development times. Additionally there are difficulties setting up technical facilities inside Antarctica (which require stringent monitoring of seawater carbonate chemistry) and limited availability of such facilities outside the continent. Consequently, to date, experiments have utilized short exposure times and largely focussed on limited parts of the life-cycle. Early life-stage response studies have utilized gametes and/or offspring obtained from parents maintained in ambient conditions and then immediately introduced to altered saturation state conditions. These therefore preclude the effects of altered seawater saturation levels on gonad development and adult acclimation effects. Hence it is essential now to include parental pre-exposure prior to evaluating larval success. We address this gap in our knowledge and assess the response of an ecologically important Antarctic marine calcifier, the sea urchin *Sterechinus neumayeri*, exposed to current and IPCC future seawater carbonate saturation for long-term exposures (2 years). Physiological and reproductive responses including subsequent offspring success will be presented and will contribute to our understanding on one of the biggest multi-disciplinary driven biological questions of this Century 'How will organisms respond towards a changing climate'?

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Climate change impacts on the physiology of calcifying and non-calcifying encrusting Antarctic macroalgae along the western Antarctic Peninsula

Forename: Kathryn Surname: schoenrock

Authors: schoenrock, Kathryn; Schram, Julie; Amsler, Charles; McClintock, James; Angus, Robert; Amsler, Margaret;

Presentation Allocated: Poster

abstract: The past centuries' anthropogenic emissions have increased the amount of CO₂ absorbed into the world's oceans, altering the balance of carbonate species. Currently, climate change projections predict a decline in pH from today's average level of 8.1 to 7.7 by 2100, which will coincide with increased atmospheric and oceanic temperatures. Reduced seawater pH is associated with reduced saturation states of calcium carbonate, which may compromise calcified organisms and their communities. Crustose coralline algae (CCA) are widespread and ecologically important calcified members of the marine benthic community. Along the western Antarctic Peninsula (WAP) CCA species are common in the subtidal habitat, especially above 30 m depth where percent cover can reach up to 77% of the benthos. Currently the WAP is experiencing one of the fastest rates of climate change making it an ideal location for climate change research. The goal of this project was to investigate prospective responses to reduced seawater pH and rising seawater temperature in both calcified and non-calcified crustose algae. Microcosm experiments were constructed using a 2 x 3 factorial design reflecting current, near-term, and long-term condition predictions for pH and current and near-term predictions for temperature along the WAP. Calcification of thalli, bleaching of thalli, chlorophyll a content, photosynthetic characteristics, and growth rates of a CCA species and a non-calcified crustose red alga, <Hildebrandia lecanellieri>, were used to compare physiological responses between treatments. Results may indicate a potential for a regime shift between calcified and non-calcified algae in the marine benthos along the WAP. Supported by NSF ANT-1041022.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Combatting heat in a changing ocean: Sea urchin larvae are prepared for battle

Forename: Lydia Surname: Kapsenberg

Authors: Kapsenberg, Lydia; Hofmann, Gretchen;

Presentation Allocated: Poster

abstract: Ocean acidification and ocean warming present a significant threat to the Southern Ocean marine ecosystem, yet little is known regarding the biological consequences of these simultaneous and potentially interacting stressors. Within the global change biology community, the study of early life stages has emerged as a method to detect species' vulnerability to multiple stressors. In this study, we assessed the thermal tolerance of sea urchin larvae of the Antarctic sea urchin, *Stereochinus neumayeri*, that were raised in seawater with variable pCO₂ conditions. In the Crary Labs at McMurdo Station Antarctica, larvae were reared in culture vessels under a flow-through regime in -0.7 °C filtered seawater with pCO₂ levels of 424, 658, and 1074 µatm. These levels of pCO₂ represent near present day and future levels of ocean acidification. Using an aluminum block to create a thermal gradient from -1.7 to +25 °C, sea urchins at four different developmental stages (blastula, gastrula, prism, and 4-arm pluteus) were exposed to a range of temperatures for 1 hour. Following a recovery period of ~20h, the embryos and larvae were then scored for survival. The results showed that early life history stages of *S. neumayeri* exhibited unexpectedly high thermal tolerance, surviving temperatures up to 20°C. Overall, survivorship varied as function of developmental stage, with blastula larvae being 5 °C less thermotolerant than gastrula, prism and pluteus larvae. Additionally, there was no dramatic effect of pCO₂ treatment on thermotolerance. For all stages, survivorship was largely unchanged across the three pCO₂ treatment groups, with the exception of a slight negative pCO₂ effect on thermotolerance of blastula larvae. We discuss a gene expression-based mechanism that might explain the pCO₂ effect observed at the blastula stage and the change in thermal tolerance through development. Our data highlight the importance of testing multiple stressors in order to understand sublethal and physiological effects of ocean change that single stressor studies might mask.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Combined effects of ocean acidification and iron availability on Southern Ocean phytoplankton communities

Forename: Clara Jule Marie Surname: Hoppe

Authors: Hoppe, Clara Jule Marie; Hassler, Christel; Payne, Chris D.; Tortell, Philippe; Rost, Björn; Trimborn, Scarlett;

Presentation Allocated: Oral

abstract: Accounting for about 20% of the global annual phytoplankton production, the Southern Ocean (SO) exerts a disproportional control on the global carbon cycle and contributes to a large proportion to the oceanic sequestration of anthropogenic CO₂. Primary production in that area is thought to be mainly controlled by iron and light availability as well as by grazing, but also carbonate chemistry was shown to have significant effects. While combined effects of iron and light have received a lot attention, knowledge on combined effects with ocean acidification is sparse. We present results of shipboard incubation experiments conducted with a phytoplankton community from the Weddell Sea testing the combined effects of pCO₂ and iron availability. To this end, phytoplankton communities were exposed to the three different pCO₂ levels of 180, 380 and 800 μ atm under iron-deplete and -replete conditions. Species composition, primary production and photophysiology were found to strongly differ in response to ocean acidification, which were further modulated by iron availability. Our study confirms that primary production and species composition of SO phytoplankton communities are sensitive to increased pCO₂. Under iron-limitation, however, the CO₂-sensitivity of primary production is strongly reduced. With respect to species composition, pronounced shifts in species composition at intermediate and high pCO₂ levels were observed, resulting in either Pseudo-nitzschia- or Chaetoceros-dominated communities. Effects of iron availability were also modulated by pCO₂, as stimulating effects by iron only occurred under elevated pCO₂ levels. These interactive responses have the potential to influence the biological carbon pump in the SO and thus the predictions for the CO₂ drawdown in this important region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Comparative analysis of the metabolic response of notothenioid fishes to ocean acidification

Forename: Sean Surname: Place

Authors: Place, Sean;

Presentation Allocated: Poster

abstract: For notothenioid fishes of the Southern Ocean, evolution in extremely stable, cold waters has resulted in several physiological adaptations, which likely come with a high metabolic cost. For instance, production of antifreeze glycoproteins for freeze avoidance, or the constant expression of the inducible heat shock protein, Hsp70, in response to reduced protein folding efficiency, necessitate the reallocation of precious energy expenditures away from growth and reproduction. Additionally, these fish have adapted to their cold environment by increasing mitochondrial density, utilizing lipids as a primary energy source, thereby eliminating the need for a swim bladder, as well as lowering enzyme activation temperatures. Thus, in the face of increasing global climate change, the metabolic cost of maintaining cellular homeostasis in these stenothermal fish may be significantly impacted. While the effects of thermal stress on teleost metabolic rates have been well documented, there is little to no data on the effects of ocean acidification. We have begun a comparative study to identify the potential changes in cellular energetics that may result from predicted changes to ocean environments. Here we have used intermittent aquatic respirometry of whole animals to compare the basal metabolic response of several notothenioid species to the combined effects of increasing water temperatures and decreasing ocean pH. Our results suggest most, but not all Antarctic notothenioid fish can easily compensate for changes in ocean pH and that persistent changes in ocean temperature may have a greater impact on energy expenditure.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Experimental research into the effects of warming and acidification on ecologically important Antarctic organisms

Forename: Patti Surname: Virtue

Authors: Virtue, Patti; Kawaguchi, So; Wynn-Edwards, Cathryn; Ericson, Jessica; Ho, Melanie; Koleits, Lucas; Price, Cassandra; Byrne, Maria; King, Catherine; King, Rob; Davidson, Andrew; Nichols, Peter. D; Wright, Simon; Tilbrook, Bronte;

Presentation Allocated: Poster

abstract: Laboratory studies on the impacts of ocean acidification and warming on pelagic and benthic marine species has been conducted for several years as part of Australia's Antarctic research program to assess the future prospects for biota. Warming, acidification and reduced carbonate saturation have been predicted to affect calcifying organisms such as echinoderms, and important non-calcifying biota including krill and phytoplankton. We examined the effects of warming and acidification on the calcification rates in juvenile heart urchins, *Abatus nimrodi* and *Abatus shackletoni*, and fertilization and early development of the ecologically important sea urchin *Sterechinus neumayeri*. Deleterious interactive effects between these stressors were evident in these echinoderms. The embryos and larval stages of Antarctic krill, *Euphausia superba*, were vulnerable to increased pCO₂ suggesting possible impacts on embryonic development at CO₂ levels expected by 2100 (up to 1400 μ atm within certain areas of their habitat range). Increased pCO₂ reduced phytoplankton productivity and substantially altered community composition in minicosm experiments. In separate culture studies, increased pCO₂ also reduced the nutritional quality of phytoplankton in terms of the key essential omega-3 long-chain polyunsaturated fatty acids, increasing mortality of krill subsisting on them. As benthic and pelagic species have a range of both behavioural and physiological mechanisms to cope with variable environmental conditions, a range of species needs to be investigated together with trophic and competitive interactions among species to best estimate ecosystem response to acidification at high latitudes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: How low can they go? Tolerance of near-future low carbonate saturation (high CO₂) levels by larvae of *Sterechinus neumayeri*

Forename: Pauline C. Surname: Yu

Authors: Yu, Pauline C.; Sewell, Mary A.; Hofmann, Gretchen E.;

Presentation Allocated: Oral

abstract: Ocean acidification is an inevitable anthropogenic challenge to high-latitude calcifying invertebrate fauna. The carbonate chemistry of cold oceans will result in calcium carbonate undersaturation ($\Omega < 1$) at surface waters sooner than anywhere else globally. To test the resilience of a model echinoderm to these conditions, larvae of the locally abundant (Cape Evans, Ross Island) Antarctic urchin *Sterechinus neumayeri* were subjected to experimentally elevated levels of pCO₂ (510 and 730 μatm , and 650 and 1050 μatm , in separate trials) to assess responses along a diversity of physiological metrics including skeletal development, metabolism, and calcium incorporation. In-situ pH and total alkalinity measurements from Cape Evans were used to set the experimental control level of pCO₂ (410 μatm). The experiments used multiple females, allowing a sampling of population level responses. Development occurred along normal developmental schedules, but in the two highest CO₂ treatments, more developmental anomalies were observed. These anomalies include delayed hatching at the blastula stage and abnormal skeletal development. However, larvae were able to develop normally to the advanced 4-arm pluteus stage even at pCO₂=1050 μatm , ($\Omega_{\text{ca}}=1.05$, $\Omega_{\text{ar}}=0.65$). Larvae at high pCO₂ treatments were significantly smaller in size, primarily along the skeletal rods of the larval arms, which are important for swimming stability and food particle capture. However, there is also a wide range of size responses between individuals, because size is a highly plastic trait among larvae of sea urchins. Biochemical differences (lipid and protein content) between pCO₂ treatments were non-significant over most of development. Decreased physiological rates at the highest levels of pCO₂ were observed for calcification rate, and for respiration rate at critical developmental stages. Antarctic urchin larvae surviving at levels of $\Omega_{\text{ca}}=1$ appeared to maintain internal skeleton better than planktonic mollusks (pteropods) observed with corroded shells at $\Omega_{\text{ar}}=1$. While these aggregated observations are of small magnitude at early developmental stages, potentially detrimental effects on other physiological processes, and later developmental stages are still awaiting evaluation. In summary, these data suggest that the effects on early larval development are sublethal at levels of pCO₂ ($\Omega_{\text{ca}}=1$) predicted to occur by 2100, but that later developmental progression and success are potentially affected.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Iceberg and CO₂-driven shift in Phytoplankton dominance in Southern Ocean

Forename: Suhas Surname: Shetye

Authors: Shetye, Suhas; RAHUL, MOHAN; GAZI, SAHINA; MARUTHADU, SUDHAKAR;

Presentation Allocated: Poster

abstract: Recent results from long-term studies carried out along the western Antarctic Peninsula have revealed regional changes in phytoplankton structure and latitudinal shifts in the community composition. In future, blue green algal growth will get favoured by warm water temperatures, increased CO₂ and abundant nutrients. Here, we investigated the Antarctic coastal region in the Enderby basin during the austral summer 2010 in order to understand the possible shifts in Phytoplankton distribution in high pCO₂ region. *Corethron Criophillum* was the dominant diatom species encountered in the extreme low temperature and salinity stations. *Corethron Criophillum* was nearly 75% sexual, which can be attributed to the availability of Fe. Interestingly, iceberg samples collected from the Antarctic coastal region indicated 73% Fe. Diatom abundance was limited in high pCO₂ and wind speed conditions. Blue green algae (*Spirulina* and *Nostoc*) transported by icebergs to the coastal waters, also seem to be inhibiting the abundance and perhaps the growth of diatoms. Iceberg iron could soften impact of climate change but could lead to massive biotic crisis in future. Our study suggests the possibility of an iceberg and CO₂-driven shift in Phytoplankton dominance in the future high CO₂ Southern Ocean

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Increased feeding and nutrient excretion of adult Antarctic krill, *Euphausia superba*, exposed to enhanced carbon dioxide (CO₂)

Forename: Grace Surname: Saba

Authors: Saba, Grace; Schofield, Oscar; Steinberg, Deborah;

Presentation Allocated: Keynote 20 mins

abstract: The Western Antarctic Peninsula (WAP) has undergone profound changes in the past decades: an unprecedented increase in atmospheric temperature and seawater heat content, and declines in sea ice. These rapid changes are associated with an overall decline in primary, secondary, and higher trophic levels, including Antarctic krill (*Euphausia superba*), which have declined nearly two-fold in this region since the mid-1970s. Ocean acidification poses an additional threat. Elevated CO₂ can impact organisms via disturbance to internal acid-base equilibrium, which may cause shifts in metabolism. We conducted a CO₂ perturbation experiment during a January 2011 cruise along the WAP to determine the impacts of enhanced CO₂ on the feeding and nutrient excretion of adult *E. superba*. Under CO₂ conditions predicted by the end of the century (750 ppm), ingestion rates of krill averaged 82 µg C individual⁻¹ d⁻¹ and were 2.7 times higher than krill ingestion rates at ambient CO₂. Additionally, rates of ammonium, phosphate, and dissolved organic carbon (DOC) excretion by krill reached up to 1.5, 1.5, and 3.0 times higher, respectively, in the high CO₂ treatment compared to ambient. Excretion of urea, however, was consistently about 17% lower in the high CO₂ treatment, suggesting differences in catabolic processes of krill between treatments. Overall krill metabolism (i.e., oxygen consumption) was not directly determined in this study; however, activities of key metabolic enzymes, malate dehydrogenase (MDH) and lactate dehydrogenase (LDH), were higher in the high CO₂ treatment. These shifts in metabolism likely resulted from extra costs of compensation to maintain extracellular fluid pH and represent a secondary stress that may hamper growth and reproduction and negatively impact an already declining krill population.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Sensitivity of Antarctic phytoplankton species to ocean acidification: physiological responses and species interactions

Forename: Scarlett Surname: Trimborn

Authors: Trimborn, Scarlett; Brenneis, Tina; Sweet, Elizabeth; Rost, Björn;

Presentation Allocated: Keynote 20 mins

abstract: Little information is currently available on the potential CO₂ sensitivity of Southern Ocean phytoplankton and consequently its effect on the marine carbon cycle. Key species in this region are a few diatom species and the flagellate *Phaeocystis antarctica*. To gain a better understanding of the effects of CO₂ on growth, photosynthesis and carbon acquisition, the phytoplankton species *Chaetoceros debilis*, *Pseudo-nitzschia subcurvata*, *Fragilariopsis kerguelensis* and *Phaeocystis antarctica* were studied in monocultures under CO₂ scenarios simulating glacial times, present day and future values. Using membrane-inlet mass spectrometry (MIMS), photosynthetic O₂ evolution and inorganic carbon (C_i) fluxes were determined in response to instantaneous changes in CO₂ or irradiance. Simultaneously, F_v/F_m, relative electron transport rates (rETR), nonphotochemical quenching (NPQ) as well as functional absorption cross sections (σ_{PSII}) were measured by means of a fluorescence-induction relaxation system (FIRE). Differences in growth, photophysiology and modes of carbon uptake were found in the investigated species. While instantaneous changes of irradiance affected the photophysiology of a species, CO₂ was also found to have a strong effect. Information on species interaction was obtained through competition experiments, in which *C. debilis* and *P. subcurvata* were grown in mixed cultures under the different CO₂ scenarios. To mimic different starting conditions for a bloom, three different scenarios were chosen with either equal (50%: 50%) or a 4 higher starting abundances for one of the two species (80%: 20% and vice versa). Our results suggest that species-specific differences in physiology and the CO₂-dependence therein largely explain the CO₂ sensitivity of a species, but it was also found that species interaction plays also an important role in structuring phytoplankton communities by counteracting species-specific physiological differences.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: Southern Ocean carbonate variability

Forename: Nicole Surname: Lovenduski

Authors: Lovenduski, Nicole;

Presentation Allocated: Oral

abstract: We investigate the interannual variability in the Southern Ocean carbonate ion concentration on the basis of a hindcast simulation of a coupled physical-biogeochemical-ecological model with particular emphasis on the role of physical climate variations. We find large interannual variability in the surface ocean carbonate ion concentration, 35% of which is driven by variations in surface wind speed. Years with high wind speed tend to exhibit lower surface carbonate ion concentrations. A carbonate budget reveals that surface alkalinity and dissolved inorganic carbon both contribute significantly to the variability. Given the responsiveness of the Southern Ocean carbonate ion concentration to variations in wind speed, it seems likely that the predicted century-scale trend in wind speed will accelerate the ongoing acidification of the Southern Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 9

Title: The Mg-calcite levels of Antarctic echinoderms: important implications for predicting the impacts of ocean acidification in the Southern Ocean

Forename: James Surname: McClintock

Authors: McClintock, James; Amsler, Margaret; Angus, Robert; Challener, Roberta; Schram, Julie; Amsler, Charles; Mah, Christopher; Cuce, Jason; Baker, Bill;

Presentation Allocated: Poster

abstract: The Southern Ocean is considered to be the canary in the coal mine with respect to the first impacts of ocean acidification (OA). This vulnerability is due to naturally low carbonate ion concentrations that result from the effect of low temperature on acid-base dissociation coefficients, the high solubility of carbon dioxide at low temperature, and ocean mixing. As such, both calcium carbonate polymorphs – aragonite and calcite – are expected to become undersaturated in the Southern Ocean within 50 and 100 years or less, respectively. Marine invertebrates such as echinoderms whose skeletons are comprised of high magnesium carbonate (>4% mol $MgCO_3$), are even more vulnerable to OA than organisms whose skeletons are comprised primarily of aragonite or calcite, both with respect to increased susceptibility to skeletal dissolution and being further challenged in their production of skeletal elements. Currently, despite their critical importance to predicting the impacts of OA, there is almost no information on the Mg-Calcite composition of Antarctic echinoderms, a group known to be a major contributor to the global marine carbon cycle. Here we report the Mg-Calcite compositions of 26 species of Antarctic echinoderms representing four classes. As seen in tropical and temperate echinoderms, Mg-Calcite levels varied with taxonomic class with sea stars generally having the highest levels. Sea stars and brittle stars, key players in Antarctic benthic communities, are likely to be the first echinoderms to be challenged by near-term OA. When combined with published data for echinoderms from primarily temperate and tropical latitudes, our findings support the hypothesis that Mg-Calcite level varies inversely with latitude. The basis of this relationship has been suggested to include temperature, light, salinity, seawater saturation state and/or physiological factors. We propose that predation may also be worthy of consideration as crushing predators decline with increasing latitude. High latitude echinoderms may not require as a high ratio of magnesium to calcite to strengthen their skeletal elements.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: A BIO-OPTICAL APPROACH TO PHYTOPLANKTON COMMUNITY STRUCTURE, PRIMARY PRODUCTION AND CARBON EXPORT IN THE SOUTHERN OCEAN

Forename: Ceinwen Surname: Smith

Authors: Smith, Ceinwen; Thomalla, Sandy; Waldron, Howard; Bernard, Stewart;

Presentation Allocated: Poster

abstract: In order to improve predictions of marine ecosystem responses to environmental and climate change, we need to determine how to quantify and parameterize key physiological responses of phytoplankton that will in turn affect marine food webs and the carbon-climate system. The Southern Ocean is an important "sink" for CO₂, thus requiring a detailed understanding of the sensitivity of the Southern Oceans biological carbon pump to variability in physical forcing mechanisms. In this study, measurements of phytoplankton primary production and carbon export estimates are made using ¹⁵N stable isotope tracers while phytoplankton enumeration using light microscopy is used to characterise the size structure and species composition of the phytoplankton community. The environmental controls on changes in phytoplankton production, community structure (dominant size and species composition) and export are investigated together with the response of the inherent optical properties (IOP's) to these changes. The significance of unveiling relationships between optical properties and physiology is that it provides a new tool for investigating broad-scale changes in algal physiology that will allow insights into the causative environmental forcing of the observed variability.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: A MODEL-BASED COMPARISON OF ANTARCTIC PENINSULA AND SOUTH GEORGIA FOOD WEBS

Forename: Tosca Surname: Ballerini

Authors: Ballerini, Tosca; Hofmann, Eileen E.; Murphy, Eugene; Hill, Simeon;

Presentation Allocated: Poster

abstract: The marine ecosystems of the Antarctic Peninsula (AP) and of South Georgia (SG) are part of a continuum of Southern Ocean food webs that are connected by oceanic circulation. The potential responses of these two food webs to climate-induced changes in ocean circulation and sea ice extent were investigated with a generic Southern Ocean food web model. Two top-down Ecopath-style models developed independently for the two regions were aggregated to have the same number/type of functional groups. To address uncertainty in model parameters, three sets of 1000 random ecosystems for each region were created using a Monte Carlo sampling of model parameters from probability distributions of 25, 50 and 75% around mean parameter values in the aggregated models. The random ecosystems were then transformed into bottom-up models that included recycling of nutrients and used to investigate the effects of changes in the relative abundance of small and large phytoplankton, enhanced microzooplankton production, and decreased Antarctic krill production on the two food webs. Simulations showed that in both regions a 50% increase of small phytoplankton contribution to total primary production increased small zooplankton production by 13-26% and decreased Antarctic krill production by about 10% (but min and max values within all levels of uncertainty range between -20% and +94%). A 50% reduction of Antarctic krill production resulted in decreased production of krill-dependent predators (40% for penguins, crabeater seals and baleen whales; 30% others). In both food webs, a 25% increase in microzooplankton production had the greatest negative impact on Antarctic krill and vertebrate predator production (as much as 80% decrease). The level of uncertainty associated with the model parameters made detection of significantly different changes difficult, but both regions showed large potential impacts from changes in the size composition of the plankton assemblages. The generic food web model structure provided a useful framework for consistent comparisons of the responses of the AP and SG food webs to common environmental drivers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Beyond carbon sinks: the importance of feedbacks involving high trophic levels in Southern Ocean ecosystem models

Forename: Jessica Surname: Melbourne-Thom

Authors: Melbourne-Thomas, Jessica; Corney, Stuart; Constable, Andrew;

Presentation Allocated: Oral

abstract: End-to-end ecosystem models that capture coupled bio-physical processes from the level of top predators through to physical forcings are emerging as important tools to evaluate climate change impacts for Southern Ocean ecosystems. To date, climate change effects on pelagic ecosystems have been regarded as 'bottom-up' impacts, where changes in the physical environment affect biogeochemical processes at the base of the foodweb. In models, the emphasis has been on assessing potential changes in carbon cycling; any effects on higher trophic levels are regarded as second-order impacts, which may or may not be of interest for fisheries management. Indeed, dynamic responses of higher trophic levels have been dismissed as largely inconsequential to climate change debates because they are not seen to have any role in the carbon cycle, and are regarded merely as carbon sinks. Recent findings regarding the potential role of whales in influencing the bio-availability of iron demonstrate how high-level biophysical feedbacks involving large predators may affect the carbon cycle in unforeseen ways. Such foodweb-level feedbacks may be important in moderating the mortality of primary producers or even in modifying habitats in ways that enhance or impede production. We discuss the need for revised thinking about the role of high trophic level taxa and functional groups in carbon cycling and ecosystem responses to climate change. We present an example framework for capturing these effects in the form of an end-to-end ecosystem model currently being developed by the Antarctic Climate & Ecosystems Cooperative Research Centre.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Biogeographic assessment of the marine landscape near the South Shetland Islands: integrating physics, micronekton, seabirds and marine mammals

Forename: Jarrod Surname: Santora

Authors: Santora, Jarrod; Loeb, Valerie;

Presentation Allocated: Poster

abstract: The marine ecosystem of the Antarctic Peninsula region has and has been impacted by human disturbances over the past two centuries (e.g., commercial whaling, krill fishery, ship accidents) and has been subject to substantial climate change in recent years. Biogeographic assessment via spatial integration of marine landscapes provides basic understanding of ecosystem state, trophic interactions and food web dynamics, and thus generates reference points for management and conservation of marine ecosystems. Therefore, the development of geospatial tools to describe the Antarctic Peninsula marine ecosystem structure and function greatly benefits resource management and conservation efforts there. We provide a preliminary investigation of the spatial relationships between landscapes of physics, micronekton and top predators across the South Shetland Island region. We use data from the US AMLR program which conducted annual shipboard ecosystem assessment surveys during austral summer (January-March) 1989 to 2010 during which it systematically mapped physical oceanography, zooplankton (acoustics and nets), and top predators. The objective of this study is to quantify baseline patterns of distribution and abundance to compare the habitat associations of micronekton species assemblages relative to physical oceanographic processes; we then link these to seabird and marine mammal predators of micronekton.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Can we rely on physical models when it comes to modelling ecosystems experiencing a changing climate?

Forename: Stuart Surname: Corney

Authors: Corney, Stuart; Melbourne-Thomas, Jessica; Constable, Andrew;

Presentation Allocated: Oral

abstract: Developing end-to-end (E2E) models for Southern Ocean ecosystems has become a priority for evaluating potential impacts of climate change in the region. These models aim to satisfactorily include all ecosystem processes, from interactions of top predators to the physical environment. The physical components of such models are, in many ways, better developed than the ecological components. Given the complexities of Southern Ocean systems, and the mechanics of coupling physical and ecological processes in an E2E framework, there is a need to critically evaluate the strengths and weaknesses of physical models in the context of modelling Antarctic marine ecosystems under changing climatic conditions. Here, we evaluate three key capabilities of physical models in informing E2E ecosystem models for the Southern Ocean, using the coupled ROMS-Atlantis system currently being developed by the Antarctic Climate and Ecosystem CRC as a specific example. Coupled ocean-atmosphere global models, or regional models forced from global models, are capable of providing robust projections of many of the variables needed for the physical forcing of ecosystem models, such as temperature, salinity and ocean currents. Other physical variables are just as important for ecosystems, but are less well captured in physical models. Properties of sea-ice such as thickness, seasonality, extent and timing of openings, degree of deformation and rugosity are crucial for modelling ecosystem dynamics in the Antarctic region, but are currently not well captured by physical models.

□

Ocean models are generally gridded, and often at a sufficient resolution to be eddy resolving. In contrast, ecological models are often developed using a box model approach with consequently much larger cells. The interplay between these two scales and how changing the resolution of the ocean model affects the forcing data used to drive the ecological model is not well understood. Climate change impacts on ecosystems have largely been regarded as “bottom-up” forcing, with a physical climate model delivering changes that affect productivity in a modelled ecosystem. Feedbacks to the physical model from the productivity are simple at best. Importantly, physical models are generally not well configured to incorporate the effect that higher trophic levels have on the productivity of the system. Modelling productivity within the ecological model comes at the cost of capturing fine-scale features.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Change in Southern Ocean ecosystems: evidence for change and development of projections

Forename: Eugene Surname: Murphy

Authors: Murphy, Eugene; Hofmann, Eileen; Constable, Andrew; Johnston, Nadine; Watkins, Jonathon;

Presentation Allocated: Poster

abstract: Rapid physically driven changes are occurring in Southern Ocean ecosystems and further changes are expected to occur over the coming decades. In addition historical impacts of harvesting have generated long-term effects on ecosystem dynamics, some of which are still continuing. Here we assess the evidence for change in the circumpolar ecosystem and their possible drivers. We consider what is known about links between climate related variability and biological change in different regions of the Southern Ocean. We highlight the uncertainty associated with these changes and in identifying the major drivers of change as a result of limited availability of long-term biological datasets. In developing projections, we note the importance of understanding the major determinants of food web structure and also the major ecological interactions that characterise the response of the ecosystems to change. Finally, we consider the global interactions and potential feedbacks of Southern Ocean ecosystems with the Earth System.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Climate Change and the King-Crab Invasion of Antarctica

Forename: Richard Surname: Aronson

Authors: Aronson, Richard; Vos, Stephanie; Thatje, Sven; McClintock, James; Amsler, Margaret;

Presentation Allocated: Poster

abstract: Global climate change is altering polar marine ecosystems through rising temperatures and ocean acidification. Marine communities in Antarctica face an additional threat: climatically driven biological invasions. Shell-crushing, or durophagous, king crabs (Lithodidae) have recently been discovered on the continental slope off Marguerite Bay, western Antarctic Peninsula (WAP). As sea temperatures off the WAP warm over the next several decades, predatory lithodids could move onto the continental shelf, with profound ecological consequences. Because the marine environment surrounding Antarctica remains largely unexplored, however, the extent and viability of lithodid populations on the slope remain poorly known. During the 2010–11 season, we established a 100x100 km study area on the shelf, slope, and shallow rise off Marguerite Bay. Intensive imaging of the sea floor revealed a large population of *Paralomis birsteinii* in a depth range of 837–2263 m, occurring over a temperature range of 0.7 °C. Spatial analysis showed that the distribution of crabs was patchy at a scale of multiple kilometers, and that the patches were internally structured. Three lines of evidence point to a reproductively viable population: (1) several pairs of *Paralomis* appeared to be engaged in precopulatory embrace; (2) crab molts, visible in some of the images both on the seafloor and still attached to individuals, indicated that the *Paralomis* had been molting and/or entering reproductive phase; and (3) a number of juveniles were observed. The establishment of viable populations of *Paralomis* on the shelf of the WAP would likely disrupt the endemic fauna and its unique trophic structure.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Episodic abundance peaks of pteropods in the South Shetland Island region, 1994-2009

Forename: Valerie Surname: Loeb

Authors: Loeb, Valerie; Santora, Jarrod;

Presentation Allocated: Poster

abstract: South of the Polar Front in the Southern Ocean the most common pteropods include the Thecosome (shelled) species *Limacina helicina antarctica* f. *antarctica* and *Clio pyramidata* f. *sulcata* and their predators, the shell-less (Gymnosome) relatives *Clione limacina* and *Spongiobranchaea australis*. These four species were regularly collected in the South Shetland Island region by the US Antarctic Marine Living Resources (AMLR) Program during annual austral summer surveys, 1994-2009. Over this 16 year period pteropods demonstrated episodic periods of elevated abundance, when the shelled species comprised relatively large proportions of the total zooplankton sampled: 1995-1996, 2000, 2002-2004 and 2009. These interannual abundance variations are likely due to the complex hydrography of the region and differential transport here from coastal and oceanic source areas. Here we describe the environmental conditions associated with the episodic events.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Feeding ecology of toothfish species as a means for characterising the slope megafauna of the South Sandwich Islands, Southern Ocean

Forename: Jim Surname: Roberts

Authors: Roberts, Jim; Xavier, Jose; Agnew, David;

Presentation Allocated: Poster

abstract: The South Sandwich Islands remain one of the least well sampled areas of the Southern Ocean. The few survey trawls conducted here have mostly been limited to regions shallower or deeper than the 500-2000m depth range operated by the longline fishery. In this study, the diet of Patagonian toothfish (*Dissostichus eleginoides*) and Antarctic toothfish (*D. mawsoni*) was examined in one of few regions with overlapping distributions of the two species. Macrourids and muraenolepidids dominate the finfish prey and the spatial distribution of their occurrence in toothfish stomachs is correlated with estimates of relative abundance from fishery bycatch data. Large onychoteuthid squid (particularly *Kondakovia longimana*) also appear to be important prey for both toothfish species and are likely to be abundant throughout the island chain. A single colossal squid (*Mesonychoteuthis hamiltoni*) beak and two portions of tissue were also found in three separate stomachs. This study highlights the usefulness of analysing predator diet as a means for 'sampling' prey faunal distributions where information from other means is limited.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Feeding ecology of top predators in the Southern Ocean: Have we always have been under-estimating the role of cephalopods in their diets?

Forename: Jose Surname: Xavier

Authors: Xavier, Jose; Cherel, Yves; Phillips, Richard;

Presentation Allocated: Poster

abstract: Dietary studies are essential understanding the role of top predators in the Antarctic marine ecosystem and therefore, form an integral component of most monitoring programs around the Antarctic, following SCAR and CCAMLR recommendations. Cephalopods (e.g. squid and octopods) play an important role in the Antarctic, being a major component in the diet of many Antarctic predators, such as whales, albatrosses, seals and penguins. Cephalopods are identified mainly using their chitinized upper and lower beaks, but because it has been assumed that the number of upper and lower beaks would be the same in predator diet samples, more effort has been put into creating keys for the lower beaks, which are more easily identifiable from morphology. In this presentation, we will show results evaluating critically whether the number of upper and lower beaks differs in diet samples collected from a major cephalopod predator, the wandering albatross (*Diomedea exulans*), potential biases in the estimation of predator diets are assessed, and upper:lower beak ratios in published studies of other seabirds, seals, whales, and fish from around the world reviewed. The ratio of upper to lower beaks in diet samples from predators varied greatly in a single year, between years, and biases were greater for certain cephalopod species, resulting in underestimation of their relative importance. We will recommend that diet studies MUST consider using a new way of analyzing the diets of Antarctic top predators, using both upper and lower beaks (instead of just using lower beaks), in order to improve the assessment of the contribution of different cephalopods to predator diets, and consequently to be incorporated in assessment/management of Antarctic marine resources in the future.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: How do two key seaweed species respond to glacier retreat in Potter Cove, South Shetland Islands, Antarctica

Forename: Dolores Surname: Deregibus

Authors: Deregibus, Dolores; Zacher, Katharina; Campana, Gabriela Laura; Wiencke, Christian; Quartino, Maria Liliana;

Presentation Allocated: Oral

abstract: The aim of this study is to understand the macroalgal vertical zonation at Potter Cove (Isla 25 de Mayo/ King George Island) in three selected newly ice-free areas. Each area is exposed to a different degree of glacial influence (low: area 1, intermediate: area 2, and high: area 3), and thus a different degree of sedimentation/underwater light penetration. In summer 2010 (January and February) and spring 2011 (November), two key macroalgal species (*Himantothallus grandifolius* and *Palmaria decipiens*) were sampled at 5, 10, 20 and 30 m depth. After collection, photosynthesis – irradiance curves were performed and photosynthetic parameters were calculated. Photosynthetically active radiation (PAR, 400-700 nm) was logged continuously over seven days during spring 2011 and summer 2012 at 0, 5, 10, 20 and 30 meters depth in each area. Subsequently, the daily metabolic carbon balance (DMCB) was determined using the obtained photosynthetic parameters and the underwater PAR data. In areas with high glacial influence the maximal vertical distribution limit of both species was 10 m depth, while in areas with intermediate and low glacial impact, it was 20 and 30 m depth, respectively. PAR values were higher in spring than in summer. For both species, DMCB values were significantly higher in spring compared to summer. In addition, both species DMCB values decreased significantly with increasing depth, and were significantly higher in areas 1 and 2 (low and intermediate glacial influence) compared to area 3 (high glacial effect). The observed vertical distribution in all the studied areas seem to be determined mainly by the spring PAR conditions, as in summer the DMCB values are too low or even negative for both species to explain their survival. Furthermore, vertical zonation of the studied species is positively correlated to the light penetration which decreases as the glacial influence (as production of sediment input) increases. A further increase of sedimentation due to global warming will lead to an elevation of the lower distribution limit of the studied species, probably affecting macroalgal primary productivity in Potter Cove.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Iceberg Alley, East Antarctic Margin: A site of unusually high primary productivity

Forename: Karen Surname: Alley

Authors: Alley, Karen; Dunbar, Robert; Leventer, Amy;

Presentation Allocated: Poster

abstract: A 25-meter jumbo piston core (NBP0101 JPC41) collected from an inner shelf basin in Iceberg Alley, reveals an approximately 2000-year history of unusually high primary productivity. Iceberg Alley, an ~85 km long and 10-20 km wide cross-shelf trough on the MacRobertson Shelf, East Antarctica reaches depths of 850 meters, and is bounded on either side by shallow banks that are lined with grounded icebergs. The sediments are laminated on a mm- to cm-scale throughout and are highly biosiliceous. Microscopic examination of both smear slides and sediment thin sections reveals that the sediments are dominated by the diatom *Corethron pennatum*, a large and lightly silicified species notable for its long and narrow shape; the valves, girdle bands and spines are all exceptionally well-preserved, suggesting rapid sedimentation. Other common species include sea ice-related *Fragilariopsis*, such as *F. curta* and *F. cylindrus*, with lesser contribution from large centrals, such as *Thalassiosira tumida* and *Porosira glacialis*. *Chaetoceros* resting spores, typically associated with large spring blooms and common in other laminated sediments around the Antarctic margin, are surprisingly rare. Terrigenous material also is very rare. Individual laminations appear to represent blooms, and in some cases sub-seasonal events are likely preserved. We speculate that this persistently productive system may result from processes associated with the continuous presence of icebergs and associated meltwater. For example, micronutrients such as iron may be continuously replenished by material derived directly from the ice and by upwelling associated with the freshwater input from iceberg melt.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Interannual changes in deep temperatures over shelf west of Antarctic Peninsula observed by instrumented seals

Forename: Jennifer Surname: Burns

Authors: Burns, Jennifer; Klinck, John; Hofmann, Eileen; Costa, Dan;

Presentation Allocated: Poster

abstract: Conductivity-temperature-depth recorders attached to crabeater (*Lobodon carcinophagus*) and southern elephant seals (*Mirounga leonine*) along the west Antarctic Peninsula (wAP) from 2005 to 2009 provided vertical profiles of temperature and salinity for much of the Bellingshausen Sea and wAP regions. The maximum temperature below 200 m was calculated from each vertical profile and averaged over 5-km squares for each month and year. For 2007 to 2009, there were sufficient observations over the southern half of the wAP during fall and winter to estimate the frequency at which the monthly-averaged temperature exceeded 1.7°C, which indicates a recent intrusion of Circumpolar Deep Water (CDW). For all three years, maximum temperatures above 1.7°C occurred most frequently in July (28%, 14% and 18% for years 2007, 2008, 2009, respectively). For the sampled regions during other winter months, the frequency of temperatures above 1.7°C was less than 10% in 2008 and 15 to 20% in 2007 and 2009. Overall, 2007 had the highest average subsurface temperatures. Similar interannual temperature variations were observed for the entire wAP shelf and the Bellingshausen Sea regions sampled by the seals. The interannual variations in subsurface temperature imply different rates of shelf-ocean exchange.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Latitudinal fluctuations in density and biomass of heterotrophic bacterioplankton from Antarctic Peninsula to Argentine shelf waters

Forename: Claudio Atilio Surname: Franzosi

Authors: Franzosi, Claudio Atilio; Lara, Rubén; Kattner, Gerhard; Alder, Viviana Andrea;

Presentation Allocated: Poster

abstract: This study describes the changes in density and biomass of heterotrophic bacteria along a latitudinal gradient as related to different biogeochemical variables (dissolved organic carbon and nitrogen, ammonia, nitrite, nitrate, phosphate), total chlorophyll, and the density of heterotrophic nanoflagellates. The analysis was based on sub-surface samples (9m depth) collected during the end of summer – beginning of autumn 2005 at 38 oceanographic stations established between Antarctic Peninsula and the Argentine shelf (38°-68° S). Bacterioplanktonic density and biomass correlated positively with each other and with DOC and temperature, while negatively with phosphate and the dissolved inorganic nitrogen species. In addition, positive correlations were found for biomass vs. DON and chlorophyll, and for density vs. heterotrophic nanoflagellate biomass. Mean abundance values recorded in waters off Antarctic Peninsula (5.8×10^5 cells mL⁻¹; 14 µgC L⁻¹) were quite similar to those of the Drake Passage (4.4×10^5 cells mL⁻¹; 11 µgC L⁻¹). These two regions, instead, showed values significantly lower than those estimated for the subantarctic waters of the Argentine shelf (1.6×10^6 cells mL⁻¹; 32 µgC L⁻¹). The results obtained suggest that the density of heterotrophic bacteria within the latter region is controlled by nitrogen concentration in its northern sector and by consumption by nanoflagellates in its middle part.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Life history of short-lived euphausiids; potential indicators of changing Southern Ocean ecosystems

Forename: Ryan M. Surname: Driscoll

Authors: Driscoll, Ryan M.; Reiss, Christian S.; Hentschel, Brian T.;

Presentation Allocated: Oral

abstract: Changes in the zooplankton community structure in the Southern Ocean owing to climate change are still poorly understood. If the abundance of *Euphausia superba* continues to decline, other highly abundant but smaller euphausiids like *Thysanoessa macrura* might become more important and alter trophic pathways in the West Antarctic Peninsula region. Here we report on the size structure and energetics of *T. macrura* from 19 years of samples collected as part of the US AMLR Program. We infer growth and recruitment and examine temporal variability in the size- and abundance-at age, and correlate them with potential environmental and climatic drivers. Post-larval *T. macrura* ranged from 10 to 30 mm in length, but the vast majority of the population sampled was <20mm. Based on these findings, correlations between *T. macrura* abundance from survey data and environmental and climate forcing might represent relationships only for year-1 recruits, and not for the overall *T. macrura* population. Energetic calculations applied to these data suggest that *T. macrura* could represent a major energetic shunt in this system. The population dynamics of species such as *T. macrura* is critical to projecting the impacts of climate change on the pelagic ecosystem in the Antarctic Peninsula area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Measuring whole-of-ecosystem change in the Southern Ocean: progress of ICED's Southern Ocean Sentinel to establish standard methods and an internationally integrated program to benchmark the circumpolar pelagic ecosystems

Forename: Andrew J. Surname: Constable

Authors: Constable, Andrew J.;

Presentation Allocated: Oral

abstract: The Southern Ocean Sentinel is an ICED project to develop an internationally integrated program to estimate climate change impacts on Southern Ocean ecosystems. Impacts on the physical environment of changing atmospheric carbon and ozone are expected to differ between regions in the Southern Ocean. With studies synchronised between regions, this provides an opportunity to test hypotheses about direct and indirect ecosystem responses to changing physical habitats. The Sentinel aims to build on the experience of the WOCE, GLOBEC, and the IPY to facilitate simultaneous benchmarking of the regional ecosystems in order to standardise regional measurements in a circum-polar assessment of ecosystem change. A second workshop in May 2012 will consider three aspects of the Sentinel. First, it will further develop standardised methods for measuring different components of the ecosystem. An internationally coordinated work program will also be determined for trialling the methods across multiple platforms and for determining how to analyse and assess status of the marine ecosystems on the basis of those data. Second, the workshop will consider the design of a collaborative, standardised, multinational program to measure oceanographic and biological parameters (protists, zooplankton, krill, fish, squid) along transects intended to characterise the background state of the Southern Ocean along with the ecosystem properties of the major gyres, frontal systems and shelf and plateau areas. Land-based and at-sea measurements of foraging locations of marine mammals and birds will complete the picture. Analyses required to determine number and placement of transects will be discussed, along with a timetable for completing a full proposal for implementation of the field program. Third, the workshop will consider how to use the data and models to assess and forecast future changes in these ecosystems. In this talk, I will summarise the outcomes of the workshop and elaborate the agreed work program to benchmark the status of Southern Ocean ecosystems with a coordinated circumpolar experiment in a single year and to establish, in conjunction with the Southern Ocean Observing System, routine locations and times for estimating regional and local-scale ecosystem change. I will also discuss how collaborations have been initiated between ICED scientists and scientists outside the Antarctic to explore changing ecosystems at both poles and in the Earth System context.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Population dynamics of *Salpa thompsoni* near the Antarctic Peninsula: growth rates and interannual variations in reproductive activity (1993-2009)

Forename: Valerie Surname: Loeb

Authors: Loeb, Valerie; Santora, Jarrod;

Presentation Allocated: Oral

abstract: The salp *Salpa thompsoni* has exhibited increased abundance in high latitude portions of the Southern Ocean in recent decades and is now frequently the numerically dominant zooplankton taxon in the Antarctic Peninsula region. The abundance increase of this species in high latitude waters is believed related to ocean warming. Due to its continuous filter feeding and production of dense rapidly sinking fecal pellets *S. thompsoni* is considered to be an important link in the export of particulate carbon from the surface waters. Hence basic information on the life history of this component of the Antarctic marine ecosystem is essential for assessing its impact given continued climate warming. Here we cover various aspects of the life history of *S. thompsoni* collected in the north Antarctic Peninsula during annual austral summer surveys of the U.S. Antarctic Marine Living Resources (AMLR) Program between 1993 and 2009. We focus on interannual variations in the size composition and abundance of the aggregate (sexual) and solitary (asexual) stages. This information is valuable for refining components of Southern Ocean food web models that explicitly deal with size-structured and life history information on zooplankton. Intraseasonal changes in length-frequency distribution of both stages are used to estimate their growth rates. These average 0.40 mm day⁻¹ for aggregates and 0.23 mm day⁻¹ for solitaries; together these represent ~ 7 week and ~7.5 month generation times, respectively, and a nine month life cycle (i.e., onset of aggregate production year 1 to aggregate production year 2). Length-frequency distributions each year reflect interannual differences in timing of the initiation and peak reproductive output. Interannual differences in the abundance of total salps and proportions of the overwintering solitary stage are significantly correlated with El Niño Southern Oscillation indices (SOI and Nino3.4) prevailing over the previous two years. Massive salp blooms result from two successive summers of elevated solitary production following a reversal from La Niña to El Niño conditions. These results indicate the role of basin-scale atmospheric-oceanic processes in establishing optimal conditions that support aggregate and solitary stage reproduction, development and growth.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Rediscovering the discovery: Data rescue and analysis of the Discovery investigations (1925-1951)

Forename: Nadine Surname: Johnston

Authors: Johnston, Nadine;

Presentation Allocated: Poster

abstract: The Discovery Investigations (1925-1951) form an unprecedented and unparalleled resource of historical Southern Ocean science data, representing the first programme of sustained oceanographic research and exploration in Antarctica. The investigations, which covered the entire Southern Ocean, yielded a wealth of groundbreaking knowledge and data that has shaped our understanding of this ecosystem, remains a valuable, yet inaccessible, asset for understanding the impacts of current and future climate change. Over time the elements of this special collection have become separated across a range of locations, existing mostly in analogue format. As part of a continuing research effort, the British Antarctic Survey has been involved in digitising and uniting the elements of this collection into a single open access website that will enable the public and research communities to rediscover the Discovery Investigations. Here we present our progress to date, including circumpolar distribution and abundance maps of a number of macro-zooplankton groups (e.g. euphausiids, copepods, amphipods, and pteropods). These provide an historical baseline against which we can assess change in Southern Ocean ecosystems and for the development of models of the major food web components. We also present current efforts to produce scientific outputs required by the international community engaged in Southern Ocean and climate change research, such as bioclimatic envelop models to examine changes in the population dynamics of key species during the last century.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Integrating Climate and Ecosystem Dynamics in the Southern Ocean Programme

Forename: Nadine Surname: Johnston

Authors: Johnston, Nadine;

Presentation Allocated: Poster

abstract: General ICED Programme poster

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Seasonal and latitudinal variability of the food web structure in the Lazarev Sea

Forename: Svenja Surname: Kruse

Authors: Kruse, Svenja; Pakhomov, Evgeny; Hunt, Brian; Bathmann, Ulrich;

Presentation Allocated: Oral

abstract: To assess the impact of ongoing climate change on marine ecosystems, we need to investigate the mechanisms controlling both the magnitude of carbon export and its fate in the mesopelagic zone. Despite studies of the feeding habits of several micronektonic and epipelagic species, substantial gaps in our knowledge on the trophic interactions between species inhabiting the mesopelagic layer exist. Therefore, we studied the seasonal dynamics of the food web structure in the Lazarev Sea by means of stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope measurements of various pelagic ecosystem components during summer, fall and winter between 2004 and 2006. Epi- and mesopelagic samples were collected between 51° and 70°S covering an area from the Antarctic Polar Front to the Antarctic Coastal Current. We investigated stable isotope signature dynamics of the surface particulate organic matter (POM), several copepod, pteropod, euphausiid, amphipod, chaetognath and gelatinous species as well as a variety of common midwater fish. To highlight the relevance of seasonal differences in the energy flow through lower trophic levels of the pelagic ecosystem, trophic positions of all species as well as the food chain length were assessed in different geographical regions and seasons. The $\delta^{13}\text{C}$ signatures at the base of the food web showed a significant spatial (latitudinal) and temporal (seasonal) variation possibly reflecting different (alternative) trophic pathways. Summer isotopic $\delta^{13}\text{C}$ signatures of consumers appear to reflect the pelagic sources expressed as surface POM, whereas in winter, the food web likely relied on a different food source. The drivers of the winter food web as well as the variation in the length of food chains are discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Studying whales to understand ecosystems and change; The Southern Ocean Research Partnership

Forename: Nick Surname: Gales

Authors: Gales, Nick;

Presentation Allocated: Poster

abstract: Whales were once the dominant predator, in terms of consumption of krill, of Southern Ocean ecosystems. Their near extirpation had unknown direct and indirect ecological consequences which have been the subject of substantial speculation and hypotheses. While the management and regulation of whaling was poor, the records of industrial scale whaling activity remain, and have the potential to provide an insight into, a key baseline of the nature of the Southern Ocean ecosystem in the early 20th Century. Contemporary science that aims to determine the primary drivers of ecological change in the Southern Ocean has the substantial challenge of disentangling the complex influences of climate change from the top-down effects of the variable scales of recovery of whales and other previously-exploited predators. For a complex range of reasons, not least of which is that whales are highly migratory and have a wholly pelagic habit, the study of whales and their interactions with their environment has lagged behind progress made for other Southern Ocean predators, which can be accessed at colonies on land. The Southern Ocean Research Partnership (SORP) is a collaboration of IWC members to undertake a suite of core, circumpolar research projects that use non-lethal whale research to provide insights into the recovery of whales and their relationship, at a range of scales, with their environment. Combined with analyses of historic data, these projects have the potential to provide unique insights into near-Century ecological change in the Southern Ocean, the longest time-series of circum-polar observations on abundance available for any biota in the region. The SORP projects will be presented in the context of its relevance to the objectives of ICED, as well as to broader objectives relevant to the understanding and maintenance of resilient Southern Ocean ecosystems.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: The fate of biological hot spots in a changing climate

Forename: Andrea Surname: Piñones

Authors: Piñones, Andrea; Hofmann, Eileen; Dinniman, Michael;

Presentation Allocated: Oral

abstract: Localized regions of the western Antarctic Peninsula (wAP) continental shelf, which are characterized by sustained biological production, support large numbers of marine mammals and other higher trophic level predators. Lagrangian tracking experiments showed that the circulation of the wAP continental shelf is a key factor in developing and maintaining these localized biological hot spots. Projected climate-related changes for the wAP region include stronger westerlies and strengthening of the Antarctic Circumpolar Current (ACC), both of which will affect the circulation over the continental shelf. The consequences of these changes for the distribution of biological hot spot regions were investigated with Lagrangian particle tracking simulations that used circulation and sea ice distributions obtained from a high-resolution version of the Regional Ocean Modeling System, coupled with a sea ice model, configured for the wAP region for current conditions and with simple increases in the winds and ACC transport. The simulated particle transport pathways and particle residence times provided measures of the effect of changes in forcing relative to current conditions. Simulations using the increased winds and ACC strength showed increased advection of particles (20-40% more) onto the wAP continental shelf that were supported by inputs from regions along Marguerite Trough from a common transport pathway that is cyclonic around Marguerite Bay. The stronger winds and ACC favor particle aggregation in regions of the wAP shelf which are different from current hot spot regions, such as areas to the southwest off Alexander and Charcot Islands. The current hot spot area off Crystal Sound was enhanced by increased winds and ACC strength, with particle aggregation increasing by 15-20%. Areas along Marguerite Trough and current hot spot areas in Laubeuf Fjord and the mid and outer shelf off Renaud Island showed decreased (15%) particle aggregation with the flow obtained using increased winds and ACC strength. The simulated particle trajectories showed that the areas with the largest sea ice reduction were the same as those that provided inputs to the present biological hot spot regions. These results have implications for top predator distributions, and suggest that present predator distributions on the wAP continental shelf may be restructured under projected future environmental conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: The Role of Continental Margins in Creating Top Predator Hot Spots

Forename: Daniel Surname: Costa

Authors: Costa, Daniel;

Presentation Allocated: Oral

abstract: The Antarctic continental margins play a critical role in the oceanography of the Southern Ocean. Physical processes unique to the region include ocean interactions with the Antarctic ice sheet, dense water formation on the continental shelves, and sea ice production in coastal polynyas. Upwelling at the shelf break provides warm nutrient rich water that fuels primary production on the continental shelf, contributing to a rich ecosystem. In the Western Antarctic Peninsula intrusions of upper Circumpolar Deep Water bring both nutrients and heat onto the continental shelf, which result in regions of high productivity with abundant krill and associated top predators. Field observations using conventional approaches (ship surveys and moorings) and animal tracking show that regions where UCDW upwells onto the continental shelf are associated with troughs in the continental shelf. These are regions where predator hot spots occur. The occurrence of these incursions of UCDW is associated with wind patterns that vary with climate.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: The spatial-temporal distribution of fishing ground for Antarctic krill fishery around the South Orkney Islands and its relations to environmental factors based on generalized additive model

Forename: Guoping Surname: ZHU

Authors: ZHU, Guoping; ZHU, Xiaoyang; XIA, Hui; LI, Yingchun; XU, Pengxiang;

Presentation Allocated: Poster

abstract: The present study analyzed the spatial-temporal distribution of Antarctic krill (*Euphausia superba*) fishery in the South Orkney Islands during 2009/2010 season and 2010/2011 season using the generalized additive model (GAM) based on the data collected from the large-scale trawlers that implemented the Exploitation and Utilization on Marine Living Resource in the Antarctic Waters Programme, Ministry of Agriculture of China, the relationship between the spatial-temporal distribution of Antarctic krill fishery and environmental factors (sea surface temperature (SST) and sea state) are also be analyzed. The results showed that the rate of deviance explained about CPUE (catch per unit effort) is 41.78 %, the factor that provides the largest contribution is month and the contribution rate is 15.53 %. Significant difference can be found for the distribution pattern on CPUE in different months. The average CPUE value is the lowest in January and is the highest in April; significant difference can also be occurred in average CPUE value among months. The main fishing ground is concentrated in $60^{\circ}12'6''$ to $60^{\circ}30'S$, $45^{\circ}30'W$ to $47^{\circ}30'W$ for the Antarctic krill fishing ground in the South Orkney Islands. The suitable SST range is 0.1 to 1.8 and the most suitable range of SST is 0.5 to 1.5 . The average CPUE values have remarkably difference among sea states and vessels. The results of stepwise GAM show that the relative importance of the six variables affecting CPUE of Antarctic krill fishery in the South Orkney Islands can be described as the following order: month, vessel, longitude, SST, latitude, and sea state.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Trophic ecology of seven Antarctic gorgonians through stable isotope analysis and biochemical balance

Forename: Francyne Surname: Elias-Piera

Authors: Elias-Piera, Francyne; Rossi, Sergio; Gili, Josep-María; Orejas, Covadonga;

Presentation Allocated: Oral

abstract: A large part of Antarctic shelf communities consist of sessile suspension feeders, which play a key role in the biogeochemical cycles and are linked to the pelagic productivity. Gorgonians are the second most dominant macrobenthic taxon in abundance in the Weddell Sea, but there have been very few studies on their basic ecology including its trophic ecology. Studies of food web structure are complex but stable isotope analysis and the biochemical levels (i.e. lipid-protein-carbohydrate balance) may give some cues of its role in the benthic-pelagic coupling processes and its trophic strategies. The trophic ecology of seven gorgonian species (*Primnoisis* sp, *Faniella nodosa*, *Ainigmadilon antarcticus*, *Notisis* sp, *Primnoella* sp, *Dasystinella* sp and *Thouarella* sp) in two contrasting areas (Antarctic Peninsula and Eastern Weddell Sea) in autumn conditions was studied to understand the energetic guilds linked to the feeding and energy storage, which may be part of the explanation of the reproductive traits of these gorgonians. All the seven species showed a small range in $\delta^{13}\text{C}$ values, from about -27.7‰ to -24.8‰ . The range in $\delta^{15}\text{N}$ was slightly larger, from 4.1‰ to 7.5‰ . The lower average of protein was 158.7 ± 76.9 $\mu\text{gProteins mg-1OM}$, and the higher, 556.3 ± 78.6 $\mu\text{gP mg-1OM}$. The carbohydrate average ranged from 10.5 ± 3.4 $\mu\text{gCarbohydrates mg-1OM}$ to 80.7 ± 28.7 $\mu\text{gC mg-1OM}$, and the lipid values ranged from 105.1 ± 99 $\mu\text{gLipids mg-1OM}$ to 776.4 ± 354.1 $\mu\text{gC mg-1OM}$. The results of the stable isotope data of the seven gorgonians fit very well with phytodetritus found in green carpets in autumn and is in line with previous one in polar or deep sea areas. This means that an important part of the diet is based on sinking or resuspended material, which confirms the previous hypothesis that part of the suspension feeders survive because of the fuelling through this phytoplankton material. Whilst stable isotope analysis indicates similar feeding strategies in these seven gorgonian species, the biochemical balance indicates a very different energy storage and metabolism strategies among species. Lipids reflect the capability of a species to integrate environmental constraints even in very short distances. It has been shown that in autumn, potentially resuspendable sediments may be different in the lipid contents (food availability in form of senescent or died phytoplankton) in the eastern Weddell Sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Ultraviolet-radiation absorption by microbiota and transfer through sea ice during austral spring

Forename: Eric Surname: Wirthlin

Authors: Wirthlin, Eric; Fritsen, Christian; Memmott, Jeramie;

Presentation Allocated: Poster

abstract: Seasonal reduction of stratospheric ozone in the Southern Hemisphere allows a greater flux of ultraviolet radiation (UVR) to the surface of the Earth. Sea ice coverage of the Southern Ocean is present during this enhanced UVR flux. The sea ice may mitigate the potential harmful effects of UVR on organisms in the upper ocean by intercepting UVR. These organisms – through ecological interactions – rely on productivity of microbial communities within the sea ice itself. These microbial communities may be affected by enhanced UVR and, therefore, affect the greater Antarctic ecosystem. During the IceBELL cruise on the James Clark Ross (1) fluxes and radiative transfer of UVR and photosynthetically available radiation (PAR) through sea ice and (2) the light absorption properties of sea ice microbiota were documented in the austral spring. Ultra-violet radiation transfer through the snow and ice habitat was greatly attenuated, with typically less than 1% of incident UV radiation penetrating through the snow and ice. Photosynthetically available radiation was most strongly attenuated at wavelengths attributable to algal pigments (400 to 550 nm and at 680 nm). Chlorophyll a concentrations were between 0.1 and 560 $\mu\text{g}\cdot\text{L}^{-1}$ with high concentrations ($>10 \mu\text{g}\cdot\text{L}^{-1}$) throughout the depths of sea ice. Absorption of radiation by microbiota was maximal in the UVR region of the spectra, near 330 nm. These absorption features were typically orders of magnitude greater than absorption peaks attributable to pigments (e.g. Chla absorption peaks at 448 and 667 nm). Absorption of radiation by microbiota was greatest in the UV region and resembled absorption properties of mycosporine-like amino acids (MAAs). Ratios of absorption at 330nm:670 nm indicate less MAA production in ice habitats exposed to less radiation. Findings are consistent with previous results that indicate in situ photo-adaptation and growth of sea ice microbiota throughout the dynamic sea ice cover in spring. These results, combined with other seasonal studies, demonstrate Antarctic sea ice microbiota respond to enhanced UVR within a variety of sea ice habitats. This response appears to occur on a wide, ecosystem scale (in both the Bellingshausen and Weddell seas). The effects of enhanced UVR on the Antarctic marine ecosystem may partially be mitigated by sea ice and snow - yet the inhabitants of sea ice are affected. The overall effect on the ecosystem remains unknown.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 10

Title: Variable diatom preservation in N.B. Palmer core NBP01-01 24

Forename: Jonathan Surname: Warnock

Authors: Warnock, Jonathan;

Presentation Allocated: Oral

abstract: Fossil diatoms are utilized as biostratigraphic indicators, paleotemperature proxies, and to assess paleoproductivity. However, it is generally unknown how diatom preservation has fluctuated in the past, and how such fluctuations might affect our proxies of past ocean conditions. These uncertainties are particularly significant as we continue to look at past climatic changes in order to predict coming anthropogenic change. A novel, fully quantitative proxy of diatom preservation for southern ocean diatoms has been formulated. Diatoms are grown in the laboratory, and subjected to dissolution. During the dissolution process, cultures are subsampled and analyzed morphologically via SEM. These dissolution-induced morphological changes have been compared to preserved plankton tow and sediment trap material, as well as to the core NBP01-01 24. The core was collected from Prydz Bay in 2001. The core is composed of massive, bioturbated, and laminated diatomites above a diamict. Data show variability in diatom preservation through the core, associated with sedimentological and ecological changes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Antarctic Eocene loon (Gaviiformes): last refuge of survivor of a long lineage typically Holarctic?

Forename: Claudia Patricia Surname: Tambussi

Authors: Tambussi, Claudia Patricia; Degrange, Federico Javier; Reguero, Marcelo Alfredo; Marensi, Sergio Adolfo; Santillana, Sergio Néstor;

Presentation Allocated: Poster

abstract: Extant loons (four species of the genus *Gavia*) are footpropelled divers found in North America and northern Eurasia. They breed at northern freshwater sites, but winter along sea coasts in temperate areas. Loons had a more southerly distribution than today, and their fossils have been found in California, Florida, Italy, Austria, Chile and Antarctica. The earliest fossil gaviiform that resembles the highly derived bone of modern loons had been described from the Upper Cretaceous of Chile (Quiriquina Formation) and Antarctica (López de Bertodano Formation). It is likely that both records belong to the same species, *Neogaeornis wetzeli*. A near complete left coracoid (MLP 95-I-10-14) collected in the Cucullaea I Allomember of the marine La Meseta Formation at Seymour (Marambio) Island (Early-Middle Eocene, Ypresian/Lutetian, ~49-52 Ma) can be assigned to a Gaviiformes. The coracoid has a short and robust shaft; the cotyla scapularis is subtriangular and deep; the facies articularis humeralis is flat, oval, and broad; the procoracoid process is broken but the base is very broad; the processus acrocoracoideus is partially broken but it was very well developed; the foramen n. supracoracoidei is inconspicuous; the facies articularis sternalis is broad at the level of the angulus medialis; the impressio m. stercoracoidei is shallow and the sulcus m. supracoracoidei is broad and deep; the impressio lig. acrocoracohumeralis is conspicuous, deep and situated proximad to the facies articularis humeralis. Although this fossil cannot be distinguished in size and morphology from the living taxa (e.g. *Gavia immer*), the features of the only available specimen is insufficient to determine the specific level at the moment. Several mammalian terrestrial groups, mostly small-sized marsupials (e.g. polydolopids) of likely insectivorous to frugivorous habits and larger-sized placental herbivores (litopterns and astrapotheres) are recovered from Cucullaea I Allomember. Co-occurring penguin bones and mammals in the same level indicates complex depositional environments. By the time of deposition of this high productive mammalian locality, a *Nothofagus*-dominated megafauna is associated. The presence of a loon in the Eocene of La Meseta Formation does not contradict this scenario. The fossil presented here constitutes the earliest record of Gaviiformes in the Southern Hemisphere and, also extends the permanence of this Holarctic lineage to the Eocene in the Southern Hemisphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: BIODIVERSITY OF LICHENS ALONG THE TRANSANTARCTIC MOUNTAINS: A SURVEY TO 87°S

Forename: Leopoldo Surname: Sancho

Authors: Sancho, Leopoldo; Perez-Ortega, Sergio; Green, Allan; De los Rios, Asuncion; Vivas, Mercedes; Hogg, Ian;

Presentation Allocated: Poster

abstract: With a total length of about 3,500 km, the Transantarctic Mountains are one of the longer mountain ranges on Earth. The range runs approximately north-south over a latitudinal gradient from about 70 to 87°S. During the 2011 austral summer as part of the Latitudinal Gradient Project (LGP; New Zealand) and with the assistance of the Central Transantarctic Mountain (CTAM) field camp (NSF, USA) we had the opportunity to explore the most southern parts of the Transantarctic Mountains reaching as far south as 87°S. This visit allowed us to complete our studies on the distribution of lichens along these mountains that we started about 10 years ago. Due to the important morphological modifications usually shown in lichen thalli from these extreme environments and due to the abundance of sterile samples, we used a combined approach using standard characters and molecular markers (nuclear ITS) in order to identify the lichen-forming fungi present at the studied localities. In contrast to what we expected, the diversity of lichen-forming fungi did not show a strict decrease pattern along this latitudinal gradient. We found two regions with high biodiversity, one between 70 and 77°S, and the other between 83 and 85°S, both having more than 20 species of lichens. In the intermediate zone, between the Darwin Glacier and the lower part of the Dry Valleys the biodiversity is less with no more than 10 species at each site. Further, the combined approach has allowed us to be able to recognize some cryptic diversity in the area, with some new records and undescribed species. In addition, in the Dry Valleys we have measured the lowest lichen growth rate in the world, as low as 0.0036 mm per year with the lichens having an estimated age of over 5000 years.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Bioregionalisation and evolutionary origins of freshwater Antarctic diatoms

Forename: Wim Surname: Vyverman

Authors: Vyverman, Wim; Verleyen, Elie; Souffreau, Caroline; VandeVijver, Bart; Hodgson, Dominic; Jones, Vivienne; Nedbalova, Linda; Antoniades, Dermot;

Presentation Allocated: Oral

abstract: We investigated biogeographical patterns and variation in species richness of freshwater diatom communities in ice-free regions of Antarctica and islands from the Southern Ocean. Our analyses are based on an extensive limnological survey of 395 freshwater lakes from twelve lake districts located between 70°S and 45°S. Microscopic analysis of surface sediment samples resulted in a taxonomically consistent database containing diatom species abundance and spatial and environmental data. Multivariate analyses revealed a strong bioregionalisation into continental Antarctic, Maritime Antarctic and sub-Antarctic diatom floras. Local and regional diversity and the incidence of endemism scale with latitude and geographic isolation. Compared with limnologically similar lake districts in the Northern Hemisphere, Antarctic diatom floras are strongly disharmonic and are dominated by lineages with a predominantly terrestrial distribution. Furthermore, molecular phylogenies based on the plastid gene *rbcl* and the nuclear 28S rDNA (D1-D3 region) revealed that two cosmopolitan morphospecies (*Pinnularia borealis* and *Hantzschia amphioxys*) both consist of multiple lineages, each including a distinct Antarctic lineage. A molecular clock estimate suggests that the Antarctic *P. borealis* lineage diverged 7.8 (2-15) Ma ago. Despite not being psychrophilic, the Antarctic lineages of *P. borealis* and *H. amphioxys* have a lower optimal growth temperature and upper lethal temperature than most lineages from more temperate regions. Together, this suggests that many presumed cosmopolitan Antarctic diatom species are in fact species complexes, possibly containing Antarctic endemics with low temperature preferences. Analyses of Late Quaternary lake sediment records suggest a long-term stability of local and regional diatom floras, thus providing opportunities for local adaptation and – over long time scales – significant allopatric speciation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: COI beyond barcoding, barcoding beyond COI: phylogeny and metagenetics of the Southern Ocean Deuterostomes

Forename: Agnes Surname: Dettai

Authors: Dettai, Agnes; Debruyne, Regis; Hauteceur, Melyne; Pothier, Joel; Gallut, Cyril; Brouillet, Sophie; Monniot, Françoise; Cruaud, Corinne; Ozouf, Catherine; Duhamel, Guy; Ameziane, Nadia; Lecointre, Guillaume;

Presentation Allocated: Poster

abstract: The Barcode of Life project, through its international collaboration effort and data standardisation and quality, has provided a wealth of new and sometimes unexpected results for the systematics of Southern Ocean animal species. Molecular identification using COI barcodes is very promising in this area, although it requires validation group by group before it can be used routinely for identification. But the usefulness of the barcode marker COI goes beyond molecular identification for some groups, as attested by the multiple publications in the last few years. For teleost fish, when analysed with phylogenetic approaches like maximum parsimony or maximum likelihood, COI also is a good quality mitochondrial phylogenetic marker at infra familial scales. For other groups like ascidians, its value is much less clear, especially in regard to the difficulty of obtaining the data in the first place. We explored the results obtained for teleost fish and ascidians using morphology, mitochondrial COI, and nuclear sequences (18S rDNA and single copy genes). Molecular sequence data allowed the detection of several cryptic species and taxonomic problems, providing a better picture of the Southern Ocean diversity. However the new developments in DNA sequencing using second and third generation sequencers are promising much more than what the classical laboratory techniques currently deliver, provided that some technical hurdles are overcome. Among these hurdles is the reliable obtention of comparable markers for multiple species, and the optimal management of the large volume of sequences generated to get as much specimens as possible per sequencing, while still being able to discriminate among them. We will here describe a new, efficient approach that provides long sequences to complement COI data for both larger, vouchered specimens and planctonic samples.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Divergence in skeletal mass and bone morphology in Antarctic notothenioid fishes

Forename: Joseph T. Surname: Eastman

Authors: Eastman, Joseph T.;

Presentation Allocated: Poster

abstract: Differential use of benthic and water column habitats is the major ecological axis of the notothenioid adaptive radiation, and this is reflected in the divergent buoyancies of various species. As notothenioids lack a swim bladder, buoyancy reflects the proportions and densities of various body tissues, with dense skeletal tissues inordinately influential in determining buoyancy. I obtained dry skeletal masses and examined gross and microscopic anatomy of 21 species from 6 of 8 notothenioid families, and analyzed the data in a phylogenetic context. The skeleton is lighter in notothenioids (1.1–3.4% of body mass) than in non-notothenioids (3.7–4.7%). Phyletically basal *Bovichtus* has the heaviest skeleton (3.4%) and skeletons with reduced bone mass characterize *Eleginops* (1.9%), the non-Antarctic sister group of the Antarctic clade, and all other Antarctic notothenioids (1.1–2.5%). Thus a light skeleton predates habitation and radiation of notothenioids in Antarctic waters. Within the five Antarctic families, skeletal mass is interspecifically variable and tracks buoyancy. Skeletal mass scales near isometry ($b = 0.98$) with body weight for the entire sample of 54 specimens from 21 species. When only the largest specimen of each species is analyzed, negative allometry ($b = 0.93$) is indicated, attributable at least in part to slowing of skeletal growth with maturity. Skeletal masses reflect known buoyancies in that the most benthic and pelagic taxa are outside the 95% CI for the slope of the power function of the regression of skeletal mass on body mass. Benthic *Bovichtus*, *Pogonophryne* and *Notothenia* with heavy skeletons are scattered above the regression line whereas and pelagic *Pagothenia* and *channichthyids* with light skeletons are below the line. There is considerable morphological disparity in skeletal gross and microscopic anatomy and this is illustrated with light micrographs, radiographs and CT scans. The skeleton of *Bovichtus* consists of well-ossified compact bone—the phyletically basal condition in notothenioids. In other notothenioids, however, bone is spongy and large areas of cartilage persist throughout life, especially in *channichthyids* where “bones” of the skull and fin girdles consist of hyaline cartilage with a thin covering of bone. Thus evolutionary alterations in density and buoyancy among notothenioids are achieved in part through static mechanisms including reduced skeletal ossification and persistence of cartilage.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Divergence time estimations and contrasting patterns of genetic diversity between Antarctic and southern South America benthic invertebrates

Forename: Claudio A Surname: Gonzalez Wevar

Authors: Gonzalez Wevar, Claudio A; Díaz, Angie D; Gérard, Karin; Poulin, Elie; Maturana, Claudia;

Presentation Allocated: Oral

abstract: Diversity, abundance and composition of taxonomic groups in the Southern Ocean differs from elsewhere in the planet since the biogeography in this region reflects the complex interactions of tectonics, oceanography, climate and biological elements since the Eocene. Several groups of marine benthic organisms exhibit high levels of genetic differentiation among Provinces in this region, supporting the existence of vicariant process through plate tectonics while other groups with high dispersive capacity exhibit more recent divergence processes. Moreover, the discovery of non-Antarctic decapod larvae in Antarctic Peninsula suggests that some groups can travel across the Antarctic Circumpolar Current. Here, we analyzed levels of genetic divergence in congeneric species of three Southern Ocean's benthic invertebrate groups with dispersive potential. For this purpose, we included in the analyses COI sequences of an echinoid (*Sterechinus*), a gastropod (*Nacella*), and a bivalve (*Yoldia*). Considering the levels of genetic differentiation and assuming the Molecular Clock Hypothesis we estimated the separation of invertebrates from both continents. We also compared levels of genetic variation between Antarctic and sub-Antarctic species of *Nacella* and *Sterechinus* to determine the effect of the Quaternary glacial episodes in the demography of these groups. We found marked genetic differences between Antarctic and sub-Antarctic congeneric species of *Sterechinus*, *Nacella*, and *Yoldia*. According to our results, the installation of an effective barrier between these Antarctic and sub-Antarctic genera occurred almost at the same time (between 3.7 and 5.0 Ma), long after the physical separation of both continents. Genetic comparisons between species of *Nacella* and *Sterechinus* showed lower levels of genetic diversity in Antarctic groups suggesting a more pronounced effects of the glacial episodes in Antarctica than in southern South America. These results could reflect the dramatic effect of the Quaternary glacial cycles on Antarctic populations sizes, especially in groups with narrow bathymetric ranges. The present study provides new evidence about the differentiation processes between Antarctic and South America organisms. None of the analyzed genera showed evidence for recurrent gene flow across the Antarctic Circumpolar Current since the Mio-Pliocene.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: DIVERSITY TRENDS OF BRYOPHYTES IN CONTINENTAL ANTARCTICA

Forename: Nicoletta Surname: Cannone

Authors: Cannone, Nicoletta; Convey, Peter; Guglielmin, Mauro;

Presentation Allocated: Oral

abstract: Bryophyte distribution data were analyzed to identify diversity and biogeographic patterns at local, intra-regional, regional and continental scale in the context of bryophyte biogeography across Antarctica. The study area is located in the Ross Sector (continental Antarctica), and includes 63 sites along a latitudinal transect from the Transantarctic Mountains (84°S) to northern Victoria Land (70°S). Distribution data of bryophyte species were obtained from recent field surveys, the Antarctic Plant Database and existing literature. Data analyses included rarefaction, hierarchical classification, multivariate analyses, assessment of richness trends by latitude bands, and use of the Jaccard similarity index. Despite an almost linear climatic gradient, bryophyte diversity in the Ross Sector was not influenced by latitude. At intra-regional scale, site location in the coast or slope biogeographic province was the most effective predictor of bryophyte diversity. A bimodal diversity pattern was found in both provinces, with clustering in northern and southern sites based on site floristic composition. At continental scale, the Ross Sector includes the highest diversity among the geographic sectors of continental Antarctica. Bryophyte diversity is different depending on the scale of analysis. At local scale, diversity “hot spots” appear to be related to favourable local microclimatic conditions. At intra-regional scale, the site clustering within each province is consistent with precipitation, and with the biogeographical separation of two sub-regions due to important dispersal barriers, a pattern consistent with that reported in the regional microarthropod fauna. Diversity peaks may also be related to longer duration of surface exposure and survival in refugial locations. At continental scale, the patterns of bryophyte diversity among sectors suggest a continent-Antarctic Peninsula separation, previously observed in most terrestrial fauna (the Gressitt Line) and here now detected also for vegetation, suggesting a common evolutionary history. The high similarities of the floras of adjacent continental sectors suggest a potential route for bryophyte dispersal along the coast of continental Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Foraminifera from the Polonez Cove Formation (Oligocene) of King George Island, West Antarctica

Forename: Andrzej Surname: Gaździcki

Authors: Gaździcki, Andrzej; Majewski, Wojciech;

Presentation Allocated: Poster

abstract: A pervasive set of narrow fractures trace the grounding line of the Kamb Ice Stream in West Antarctica. These features, called tidal cracks or strand cracks in other locations, are more common at the grounding line of the currently stagnant Kamb Ice Stream than at the outlet of the adjacent, fast flowing, Whillans Ice Stream. At least some propagation events appear to be audible and a subset of audible events are accompanied by settling of near-surface firn. An array of three geophones and 77 continuous GPS receivers was deployed across the grounding line of the Kamb Ice Stream in order to observe these events. GPS data sampling rate was 4Hz; geophone data sampling rate was 250Hz. This data was recorded over the course of seven days, from November 27, 2007 to December 3, 2007. Surface expression of fractures around the study area was mapped at the same time. Fracture propagation events recorded in the geophone data are correlated with tidal displacement of the floating ice. Analysis of the frequency and amplitude of fracture propagation events shows that both are largest during the falling tide, a time when horizontal displacements indicate stretching at the surface. We speculate that bending as the tide falls generates compressive stresses at depth which promote vertical propagation of the fractures.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: FUNCTIONAL IMPLICATIONS OF A SINGULAR PENGUIN SCAPULA (AVES, SPHENISCIFORMES) FROM THE EOCENE OF ANTARCTICA

Forename: Carolina Surname: Acosta Hospitalec

Authors: Acosta Hospitaleche, Carolina; Di Carlo, Ulises; Reguero, Marcelo;

Presentation Allocated: Poster

abstract: Penguins have peculiar modifications in their skeletal anatomy as a consequence of their extreme specialized diving habit. The forelimb is probably one of the structures where morphological changes are more evident. However, the kinematics of the pectoral girdle appears to be a central point in the locomotion of penguins. The scapulae of penguins show an unusual morphology among birds. In all penguins, the scapula is very large, especially concerning its width. The recent finding of a partially complete scapula with a morphologically singular acromion in the Antarctic Peninsula (Antarctica), has motivated the present work. It comes from the Late Eocene Submeseta Allomember of the La Meseta Formation. The main anatomical features and their functional implications are here discussed. Osteological comparisons and muscular dissections of living penguins show that the most striking feature is the curvature of the acromion, and the consequent enlargement of the facies articularis clavicularis. The preserved portion of the scapula allows the reconstruction of a corpus scapula proportionally narrower than those of modern penguins. This would reflect a lack of functional optimization in terms of the resistance to forces transversal to the body axis. Its general morphology suggests that this scapula would belong to a medium- to large-sized penguin species with limited diving skills.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Global transcriptome sequencing and comparative analysis of three Antarctic notothenioid fishes

Forename: Seung Chul Surname: Shin

Authors: Shin, Seung Chul; Ahn, Do Hwan; Kim, Min Gyu; Lee, Jong Kyu; Lee, Hyoungseok; Kim, Su Jin; Park, Hyun;

Presentation Allocated: Poster

abstract: Over the past 10 – 13 million years, the Antarctic notothenioid fish have undergone extraordinary periods of evolution and adapted to a cold and highly oxygenated Antarctic marine environment. While these species are considered an attractive model in which to study physiology and evolutionary adaptation, they are poorly characterized at the molecular level and sequence information is lacking. The transcriptomes of the Antarctic fishes *Notothenia coriiceps*, *Champscephalus aceratus*, and *Pleuragramma antarcticum* were first obtained by 454 FLX Titanium sequencing of a normalized cDNA library. Over 1,900,000 reads were assembled in a total of 71,539 contigs. Overall, 40% of the contigs were annotated based on similarity to known protein or nucleotide sequences, and over 50% of the predicted transcripts were validated as full-length or putative full-length cDNAs. Our parallel transcriptome profiling study of Antarctic notothenioid fish provide information on the variation of evolution and speciation in organisms that live at permanently cold temperatures. Supported by Functional Genomics on Polar Organisms grant to H. P. funded by Korea Polar Research Institute.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Holocene paleolimnological changes in the Soya Kaigan of Syowa Station area inferred from the analyses of lake sediment cores in Antarctica

Forename: Genki I. Surname: Matsumoto

Authors: Matsumoto, Genki I.; Honda, Eisuke; Tani, Yukinori; Seto, Koji; Kashima, Kaoru; Watanabe, Takahiro; Nakamura, Toshio; Ohtani, Shuji; Imura, Satoshi; Ito, Keisuke; Ikuta, Shigeru; Takemura, Tetsuo;

Presentation Allocated: Poster

abstract: Studies on paleolimnological and paleoenvironmental changes are important to estimate the possible influence of future global warming induced by human activity. Here we studied Holocene paleolimnological changes inferred from biomarkers and microscopic observation of microalgae and cyanobacteria in sediment cores from Lakes Oyako-ike (Ok4C-01, core length 135 cm) and Maruwanminami-ike (MwS4C-01, core length 147 cm) in the Soya Kaigan, along with sedimentary facies and ^{14}C dating by a Tandetron accelerator mass spectrometry. The Ok4C-01 core was composed of clayish mud containing laminae between 135-75 cm. This was overlain by organic sediments containing algal mats between 60-0 cm. The mean sedimentation rate and uplifting rate were estimated to be 0.72 mm/y and 5.0 mm/y, respectively. The low biological production with diatom in coastal marine environments (135-75 cm, 2,200-1,300 cal BP), changes into green sulfur bacteria and Cryptophyta in stratified saline lake at 75 cm (ca.1,300 cal BP), and then high biological production with cyanobacteria and green algae in lacustrine environments (60-0 cm, 1,100-300 cal BP). The ongoing retreat of glaciers and ongoing isostatic uplift during the mid-Holocene Hypsithermal (4.5-2.8 cal ka BP) and thereafter are the main reasons for this isolation, whereas eustatic sea level change is believed to have played only a minor role. The MwS4C-01 core was composed of clayish mud containing laminae between 147-65 cm. This was overlain by organic sediments containing algal mats between 65-0 cm. The mean sedimentation rate and uplifting rate were estimated to be 0.78 mm/y and 7.4 mm/y, respectively. The coastal marine period (147-65 cm, 4,800-2,400 cal BP) in Lake Maruwanminami-ike is characterized by low biological production with the predominance of diatoms, while the lacustrine period (65-0 cm, 2,400-1,150 cal BP) is characterized by high biological production with the predominance of cyanobacteria and green algae. The transition zone from a marine inlet to a freshwater lake was characterized by stratified conditions with the presence of green sulfur bacteria at a depth of 67.8 cm in the bottom of photic zone.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Morphology and phylogenetic relationships of the Bangiales (Rhodophyta) from King George Island, Antarctica

Forename: Han-Gu Surname: Choi

Authors: Choi, Han-Gu; Kim, Ji Hee; Hwang, Mi Sook;

Presentation Allocated: Poster

abstract: Members of the Bangiales (Rhodophyta) are distributed worldwide from tropic to Antarctic and Arctic waters. Three species of the Bangiales; *Bangia fuscopurpurea* (as *B. atropurpurea*), *Porphyra plocamiestris* and *Pyropia endiviifolia* (as *Porphyra endiviifolium*), have been reported in the Antarctic. Morphological and molecular data were investigated for the Bangiales from the Antarctic and its adjacent waters. Each six sequences of SSU rDNA, plastid *rbcL* and mitochondrial *cox1* gene were newly determined in this study. Molecular data from over 60 taxa of the Bangiales worldwide including previously published sequences, indicated that the genera *Bangia*, *Dione*, *Pyropia*, *Porphyra*, *Wildemanina* and other related genera be recognized in the Bangiales as in the previous molecular study. *Bangia fuscopurpurea* from the Antarctic was different from *B. fuscopurpurea* from north Pacific (Korea and Japan) by 12 bp in *cox1* gene sequence. *Porphyra plocamiestris* growing on other macroalgae in sub-tidal zone grouped into the genus *Wildemanina* with the species having one or two cell layers in molecular data. *Pyropia endiviifolia* is olive green in color and it allied to a clade with *P. cinnamomea* and *P. virididentata* from New Zealand. The taxonomic issues and phylogenetic relationships of the Antarctic members of the Bangiales will be discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: New perspectives on the origin of the Antarctic marine fauna

Forename: Alistair Surname: Crame

Authors: Crame, Alistair;

Presentation Allocated: Oral

abstract: The fossil record of Seymour Island, Antarctica has established that a major change in benthic marine faunas occurred at 41 Ma, more or less coincident with the onset of global cooling. This was a time when many predatory groups became extinct in Antarctica and so-called retrograde communities comprising crinoids, ophiuroids, brachiopods and other taxa were able to recolonise shelf depths from the deep sea. Nevertheless, further examination of the extensive Seymour Island fossil record is indicating that a number of modern Antarctic benthic taxa are in fact of considerably greater antiquity. This is particularly so of a number of molluscan genera that can now be traced back 50-60 m.y., or even further. Such a finding suggests that seasonality may be an even more important determinant of Antarctic community structure than temperature. There is evidence to suggest that polar marine faunas have always comprised a relatively high proportion of ecological generalists, such as deposit feeders and broad-diet carnivores. Such taxa require relatively large proportions of the available resources to persist and thus, once established, become progressively more difficult to dislodge. The polar regions have been characterised by ecological incumbents throughout the Cenozoic era (i.e. last 65 m.y.).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: New reports on foraminiferal assemblages from Cenozoic of West Antarctica

Forename: Wojciech Surname: Majewski

Authors: Majewski, Wojciech; Gaździcki, Andrzej;

Presentation Allocated: Poster

abstract: Foraminifera are among key microfossils for paleoenvironmental studies and biostratigraphy. Moreover, thorough reconstruction of their fossil record places them among the best groups for understanding evolutionary processes and their relation with changing habitats. Cenozoic evolution of Antarctic ecosystem stands among main developments in Earth's paleoclimatic history. Thus, it must have had a predominant influence on foraminiferal communities, the influence that still calls for full comprehension. Although a considerable effort to reconstruct fossil record of foraminifera was undertaken in the Ross Sea region, our knowledge on their pre-Quaternary communities from West Antarctica is far from satisfactory. Up to recently, Cretaceous-Paleocene foraminifera were described from Seymour Island, while Oligocene planktonic and Miocene benthic foraminiferal assemblages were reported from King George Island, South Shetlands. Miocene-Pliocene, and Pliocene benthic assemblages were also reported from James Ross and Cockburn islands west off Antarctic Peninsula. We are presenting three new foraminiferal finds from Eocene of Seymour Island, Oligocene of King George Island, and Middle Miocene of Weddell Sea, ~150 km east off Joinville Island. At all these locations, calcareous, benthic foraminifera strongly dominate, representing rather shallow-water biota. They are dominated by Globocassidulina, Cibicides, Lobatula, Criboelphidium, and Nonionella; genera that are still prominent among near-shore, shallow-water Antarctic communities. Although the new finds provide only spotty insights, they significantly improve our knowledge of Cenozoic benthic foraminifera from West Antarctica. Thus, they may contribute to better exploitation of this microfossil group in future stratigraphic, paleoenvironmental, and evolutionary studies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Out of Antarctica, into the cold: overlooked diversification of hardy alpine, polar, and temperate lineages around the world

Forename: Gabriela Surname: Iburguchi

Authors: Iburguchi, Gabriela;

Presentation Allocated: Poster

abstract: Until recently, Antarctica was considered to be a long-frozen continent, where the extinction of warm-temperate Gondwana lineages was the general rule. However, evidence of temperate micro and macrofossils dating ~ 3 to 15 MA in age from the Transantarctic Mountains and elsewhere, and a growing body of evidence from genetic, systematic, and biogeographic studies, are revealing that at least some lineages within Antarctica are highly endemic, and that some are surviving ancient relicts. The harsh changing environment and cooling may have promoted in-situ speciation pre-adapted to cold, not only in within Antarctica, but including colonising taxa into other cold regions around the world possibly including the Arctic, the deep ocean, mountains, and other high latitude and temperate habitats. Here, putative examples of Antarctic lineages are examined, ranging from alpine species to seabirds. Antarctica may have directly and indirectly promoted the diversification of the biodiversity in the southern hemisphere and elsewhere, serving as an important evolutionary core until more recently than was previously considered possible.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Paleophytogeography of the South American-Antarctic connection during the Late Cretaceous

Forename: Marcelo Surname: Leppe

Authors: Leppe, Marcelo; Stinnesbeck, Wolfgang; Mihoc, Maritza; Jujihara, Toshiro; Cisterna, Katherine;

Presentation Allocated: Oral

abstract: Is not well known when the forest environments were established in Antarctica, but the evidences says that were continuously present at least since the late Paleozoic. The last trees disappeared from this continent since the late Tertiary. Nevertheless, the structure of these forests, as in other parts of the world, shows substantial evolutionary changes. During the Cretaceous, forests dominated by conifers and pteridophytes existed during the Early Cretaceous and were gradually replaced by angiosperm-dominated forests during the Late Cretaceous. Elements common to these Cretaceous forests in Antarctica are constituents of the modern Valdivian Forest, among them Nothofagaceae, Winteraceae, Lauraceae, Myrtaceae, Eucryphiaceae, Lophosoriaceae, Proteaceae, Cunoniaceae, Lauraceae, Monimiaceae, Cupressaceae, Podocarpaceae, Araucariaceae, Dicksoniaceae and Cyatheaceae. Since the Late Jurassic and until the Turonian stage of the Upper Cretaceous, Patagonia and the Antarctic Peninsula were disconnected by a deep and wide marine basin (or channel) called the Rocas Verdes Basin, generating evident differences in floral composition between both landmasses, being reconnected by land bridges during Turonian. Paleobiogeography tools were applied to palynological and leaf imprints record obtained from 13 locations from Antarctica and Patagonia, twelve of which are known already and one is a new outcrop for the Campanian-Maastrichtian lapse. Our data on potential vicariant events and areas of endemism permit discussion of paleogeographical reconstructions. They indicate that vegetation evolved in the context of environments subject to intense volcanic and climate-disturbance, e.g. one of the warmest periods of the Phanerozoic, but with pulses of cooling during the Campanian and Maastrichtian. We suggest that a continuous forest existed between Patagonia and South America which was shaped, during the latest Cretaceous, by the presence of marine basins and intermittent connection and disconnection of floral assemblages. Also it is postulated the existence of differentiated site conditions between western and eastern side of the hypothetical isthmus connecting South America and Antarctica, with a humid gradient among the west and the east, conditioning the existence of different floras in both sides. Acknowledges to Fondecyt and BMBF for the research grants 11080223 (2009-2011) and CHL 10A/09, respectively.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Patterns of genetic diversity and connectivity around the Antarctic continent in the regular sea urchin *Sterechinus neumayeri*

Forename: Angie Surname: Diaz

Authors: Diaz, Angie; Chenuil, Anne; Feral, Jean-Pierre; David, Bruno; Saucède, Thomas; Gerard, Karin; Poulin, Elie;

Presentation Allocated: Poster

abstract: The echinoderms are a very important group of the Antarctic marine benthic fauna, among them *Sterechinus neumayeri* is the most abundant species of sea urchin on its coasts and a very important component of the Southern Ocean. Nevertheless, information is still lacking to understand the distribution and patterns of genetic diversity of *S. neumayeri* around the Antarctic continent. The genetic tools open new routes to better know the evolutionary history of the species and the processes that govern their diversity and distribution. This study aims to understand the genetic diversity pattern of *S. neumayeri* species around Antarctica from the amplification of the mitochondrial gene COI and several microsatellites. From six samples groups located around Antarctica, the results show that it exists an important connectivity among all sites, no genetic structure and low levels of diversity

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Phylogeny and population history of marine bivalves in the Scotia Sea: patterns and processes

Forename: Jennifer Surname: Jackson

Authors: Jackson, Jennifer; Griffiths, Huw; Whittle, Rowan; Linse, Katrin;

Presentation Allocated: Oral

abstract: The population history and distribution of bivalves in the Southern Ocean is strongly shaped by a combination of glacial processes and taxon specific life histories. Here we describe the phylogenetic relationships and population histories of bivalves in the Scotia Sea, focusing on the genera *Limatula* (file clams *Limidae*), *Philobrya* (*Philobryidae*) and *Adacnarca* (*Philobryidae*) and using multiple nuclear and mitochondrial genetic loci. Within these genera, Mantel tests reveal strong mitochondrial structuring by depth for some species, while others are structured only by distance. Strongly supported polyphyly within all genera, and of *Adacnarca* and *Philobrya* within the philobryids, suggests that morphological species definitions require revision within all groups. Bayesian divergence time reconstructions reveal Tertiary radiations for all genera, and phylogeographic analysis indicates recent dispersal north of the polar front by members of both *Philobrya* and *Limatula*. Preliminary results point to a deep-sea origin for the *Limatula* genus in the Southern Ocean, while the ancestral origins of the *Philobryidae* remain inconclusive. Our data support previous reports of strong local-scale population structure in the Southern Ocean and also highlight the importance of collecting specimens from the poorly known Southern Ocean deep sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Pliocene radiation of *Fragilariopsis* in response to changing Antarctic glacial regime, regional climate and paleoceanographic conditions in the Southern Ocean

Forename: Charlotte Surname: Sjunneskog

Authors: Sjunneskog, Charlotte; Riesselman, Christina; Winter, Diane;

Presentation Allocated: Poster

abstract: The seasonal sea-ice belt is an important feature of the modern Southern Ocean, influencing global ocean circulation and ocean-atmospheric interaction. It is characterized by a well-defined diatom assemblage in which the genus *Fragilariopsis* is a major constituent. This assemblage, with its key species *Fragilariopsis curta*, is commonly used to trace paleo sea-ice extent. Extrapolation of paleo sea-ice conditions becomes challenging beyond the mid-Pleistocene as the sediment diatom assemblage includes an increasing number of extinct species with unknown environmental preferences. Near-continuous sediment records or sequences where extant and extinct species overlap are required to make reasonable paleoenvironmental reconstructions, to assess how diatom species and assemblages change through time, and to determine how these changes reflect an environmental influence. A late Pliocene-early Pleistocene (3.3-1.95 Ma) sequence of the AND-1B drillcore (77.89°S, 167.09°E) preserves a period of cooling following the Pliocene climatic optimum. The diatom assemblage comprises a rich diversity of extinct *Fragilariopsis* morphologies not previously described but with similarities to both extinct and extant taxa. This *Fragilariopsis* complex is short-lived (3.3-2.58 Ma, 3.3-1.95 Ma) and appears after the First Appearance Datum of *F. curta* (4.8 Ma). Its abundance does not correlate to that of *F. curta* or other extant sea-ice associated species in the AND-1B record. The *Fragilariopsis* complex reaches >45% in abundance, while *F. curta* reaches only 20% at its maximum abundance in the AND-1B record. To constrain the environmental significance of this radiation of *Fragilariopsis*, we map its presence at other sites and its co-occurrence with other species in different biostratigraphic periods. The *Fragilariopsis* complex occurs at several coastal sites around the continent. While its abundance does not correlate to the abundances of any extant taxa, it does co-occur with extant species from both the open ocean and sea-ice assemblages. We suggest that the *Fragilariopsis* complex radiated in response to a period of cooling surface water that supported less seasonal sea-ice for shorter duration, and thus represents a fundamentally different sea-ice regime than found in the Southern Ocean today. Sometime between 1.95 and 1.6 Ma, this assemblage was replaced by an assemblage more similar to, but still distinct from, the late Pleistocene/Holocene sea ice diatom assemblage.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: The application of next generation sequencing technology in phylogeny and population genetics: A test case using Southern Ocean brittle stars

Forename: Mark Surname: Harrison

Authors: Harrison, Mark; Sands, Chester; Leese, Florian;

Presentation Allocated: Poster

abstract: A general limitation in molecular evolutionary biology and systematics is that often only one or few genetic markers are employed which may lead to biases as single marker investigations are generally unrepresentative of true organismal evolutionary histories or phylogenies. We are developing a new protocol for generating multiple markers at affordable costs and on a reasonable time-scale. We are achieving this by combining AFLP and cDNA fragment generation methods with standard laboratory enrichment procedures and taking advantage of next generation sequencing techniques. Having a high number of markers will allow (1) combined analyses on different evolutionary levels, i.e. phylogeny and population genetics & (2) high resolution analyses which will help assess systematic relationships and genetic diversity much more robustly. We will be demonstrating this by testing the protocol on two complex problems involving Antarctic brittle stars. Within Antarctic ophiuroids there is a high level of both inter- and intraspecific diversity. Geographic structuring frequently occurs between populations separated by barriers to gene flow such as the polar front or inhabitable sea depths. Interspecific diversity is often not known and the true systematics of many taxa is highly contended due to the suspected existence of cryptic species and morphological plasticity. With the help of our newly developed protocol, geographic structuring within *Ophioplocus incipiens* and the contended systematics of the family 'Ophiuridae' are investigated.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: The complete mitochondrial genome sequences of the Subantarctic talitrid species, *Transorchestia* sp. and the South Korean talitrid species, *Trinorchestia longiramus* (Crustacea: Amphipoda: Talitridae).

Forename: Ye-Seul Surname: Baek

Authors: Baek, Ye-Seul; Kim, Sanghee; Min, Gi-Sik; Choi, Han-Gu;

Presentation Allocated: Poster

abstract: The talitrid amphipods are common in sand beaches, estuarine marshes, shores of lakes and rivers around the world. They are detritivores and preys for birds and other animals, and play an important role in the food chain of ecosystem. Despite of their significance and vast diversity, no complete mitochondrial genome data have been available so far. Mitochondrial genomes contain the most informative sequences and gene arrangement for deeper phylogenetic analyses and they reflect evolutionary relationships and biogeography in the metazoon. In the present study, we describe the mitochondrial genome (mitogenome) sequences of two talitrid species; *Talorchestia* sp. and *Trinorchestia longiramus*. *Talorchestia* sp. was collected in the subantarctic area and *T. longiramus* was collected from the east coastal area in Korea. To analyze the mitogenome of the talitrids, we obtained the sequences of CO1, 12S, 16S, CO3 and Cytb in each talitrid using universal primers published or newly designed in our group and then, amplified the complete mitogenome of using long-PCR and genome walking techniques. As it has been reported that some species in extreme environment show unusual mt genome composition and structure, we attempted to compare mitochondrial genome features of two species inhabiting in the Subantarctic or South Korea. Also, we attempted to solve the ordinal relationships of Amphipoda in Class Malacostraca of Subphylum Crustacea by phylogenetic analysis using sequence data from mitochondrial protein-coding genes. Our result would provide a useful information for studying phylogenetic relationships of talitrid and be helpful in the further crustacean phylogenetic study.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 11

Title: Weddellian land-bridge (West Antarctica/South America): biogeographical implications for Cretaceous/Early Paleogene terrestrial vertebrate distributions

Forename: Marcelo Alfredo Surname: Reguero

Authors: Reguero, Marcelo Alfredo; Marensi, Sergio Alfredo; Santillana, Sergio Néstor;

Presentation Allocated: Poster

abstract: The view that West Antarctica and major Gondwanan continental blocks (South America, Australia, and New Zealand) were still linked by terrestrial connections during the Late Cretaceous and until the beginning of the Paleogene (only West Antarctica with South America), and that terrestrial vertebrates were able to colonize new lands using these physiographical features, is almost certainly correct. The terrestrial vertebrate fauna of the Cucullaea I Allomember (Ypresian-Lutetian) of the La Meseta Formation (Early Eocene/earliest Oligocene?) of Seymour (Marambio) Island, Antarctic Peninsula, suggests that its endemic components (marsupials, monotremes, meridiungulates, gondwanatheres, “enigmatic zalambdodont mammal”, ratite birds, etc.) were the result of several different dispersal and vicariance events associated to these gateways. The initial marsupial dispersal, from South America into and through West Antarctica and towards Australia, must have occurred during the Campanian/Maastrichtian, to allow for the entrance of marsupials into Australia prior to the development of the seaway between West Antarctica and Australia at 64 Ma. The presence of basal stocks of these clades, currently undocumented by fossils, in the Late Cretaceous of South America, West Antarctica and Australia is supported by stratigraphically calibrated phylogenies revealing long ghost lineages that extended into the Late Cretaceous. Antarctic sparnotheriodontids indicate that the minimum divergence time of the sparnotheriodontid clade from other basal litopterns is constrained by Victorlemoinea and thus lies in the Thanetian (Late Paleocene)/Ypresian (Early Eocene), some 4–5 My earlier than the known occurrence of the Seymour Island form (Notiolofofos). We conclude that (1) throughout the Late Cretaceous there was continuous causeway through West Antarctica and associated land bridges between South America and Australia; (2) small- to large-sized, obligate terrestrial forms (e.g., opossum-like marsupials, monotremes, ratite bird) gained broad distribution across these Gondwanan land masses prior to their fragmentation and were isolated on Australia (marsupials) before the end of the Late Cretaceous; (3) based on phylogeny and calibrated stratigraphy of basal litopterns and astrapotheres the Weddellian land bridge could have been functional until the Ypresian (Early Eocene).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: A comprehensive analysis of abiotic stress-induced gene expression reveals novel genes associated stress signaling in *Deschampsia antarctica*, an Antarctic vascular plant

Forename: Jungeun Surname: Lee

Authors: Lee, Jungeun; Noh, Eun Kyeong; Lee, Hyoungseok;

Presentation Allocated: Poster

abstract: *Deschampsia antarctica*, Antarctic hairgrass, is the only natural grass colonized in the Antarctic, the most severe natural habitats in the world especially for terrestrial plants. Because this species has been successfully adapted to extremely harsh environments with wide ecological range, it has been studied in a wide range of biological fields and suggested as a valuable resource for gene discovery associated with stress tolerance. Nevertheless, we still lack of the genetic information of its stress tolerance mechanism especially for stress signaling. Here, we present the results from pysequencing analysis of transcriptomes of *D. antarctica* grown under various stress conditions. We identified 60,765 unigene sets including 28,177 contigs and 32,588 singletons. From this datasets, we provide (1) the information of genetic structure for the transcriptome, (2) numerous candidate polymorphic markers in the dataset, providing possibilities for linking the genomic and the existing genetic information of *D. antarctica*, (3) the sequence information about enzymes involved in carbon fixation process, which might be adapted to extreme environment. Lastly, we identified the novel genes including putative transcription factors which might be a key regulator for the stress signaling cascades, and stress-responsive genes expressed differentially under various stresses through comparative analysis.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: An arctic grass grew in the Antarctic

Forename: Megumu Surname: Tsujimoto

Authors: Tsujimoto, Megumu; Imura, Satoshi; Kanda, Hiroshi;

Presentation Allocated: Poster

abstract: Solar radiation, temperature, and water availability are key environmental factors controlling most processes in Antarctic terrestrial ecosystems. Limited periods of temperature above physiological and biochemical thresholds with available water severely restrict numbers of plant species present on the continental Antarctica. While there had been no previous record of natural occurrence or no evidence of successful introduction of higher plants in the continental Antarctica, an individual flowering plant was found growing at a site near Syowa Station, Antarctica in July 1995. In this study, we examined morphological characteristics as well as the molecular systematic of the grass in order to determine the species which was provisionally assigned to *Poa* cf. *trivialis* L. The results of the morphological and molecular phylogenetic analysis showed the grass to be *Puccinellia svalbardensis* Rønning, an endemic species of Spitzbergen, Svalbard, Norway. The study indicates that an Arctic grass had been introduced into Antarctica where it grew. As possible factors contributing to the introduction of the grass, similarities in environmental conditions including air temperature and possible sunshine duration between Syowa Station in Antarctica near the introduced habitat and Ny-Ålesund, Svalbard in Arctic in the vicinity of the original habitat were considered. The introduced plant flowered for at least 13 years but did not set seeds and was removed in February 2007.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: ANALYSIS OF THE INTERACTION BETWEEN WATER TEMPERATURE, SALINITY AND TROPHIC FLUORIDE ON PLASMA CONSTITUENTS OF ANTARTIC FISH NOTOTHENIA ROSSI ((Richardson,1844)

Forename: Edson Surname: Rodrigues Junior

Authors: Rodrigues Junior, Edson; Oliveira Feijo, Mariana; gannabathula, Sree Vani; Suda, Cecilia; Carvalho, Cleonice; Donatti, Lucelia; Passeri Lavrado, Helena; Rodrigues, Edson;

Presentation Allocated: Oral

abstract: The adaptive evolution of the Antarctic fish *Notothenia rossii* occurred under selective pressure of stable and low temperature along with extreme trophic seasonality. It has diverse feeding habit and is an opportunist feeder on Antarctic krill. Fluoride present in these crustacean shells apparently does not have a toxic effect on krill eater animals. Herein, we present experimental results aimed to understand the interactive effect of trophic fluoride, elevated temperature and low salinity on plasma constituent's levels of *N. rossii*. The experiments were conducted at the Brazilian Antarctic station, Comandante Ferraz (EACF) at the Admiralty bay, King George Island, Antarctica. *N. rossii* were acclimated under eight thermo-saline combinations, involving two temperatures (0 and 4°C), two salinities (35 and 20) and two trophic conditions (with and without fluoride), during 11 days. Results indicated that trophic fluoride at 0°C and salinity of 35 was not capable of changing the plasmatic levels of electrolytes (Cl⁻, Mg²⁺, Ca²⁺ and inorganic phosphate), induced a discrete elevation in glycaemia at salinity 20 and acute elevation of triglycerides. Salinity of 20 at 0°C was capable to induce expressively hyperglycemia, hypertriglyceridemia and hypocalcaemia. However, a thermic interaction at 4°C minimized the effects of fluoride and low salinity on the levels of plasmatic constituents studied. In conclusion trophic fluoride was capable to modulate the lipid metabolism of *N. rossii* at the thermo saline condition 0-35 (similar to natural conditions). The thermo-saline interaction at 4°C minimizes the fluoride and hypo salinity effect on the plasmatic levels of glucose, lipid and electrolytes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Antarctic Fish Genome Project

Forename: Cheng Surname: Chi-Hing Christina

Authors: Chi-Hing Christina, Cheng; Chen, Liangbiao;

Presentation Allocated: Oral

abstract: In the wake of the genome science revolution, NRC of the Academy of Sciences convened the workshop "Frontiers in Polar Biology in the Genomic Era" in 2002. Attending polar scientists across disciplines collectively defined the key questions in polar biological science amenable to genomic approaches, and identified critical species in important organismal groups whose genomes should be analyzed to advance system-wide understanding of the evolution of cold-able functioning in these species and their role and interactions in the polar realm. Ten years since, not a single polar eukaryotic species' genome has been sequenced and analyzed. We announce here our effort and progress in sequencing the first polar vertebrate genome – a key teleost species identified in the NRC workshop and a critical component of the Antarctic marine food web, the nototheniid fish *Dissostichus mawsoni*, commonly known as the giant Antarctic toothfish. Our overarching scientific goal is to decode the evolutionary changes in the genome structure, in geneic content and sequence features, and in the expression and function of the genes and proteins associated with the remarkable evolutionary adaptations of Antarctic nototheniid fishes confined to life in the freezing Southern Ocean. The diploid genome size of *D. mawsoni* is about 2Gbp as estimated by flow cytometry. In collaboration with BGI, China, deep-coverage whole genome shotgun and paired-end sequencing (using Illumina HySeq2000) of the toothfish genome have recently completed. A provisional draft assembly has been produced using SOAPdenovo in conjunction with the scaffold builder SSPACE . The N50 contig length and N50 scaffold length are 21.6kbp and 1.96Mb respectively in the current assembly. The toothfish genome shows no GC bias (average GC content 0.405), nor obvious heterozygosity to confound whole genome shotgun assembly from Illumina short reads. We have also generated EST sequences (see abstract by Ye, Cheng and Chen) to aid in annotation, and a BAC library that can provide BAC end sequences to aid in contig and scaffold ordering. A further refined draft genome sequence of the toothfish is expected in the summer of 2012.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Antarctic Sea Ice Microalgae: exploring physiological responses to environmental stresses.

Forename: Meghana Surname: Rajanahally

Authors: Rajanahally, Meghana; Ryan, Ken;

Presentation Allocated: Oral

abstract: Sea ice algal communities play a very significant role in primary production in the Southern Ocean as they are the only source of fixed carbon for all other life in this habitat and contribute upto 40% of Antarctic primary production in ice-covered regions. Therefore it is important to understand how these organisms adapt to this highly variable and harsh environment. UVB radiation damages many organic molecules of living organisms. In the Antarctic, ozone induced increase in UVB maybe much higher than expected and this greatly affects sea ice algae. To protect themselves from UVB, they produce mycosporine-like amino acids(MAAs). MAAs were analysed by high performance liquid chromatography (HPLC). Varying levels of light and temperature in the annual cycles of sea ice present the algae with stresses on their photosynthetic performance and lead to the algae having to deal with problems like over production of antioxidants. The photosynthetic performance of these algae was determined by using pulse amplitude modulation (PAM) fluorometry. The 2 measures focused on were Φ PSII which is photosynthetic yield and ETR max which measures the electron transport rate. Experiments were conducted with mixed communities of bottom ice algae in the field and in the lab in 2007, 2009 and 2010. Algae were subjected to various levels of light, UVB and temperature and MAAs were analysed by HPLC to determine whether the algae were producing MAAs in response to UVB stress. PAM was used to measure how well the algae were holding up to these stresses, photosynthetically. Experiments were also conducted on single species cultures from the Ross Sea and the Antarctic Peninsula region. These were subjected to different light and UVB levels at 4°C which is the temperature at which they were cultured. MAAs were recorded and photosynthetic health was determined by PAM.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Antioxidant enzymes: Superoxide Dismutase and Catalase from an Antarctic microorganism

Forename: María Surname: Monsalves

Authors: Monsalves, María; Ollivet-Besson, Gabriela; Pereira, Jairo; Peralta, Rocío; Blamey, Jenny;

Presentation Allocated: Poster

abstract: All organisms present in Antarctica are exposed to several extreme conditions such as UV radiation present in this area due to the depletion of the stratospheric ozone layer over the past three decades. This conditions trigger generation of reactive oxygen species (ROS) such as superoxide anion (O_2^-), hydrogen peroxide (H_2O_2) and hydroxyl radical (OH^-), damaging constituents such as nucleic acids, proteins and lipids. The harmful effect of oxidative stress can result in mutagenesis and even cell death. Therefore, microorganisms found under this condition must have an important antioxidant defense in order to prevent the oxidative stress generated by ROS. Among the components of the antioxidant system, we focused on the most important enzymes: Catalase (CAT) and Superoxide Dismutase (SOD). Both enzymes have a protective role in aerobic organisms against oxygen toxicity. CAT catalyzes the decomposition of hydroxide peroxide to water and oxygen and SOD catalyzes the dismutation of superoxide radicals to hydroxide peroxide and oxygen. In the present work SOD and CAT enzymes will be studied from a psychrophilic bacteria (I1P), isolated from an Antarctic. One of the properties of this microorganism includes resistance to ultraviolet radiation. This makes it a potential source of antioxidant enzymes that can be used in biotechnology. Superoxide Dismutase and Catalase activity were studied during the different growth phases of the microorganism. The greatest enzyme activity was obtained in the late exponential phase, under standard condition. The effect of ultraviolet radiation on SOD from I1P when crude extract was exposed to different ultraviolet radiation (UV-A, UV-B and UV-C) was studied. When the microorganism was exposed to 50 min UV-B of radiation an increment in SOD specific activity and a decrease of superoxide anion was observed. The effect of the ultraviolet radiation UV-A and UV-C did not present any improvement on the activity in comparison with the type UV-B radiation. SOD and CAT enzyme obtained from I1P were purified and partially characterized. The optimum pH was 7 and optimum temperature of SOD ranged from 20 at 50 °C. In the case CAT from I1P the optimum pH was 8 and the optimum temperature 20 °C. The enzyme maintained 100 % of its activity after being incubated at 4 °C for 1 month.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Chaperonin-Assisted Protein Folding at Low Temperature: Co-Evolution of Antarctic Fish CCT and Its Substrates

Forename: Bill Surname: Detrich

Authors: Cuellar, Jorge; Yebenes, Hugo; Parker, Sandra; Carranza, Gerrado; Valpuesta, Jose; Zabala, Juan Carlos; Detrich, H William;

Presentation Allocated: Oral

abstract: Marine ectotherms of the cold Southern Ocean (-2 to +1.5°C) surrounding Antarctica face energetic challenges to protein folding assisted by the chaperonin CCT. We hypothesize that CCT and its client proteins (CPs) from these organisms have co-evolved compensatory molecular alterations that facilitate CP-CCT binding and the ATP-driven folding cycle at low temperature. To evaluate this hypothesis, we compared CP/CCT systems purified from testis tissues of an Antarctic fish, *Gobionotothen gibberifrons*, and of the cow, *Bos taurus* (body T = 37°C). Purification of folding-competent *G. gibberifrons* CCT required substantial modifications to protocols used to isolate testis CCT from mammals. After establishing the fish CCT protocol, we tested the binding of denatured CPs (β -actin, β -tubulin) by the CCTs, both in homologous and in heterologous combinations and at temperatures of 4 and 20°C. Samples were processed for negative-stain electron microscopy at the incubation temperature, micrographs were recorded and digitized, and 1,000-2,000 particles from each reaction were scored as apo- or holo-CCT using maximum-likelihood classification procedures. In homologous combination, *G. gibberifrons* CCT possessed a higher affinity for β -actin or β -tubulin at 4 °C compared to 20 °C, whereas the converse was true for bovine CCT and its actin/tubulin CPs. When tested in heterologous combination, the binding affinities of the CCTs for the CPs were low at both Ts. The temperature dependence of the binding affinities of homologous CCT/CP pairs was analyzed in triplicate experiments at four temperatures between -4 and +20°C. Irrespective of CP, the percentage of client bound by *G. gibberifrons* CCT declined linearly with increasing T, whereas the % of client bound by bovine CCT increased linearly with increasing T. The kinetics of the folding and release of native actin by *G. gibberifrons* CCT at 2°C were slow, reaching a plateau at 48 h. Together, our results suggest that CCT and CPs from Antarctic fishes have evolved interaction surfaces that place a greater reliance on polar and electrostatic bonds, which increase in strength as T decreases, at the expense of hydrophobic interactions, which weaken with decreasing T. Supported by NSF grants ANT-0635470 and ANT-0944517 (HWD) and by MICINN grants BFU2010-15703 (JMV), CTM2009-08095-E/ANT (JMV, JCZ) and BFU2010-18948 (JCZ).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Characterization of Psychrophilic and Psychrotolerant Bacteria Isolated from Antarctic Soil

Forename: Norio Surname: Kurosawa

Authors: Kurosawa, Norio; Tsuboi, Yuki; Sonoda, Kazuhiko; Yamamoto, Shuichi; Imura, Satoshi;

Presentation Allocated: Poster

abstract: Psychrophilic and psychrotolerant microbes and their unique cold adapted biomolecules have a potential for biotechnology applications. They are also excellent model organisms for study of cold adaptation strategies of lives. In this study, characterization of two bacterial strains, isolated as SA4125 and SA4127 from Antarctic soil was conducted based on the phenotypical, chemotaxonomical, and biochemical analysis. The effects of temperature on fatty acid composition of the strains were also examined. Analysis of 16S rDNA sequences indicated SA4125 and SA4127 were novel species of the genus Aurantimonas and Frigoribacterium, respectively. Both strains were characterized as aerobic and motile rods. The optimum growth was obtained at 25°C for SA4125 and 10°C for SA4127, respectively. Strain SA4127 was only considered as psychrophiles. Analysis of fatty acid composition indicated SA4127 harbored branching fatty acids predominantly, and did not change its fatty acid composition. The membrane fluidity of SA4127 might rely on the branching fatty acids at low temperatures. In contrast to SA4127, SA4125 changed its fatty acid composition with temperature, resulting that SA4125 is able to grow at wide temperature range.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Characterization of the freezing avoidance attributes of the sub-Antarctic notothenioid fish species

Forename: Tshoanelo Surname: Moloi

Authors: Moloi, Tshoanelo; Cheng, Christina; Mwale, Monica; Gon, Ofer;

Presentation Allocated: Oral

abstract: The 1970-80s had seen a significant contribution to the knowledge of Antarctic fishes diversity, mostly through the international BIOMASS program. More recent research associated with this region has exposed a gap in our knowledge of the sub-Antarctic component of the Southern Ocean, particularly with regard to the adaptations of fishes of the suborder Notothenioidei. We investigated the freezing avoidance attributes of these fishes using specimens belonging to five notothenioid families present in sub-Antarctic waters. The presence of antifreeze glycoprotein (AFGP) sequence in genomic DNA was assessed using southern blot analysis. Species from four families (Harpagiferidae, Artedidraconidae, Bathydraconidae and Channichthyidae) all had high hybridization signal indicating the presence of the AFGP sequence in their genome. On the other hand, sub-Antarctic species of the Nototheniidae had varying hybridization signals. For example, two *Lepidonotothen* species, *L. larseni* and *L. nudifrons*, had high hybridization signal, as opposed to congener *L. squamifrons* which had a weak signal suggesting that there is little or degenerate AFGP sequences in its genome. This was consistent with our northern blot analysis for AFGP messenger RNA expression, which revealed hybridization signal for *L. larseni* and *L. nudifrons* but no detectable signal in *L. squamifrons*. These results are also supported by serum AFGP activities where *L. nudifrons* appeared to have high AFGP activity in its blood as opposed to *L. squamifrons*. The distribution of the AFGP gene among notothenioid species was mapped onto a phylogenetic tree based on complete NADH dehydrogenase subunit 2 (ND2) sequences. The results suggest that the four Antarctic families are monophyletic and share a common AFGP-bearing ancestor, while Nototheniidae is paraphyletic and appears to have four clades which differ in the level of AFGP in their genome. Therefore the possibility exists that either some sub-Antarctic species diverged before the evolutionary gain of the AFGP gene or the latter was lost after they had arrived at their current habitat.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Disentangling the effects of historical and adaptive processes in molecular evolutionary studies in Antarctica: limpets as a model case

Forename: Christoph Surname: Held

Authors: Held, Christoph; Pohlmann, Kevin; Konigstein, Stephan;

Presentation Allocated: Keynote 20 mins

abstract: Predicting the response of species to changing climatic conditions is difficult because the pattern we find in modern molecular data integrates the impact of population demography and also selection and adaptation, all of which can act on different temporal scales. Using shallow-water limpets distributed in Patagonia and Antarctica we present an integrated, multi-disciplinary study combining neutral markers resolving different time windows, enzyme studies, expression studies, and markers under selection. Our data indicate that isolation of Antarctic and South American populations and the appearance of physical barriers between them occurred asynchronously. Increasing habitat availability after the last glacial maximum led to an increased population growth and genetic diversity in Patagonia, with neutral markers evolving at a different rate than markers affording adaptation to temperature.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Diversity, abundance and southern extent of calcifying algae (Coccolithophore) in the Indian sector of Southern Ocean

Forename: Shramik Surname: Patil

Authors: Patil, Shramik; Mohan, Rahul; Shetye, Suhas; Gazi, Sahina;

Presentation Allocated: Poster

abstract: The Nine vertical profiles (S1-S9) between 39 to 65.49°S located along 57.3°E transect analyzed for coccolithophores in the Indian sector of SO during austral summer of 2010. Based on the results, the stations are demarcated into: stations at north of Southern Subtropical Front (SSTF), SSTF, Sub Antarctic Front (SAF) and South of SAF. The total coccolithophore cell density varies between 274.2×10^5 cells/l (S6) and 4.9×10^5 cells/l (S9). The abundance of coccolithophores at north of SSTF (S1-S3) varied from 189.2×10^5 to 115.9×10^5 cells/l (29 species at each station). *E. huxleyi*, *G. ericsonii*, *S. rotula* and *O. fragilis* were found abundant at these stations. The highest species richness was observed at station S4 (at vicinity of SSTF 38 species, abundance 204×10^5 cells/l), and *E. huxleyi*, *S. rotula*, *A. acanthus* and *P. vandellii* were in dominance. The highest abundance of coccolithophores was observed at SAF (S6) (274.2×10^5 cells/l (25 species)) where *E. huxleyi*, *S. rotula*, *S. ampliora* and *U. foliosa* observed in abundance. The station located at PF (S7) and Southern Antarctic Circumpolar Current Front (SACCF) (S8) showed low species diversity (4 species in each station) and abundance (142.6 and 69.1×10^5 cells/l). *E. huxleyi* morphotypes also show variation, at stations between S1 and S4, *E. huxleyi* morphotype A was predominant than B/C and D whereas, southward of station S5, an increase of *E. huxleyi* morphotype B/C was observed. The morphometric analysis of *E. huxleyi* morphotype A revealed, length and width of distal shield variation from 3.05 to 2.52 μm and 2.61 to 2.25 μm respectively whereas, the diameter ranged from 6.34 to 4.41 μm . The highest length, width and diameter of *E. huxleyi* morphotype A is observed in the vicinity of SSTF (S5). Our study highlighted the increase in coccolithophore diversity in the vicinity of SSTF at surface and subsurface waters (0-40m) which is attributed to favorable temperature, salinity, nitrate as also available light conditions. Whereas, decreasing salinity at SAF and increasing nitrate concentration might have triggered the *E. huxleyi* morphotype B/C abundance with low species diversity. The increase in diameter, length and width of distal shield of *E. huxleyi* morphotype A in the vicinity of SSTF is attributed to low salinity concentration. This study highlights the combined effect of physical and nutrient forcing on coccolithophore abundance, distribution and southern extent of coccolithophores in study region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Evolution of Polyketide Synthase Genes in Cladonia species

Forename: Hyun-Ju Surname: Noh

Authors: Noh, Hyun-Ju; Park, Chae Haeng; Lee, Jin sung; Kim, Eung-Soo; Hong, Soon Gyu;

Presentation Allocated: Poster

abstract: Lichens are well known for producing a great variety of secondary metabolites including polyketide chemicals. Polyketides are involved in stress responses such as drought, UV, microbial infection, and so on. Biosynthesis of polyketide chemicals are carried out by polyketide synthases (PKS). Most of the lichens contain multiple copies of PKS genes and it is believed that each copy of the PKS gene is involved in biosyntheses of different polyketide chemicals. As it is regarded that each chemical has unique biological role in stress responses, it is important to study the evolution of the gene to understand its role in environmental adaptation of lichen species. In the current study, we amplified and sequenced KS domains of PKS genes from thirty two samples, which belonged to ten Cladonia species, collected from King George Island, Chile, and Svalbard. Sixty-two KS domain sequences were obtained by direct sequencing and cloning of the PCR amplicons. Phylogenetic analyses revealed that they belonged to non-reducing PKS gene and grouped into twelve clades by the criterion of monophyly and 90% similarity cut off. We examined presence of two of the most frequently found clades (clade 6 and clade 7) and one of the rare clades (clade 4) by specific amplification method. Clade 7 was detected from all of the samples, but clade 4 and clade 6 were detected only from fifteen and thirty samples, respectively. Reconstruction of character change revealed that current distribution of clade 4 PKS genes can be explained by eight acquisition and loss events. Comparison of PKS phylogeny and rDNA phylogeny revealed that clade 7 PKS genes evolved non-orthologously but we could not find concrete evidence to contradict orthologous evolution of clade 6 PKS genes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Gadd45 expression in Antarctic notothenioid fishes exposed to heat shock

Forename: Daniel Surname: Hassumani

Authors: Hassumani, Daniel; Buckley, Bradley;

Presentation Allocated: Poster

abstract: Throughout their millions of years of evolution in the cold, stable Southern Ocean, the Antarctic notothenioid fishes have acquired cold-adapted physiologies. One species, *Trematomus bernacchii*, has lost the ability to up-regulate the expression of any size class of heat shock proteins (hsps). However, cDNA microarray analysis has shown that it has retained the ability to modify gene expression in response to heat stress. Many of these genes play pivotal roles in the evolutionarily conserved cellular stress response (CSR). The CSR involves a suite of genes and their respective proteins that respond to environmental perturbations. One of these proteins, the CCAAT/enhancer binding protein δ (C/EBP- δ), is involved in cell-cycle arrest and in inducing apoptosis in some cellular contexts. C/EBP- δ is up-regulated in *Trematomus bernacchii* white muscle tissue in response to heat shock. Because of this, the Antarctic fish are an intriguing model for studying the CSR since they lack an inducible heat shock response yet other mechanisms are still responsive to environmental stressors. Here, we examine the growth arrest and DNA damage protein (gadd45). Gadd45 genes function as stress sensors involved in the response of cells to physiological stressors and in tumor formation. Gadd45 proteins interact with stress responsive proteins including PCNA, p21 and p38 kinase. White muscle, gill and liver tissue from three Antarctic notothenioid species, *T. bernacchii*, *T. nicolai* and *T. newnesi* were exposed to a range of temperatures and were sampled over a time series. The goal is to determine if gadd45 is heat-inducible in thermally stressed Antarctic fishes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Gene Expression Analysis of Yeast, *Glaciozyma antarctica* Exposed to Cold and Freeze Stresses

Forename: Clemente Michael Surname: Wong

Authors: Wong, Clemente Michael Vui Ling; Boo, Sook Yee; Najimudin, Nazalan; Rodrigues, Kenneth Francis;

Presentation Allocated: Oral

abstract: *Glaciozyma antarctica* is a psychrophilic yeast that has adapted well to the freezing conditions of the Arctic and Antarctic. Nevertheless, it also has to cope with occasional rapid temperature changes brought about by the sand and snow storms associated with the Austral summer. *G. antarctica* can serve as a model organism for us to analyse how genes related to thermal stress react to temperature change. Hence, this project was set out to determine expression patterns of several genes under cold- and heat- shock conditions in *G. antarctica*. Routine microbiological techniques were used to characterize the yeast, while for the gene expression experiment, 14 thermal stress related genes namely, *afp*, *nth1*, *tps1*, *tps2*, *hsp70*, *hsp90*, *hsp100*, *fad*, *prx*, *gst*, *grxA*, *grxB*, *cat* and *MnSOD* were assayed using real time quantitative RT-PCR (qPCR). *G. antarctica* PI12 was found to grow best in Yeast Peptone Dextrose (YPD) broth medium at 12°C, pH 5.5 to 6.5 and 0 to 3% of NaCl. It had a doubling time of approximately 10 hours 30 minutes. Under cold shock conditions at 0°C and 5°C, the antifreeze protein (AFP) encoded gene, *afp* was up-regulated 15-fold and 3-fold respectively. Under heat stress conditions, *hsp70* gene was up-regulated, while *hsp90* and *hsp100* were not affected. Trehalose biosynthesis genes, *tps1* and *tps2* and all oxidative stress related genes were not affected by exposure to any of the above thermal stress conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Heat shock protein in Antarctic sea urchin: atypical coelomocytes like to vacuolated cells express an HSP70.

Forename: Camila Surname: Calfio

Authors: Calfio, Camila; Bethke, Jörn; Mercado, Luis; Gonzalez, Marcelo;

Presentation Allocated: Poster

abstract: Heat stress proteins are a classical proteins implicated in stabilize and refold denatured proteins. Members of the HSP70 gene family comprising the cognate and inducible HSP70. Under stressful condition, molecular chaperones stabilize denaturing proteins and refold proteins. In the Antarctic sea urchin (*Sterechinus neumayeri*) has not describe the heat shock protein. From coelomocytes we have amplified and cloning a partial sequence of 600 pb that shown high identity with HSP70. By chemical synthesis we have obtained a conserved peptide present in a HSP70 sequence family. This peptide was used to produce a specific antibody against HSP70, the protein was immunodetecting by Western Blotting in homogenized coelomocytes. Antarctic sea urchins were exposed to 5°C and 10°C during 1, 24 and 48 h. By immune fluorescence was detected the specific expression in atypical coelomocytes, this cells were characterized by an eccentric nucleus and the vacuolated cytoplasm. In a normal condition (0°C) the percentage of target cells was 3.5 %. No significant change in a numbers of these cells was observed after acute heat shock experiments. Our results provide the first molecular evidence that HSP70 of Antarctic sea urchin.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Internalized ice in notothenoid fishes: physiological demands and environmental constraints on survival in freezing seawater

Forename: Paul Surname: Cziko

Authors: Cziko, Paul; Cheng, C.-H. Christina; Evans, Clive; DeVries, Arthur;

Presentation Allocated: Poster

abstract: The evolution of antifreeze proteins to combat lethal freezing in polar marine fishes is a dramatic example of the evolution of molecular novelty in response to environmental change. In the absence of mechanisms to prevent the introduction or inhibit the growth of ice, fishes exposed to environmental ice at temperatures below the colligative freezing point of their body fluids will freeze and die. Many lineages of polar marine fishes have thus evolved antifreeze proteins (AFPs) that specifically bind to internalized ice crystals and inhibit their growth, by a non-colligative mechanism, to below the equilibrium freezing point of body fluids. Once stabilized by the binding of AFPs, ice crystals will accumulate within fishes, potentially disrupting physiological processes. Internalized ice crystals may be melted by seasonal warming events or removed or destroyed by physiological or biochemical means, but the contribution of each has not been previously described. Here we show that a melting hysteresis (MH) defines the temperature at which internalized ice in Antarctic notothenoid fishes is melted. Ice crystals can be superheated by as much as 1°C above the colligative melting point in vivo, suggesting that AFPs stabilize ice crystals both above and below the equilibrium freezing point of body fluids. Taken together with oceanographic observations and a high-resolution temperature record over a 10-year period at three collection sites in McMurdo Sound, Antarctica, our results suggest that superheating of ice is physiologically important. In the absence of a biochemical mechanism for ice removal or destruction, marine fishes living in many locales in Antarctica are destined to accumulate and then retain ice crystals within their bodies for the duration of their lives.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: ISOLATION AND CHARACTERIZATION OF A THERMOPHILIC MICROORGANISM WITH BIOTECHNOLOGICAL POTENTIAL FROM DECEPTION ISLAND, ANTARCTICA

Forename: Patricio Surname: Flores

Authors: Flores, Patricio; Blamey, Jenny;

Presentation Allocated: Poster

abstract: Due to its intrinsic characteristics, Antarctica is an important source of extreme microorganisms. Millions of years of isolation have produced unique adaptive responses to Antarctica's extreme environment, making the study of this continent's biodiversity and the mechanisms of adaptation to its extreme conditions one of its greatest treasures. Antarctica is mostly a cold continent; however, it has several areas with geothermal activity, allowing for the presence of thermophilic microorganisms. Thermophilic and hyperthermophilic microorganisms are of great interest to industry for their enzymes. The thermostability characteristics of these enzymes facilitate its use in high temperature processes. Glutamate dehydrogenase (GDH) is an oxidoreductase that plays a major role in the metabolism of carbon and nitrogen. It reversibly catalyzes the oxidative deamination of glutamate to alpha-ketoglutarate and ammonia. Oxidoreductases, including GDH, have been highly regarded for use as biosensors. However, the use of enzymes as biosensors is relatively problematic due to its instability in the presence of high temperatures, organic solvents and denaturing agents. In this study, a thermophilic microorganism has been cultivated and isolated from a soil sample from Cerro Caliente, Deception Island, Antarctica, collected on Antarctic Scientific Expedition ECA47. This microorganism was characterized biochemically and identified by 16S rRNA gene analysis as *Bacillus gelatini*. It has an optimum temperature and pH of 50 °C and 8.0, respectively. Additionally, we have been able to standardize the measurement of the specific activity for GDH during different stages of growth, which could be useful for future enzyme purification.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Metabolic costs in the face of climate change: A keystone species on sub-Antarctic Marion Island

Forename: Tanya Surname: Haupt

Authors: Haupt, Tanya; Marais, Erika; Sinclair, Brent; Chown, Steven;

Presentation Allocated: Oral

abstract: Recent forecasts suggest that climate change has resulted in widespread metabolic costs to ectotherms. The assumption is based on an exponential increase in metabolic rate with increasing experimental temperature. Using this prediction, Jensen's inequality suggests that higher temperature extremes at high average temperatures may considerably elevate resting metabolic costs. Variation in metabolic rate has also been explained by metabolic cold adaptation (MCA), which is the elevation of metabolism at cold temperatures, and also metabolic depression at warm temperatures in response to stressful or resource (e.g. water) limited conditions. Ectotherms are therefore not simply at the mercy of Boltzmann and might have the restriction of metabolic water loss as a greater concern than simple metabolic costs. Here we tested these ideas in a sub-Antarctic organism, the caterpillars of the flightless moth *Pringleophaga marioni*. We do so by examining the metabolic rate and water loss rate consequences of acclimation exposures to constant (5, 10 and 15°C) and fluctuating temperatures (0-10, 5-15 and 10-20°C). We found a significant reduction in metabolic rate at fluctuating temperatures when compared to the constant temperature of the same mean, and overall, water loss rates were mainly equivalent between acclimation exposures. If water conservation were driving the metabolic response, then it is hypothesized that water loss should be equivalent among temperature treatments, as is evident here. However, an elevation in metabolic rate at constant temperatures may also be evidence for metabolic cold adaptation, as caterpillars may benefit from increasing their productivity in cold environments. Depressed metabolic rates at fluctuating temperatures may be due to higher costs at the extremes, thus in keeping with Jensen's inequality. Findings from this study suggest that predictions of climate change effects based on simple rate-temperature relationships are overly pessimistic, and a more thorough examination of the contrasting hypotheses is essential.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Organismal Thermotolerance and the Cellular Stress Response in Antarctic Fishes: From Genomics to Protein-Level Processes

Forename: Bradley Surname: Buckley

Authors: Buckley, Bradley;

Presentation Allocated: Keynote 20 mins

abstract: The fish fauna of the Southern Ocean possess some of the lowest upper lethal thermal thresholds of any species and inhabit waters that have been near-freezing for millions of years. Evolution in a stable, frigid environment has profoundly affected the physiologies in these species, giving rise to novel adaptations to cold temperatures and dramatically altering other cellular functions and organismal processes. Despite lacking a traditional heat shock response (HSR), characterized by the induction of heat shock proteins during thermal stress, cDNA microarray analysis reveals that hundreds of genes related to numerous cellular processes are potentially stress-inducible in Antarctic fishes. Based on these observations, we propose that a modified version of the broadly conserved cellular stress response (CSR) may exist in cold-adapted species. It may be possible that in the absence of the ability to increase molecular chaperoning capacity via the inducible HSR, the CSR in extremely cold-adapted species may favor cell cycle arrest and/or apoptosis. To begin to characterize the CSR at the protein level in fishes from the Southern Ocean, we measured the heat-induced production of a key regulator of cell cycle arrest and apoptosis, CCAAT/Enhancer-Binding Protein Delta (C/EBP- δ) in common fish species from McMurdo Sound in the southern Ross Sea. We also investigated the effect of heat stress on the expression of the growth arrest and DNA damage protein 45 (GADD45), a protein that is involved in cell fate determination. The overall goal of these efforts is to build an integrated understanding of the CSR, from genomic responses to cellular events, in environmentally sensitive Antarctic fishes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Physical changes in morphology, growth and shell structure in a population of *Lissarca miliaris* over 40 years at Borge Bay, Signy Island

Forename: Adam Surname: Reed

Authors: Reed, Adam; Thatje, Sven; Linse, Katrin;

Presentation Allocated: Oral

abstract: The Antarctic Peninsula and Scotia Sea Islands have been identified as some of the most rapidly warming areas on the planet and this is most noticeable by warmer summer temperatures. The South Orkney Islands are a well-studied island group with long running environmental data collection. Using historical collections, new material and published data, specimens of the small brooding bivalve *Lissarca miliaris* at Borge Bay, Signy Island, were analysed to measure the temperature effect on growth, reproduction and shell structure. Specimens from 1976, 2002 and 2011 were used for analysis and published growth data from 1972 added as complimentary data. Changes were correlated to monthly air temperature data from Orcadas research station, revealing a temperature increase of $\sim 1.5^{\circ}\text{C}$ from 1972 to 2011. Since 1972 the growth rate of *L. miliaris* has increased with years studied to its fastest rate in 2011. This trend is followed by a decrease in length/height ratios of the larval shell (prodissoconch I) and a change in adult shell morphology. Morphology and prodissoconch size can be used as indices of reproduction in *L. miliaris* as fecundity is limited by the female's capacity to brood her young. Shell chemistry and structure has also been analysed to determine the effects of faster growth and increased temperatures on strength, thickness and composition over time. Although living in temperatures within the range expected for this species, this study demonstrates the phenotypic and reproductive response of a population to small changes in temperature in what is considered a cold stenothermal environment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Potential for survival and adaptation of extremophile *Exiguobacterium antarcticum* in simulated extraterrestrial environments

Forename: Felipe Surname: Nóbrega

Authors: Nóbrega, Felipe; Baraúna, Rafael; Silva, Artur; Pellizari, Vivian;

Presentation Allocated: Poster

abstract: Microorganisms that inhabit subzero temperature environments, like sea ice, has been attracting the attention of researchers for their unique cellular mechanisms that allow them to be an important component of polar ecosystems. Many of these extreme environments on Earth are, in many ways, similar to the environments found in other bodies of our solar system. Studies have been conducted comparing the oceans in Jupiter's moon Europa with the polar saline oceans on Earth, and the frozen soils on Mars with the Antarctic and Siberian permafrost. Nearby "Comandante Ferraz" Antarctic Station, under the Brazilian PROANTAR program, the B7 strain of extremophile *Exiguobacterium antarcticum* was isolated. This gram-positive bacterium is able to grow at temperatures ranging from -3 to 42°C. A versatile genetic repertoire was observed in its recently sequenced genome. In this project, along with the development of proteomic analysis comparing protein expression in different temperatures, we propose to investigate the potential for survival of *E. antarcticum*, and their mechanisms of adaptation, to environmental conditions external to Earth, especially to those found in Europa and Mars. The simulated extraterrestrial environments experiments are planned to be conducted in a simulation chamber, in its final stage of development within the Brazilian Astrobiology Laboratory (Astrolab) of the Institute of Astronomy, Geophysics and Atmospheric Sciences at the University of São Paulo. This simulation chamber will be capable to recreate the composition of different atmospheres, work at very low pressures of up to 8mbar, temperatures ranging from -193°C to 226°C and generate radiation of varied sources. We expect that this study can help throw light in the peculiar physiology of psychrophiles and its response to conditions found in solar system's icy worlds that could also help to better understand the plausibility of cross contamination between these bodies and the Earth. At first, we obtained a protein extraction protocol for psychrotrophic organisms aiming a gel-based proteomic analysis. The proteome of *E. antarcticum* B7 grown at temperatures of 0°C and 37°C was compared by 2D-DIGE. Preliminary software analysis revealed 68 proteins that were differentially expressed depending on the temperature, with some being around 20 times more abundant at 0°C.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: PURIFICATION AND CHARACTERIZATION OF AN ALKALINE PHOSPHATASE FROM AN ANTARTIC ALKALINETOLERANT MICROORGANISM

Forename: Rocio Surname: Peralta

Authors: Peralta, Rocio; Blamey, Lotse; Pereira, Jairo; Blamey, Jenny;

Presentation Allocated: Poster

abstract: The Antarctic microorganisms reported to date, represent new species and have broad phylogenetic diversity with representatives from Bacteria and Archaea domains. Cold extreme environments are populated by psychrophiles and psychrotrophs which produce cold adapted enzymes, allowing them a high flexibility in their adaptation at these conditions. Some of these microorganisms are alkaliphiles, defined as organisms that have their optimum growth rate at least two pH units above neutrality. The Alkalitolerant are capable of growing at values of pH higher than 9 or 10, but their optimum growth rate is around neutrality or less. These microorganisms have been described as producing a variety of interesting extracellular enzymes, such as alkaline phosphatases, this enzyme belongs to the category of hydrolases enzymes responsible for removing phosphate groups from many types of molecules, including nucleotides, proteins, and alkaloids, this process of removing the phosphate group is called dephosphorylation. Alkaline phosphatase has become a useful tool in molecular biology, since DNA normally possesses phosphate groups on the 5' end, removing these phosphates prevents the DNA from ligating (the 5' end attaching to the 3' end), thereby keeping DNA molecules linear until the next step of the process for which they are being prepared; also, removal of the phosphate groups allows their use as biochemical markers (radiolabeling) and enzymatic label in immunoassays. In this work we have isolated an alkalitolerant microorganism belonging to the genus *Shewanella*. This microorganism has an optimal growth pH of 8 and a maximum growth rate of 0,068 h⁻¹ in MPA medium. This microorganism produces an alkaline phosphatase, which activity was measured using the chromogenic substrate p-nitrophenyl phosphate. The specific activity of the enzyme was of 0,72 U/mg of protein. To purify the enzyme it was used an anion exchange step, using a DEAE-Sepharose fast flow column (Pharmacia Biotech). The actual focus of this research is the cloning and heterologous expression of the recombinant alkaline phosphatase to be applied in important molecular biology processes due to its peculiar and novel properties.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Resilient Antarctic mosses surviving under an elevated UV climate

Forename: Melinda Surname: Waterman

Authors: Waterman, Melinda; Nydahl, Anna; Keller, Paul; Robinson, Sharon;

Presentation Allocated: Poster

abstract: As the dominant flora of icy Antarctica, bryophytes have shown to be extremely tolerant to the harsh conditions especially against high ultraviolet (UV) radiation levels. It is known that Antarctic bryophytes produce ultraviolet-B (280-315 nm; UV-B) absorbing compounds (or sunscreens) within the cell and cell walls. These compounds have high photoprotection value for Antarctic mosses and liverworts especially for plants surviving under diminished stratospheric ozone. We aimed to examine the cosmopolitan moss species *Ceratodon purpureus* and *Bryum pseudotriquetrum* in comparison with the Antarctic endemic *Schistidium antarctici* in order to determine 1) whether UV-B radiation specifically enhances the production of sunscreens within these Antarctic mosses, 2) whether these sunscreens are reduced in low light and 3) to identify the specific chemical structures of the cell wall sunscreens in *C. purpureus*. Field populations of these three Antarctic mosses were subjected to screening treatments that either 1) blocked UV-B radiation but transmitted 90% of remaining solar radiation or transmitted 2) 90%, 3) 25% or 4) 0% of solar radiation (including both UV-A (315-400 nm) and UV-B radiation) for 6 weeks. Moss gametophyte tissue was harvested during this period and compounds were extracted using methanol (intracellular) and alkali hydrolysis (cell wall). These plant extracts were analysed using UV-visible spectrophotometry and analytical HPLC to monitor any change in total and specific sunscreen concentrations. Early results show that the three Antarctic species were thriving under reduced radiation. From concurrent and similar field experiments in Australia we show that cell wall sunscreen concentrations within Australian *C. purpureus* increased with increasing UV whilst mosses grown in low UV environments have reduced intracellular and cell wall UV-B absorbing compounds. These experiments suggest that the synthesis of sunscreens in *C. purpureus* is enhanced by UV radiation and is mainly localised within cell walls during new growth. This implies that these cell wall sunscreens have a long-term protective role in this species. This role and the structural elucidation of the cell wall-bound UV-B absorbing compounds that are specifically induced will be discussed. Our work demonstrates the importance of investigating cell wall sunscreens in plants and suggest that they could be much more widespread than so far elucidated.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Sequence and de novo assembly of the genome of an Antarctic nototheniid fish, *Notothenia coriiceps*

Forename: Seung Chul Surname: Shin

Authors: Shin, Seung Chul; Ahn, Do Hwan; Kim, Min Gyu; Kim, Su Jin; Detrich, H. William; Edwards, David; Lee, Jong Eun; Park, Min Young; Lee, Hyoungseok; Postlethwait, John; Park, Hyun;

Presentation Allocated: Poster

abstract: The fishes of the Antarctic have undergone extraordinary changes in diversity since the onset of widespread glaciation in Antarctica ~34 million years ago and the subsequent, intermittent cooling of the Southern Ocean to the freezing point of seawater (-1.9°C). Many fish groups became locally extinct, whereas the nototheniid suborder, which is largely endemic to the High Antarctic, experienced an adaptive radiation based on acquisition of antifreeze glycoproteins and the development of secondary pelagicism. Today, the notothenioids constitute the best known example of a marine species flock. As a first step in understanding the evolutionary history of the notothenioids, we have successfully assembled and generated a draft sequence of the genome of the Antarctic nototheniid, *Notothenia coriiceps*, using next-generation sequencing and PacBio SMRT[®] technology. The assembled contigs (550 megabases (Mb)) cover approximately 90% of the *N. coriiceps* genome, and the remaining gaps (50 Mb) appear to be tandem repeats. A standard annotation approach based on protein orthology, complemented by whole-genome alignment of the *N. coriiceps* genome to those of other fishes, revealed ~22,000 genes. Understanding the evolution of the genomes of cold-living Antarctic fishes will provide insight into fundamental genetic questions regarding the adaptability of ectothermic marine organisms to environmental challenge during climate change. Supported by Antarctic Fish Genome Project grant to H. P. funded by Korea Polar Research Institute, by U.S. National Science Foundation grant ANT-0944517 to H.W.D., by U.S. National Institutes of Health grant R01AG031922 from the National Institute on Aging (J.H.P., H.W.D.), and by the Australian Research Council (Projects LP0882095 and LP0989200) to D. W.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: THE PHOTOSYNTHETIC PARAMETERS OF THE BENTHIC MICROALGAL COMMUNITY FROM BROWN BAY, CASEY, ANTARCTICA

Forename: SAZLINA Surname: SALLEH

Authors: SALLEH, SAZLINA; MCMINN, ANDREW; MOHAMMAD, MAHADI;

Presentation Allocated: Poster

abstract: Benthic microalgal communities are responsible for most of the primary production in shallow intertidal areas. A total of 23 species of benthic diatom species were recorded in samples from Casey Station. The dominant genera observed were *Navicula*, *Thalassiosira* and *Cocconeis*. The most common species in this assemblage were *Navicula directa* (W.Smith) Ralfs *Navicula glaciei* V. Heurck, *Cocconeis costata* Gregory and *Thalassiosira gracilis* (Karsten) Hustedt. Other common species included *Thalassiosira symmetrica* Fryxnell & Hasle, *Trachyneis aspera* (Ehrenberg) Cleve, *Biddulphia areolata* Greville and *Asteromphalus hookeri* Ehrenberg. In order to gain a better understanding of how climate change would impact the physiological process of benthic diatoms and their photosynthetic capabilities, it is important to understand the environmental temperature optima and tolerance limits of these species from polar regions. Elevated temperature affects marine benthic algae by reducing growth, limits the transport of electron or carbon fixation which may reduce the ability of the cell to use light. This resulting excess light energy may cause photoinhibition. In this study, the Photosystem II (PSII) of benthic microalgal communities from Casey, eastern Antarctic were relatively unaffected by significant changes in temperatures up to 8°C, along with high PAR level (450 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$). Similarly, the community was able to photosynthesize as temperature was reduced to -5°C. Recovery from saturating and photoinhibiting irradiances was not significantly influenced by temperature at both -5° and 8° C. Although the benthic microalgae in this study were exposed to unnaturally low and high temperatures in the experimental incubation, they were quite resilient to the damaging effects. They were apparently able to activate protective strategies such as avoidance (downward migration and shading), non-photochemical quenching and repair (recovery) in order to avoid damage to Photosystem II (PSII). These responses are consistent with those recorded by past experiments on Antarctic benthic diatoms and temperate diatoms and suggest that climate change will not have a significant impact on the ability of benthic microalgae to recover from photoinhibitory temperature stress.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Thermal tolerance is not limited by oxygen-carrying capacity in Antarctic notothenioid fishes

Forename: Devin Surname: Devor

Authors: Devor, Devin; O'Brien, Kristin; Crockett, Elizabeth;

Presentation Allocated: Poster

abstract: Antarctic icefishes (Family Channichthyidae) are unique in lacking the oxygen-carrier hemoglobin (Hb) in their blood. Consequently, the blood of icefishes has only 10% of the oxygen-carrying capacity observed in closely related red-blooded fishes. Previous studies have shown that icefishes have a lower critical thermal maximum (CT_{max}) than red-blooded notothenioids and that there is a positive correlation between CT_{max} and hematocrit indicating that oxygen-carrying capacity may contribute to thermal tolerance. We tested the hypothesis that the lower CT_{max} of icefishes is associated with their reduced oxygen-carrying capacity. We also hypothesized that correlates of oxygen limitation (hypoxia inducible factor-1 α and lactate) would increase to a greater extent in icefishes compared to red-blooded fishes as temperature rises, and that this trend would be minimized under hyperoxic conditions. We sampled *Chaenocephalus aceratus* (Hb-) and *Notothenia coriiceps* (Hb+) at three temperatures (ambient, 8°C, and CT_{max}) during an experimental heat ramp (4°C hr⁻¹) under normoxia and environmental hyperoxia. We found that under hyperoxia, CT_{max} increased in *N. coriiceps* (16.4 \pm 0.2°C and 17.2 \pm 0.2°C; normoxia and hyperoxia, respectively; P<0.05) but not in *C. aceratus* (13.0 \pm 0.5°C and 13.1 \pm 0.7°C; normoxia and hyperoxia, respectively; P>0.05). For all temperatures and oxygen treatments, both PaO₂ and PvO₂ were significantly higher in *C. aceratus* than in *N. coriiceps* (P<0.05) with the exception of PaO₂ being equal between species at CT_{max} under normoxic conditions. For all temperatures measured, the PaO₂ of *C. aceratus* was at least 1.5-fold higher under hyperoxic conditions than under normoxic conditions, while an increase in PaO₂ in response to hyperoxia was only observed in *N. coriiceps* at 8°C. For all temperatures and oxygen treatments, HIF-1 α mRNA levels were at least 5.6-fold higher in heart ventricles of *N. coriiceps* compared to hearts of *C. aceratus*. However, HIF-1 α mRNA levels did not change in response to elevated temperature or environmental hyperoxia in either species. Quantification of lactate in plasma, ventricle, and oxidative and glycolytic skeletal muscle is ongoing and will also be presented. Supported by NSF ANT 0741301 and NSF ANT 0739637.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Transcriptional response of the Antarctic nototheniid *Pagothenia borchrevinki* during warm acclimation

Forename: Kevin Surname: Bilyk

Authors: Bilyk, Kevin; Cheng, C.-H.C;

Presentation Allocated: Poster

abstract: Antarctic notothenioid fishes of the frigid Southern Ocean show a limited tolerance to heat, with some high-latitude species incapable of surviving prolonged exposure to temperatures above 5 to 7 °C. Despite their marked stenothermy, when warm acclimated the heat tolerance of these fishes increases indicating that they retain some thermal plasticity. This increase happens rapidly, with most of the growth in heat tolerance occurring within the first week of acclimation to 4°C. However, little is known about the mechanisms underlying the thermal plasticity in these fishes or how they differ from those of temperate fishes inhabiting wider thermal ranges. To investigate these mechanisms we used RNA-seq to study the global transcriptional response occurring in the nototheniid *Pagothenia borchrevinki* during the first few days of warm acclimation to 4°C. This cryopelagic species was selected as our model for high-latitude notothenioids both as it inhabits the coldest and iciest Antarctic waters, and we have previously quantified the plasticity of its heat tolerance. A reference transcriptome was constructed using transcripts obtained by Roche's 454 pyrosequencing, which includes most of the genes expressed in six tissues of specimens from ambient waters, during warm acclimation, and following acute heat stress. Illumina sequencing was then used to get frequency counts of the identified genes from liver samples of individual specimens at environmental temperatures (-1.9°C), then after warm acclimation for two and four days. In our initial screening of the reference transcriptome against public databases, we identified putative homologues for 16,603 out of 40,062 assembled sequences. Of the identified sequences, 3% showed significant differences in expression at two days of warm acclimation, and 11% by four days. A Gene Ontology enrichment analysis was then used to relate differentially expressed genes to biological functions. This identified a small conserved response found at both two and four days and which comprised most of the two day response. By comparison, the larger number of enriched terms at four days suggests a more widespread transcriptional reorganization compared to fish in their native freezing waters. While warm acclimation to 4°C does not appear to elicit dramatic differential gene expression as measured by fold change, the identified changes in expression span a number of functional gene families.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Transcriptome profile analysis in the Antarctic limpet *Nacella concinna* and a comparison with related species.

Forename: Leyla Surname: Cardenas

Authors: Cardenas, Leyla; fuenzalida, Gonzalo; Gonzalez, Claudio; Poulin, Elie;

Presentation Allocated: Poster

abstract: Marine biodiversity encompasses a range of hierarchical levels, including genetic, individuals, species, ecosystem and functional diversity. Interactions among such levels determine the distribution, abundance, and ultimately the evolutionary potential and resilience of marine taxa. At present and in face of the rapid global change the identification, detection and monitoring of the biodiversity in the total levels becomes urgency. The Antarctic ecosystem represents a natural laboratory, available to study the genomic basis of responses of organisms to environmental variations. Next-generation sequencing technology is now frequently being used to develop genomic tools for non-model organisms, which are generally important for advancing studies of evolutionary ecology. However, the current knowledge of many of the marine species inhabiting the Antarctic remains still scarce. Here, using High Throughput sequencing technology we develop a deep sequencing of transcriptome of the marine gastropods *Nacella concinna* and we analyzed the transcriptional landscape by compare this database with information from the public database and from the new transcriptome profile of other two species of *Nacella* from South America. The information is analyzed in the light of the molecular adaptation and the genes innovations in the three species. It is the first effort to search for genetic differences among closer species that could explain the species differentiation process.-

SCAR OSC 2012 - Portland July 16th-19th

Session number: 12

Title: Trends of protein evolution in cold adapted fishes

Forename: Hua Surname: Ye

Authors: Ye, Hua; Cheng, Chi-Hing Christina; Chen, Liangbiao;

Presentation Allocated: Oral

abstract: To elucidate the mechanisms underlying adaptation of genes and proteins of notothenioid fishes to the extremely cold Antarctic environments, we characterized transcriptomes from four notothenioids inhabiting different temperature regimes. RNAs from tissues of brain, liver, spleen, intestine and gill of two species (*Cryodraco antarcticus*, *Dissostichus mawsoni*) from frigid Antarctic waters, and two species (*Notothenia angustata* and *Eleginops maclovinus*) from the non-freezing New Zealand and South American waters were sequenced through Roche 454 technology. The species investigated include the basal non-Antarctic (*E. mac*), basal Antarctic (*D. maw*), secondary temperate fish (*N. ang*) and derived Antarctic species (*C. ant*), representing the major notothenioid lineages in the Antarctic radiation. We obtained 30,000-50,000 protein-coding unigenes from each species. By incorporating transcriptome data from other teleost fishes, large scale comparisons between the translated proteomes from fishes of cold/Antarctic, cool and warm temperature regimes showed a general trend of amino acid substitution, in which amino acids with lower molecular weights (MWs) tend to replace the higher MW ones in fishes inhabiting the colder environments. In addition, higher levels of Methionine are found in the alpha-helical regions of the proteins from cold-adapted fishes. The biochemical significance of these findings is currently under investigation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: Does natural selection explain the fine scale genetic structure at the nuclear exon Glu-5' in *Mytilus* from Kerguelen?

Forename: Karin Surname: Gerard

Authors: Gerard, Karin; Roby, Charlotte; Bierne, Nicolas; Féral, Jean-Pierre; Chenuil, Anne;

Presentation Allocated: Oral

abstract: The Kerguelen archipelago isolated in the Indian sector of the Southern Ocean, shelters a *Mytilus* community far from any influence of continental populations or any known hybrid zones. The very carved coast leads to a highly fragmented environment. We investigated the impact of the environment on the genetic structure correlating genetic differentiation between samples and habitat descriptors. The genetic structure is analyzed in 35 locations using a mitochondrial marker (cytochrome oxidase subunit I) and two nuclear markers, the intron mac-1 and the exon Glu-5' diagnostic of the *Mytilus* complex of species in the Northern Hemisphere. Two other markers (EF introns) did not display polymorphism in Kerguelen. The exon Glu-5' genotyped in 2248 individuals reveals a genetic differentiation between samples from distinct regions, defined as the North coast, the South coast and the Gulf of Morbihan (an enclosure with particular hydrological conditions), as well as genetic differentiation within two regions undetected by the other polymorphic markers (COI and mac-1). This pattern is likely to be a consequence of the surrounding hydrology, limiting dispersal among regions. In parallel, power analyses establish that, among regions, the distinct markers unambiguously provide contrasted differentiation patterns incompatible with strictly neutral processes, Glu-5' displaying higher and much more significant F_{ST} values. At finer scale also, the influence of habitat through natural selection is strongly suggested on Glu-5'. Significant effects of the presence of *Macrocystis* and the wave exposure on Glu-5' genetic data, are evidenced, particularly in the most sampled region of the Gulf of Morbihan (22 population samples). Despite the high dispersal potential of this species, some pairs of samples separated by less than 500 metres display contrasted frequencies at Glu-5'. Although the high fragmentation of the archipelago may more finely structure the neutral genetic diversity than elsewhere, the results strongly suggest the role of environmental selection at fine scale, especially wave exposure, *Macrocystis* and to a lesser extent the substrate. In *Mytilus* as in most marine organism with high fecundity and high dispersal potential, gene flow tends to erase the genetic differentiation, but the present study shows that it nevertheless may be detected when high effectives are considered.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: Does the Scotia Arc facilitate connectivity between South America and Antarctica? An example from the planktonic sea star *Porania antarctica*

Forename: Jenna Surname: Moore

Authors: Moore, Jenna; Rouse, Greg W.; Wilson, Nerida G.;

Presentation Allocated: Oral

abstract: The Antarctic Circumpolar Current is a potentially powerful isolating force separating the faunas of South America and Antarctica. Marine invertebrates exhibiting distributions on the continental shelves of both Antarctica and South America provide evidence for genetic connection via dispersal across the Polar Front, or alternatively, the existence of cryptic species complexes. This study tested the hypothesis that the islands of the Scotia Arc allow dispersal and gene flow of a sea star with planktonic larvae, *Porania antarctica*. We sampled 15-20 individuals from 7 sites spanning the Scotia Arc from Burdwood Bank in the southern Atlantic Ocean to Bransfield Strait, Antarctica, as well as additional sites with fewer than 20 individuals. We built multi-gene phylogenetic trees and haplotype networks to test the presence of cryptic species complexes, and then used Φ_{ST} to infer patterns of genetic connectivity along the Scotia Arc.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: Limited potential for adaptation to future climate change of marginal Antarctic populations as a result of insufficient isolation

Forename: Christoph Surname: Held

Authors: agrawal, shobhit; held, christoph;

Presentation Allocated: Oral

abstract: The Scotia Arc is said to act as the stepping stone of fauna in and out of the Antarctic with South Georgia Island situated closest to the Antarctic Polar Front (APF) demarcating the physiological and distributional edge of many endemic Antarctic species. The recent rapid climate change is expected to affect the populations inhabiting this area the most due to its proximity to the APF but also as these populations are already living at the upper limit of their thermal tolerance. Moreover, with increasing temperatures the establishment of invasive species is likely to occur in this region. The ability of fringe populations to adapt to these upcoming changes depends on their genetic diversity, population size and the influx of non-adaptive alleles from cold-adapted central populations. The giant isopod *Glyptonotus antarcticus*, a key species of the South Georgia benthos, was characterized by several neutral and selective markers (10 genes ~7kbp) comprising nuclear gene fragments (18S rDNA, elongation factor, haemocyanin, myosin, and four anonymous markers), mitochondrial markers (cytochrome oxidase 1, 16S rDNA) and 14 nuclear microsatellite markers. The neutral markers show that the population size of South Georgia is small with unidirectional gene flow from the Antarctic peninsular region but excluding South Orkney and South Sandwich Islands as sources, which are genetically distinct. Markers under natural selection indicate that South Georgia is a subset of populations from the Antarctic Peninsula casting doubt on the potential for local adaptation in this fringe population. Our study suggests that *Glyptonotus* around South Georgia may suffer from the influx of maladaptive alleles and may be strongly limited in its adaptive response to future environmental change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: Low genetic diversity of the brooding sea-urchin *Abatus agassizii* (Spatangoidea: Schizasteridae) in the South Shetland Islands: a bridgehead population before the spread to the northern Antarctic Peninsula?

Forename: Karin Surname: Gerard

Authors: Gerard, Karin; Maturana, Claudia; Martinez, Andrea; Diaz, Angie; Poulin, Elie;

Presentation Allocated: Poster

abstract: The marine benthos from Antarctica presents an unusual proportion of brooding species. The breeding corresponds to the lack of larval phase and the retention of eggs by the female during the development, which limits the dispersal of juveniles. The echinoid genus *Abatus* is composed of 11 brooding species exclusively distributed in the Antarctic and Subantarctic. In these species, the low dispersal of male gametes and the limited mobility of the adults should drastically limit the gene flow between isolated patches of individuals. In *A. cordatus*, an endemic species from Kerguelen Archipelago, the occurrence of genetic differentiation over several kilometers to few meters, was described. In the context of an INACH (Instituto Antártico Chileno) project, was discovered the unique population of *A. agassizii*, in the Fildes Bay (King Georges Island, South Shetlands). This population is found between 1.5 and 12 m of depth in the Ardley Peninsula. The first description of this population reported its extension to a larger zone. Here, we characterized the limits of this population at the scale of the Fildes bay and sampled *A. agassizii* in 8 additional locations separated by 500 m to 5.7 km. We analyzed and compared the genetic diversity in the 9 sampling sites using 9 microsatellite loci, then we related the occurrence of a genetic structure to the geographic scale. Among the 9 microsatellite loci, 6 were used, one of which had null alleles. The genetic diversity appeared equally spread over all locations. Genetic differentiations were observed between sites separated by at least 800 m. Four groups of samples were identified. The population of *Abatus agassizii* in Fildes Bay extends in several patches of various size, separated by zones with non-optimal conditions for this species such as high depth, rocky, exposed shores without sediment. Despite the putatively reduced dispersal capacity of *A. agassizii*, we detected a level of genetic diversity that is maintained at the global scale of Fildes Bay. The genetic differentiation revealed even if significant, was very low and appears from 800 m. In parallel, we observed within each differentiated group, a genetic homogenization sometimes over 1 km, thus suggesting the occurrence of various large panmictic units.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: Patterns of genetic diversity, structure, and connectivity in the Antarctic limpet *Nacella concinna* (Strebel, 1908) along its distribution in the Southern Ocean.

Forename: Claudio A Surname: González-Wevar

Authors: González-Wevar, Claudio A; Chown, Steven; Poulin, Elie; Morley, Simon;

Presentation Allocated: Oral

abstract: Endemic to Antarctic ice-free rocky ecosystems, the limpet *Nacella concinna* is a conspicuous and dominant marine benthic macro-invertebrate along its distribution in Antarctic Peninsula, the Scotia Arc, and their associated islands. To examine the patterns of genetic diversity and structure in this species we amplified 663 bp of the mtDNA COI in 250 specimens from different localities along western Antarctic Peninsula (3), the South Shetland Islands (3), eastern Antarctic Peninsula (1), and the Scotia Arc (1). For comparison purposes we also included in the analyses 15 individuals of the Subantarctic relative *N. delesserti* (Marion Island). Levels of genetic diversity in the Antarctic limpet were low but similar to those detected in other Antarctic benthic organisms. Pairwise GST and NST comparisons did not detect significant differences among western Antarctic Peninsula and South Shetland Islands populations. However, we found high levels of genetic structure between South Georgia and all the other analyzed populations. Similarly, Ross Island (eastern Antarctic Peninsula) exhibited evidence of genetic differentiation, especially with geographically distant populations in western Antarctic Peninsula such as Rothera and South Bay. The Median-joining haplotype network resulted in a star-like genealogy with a dominant haplotype (H3) that was present in more than 60% of the individuals and in all the Antarctic localities. A marked L-shaped distribution of pairwise differences and negative Tajima's D and Fu's FS indices suggest a recent demographic expansion that according to our estimations occurred between 7.500 and 22.000 y.a. Low levels of genetic diversity in *N. concinna* could reflect the dramatic effect of glacial periods on population sizes, especially in Antarctic species with narrow bathymetric range. Higher levels of genetic diversity detected in South Georgia Island and the discovery of this island of Antarctic Peninsula and endemic haplotypes suggest that these islands could have constituted glacial refugia for the species during the LGM. Genetic affinity between *N. delesserti* and *N. concinna* fell within the range of intraspecific variation and suggest that the former species require a taxonomic revision. The genetic proximity between these nominal species could be explained through recent colonization of Marion Island from the Scotia Arc and further in-situ differentiation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: Population connectivity and gene flow in East Antarctic echinoids

Forename: Jacob Surname: van Oosterom

Authors: van Oosterom, Jacob; Miller, Karen; King, Catherine; Miskelly, Ashley; Mondon, Julie;

Presentation Allocated: Oral

abstract: Understanding population structure, in terms of connectivity and gene flow, is crucial for effective conservation management strategies involving marine protected areas, in the face of environmental change. For sessile marine invertebrates, the major mechanism for dispersal is usually a planktonic larval phase, where wind and current patterns play a major role in determining dispersal. When this larval phase is absent, such as in brooding organisms common in Antarctic waters, dispersal can be reduced, and populations can become reproductively isolated. This can increase genetic diversity within a species and lead to speciation; however isolated populations are more vulnerable to environmental change through reduced immigration, and an increased risk of local extinction. Molecular techniques provide valuable insight into the processes of dispersal and recruitment, where the life history characteristics of marine organisms and the Antarctic setting make direct measurement extremely difficult. To date, our knowledge of these processes in East Antarctica is limited. Our study uses molecular techniques to explore past and present patterns in population structure across a range of spatial scales in three echinoid species with different life history characteristics, *Sterechinus neumayeri*, *Abatus nimrodi* and *Abatus ingens*. As predicted from life-history characteristics, mitochondrial DNA sequence data (CO1 and 16S) indicated the broadcast spawning *S. neumayeri* comprised a single genetic group across 2000 km of the East Antarctic coastline ($F_{ST} p > 0.05$) whereas the brooding *A. nimrodi* and *A. ingens* showed significant genetic subdivision between populations from the same locations ($F_{ST} = p < 0.001$). Haplotype networks and a bayesian phylogenetic analysis of *Abatus* spp. from East Antarctica showed the presence of genetic subdivision between locations. This indicates reproductively isolated populations which are under the influence of genetic drift. Phylogenetic analysis indicated *A. nimrodi* is more closely related to *Amphipneustes lorioli* than to the other *Abatus* spp. supporting acceptance of the *Pseudabatus* genus (Koeler 1911) incorporating *A. nimrodi*. These results indicate population structure of echinoids in East Antarctica is linked to life history characteristics, where brooders comprise reproductively isolated populations, and broadcast spawners are a single well connected population. This is essential for well informed future management strategies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: State of the art of achieved work on intraspecific genetics of Antarctic marine fauna

Forename: Elie Surname: Poulin

Authors: Poulin, Elie; Diaz, Angie; Gerard, Karin; Gonzalez-Wevar, Claudio;

Presentation Allocated: Poster

abstract: The distribution, abundance and composition of the marine near-shore fauna in the SO reflect complex interactions of geological, oceanographic and biological factors through space and time. A mixture of taxa with different biogeographic affinities composes the SO marine benthic fauna: (1) relict autochthonous groups; (2) a group derived from adjacent deep-water basins; (3) a group dispersing from South America along the Scotia Arc; (4) a group that spread northward from Antarctica along the Scotia Arc. Several families of marine benthic organisms that are abundant and diverse in other adjacent regions are scarcely represented or even absent in the SO. Nevertheless, porifera, bryozoa, echinodermata, polychaeta, ascidians, pycnogoniids, amphipods and isopods are highly rich and varied in this continent, suggesting that major climatic and oceanographic changes in the region did not impeded their evolutionary success. In less than half a century, advances in molecular biology introduced many types of molecular markers that have totally changed our view of the evolutionary process. The development of DNA manipulation techniques (PCR) in the middle 80's promoted a shift from enzyme- to DNA-based methods. The application of DNA-based analyses in Antarctic organisms is limited to few studies, most of them based to key and dominant organisms. The limited number of molecular studies in Southern Ocean areas may be due to logistical and operational problems related to the access of samples from such isolated areas. However, the Southern Ocean represents an interesting area to test for important issues in evolutionary biology. Here, we present a revision of most of the published articles concerning patterns of genetic diversity and structure in marine benthic macro-invertebrates and fishes from Antarctica and Subantarctic related areas. The information contained in these studies permitted us first to generate a list of geographical areas y taxonomic groups that have been better surveyed. At the same time, we will also identify the relevance of life history traits, reproductive modes and bathymetrical ranges on the patterns of genetic diversity and structure among Antarctic and Subantarctic marine benthic taxa. Finally, we aim to identify the priorities for future work in population genetics along the Southern Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 13

Title: The role of reproductive modes on dispersal and population connectivity in Antarctic benthic invertebrates.

Forename: Andrew Surname: Mahon

Authors: Mahon, Andrew; Janosik, Alexis; Halanych, Kenneth;

Presentation Allocated: Oral

abstract: Antarctica is a region of extreme isolation and many of inhabitants of the Southern Ocean are endemic. Some species are also described as being circumpolar in distribution. Previous work has shown that invertebrates in Antarctic waters exhibit many different developmental modes, including species that exhibit planktotrophic life history stages or brood their offspring. With developmental mode significantly affecting hypothetical limits of dispersal in marine organisms, those species that have a planktotrophic life history stage should have an increased ability to maintain genetic continuity over greater distances. The aim of this work is to describe the life history and genetic connectivity of multiple species of Antarctic organisms with different modes of reproduction including members of the Asterozoa, Pycnogonida, and Nemertea as case studies. Using mitochondrial sequence data, we find that both species with brooding life history stages and those with planktotrophic larval stages brooding and planktotrophic exhibit genetic connectivity across large distances around the continent of Antarctica. Results of our work show that a brooding organism in Antarctica does not necessarily conform to previous hypotheses of limited dispersal capabilities and that gene flow can occur across large distances in the Southern Ocean. Future work should investigate both the limits of this connectivity around the entire continent of Antarctica and the mechanisms by which organisms are dispersed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: A new DNA barcoding method using Support Vector Machines

Forename: Tae-Kun Surname: SEO

Authors: SEO, Tae-Kun;

Presentation Allocated: Poster

abstract: Species identification is a very important issue in biological researches, and the molecular data play a crucial role in its study. DNA barcoding - the identification of species using DNA sequences - is being applied in many areas due to the increases of genomic information and the development of sequencing technologies. Several DNA barcoding methods have been suggested. These methods utilize similarity scores, analyze phylogenetic and population genetic information, or detect species-specific sequence patterns. Although these methods have demonstrated good performance under various circumstances, they also have limitations because they are subject to loss of information, require intensive computation and/or are sensitive to model mis-specification. Furthermore, it can be difficult to evaluate the significance of species identification for some methods. Here, we introduce a new DNA barcoding method in which support vector machine (SVM) procedures are adopted. For this method, we consider a 3-dimensional transform of 4 nucleotides and the distance measures among DNA sequences. The new transform and distance measures enable us to adopt bootstrap procedures to evaluate the significance of DNA classification. Our new method is nonparametric and thus is expected to be robust for a wide range of evolutionary scenarios as well as multilocus analyses. In this presentation, we show the performance of our method via simulation studies and empirical data analyses.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Acari and Collembola from northern islands of the Argentine archipelago (Antarctic Peninsula)

Forename: Vladlen Surname: Trokhymets

Authors: Trokhymets, Vladlen; Caruso, Tancredi; Bargagli, Roberto;

Presentation Allocated: Poster

abstract: Little data exist on soil invertebrates from Antarctic Region such as the southernmost part of the Antarctic Peninsula. Here we report results from the Argentine archipelago, where the Ukrainian Antarctic station "Akademik Vernadsky" is located. The investigation of terrestrial ecosystems in this region started in 2007 thanks to a cooperation established between Ukrainian and Italian researchers. The aim was to address the relative roles that birds, invertebrates and climatic changes have on the dynamics of soil ecosystems. Recently, three islands of this region (Fanfare Is., Irisar Is. and Uruguay) were systematically studied with regard to the species composition and distribution of mites, collembolan and chironomids associated with algae, moss and soil-substrate. Overall 11 species of invertebrates were recorded from the sampling sites, including 7 species of Acarina, 3 species of Collembola, and 1 species of Chironomidae. The distribution of these species within and between the islands slightly varies. Six species were found in all three islands: Acarina – *Alaskozetes antarcticus* (Michael, 1903), *Halozetes belgicae* (Michael, 1903), *Gamasellus racovitzai* (Trouessart, 1903); Collembola – *Cryptopygus antarcticus* Willem, 1901, *Friesea grisea* (Schaffer, 1891); Chironomidae – *Belgica antarctica* Jacobs, 1900. Three mite species (*Protereunetes minutus* Strandtmann, 1967, *Rhagidia leechi* Strandtmann, 1963, *Stereotydeus villosus* (Trouessart, 1902)) were found in the Fanfare Is. alone, whereas one mite species (*Oppia loxolineata* Wallwork, 1965) was recorded from the Uruguay Is. only. The collembolan *Isotoma octo-ocellata* Willem 1902 was found in the Fanfare Is. and Uruguay Is. As regards other groups of invertebrates, which have not been identified yet to the species level, Nematoda and Rotifera were found in high abundance.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Antarctic Asteroidea (Echinodermata) collected during the Brazilian Antarctic Programme

Forename: Thayane Surname: da Cunha Oackes

Authors: da Cunha Oackes Souza, Thayane; Bendayan de Moura, Rafael; Campos Leal, Daniele; de Siqueira Campos, Lucia;

Presentation Allocated: Oral

abstract: During the past 29 years, benthic organisms have been sampled during the Brazilian Antarctic Programme (PROANTAR) from the intertidal to approximately 520 m at the Bransfield Strait and South Shetland Islands. Different types of equipment were used over the years, such as trawls (e.g., Agassiz, Otter), traps, and van Veen. One of the most conspicuous benthic groups sampled were the sea stars (echinoderms). Thus, this work aimed to evaluate their species richness and diversity from these samples. A total of 59 morphospecies were identified, representing 30% of the Asteroidea known for the Southern Ocean. From these, 37 morphospecies were recorded during the Austral Summer of 1985/86, when samples were taken through trawling along the Bransfield Strait at depths varying from 60 to 362 m. A Redundancy Analysis was applied to these data in order to test the hypothesis that the specific composition would be distinct in terms of depth and geographic distribution along the strait. The results have shown a species composition homogeneity in both cases, which is probably related to the main physical features of the Antarctic Circumpolar Current. However, a possible tendency of a highest species richness and diversity at both SW and NE extremes of the strait, near Low and Elephant islands respectively should be investigated. Amongst all recorded species, *Notasterias bongraini* was the most abundant, followed by *Diplasterias brucei*, *Remaster gourdoni*, *Odontaster validus* and *Labidiaster annulatus*. The later four were the most frequent. Therefore, these five species were selected for a more detailed taxonomic study, being redescribed. *N. bongraini*, *D. brucei*, *O. validus* and *L. annulatus* are circumpolar species. The first three have shown morphological variation, which indicates that they may be semi-cryptic species. A correlation between the ratio radius/interradius (R/r) and specimens' size (R) has shown that the arms of *N. bongraini* and *D. brucei* have the tendency to grow at a higher rate than the disk, what could be characteristic from the Asteroidea. A detailed ecological work, including appropriate replicates at different stations along the Bransfield Strait would be necessary to adequately test the hypothesis related to species distribution, however the material sampled during the Austral Summer of 1985/86 provided valuable data of a fairly extensive geographical area and bathymetric range in a single expedition to Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Antarctic echinoderms in local and global context

Forename: Piotr Surname: Kuklinski

Authors: Kuklinski, Piotr; Borszcz, Tomasz; Balazy, Piotr;

Presentation Allocated: Oral

abstract: Echinoderms are among the highest biomass and carbonates producers in the polar waters. However we still do not have modern base line information about their basic ecology especially in Antarctic shallow waters where climate changes will have probably the most severe impact. Goal of this study is to provide knowledge on echinoderm's assemblage parameters from maritime Antarctic island – King George. The study provides quantitative information about species richness, ecology and carbonate production in both local and global context. We sampled qualitatively and quantitatively shallow subtidal down to 30 m with use of SCUBA. Additionally carbonate production was measured by ashing and directly by bleaching organic matter of all echinoderm species encountered. Overall 23 spp. of echinoderms were recorded from 90 samples (1 m² frames). Sea stars were the most species rich (15 spp.) while crinoids and sea cucumbers were represented only by one species each. Sea urchins had the highest biomass and were the largest carbonate producers. There was no any clear trends along the bay when it comes to species distribution and abundance. On the other hand there was strong stratification in species distribution, richness and biomass with depth. All these parameters were higher at deeper locations. With over 7 indiv. and 2 spp. on average per m² this assemblage could be considered as highly abundant and moderately diverse in comparison to lower latitude locations. Carbonate content on average was over 13 g. per m² and was species specific. In comparison to existing data from tropics skeletal mass of Antarctic echinoderms is rather small. This provide support for hypothesis predicting heavier calcification in tropical regions. This study revealed very rich and abundant echinoderm assemblage. It is shaped to high degree by physical disturbance (eg. ice) as indicated by lower diversity and abundance at the shallowest stations. The group was shown to be locally one of the greatest contributor of biomass and carbonates. Revealed species specific control of carbonate content has great implication for understanding influence of climate change on echinoderms especially with predicted ocean acidifications as those species producing the thinner skeletons might be impacted the first. Obtained results will act as great baseline study for future investigations regarding influence of climate change and other human or environmentally driven impacts.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Antarctic Marine Biodiversity Field Guide from King George Island and adjacent areas

Forename: Lúcia S. Surname: Campos

Authors: Campos, Lúcia S.; Bassoi, Manuela; Costa, Erli Schneider; Osman, Layla P.; Moura, Rafael B.;

Presentation Allocated: Poster

abstract: This guide comprises information about many forms of marine life sampled and observed at Admiralty Bay, King George Island, and its vicinity around the South Shetlands Archipelago and Bransfield Strait, Antarctica. The main objective of this guide is to assist general public and scientists in recognizing marine organisms both in the field and laboratory. It includes introductory chapters for each group and highlights mainly the most relevant morphological features for identification and further information on biology, ecology and distribution of more than 80 antarctic species, from microorganisms to the megafauna. In addition, each species photographs were organized into plates, including colour images of live specimens, and where applicable, photomicrographs of the main important structures for identification. This guide has been produced within the context of the Brazilian IPY project "Marine Life in Relation to the environmental Heterogeneity in Admiralty Bay and Adjacent Areas (MABIREH)" as a contribution to the Census of Antarctic Marine Life (CAML).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Antarctic Microbial Biodiversity : the importance of geographical versus ecological factors

Forename: Dagmar Surname: Obbels

Authors: Obbels, Dagmar; De Carvalho Maalouf, Pedro; De Wever, Aaike; Peeters, Karolien; Willems, Anne; Verleyen, Elie; Vyverman, Wim; Wilmotte, Annick;

Presentation Allocated: Poster

abstract: Antarctica is a prime region to test whether microbes have a biogeography and to study their metacommunity dynamics, because (i) it is isolated from the other continents, (ii) its extreme environmental conditions allow microorganisms to dominate its ecosystems, and (iii) lacustrine and terrestrial habitats occur isolated in a matrix of ice and ocean. We compiled a large set of samples from benthic microbial mats from Antarctic lakes in different ice-free regions and used a polyphasic approach to study their microbial biodiversity by combining morphological characterization of diatoms with molecular techniques such as Denaturing Gradient Gel Electrophoresis (green algae and cyanobacteria), 454 pyrosequencing and cultivation (prokaryotes). A variation partitioning analysis of a selection of 41 samples revealed that geographical variables explained a significant part of the variation in the eukaryotic microorganisms, whereas they failed to significantly explain patterns in the prokaryotes. The incidence of endemism also differed between the different taxonomic groups. For cyanobacteria, DGGE bands of 59 samples were grouped into 39 OTUs. The majority (64.9%) had a cosmopolitan distribution whereas the rest seemed to be restricted to polar and alpine environments. 16.2% were restricted to Antarctica. Diatoms showed a relatively high incidence of endemism (49%) based on the morphospecies concept. For bacteria, 42% of phylotypes based on the 16S rRNA gene are at present only known from Antarctica. A high number of prokaryotic sequences obtained by pyrosequencing and almost 20% of the Chlorophyte sequences (DGGE) had less than 97.5% similarity with a sequence in public databases, which might indicate the presence of new species and potential endemics. The contrasting patterns in the metacommunity dynamics and the incidence of endemism between the different microbial groups might be related to cell size and life cycle characteristics, such as the formation of spores and the presence of a sexual phase. We conclude that findings from one particular microbial group cannot be generalized to microbes as a whole.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Archaeal and bacterial community structure in Potter Cove marine environment

Forename: Edgardo Alejandr Surname: Hernández

Authors: Hernández, Edgardo Alejandro; Piquet, Anouk; López, José Luis; Mac Cormack, Walter Patricio; Buma, Anita G. J.;

Presentation Allocated: Poster

abstract: Archaeal and Bacterial community structure were studied in sea water samples taken from three different sites at Potter Cove (25 de Mayo Island, South Shetland Islands). We studied three bacterial and archaeal 16S rRNA clone libraries obtained from an intermediate site where a significant marine and freshwater mixing process occurs (Station 1), an open sea site, outside the cove and far from freshwater input (Station 2) and finally one site directly receiving the freshwater input of the Potter Creek (Station 3). Ninety-six archeal sequences and 192 bacterial sequences from each station were phylogenetically analyzed. The major part of the Archaeal sequences (145 out of 192) could not be clearly assigned to an archaeal phyla and only 47 sequences were affiliated to the phylum Euryarchaeota. The high number of unclassified archaeal sequences reveals the limited information existing about diversity of this domain of organisms. Affiliation of bacterial sequences showed the dominance of members of phylum Proteobacteria in all the studied sites, ranging between 38.0 and 58.9 %. Bacteroidetes represented between 23 and 30% of the identified sequences. Actinobacteria was highly represented in Station 3 (22.4%) but much more poorly represented in open sea waters (6.8%). Another remarkable finding is the lack of Cyanobacteria (only one sequence out 192 in Station 3) and the abundance of the anoxygenic photosynthetic members of the family Rhodospirillaceae. A further and deeper analysis of the physicochemical characteristics of this environment could explain this particular finding about the phototrophic components of the bacterial community of Potter Cove. Data from both archaeal and bacterial sequences analyzed with distance and parsimony methods evidenced some clusters containing only sequences of freshwater origin, other clusters containing only "marine sequences" and also clusters with sequences from both origins. Mixed groups showed similar but no identical sequences which could mean that some bacterial and archaeal strains evolved in the marine environment from microorganisms previously transported by the freshwater runoff.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Associated Fauna of *Prasiola crispa* (Chlorophyta) related to penguin rookery at Arctowski (King George Island, South Shetland Islands, Maritime Antarctic)

Forename: Dalto Surname: Adriana

Authors: Adriana, Dalto; Geyze, Faria; Yocie, Yoneshigue-Valentin;

Presentation Allocated: Poster

abstract: Associated Fauna of *Prasiola crispa* (Chlorophyta) related to penguin rookery at Arctowski (King George Island, South Shetland Islands, Maritime Antarctic) Adriana G. Dalto, Geyze M. de Faria, Caio A. de A. Imbassahy, Tais de S. C., Yocie Yoneshigue-Valentin Universidade Federal do Rio de Janeiro, Instituto de Biologia, Departamento de Botânica, Laboratório de Macroalgas Marinhas e-mail: agdalto@gmail.com The community of terrestrial invertebrates associated to the vegetation of ice-free areas are particularly poorly studied in the Antarctic region. Its terrestrial biota includes organisms ecophysiology adapted to environmental pressures involving very low temperatures, nutrient limitation, environmental radiation, lack of liquid water, desiccation and physical abrasion. These characteristics result in the terrestrial communities of Antarctica being particularly sensitive to the effects of human presence in the region and to climate change. The present study intends to contribute to the knowledge of the terrestrial invertebrate fauna associated to *Prasiola crispa*, a nitrophilous green algae that occurs especially in the supralittoral zone and free ice areas located near seabird colonies, where they benefit from the guano. The samples were collected in January 2011 on the rocks in the region adjacent to the penguin rookery at the Henri Arctowski Polish Research Station (Admiralty Bay). The preliminary results showed that Tardigrades and Nematodes are the most abundant organisms of the associated fauna of *P. crispa*, being found in extremely high density ($> 3965 \text{ ind.cm}^{-2}$). Other invertebrates were found in low densities ($< 70 \text{ ind.cm}^{-2}$) including Acari, Rotifer and Collembola. The taxonomic identifications are still underway, however, up to the present time the most abundant organisms have all been identified; amongst them are three species of Collembola (*Cryptopgus antarcticus*, *Fiesia cf. grisea* and *Friesia sp.*), one genera of Nematode (*Plectus*) and one genera of Tardigrade (*Hysibius*). All the taxa identified up to the present time have already been described as pertaining to the Antarctic Maritime region. Furthermore, recent research studies have shown that *P. crispa* possesses potential bioactive substances for insecticide activity, which is indicative of how important it is to increase the knowledge about this alga and all the associated microfauna related to it. Financial support: CNPq, CAPES, FAPERJ, INCT-APA

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Bacterial biodiversity and function in a cold desert ecosystem

Forename: Cristina Surname: Takacs-Vesbach

Authors: Takacs-Vesbach, Cristina; VanHorn, David; Gooseff, Michael; Barrett, John;

Presentation Allocated: Poster

abstract: For many decades the soils of the McMurdo Dry Valleys, Antarctica were thought to be essentially aseptic. We now know that this is an ecosystem that is dominated by microorganisms, however, early cultivation efforts failed to detect the apparently high diversity of the region's poorly weathered, low organic-matter soils. Initial surveys of microbial diversity using 16S rRNA gene sequencing revealed a surprising bacterial richness, including representatives from at least ten different phyla, and a high proportion of unique and rare sequences. Yet, initial surveys of microbial diversity were not exhaustive and little information was gained about the function of the detected microorganisms. Furthermore, given the low rates of microbial activity and decomposition rates, the question of whether this richness represents functioning vs dormant members of the community has been raised. We have conducted an exhaustive survey of the microbial richness, function, and activity of soil bacteria across gradients of moisture and salinity using pyrosequencing of 16S rRNA bacterial tag-encoded FLX amplicons (bTEFAP) and environmental DNA (metagenomics) combined with extracellular enzyme assays. Our metagenomic analysis included approximately 1 Gb of DNA sequences from four samples and represents a first step in linking community diversity and function, an essential step in this model ecosystem as well as soil ecosystems worldwide. Comparisons of the microbial communities detected by both methods reveal a soil biodiversity that is dominated by Actinobacteria, Proteobacteria, Firmicutes, and Acidobacteria. However, even our metagenomic analysis pointed to a moderate level of diversity for these samples, including many singleton species and ranging from 550 to 780 OTUs per sample. A majority of the metagenomic sequence was assignable to a putative function, including a large proportion of metabolic genes. The potential microbial function of dry valley soil will be discussed with the ultimate goal of understanding the role of bacteria in cold arid soils.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Benthic environments and communities on the George V Shelf, East Antarctica

Forename: Alix Surname: Post

Authors: Post, Alix; Smith, Jodie; Beaman, Robin; Eléaume, Marc; O'Brien, Phil; Riddle, Martin;

Presentation Allocated: Oral

abstract: Physical and biological characteristics of benthic communities on the George V Shelf have been analysed from underwater camera footage collecting during Aurora Australis voyages in 2007/08 and 2010/11. The 2007/08 data reveals a high degree of variability in the benthic communities across the shelf, with the benthic habitats strongly structured by physical processes. Iceberg scouring recurs over timescales of years to centuries along shallower parts of this shelf, creating communities in various stages of maturity and recolonisation. Upwelling of modified circumpolar deep water onto the outer shelf and cross-shelf flow of high salinity shelf water create spatial contrasts in nutrient and sediment supply, which are largely reflected in the distribution of deposit- and filter-feeding communities. Long-term cycles in the advance and retreat of icesheets (over millennial scales) and subsequent focussing of sediments in troughs such as the Mertz Drift create patches of consolidated and soft sediments, which also provide distinct habitats for colonisation by different biota. These interacting processes of iceberg scouring, current regimes and depositional environments, in addition to water depth, are important factors in the structure of benthic communities across the George V Shelf. In February 2010, iceberg B09B collided with the Mertz Glacier Tongue, removing about 80% or 2500km² from the protruding tongue. This event provided a rare opportunity to access an area previously covered by the glacier tongue, as well as regions to the east where dense fast ice has built up over decades, restricting access. The 2010/11 voyage imaged 3 stations which were previously beneath the floating tongue, as well as 9 stations covered by multi-year and annual fast ice since the mid 1970s. Seabed imagery from these regions provides the first glimpse of the benthic communities in these previously ice-covered and food-limited areas, revealing a seabed environment that is sparsely populated but relatively diverse. The impoverished nature of these communities is consistent with observations in the regions formerly covered by the Larsen A and B ice shelves. The calving of the Mertz Glacier Tongue has vastly changed the geography of the region, and will likely result in changes to the oceanographic regime, particularly the formation of the Mertz polynya. The two image datasets from these regions therefore provide a baseline for assessing any impacts on the benthic communities.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Biodiversity patterns of Southern Ocean Ostracoda (Crustacea)

Forename: Simone Nunes Surname: Brandao

Authors: Brandao, Simone Nunes; Brandt, Angelika; Martínez Arbizu, Pedro;

Presentation Allocated: Poster

abstract: Although one of the largest habitable areas on Earth are in the Southern Ocean little is known about their biodiversity patterns. In the present project, we investigate large-scale biodiversity patterns using the Ostracoda (the taxa with one of the most extensive fossil records among all metazoans) as model organism. We studied almost 100 epibenthic sledge samples collected from the Atlantic and Pacific sectors of the Southern Ocean from the sublittoral to >6,000m depth. Our first results indicate no clear bathymetric pattern, but fluctuating biodiversity values in different depths. In order to keep our analyses robust, taxonomic revisions of previously described species were performed. We record a large number of new species in the Southern Ocean, indicating that: (1) a considerable part of Southern Ocean biodiversity remains undiscovered; and (2) several species previously considered circum-antarctic are actually groups of distinct species. The present project is financially supported by CeDAMar, EOL, SCAR-MarBIN-CAML- TOTAL Foundation, SYNTHESYS, Hansische Universitäts-Stiftung.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Biological activity of phage isolates which collected on archipelago Agentian islands, Antarctica

Forename: Olga Surname: Pugach

Authors: Pugach, Olga;

Presentation Allocated: Poster

abstract: In most modern researches were demonstrated that viruses have an influence on biochemical and ecological processes, including biodiversity of bacteria. In spite of geographical isolation of Antarctic islands and special climatic conditions the most of isolated microorganisms are presented the same groups microorganisms, which were found in regions with temperate climate. Condition of systematic studies of viral communities and biodiversity in Antarctica and creation of the collection of bacteriophages is an important task. Research of phages of phytopathogenic bacteria is important for discovering ways of phytopathogenic infections control. The aim of our work was researching properties of phages of phytopathogenic bacteria. In this work were analyzed samples of the soil and moss, which were selected on archipelago the Argentinean islands near Ukrainian Antarctic station «Academician Vernadskiy» during seasonal work. The time keeping of biological (lytic) activity of phages, morphology, spectrum of lytic activity, and estimate possibility of development preparations against phytopathogenic bacteria based on Antarctic phages were investigated. Phage isolates were selected and sensitive bacterial cultures were specified – *E. carotovora* 216, *X. axonopodis* 7325, *P. syringae* 1025. Phage isolates were tested for their lytic activity against these bacteria. Were show that long period of phages keeping characterizes by gradual loss of activity. Phages lost their lytic activity to different strains nonsimultaneous. Lytic activity against sixteen strains of pathogenic bacteria belonging to *Erwinia*, *Xanthomonas* and *Pseudomonas* genera was tested. Majority of phages were polyvalent (they have lytic activity to more than one bacterial strain). Electron microscopy studies revealed that according to their morphology isolated phages can be attributed to the following taxonomic groups: C1 morphotype, Podoviridae family, and B1 morphotype, Siphoviridae family, Caudovirales order. Consequently, in our research were shown that inactivation of phages is a complicated process which closely associated with processes of adaptation to bacteria surviving in environment. Probably, in nature circulation of phages occurs with change of receptive bacterial hosts. These researches lay the foundation for monitoring phages of phytopathogenic bacteria on Argentine islands. It is open perspectives of development of prognostic model which can allow anticipation spread of the bacterial infections.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Carbon Fixation in Cold Environments: RubisCO Enzyme and Transcriptional Activity in psychrophilic laboratory isolates versus natural Antarctic lake communities

Forename: Jenna Surname: Dolhi

Authors: Dolhi, Jenna; Li, Wei; Morgan-Kiss, Rachael;

Presentation Allocated: Poster

abstract: Photosynthetic microorganisms drive fixation of inorganic carbon in the majority of aquatic ecosystems on earth including low temperature systems. Studies on photosynthetic productivity in organisms adapted to permanent cold environments are important as it is well known that low temperatures have a significant impact on a number of photosynthetic processes across distantly related mesophilic organisms. Low temperature aquatic food webs are dependent upon energy and carbon derived from autotrophic organisms: the vast majority of which rely on light-driven photosynthetic reactions catalyzed by cold-adapted photosynthetic microorganisms (or photopsychrophiles). While there are a few emerging photopsychrophilic model species, our understanding of the underlying mechanisms that allow these extremophiles to not only survive but thrive in harsh low temperature habitats is in its infancy. One of the reasons for the lack of understanding is that only a limited number of studies attempt to link physiological characterization of laboratory cultures with ecologically relevant research in the natural habitat of photopsychrophiles. In an effort to advance our understanding of photosynthetic function at low temperatures, we studied the enzyme Ribulose-1,5-bisphosphate carboxylase/oxygenase (RubisCO), which catalyzes the first step in fixation of inorganic carbon into simple sugars. Here we report on protein abundance, transcriptional activity and catalytic rates of RubisCO from laboratory cultures of the psychrophilic green alga, *Chlamydomonas raudensis* UWO241, isolated from the deep photic zone of a permanently ice-covered lake (Lake Bonney McMurdo Dry Valleys, Antarctica). In addition, we report on RubisCO phylogenetic diversity, transcriptional activity, catalytic rates and rates of primary production in the natural phytoplankton communities residing in the aquatic habitat from which *C. raudensis* was isolated. RubisCO activity in natural lake samples followed vertical trends in primary productivity and phytoplankton biomass, with maximum carboxylase activity occurring near the chemocline in the natural habitat of *C. raudensis*. In laboratory cultures, our results suggest that the RubisCO enzyme of *C. raudensis* is not cold adapted, and that this psychrophile compensates for reduced enzymatic activity at low temperatures by synthesizing higher levels of the enzyme.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: CHARACTERIZATION OF TERRESTRIAL ALGAE FROM ARGENTINA ISLANDS AREA (ANTARCTIC) USING A COMBINED MORPHOLOGICAL AND MOLECULAR APPROACH

Forename: Igor Surname: KOSTIKOV

Authors: KOSTIKOV, Igor; Friedl, Thomas; Kryvenda, Anastasiia; Tyschenko, Oksana;

Presentation Allocated: Poster

abstract: Primary producers in Antarctica terrestrial ecosystems are reduced to mosses, liverworts, lichens, two species of flowering plants and mostly microscopic algae. There are four types of algae communities in Antarctic due to literature data, such as lithophilous, soil (edaphophilous), epiphytic and cryophilous (Broady, 1996). In these communities 267 taxa including intraspecies were found. These taxa represent Cyanoprokaryota (101), Chrysophyta (1), Eustigmatophyta (1), Xanthophyta (24), Bacillariophyta (19), Chlorophyta (121). Data about terrestrial algae species composition of Argentina islands are absent in literature. Samples were collected by National Antarctic Scientific Center (Ukraine) members during 2005-2008 years on Galindes and Uruguay islands (Argentina islands) (24 samples overall). Seventy eight taxa were identified in soil, epibryophytous and cryophilous communities. Identified taxa belongs to Cyanoprokaryota (7), Chlorophyta (30), Bacillariophyta (41). 40 taxa were examined in unialgal cultures. The rest of it (38 taxa from Bacillariophyta) was identified by frustules morphology obtained from samples. Substantial differences from known species descriptions were observed for 14 taxa. 9 taxa were investigated by DNA sequence comparisons. Whether the latter are confined to certain ecological micro-niches or exhibit geographical separation is still unclear. For this ITS2 rDNA were used as a DNA barcode. Here we employ PCR primers which preferentially amplify a fragment of rDNA from green algae which stretches from the 3'-end of 18S rDNA until the LSU rDNA. With two simultaneous sequencing reactions the ITS2 region as DNA barcode as well as the 3'-end of 18S for to anchor the barcode within a phylogeny is determined. The comparison of ITS2 region sequences with ones obtained from temperate regions strains mostly confirms results of morphological identification. Results of these ongoing analyses are presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Chemical mediation of predator-prey and mutualistic interactions between macroalgae and invertebrates on the Western Antarctic Peninsula

Forename: Charles D. Surname: Amsler

Authors: Amsler, Charles D.; Schoenrock, Kathryn M.; McClintock, James B.; Baker, Bill J.;

Presentation Allocated: Oral

abstract: Macroalgae dominate hard bottom areas along the Western Antarctic Peninsula to depths of up to 40 m or more. Most of the macroalgae are chemically defended from a variety of macro- and mesograzers including amphipods but harbor very high densities of amphipod mesograzers. The amphipods benefit from living on the large, chemically-defended macroalgae because they gain refuge from fish which are their primary predators. These amphipods do not consume most of the macroalgal species, but are of benefit to the macroalgae by keeping them relatively clean of epiphytic microalgae and filamentous macroalgae. Hence, this represents a community-scale mutualistic relationship between the dominant macroalgal assemblage and the abundant amphipod assemblage that is mediated, at least in part, by the macroalgal chemical defenses. Although the macroalgae clearly benefit from amphipod grazing on epiphytes, the amphipods appear to have selected for a relatively high incidence of filamentous algal endophytes growing within some of the larger macroalgal species. The endophytes benefit by gaining refuge from the grazing amphipods. However, these endophytes can be, but are not always, detrimental to the macroalgal hosts.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Climate change simulation in continental Antarctica using Open-Top Chambers

Forename: Marie-José Surname: Mano

Authors: Mano, Marie-José; Namsaraev, Zorigto; Gorodetskaya, Irina; Elster, Josef; Wilmotte, Annick;

Presentation Allocated: Poster

abstract: In continental Antarctica, the environmental conditions are extreme and only microbial organisms can withstand them. Currently, the majority of OTCs experiments are being held in Maritime Antarctica but it would be interesting to have such data for the continental part of Eastern Antarctica. To monitor the response of the microbial communities to local simulations of climate change, 8 Open-Top Chambers (OTC) were installed close to the Princess Elisabeth station, in the Sor Rondane Mountains in January 2010. They are located on the Utsteinen ridge, the Tanngarden granite outcrop, the Teltet nunatak and the fourth nunatak of the Pingvinane range. In each location, two OTCs and a control area were established. Temperature and humidity loggers were installed inside the OTCs and outside, in the control areas, to estimate the environmental changes induced by the OTCs. The first results showed that during the summer, the mean daily temperature inside the OTCs can be up to 3.1°C higher than in the control areas. Interestingly, the highest and coldest temperatures were recorded inside the OTCs in Tanngarden. In Tanngarden, the maximal temperature recorded inside an OTC was +22,3°C whereas it was +14,5°C outside the OTC. In contrast, the minimal values were very similar: -41,5°C inside and -40°C outside the OTC. The numbers of freezing/thawing cycles were higher inside the OTC (82) than in the control area (58). According to these results, the environmental conditions seemed to be more variable inside the OTCs than in the control areas. In parallel, the initial state of the microbial community was analysed in the samples collected before the installation of the OTCs using microscopy and a molecular analysis by DGGE. The first molecular results showed the presence of several groups of cyanobacteria, including *Phormidium* sp., *Phormidium pristleyi*, *Leptolyngbya* sp. and *Cyanothece aeruginosa*. The microscopic analyses showed the presence of 7 unicellular and 5 filamentous types of cyanobacteria, including *Leptolyngbya* sp., *Phormidium* sp., *Lyngbya* sp., *Nostoc* sp. and *Stigonema* sp. In addition, 11 types of microalgae were observed. Samples from Tanngarden ridge and Teltet nunatak were dominated by cyanobacteria (76.7-93.3% biovolume). The Utsteinen ridge and Pingvinane nunatak samples were dominated by microalgae (63.5-100% biovolume). An annual monitoring of the microbial diversity and coverage of communities will be carried out during the next years.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Comparative analysis of bacterial taxonomic and functional diversity in terrestrial environments of Barton Peninsula in King George Island

Forename: Ok-Sun Surname: Kim

Authors: Kim, Ok-Sun; Cho, Ahnna; Noh, Hyun-Ju; Lim, Hyoun Soo; Oh, Jeongsu; Hong, Soon Gyu;

Presentation Allocated: Oral

abstract: Recent applications of molecular methods to study microbial ecology have allowed the extension of our knowledge that terrestrial environments in Antarctica contain unexpected high diversity of microorganisms. In the present study, we conducted a comparative analysis of bacterial communities in soil samples from Barton Peninsular in King George Island, the maritime Antarctic. Total 43 samples with different soil types near King Sejong Station were collected in December, 2010. On the basis of the 16S rRNA genes using pyrosequencing, 5,924 OTUs from total 85,078 bacterial sequences were detected using 97% similarity cutoff. Twenty known divisions and 20 unknown divisions were recognized, where the phyla of Proteobacteria (20.7%), Actinobacteria (18.6%) and AD3 (13.4%) were dominant. Interestingly, unexpected diverse phylotypes of AD3 with 99 OTUs were detected, which found only from environments. The bacterial taxonomic and functional diversity was deeply affected by various physicochemical conditions. These findings imply new perspectives of the relationship between microbial ecology and environmental characters in this unique ecosystem.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Comprehensive Analysis of Soil Bacterial Diversity and Structure in Terra Nova Bay of Victoria Land

Forename: Ahnna Surname: Cho

Authors: Cho, Ahnna; Lim, Hyoun Soo; Oh, Jeongsu; Kim, Ji Hee; Hong, Soon Gyu; Kim, Ok-Sun;

Presentation Allocated: Oral

abstract: For several decades, terrestrial environments in Antarctica had been believed as sterilized habitats without any life forms because of the extreme conditions. However, some studies nowadays have started to report the unexpected high diversity of bacteria and their community is complex in these harsh environments. In this study, we investigated the bacterial community and diversity in soil samples collected near the Terra Nova Bay of Victoria Land. Total 42 terrestrial soil samples with depths of 0-3 cm and 3-10 cm were collected in February of 2011. Measured values of soil parameters were pH ranged from 5.19 to 9.27 and water content ranged from 1.3% to 19.3%. By the 16S rRNA genes amplicon sequencing using pyrosequencing method, 67,007 sequence reads were obtained and 7,007 OTUs defined by 97% similarity cutoff were detected. Fifty onedivisions in phylum level were recognized, where the phyla of Actinobacteria (21.7%), Proteobacteria (13.7%), Acidobacteria (10.8%) and Cyanobacteria (10.7%) were dominant. Bacterial community structures were corresponded to the habitat locality. Interestingly, diverse phylotypes of Cyanobacteria with 190 OTUs were detected. Furthermore, the most dominant OTUs were assigned as *Nostoc calcicola* with 1,341 sequence reads and *Microcoleus vaginatus* with 1,005 sequence reads, which belonged to the phylum Cyanobacteria. These findings can provide new insights regarding the cyanobacterial community structure and their ecological roles in this ecosystem.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Constraining environmental preferences of diatoms present in recent sediments from Lake Fryxell, Dry Valleys, Antarctica

Forename: Matthew Surname: Konfirst

Authors: Konfirst, Matthew; Hawes, Ian; Doran, Peter; Sjunneskog, Charlotte;

Presentation Allocated: Oral

abstract: Taylor Valley, McMurdo Dry Valleys, Antarctica is a largely ice-free polar desert that supports a low-diversity ecosystem, which is critically dependent on summer melt from local alpine glaciers, frozen ground, and snow pack to rejuvenate ephemeral streams and aquatic ecosystems that exist on the margins of perennially frozen lakes and ponds. One of these lakes, Lake Fryxell, is perennially ice-covered, but a marginal meltwater moat forms during the summer, and a network of ephemeral summer streams discharge glacial meltwater into the lake. Although conditions in the valley are arid and temperatures are below freezing for most of the year, Lake Fryxell maintains a temperature of ~ 2.5 °C at the bottom of the water column, due to the buffering effect of the perennial ice-cover. Along its margins, Lake Fryxell supports modest, but active summer benthic biological activity in microbial mats composed of cyanobacteria, fungi, protozoa, and algae, including diatoms. These communities are affected by light intensity, availability of nutrients and oxygen, and grazing by consumer species. Due to harsh, variable conditions and the isolation of Taylor Valley, the overall diversity of diatom species is low and endemism high, with 24 out of 40 species known only in the Antarctic, compared to the relatively more diverse and cosmopolitan lake assemblages of East Antarctic oases, the Antarctic Peninsula and sub-Antarctic islands. Here we present initial data from eight mini cores collected from a dive hole along a depth transect in ice-covered Lake Fryxell. The cores are characterized by laminations of fine-grained sediment, carbonate and microbial mats. Samples were collected from core tops and individual sand, silt, carbonate and microbial layers near the top of each core and examined for their diatom content. Three main diatom taxa dominate the assemblages: *Pinnularia deltaica*, *Navicula gregaria* and *Diadesmis contenta* var. *parallela*. *D. contenta* var. *parallela* is associated with sandy sediments, while *N. gregaria* and *P. deltaica* are associated with silt and carbonate layers. Microbial layers are typically composed of nearly monospecific assemblages of *P. deltaica*. This study will provide information useful for interpreting sediment core paleo-records collected from lakes in the Dry Valleys.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Controls on Soil Bacterial Biomass and Richness in a Cold Desert Ecosystem

Forename: David Surname: Van Horn

Authors: Van Horn, David; Van Horn, M. Lee; Barrett, John; Gooseff, Michael; Takacs-Vesbach, Cristina;

Presentation Allocated: Poster

abstract: Understanding the controls on the distribution of soil bacteria is a fundamental step toward describing soil ecosystems, determining their functional capabilities, and predicting their responses to local and global change. This study investigated the controls on the biomass and richness of soil bacterial communities in the McMurdo Dry Valleys (MDV), Antarctica, at local and regional scales, with a focus on water availability as a master variable. At each of six sites located in the major MDV sub-basins dry mineral soil samples and samples associated with snow packs were collected for local and inter-basin landscape scale comparisons of edaphic and microbial characteristics. Snow packs are a significant source of water in this desert environment and have been shown to alter metazoan communities and local biogeochemistry. Edaphic characteristics including soil organic matter, nutrient concentrations, and salts were significantly related with soil water content. Microbial biomass and richness estimates were significantly related with soil water content and edaphic characteristics including soil pH, organic matter, total nitrogen, and conductivity. However, the magnitude and even the direction of these relationships varied across basins. Mixed effects models were used to test for main effects and contextual effects and the results highlight the importance of the geographic scale of sampling when determining the controls on microbial community characteristics.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Cryptophytes dominated diatoms in the Bransfield Strait (Antarctic Peninsula) in the late summer of 2010

Forename: Carlos Rafael Surname: Mendes

Authors: Mendes, Carlos Rafael; Tavano, Virgínia Maria; Costa Leal, Miguel; de Souza, Márcio; Brotas, Vanda; Eiras Garcia, Carlos Alberto;

Presentation Allocated: Poster

abstract: Recent global warming, which results in glacial meltwater runoff, consequently reduces surface water salinity around the Antarctic Peninsula. This predicament has increased the occurrence and abundance of certain phytoplankton groups, such as cryptophytes. The dominance of this group over diatoms affects grazers such as Antarctic krill, which preferably feed on diatoms. By using three late summer's data sets (2008-2010) from the Bransfield Strait, we observed changes in the dominant phytoplankton group using HPLC pigment analysis and confirmed by microscopy. Multivariate statistical analyses indicate that the dominance of diatoms, mainly in 2008 and 2009, was associated with deeper upper mixed layer (UML), high salinity and warmer sea surface temperature. On the other hand, cryptophytes, which were dominant in 2010, appeared at shallower UML, lower salinity and colder sea surface temperature. The low diatom biomass observed in the summer of 2010 was associated with high nutrient concentrations, particularly silicate, and low chlorophyll a (summer monthly average calculated from satellite images). The observed interannual variability in the dominance of phytoplankton groups reflected a delayed seasonal succession cycle of phytoplankton, which was, in turn, associated with a cold summer and a late ice retreat process in the region. This delay resulted in a drastic decrease of primary producers' biomass in 2010, which may have impacted regional food web interactions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Differences of phytalfauna of five algae species in King George Island, Antarctica: the importance of the substrate in diversity and abundance of vagile and sessile organisms

Forename: Francyne Surname: Elias-Piera

Authors: Elias-Piera, Francyne; Rossi, Sergio; Valério-Berardo, Maria Teresa; Navajas Corbisier, Thaïs;

Presentation Allocated: Oral

abstract: Rich communities of macro algae grow in the Antarctic rocky shores, creating conditions for the development of abundant communities of sessile and vagile organisms, but few are the studies about Antarctic macro algae phytalfauna. In this study, the diversity, density and biomass of the associated fauna and flora of five different species of macroalgae (*Monostroma* sp, *Palmaria decipiens*, *Desmarestia* sp, *Phaeurus antarcticus* and *Myriogramme mangini*) living in the sublittoral (5-12 meters depth) was studied at three sites of King George Island in summer 2000-2001. The total abundance of fauna was highly variable among algae and sites. Fifteen taxonomic groups were found associated to the algae, 295405 individuals were counted in the 27 samples, being Amphipoda and Bivalvia the most abundant. The first one is, in general, the dominant taxon in the macro algae, being the composition and structure of the fauna affected by algal morphology, the presence of epiphytes and epifauna, as well as the quantity of suspended sediments and the local topography and hydrodynamics of the different areas. In relation to media of total density of fauna, largest average was found in *Myriogramme mangini* of Napier Rock and second higher media was of *Desmarestia* sp at Wanda Glacier. ANOVA showed significant differences ($p < 0,05$) among the algae for the density of groups Amphipoda, Isopoda, Gastropoda and Polychaeta. In qualitative terms there were little differences among the communities associated to the algae. The branched algae showed Amphipoda as the dominant group while the leaf-shaped ones showed organisms that crawled, like Gastropoda and Polychaeta. In view of the results, the shape of the algae was the mainfactor to determine the dominant taxon, but the turbulence and hydrodynamism has also to be considered when making an interpretation of its distribution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Diversity and community composition of microbial photosynthetic eukaryotes in Fildes Bay, King George Island, Antarctica.

Forename: Nicole Surname: Trefault

Authors: Trefault, Nicole; De la Iglesia, Rodrigo; Egas, Claudia; Encina, Gonzalo; Henríquez, Carlos; Santibañez, Francisco; Vaultot, Daniel;

Presentation Allocated: Poster

abstract: Phytoplankton plays a central role in oceanic processes, since they are key components of the ocean food-web, nutrient and biogeochemical cycling. One of the environmental factors of greatest impact on phytoplankton is light and is precisely in high latitude regions where greater variations in level and duration of periods of light occur. In these systems, light regimes can limit the growth of phytoplankton due to short winter photoperiods, ice cover and deep surface-mixed layers. In Antarctic waters eukaryotic phytoplanktonic microorganisms have been consistently less studied than bacterioplankton and the knowledge of the structure of these communities is crucial to understand the dynamics of this threatened environment. In terms of community structuring, size has a pivotal role, affecting metabolic strategies, ecological interactions, and physical constraints, between many others. The size structure of phytoplankton communities can also alter the magnitude of carbon fixed and exported into the deep sea relative to the growth-limiting nutrient. Phytoplankton cell size and phylogenetic differences in photophysiological strategies suggest that shifts in light regimes will alter phytoplankton community size structure. In order to better understand the size composition of the microbial photosynthetic eukaryotic community in Polar marine system, a specific Antarctic coastal area was selected. Fildes Bay at the King George Island (62°12'11.12''S; 58°55'15.3''W), South Shetland Islands, Antarctica, represents a closed Bay, with annual cycles of ice formation and melting. In this site, water samples were taken daily during summer (January 2011 and February 2012) at surface (maximum Photosynthetic Active Radiation, PAR) and at depth corresponding to 10% of PAR. These samples were size fractionated (60, 20, 12, 3 and 0,2 µm). Total eukaryotic phytoplankton abundance was measured by Flow cytometry, diversity and composition was assessed by clone libraries based on 16S rRNA chloroplastial genes and T-RFLP fingerprinting. Preliminary results indicate a dominance of Bacillariophyceae, Prymnesiophyceae and Pyrenomonadales sequences, with clear differences between size fraction and light levels. Overall, these results confirm that photophysiological strategies are structuring the diversity and community composition of microbial photosynthetic eukaryotes in Fildes Bay, King George Island.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: DIVERSITY AND PHYLOGENETIC ANALYSIS OF BRYUM SPP. (MOSS) IN THE VICINITY OF SYOWA STATION IN EAST ANTARCTICA

Forename: Kengo Surname: Kato

Authors: Kato, Kengo; Imura, Satoshi; Kanda, Hiroshi;

Presentation Allocated: Poster

abstract: In the vicinity of Syowa Station in East Antarctica, three species of mosses had been recognized in genus *Bryum*, *B. argenteum*, *B. amblyodon* and *B. pseudotriquetrum* for a long time during the history of Antarctic terrestrial biology. In addition, aquatic *Bryum* was found at the bottom of many lakes in this region, and thought to be an aquatic form of terrestrial *B. pseudotriquetrum*. Molecular phylogenetic study was conducted to identify the taxonomic position of these four *Bryum* taxa. Total of 134 *Bryum* specimens from Syowa Station area, Terra Nova Bay and King George Is. were used to analyze the sequence of *rps4* and *tmL-F* region in chloroplast DNA. The data suggested following results; ❶ The aquatic *Bryum* is not an aquatic form of terrestrial *B. pseudotriquetrum*, but identical to *B. uliginosum*, which had never been reported not only in Syowa Station area, but also in Antarctica. ❷ Specimens named as “*B. pseudotriquetrum*” in Antarctica were separated into two clusters. Most of them made a major cluster with *B. amblyodon*. Others, samples from King George Is. made a small cluster with *B. pseudotriquetrum* from out of Antarctica. ❸ At least 3 or 4 taxa should be added to the list of Antarctic *Bryum* species.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Diversity of sulfate-reducing and sulfur-oxidizing organisms in sediments of Antarctic lakes

Forename: Manabu Surname: Fukui

Authors: Fukui, Manabu; Watanabe, Tomohiro; Kojima, Hisaya; Takano, Yoshinori;

Presentation Allocated: Poster

abstract: Sulfur is essential for all organisms as major components of cell materials. There are also a variety of abundant inorganic sulfur compounds in the biosphere, and prokaryotic respiratory processes depending on these chemical species are major driving force of sulfur cycle in ecosystems. In the sulfur cycle, reductive processes are mainly mediated by sulfate-reducing prokaryotes (SRP). SRP are capable of dissimilatory sulfate reduction coupled with oxidation of organic matter, and this reaction is thought to contribute largely to anaerobic mineralization in aquatic sediments. Activity of SRP results in generation of sulfide, which supports growth of sulfur-oxidizing prokaryotes (SOP). Both SRP and SOP are polyphyletic, and their diversities in natural environments are often investigated with analyses of functional genes that encode key enzymes for dissimilatory sulfate reduction or sulfur oxidation. One of such genes, *aprA* encoding adenosine phosphosulfate reductase is involved in both sulfate reduction and sulfur oxidation. In the present study, diversity of microorganisms involved in sulfur cycle in sediments of Antarctic lakes was investigated by analyzing *aprA* genes. Sediment samples were obtained from lakes located in coastal area around Lutzow-Holm Bay. From the genomic DNA directly extracted from the samples, fragments of *aprA* genes were amplified a primer pair designed for concomitant detection of SRP and SOP. From the resulting PCR products, clone libraries were constructed for sequencing and phylogenetic analysis. Both SRP and SOP were detected, and their community structures differed among the lakes. Some of them were closely related to known SRP or SOP, but others had no cultivated close relatives. Despite diversity of detected organisms, lineage specific for Antarctic lakes was not found. A lineage predominant in one of the lakes was also dominant in a temperate mesotrophic lake, but its physiological characteristics could not be inferred since it only distantly related to known organisms.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Diversity of the cyanobacterial communities from the Sør Rondane Mountains (Eastern Antarctica)

Forename: Marie-José Surname: Mano

Authors: Mano, Marie-José; Namsaraev, Zorigto; Fernandez-Carazo, Rafael; Ertz, Damien; Wilmotte, Annick;

Presentation Allocated: Poster

abstract: The new Belgian “Princess Elisabeth” research station was built in 2009 and is located 200 km inland in the Western part of the Sør Rondane Mountains (Eastern Antarctica). The BELSPO projects ANTAR-IMPACT and BELDIVA aimed to evaluate the diversity and the distribution patterns of the microorganisms from different types of habitats in a radius of 50 km around the Belgian station. These data will serve to follow future anthropogenic and climatic impacts on these communities. Here, we focus on the diversity of cyanobacteria. During the campaigns of the austral summers 2007, 2009 and 2011, 157 terrestrial samples were taken from 9 different sites, including cryoconites, nunataks and a dry valley. To estimate the cyanobacterial diversity from each site, a polyphasic approach was used, based on microscopic observations and molecular studies by DGGE (for 60 selected samples). The morphological analysis showed the presence of at least 15 morphotypes. The number of morphotypes ranged from 0 to 10 per sample. With the DGGE, we found at least 33 cyanobacterial OTUs (more than 97.5% 16S rRNA sequence similarity) and 3 groups of sequences affiliated to green algal chloroplasts. Fourteen OTUs were potentially endemic to Antarctica, including 10 OTUs that were only found in the Sør Rondane Mountains and 19 OTUs that had a cosmopolitan distribution. The number of OTUs varied between 0 to 5 per sample. The cyanobacterial sequences belonging to the OTUs related to *Chroococcidiopsis* sp., *Cyanothece aeruginosa*, *Leptolyngbya* sp., *Phormidium autumnale* and *Phormidium priestleyi* were the most widely distributed in this Antarctic region. The area of the Belgian station harbors a quite large cyanobacterial diversity despite permanently negative air temperatures. This high diversity may be explained by the presence of terrestrial microhabitats with improved environmental conditions. The local warming of rocks and the presence of meltwater allow the growth of cyanobacteria during the austral spring and summer. Precautions should be taken to minimize future anthropogenic impacts on these diverse communities due to the research station activity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Does large-scale circulation structure life history connectivity in Antarctic toothfish (*Dissostichus mawsoni*)?

Forename: Cassandra Surname: Brooks

Authors: Ashford, Julian; Dinniman, Michael; Brooks, Cassandra; Andrews, Allen; Hofmann, Eileen; Cailliet, Gregor; Jones, Christopher; Ramanna, Nakul;

Presentation Allocated: Oral

abstract: Concern over fishing for Antarctic toothfish (*Dissostichus mawsoni*) has led to calls for a marine protected area (MPA) in the Ross Sea, yet population spatial structure and life cycle remain unclear. A working hypothesis suggests that Ross Sea toothfish form a single population with a spawning migration from the continental shelf and slope out to seamounts and the Pacific Antarctic Ridge (PAR) hundreds of kilometres north in the Southeast Pacific Basin (SPB). To test this hypothesis, we measured the otolith chemistry and estimated the ages of juvenile and adult toothfish captured commercially in the Ross Sea and SPB, and compared them with simulated particle transport based on a circulation model. Chemistry laid down along the otolith edges during the period before capture showed the strongest spatial heterogeneity found in the Antarctic to date. Yet material in the otolith nuclei, laid down during early life, showed no differences between sampling areas in the SPB and northern Ross Sea. Age data indicated only adult fish on the PAR; in the northern Ross Sea, the proportion of adults to juveniles decreased westward along the shelf slope in association with rapid tidal sinking into the western SPB, consistent with movement northwards. Particle simulations predicted that early life stages following the flow in the Ross Gyre would be transported to juvenile habitats in the eastern, central and south-western Ross Sea and the northern shelf-break; whereas adults would be predominantly transported along the shelf slope, and back to spawning grounds in the SPB. Taken together, the three techniques indicate a single, self-recruiting population with a life history structured by the large-scale circulation in the SPB and Ross Sea. With a life cycle tied to the Ross Gyre, most successfully spawning fish may pass during their life history through an area around the Iselin Bank where fishing effort is concentrated. Using a multidisciplinary approach that incorporates hydrography, we can construct and test spatially explicit hypotheses relating connectivity over toothfish life history to the physical circulation of oceanic systems.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Does Size Matter? Ontogenetic and oceanographic factors affect the stable isotope signatures of a keystone prey species, Antarctic krill (*Euphausia superba*)

Forename: Michael Surname: Polito

Authors: Polito, Michael; Reiss, Christian; Trivelpiece, Wayne; Patterson, William;

Presentation Allocated: Oral

abstract: It is often assumed that variation in the stable isotope values ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) of predator tissues reflect shifts in diet between isotopically distinct prey species. However, an alternate hypothesis is that such variation could be due, at least in part, to spatial, temporal, or ontogenetic variation in the stable isotope values of key prey species which then propagate up the food chain. In this study we examine intraspecific variation in the stable isotope values of a keystone prey species, Antarctic krill (*Euphausia superba*), from sampling locations around the South Shetland Islands and northern Antarctic Peninsula. While isotopic values did not differ between sexes, $\delta^{15}\text{N}$ and to a lesser extent $\delta^{13}\text{C}$ values increased with krill body size. Spatial and seasonal variation in krill $\delta^{15}\text{N}$ values were a function of size differences across sampling stations and years. Variation in $\delta^{13}\text{C}$ values were best explained by seasonal and spatial variation in size and levels of primary production (Chl-a concentration). We examine the practical implications of intraspecific variation in Antarctic krill isotopic values to determine if they can bias estimates of predator diets due to seasonal or species-specific variation in the size of krill consumed by predators.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Evidence for a spatio-temporal island archipelago model of glacial recession, habitat suitability, and community structure of continental East Antarctic soil fauna

Forename: Uffe N. Surname: Nielsen

Authors: Nielsen, Uffe N.; Adams, Byron J.; Hogg, Ian D.; Lyons, W. Berry; Wall, Diana H.;

Presentation Allocated: Oral

abstract: The distribution of terrestrial fauna in Antarctica is constrained by current and past climates. We asked: 'How have Antarctica's terrestrial biota responded to past glaciation cycles?' Most ice sheet models of the Last Glacial Maximum (LGM) and previous glaciation events depict all of the low altitude, currently ice-free surfaces in Antarctica as covered with ice. As such, today's terrestrial biota of Antarctica would be the result of re-colonization events after each glacial maximum, meaning that the majority of Antarctica's terrestrial biota is less than 20,000 years old. However, emerging evidence suggests that much of the terrestrial Antarctic biota are of ancient origin and have somehow survived these glaciation events. The Transantarctic Mountains play a pivotal role in understanding the evolution and biogeographic history of today's Antarctic terrestrial biota. In particular, the mountain range contains numerous peaks that could have served as refugia during glacial maxima. Similar to patterns of extinction and re-colonization of biota on island archipelagos, we hypothesized that high elevation refugia existed at the LGM, but that with time, geochemical processes such as atmospheric deposition of salts resulted in decreasingly suitable habitats. To test our hypothesis we surveyed soil invertebrates from three prominent landscape features over an elevational transect along the Beardmore Glacier from Mt Kyffin at ~83.5°S to Meyer Desert at ~85°S. Our results show that taxonomic diversity and abundance, and habitat suitability decreases with the time soils have been exposed to the atmosphere. These findings support the hypothesis that high elevation features provided persistent refugia during glacial maxima, but that over time their exposed soils accumulated salts and became what are now unsuitable habitats. In essence, ice sheet recession exposed more suitable habitats for colonization while previous refugia, as they aged, became unsuitable, driving the dispersal of organisms to younger, lower elevation ecosystems. We show that this island archipelago-like model of spatio-temporal change in habitat suitability is consistent with historical and contemporary patterns of soil geochemistry, and the structure of soil invertebrate communities.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Exploring the Temporal and Spatial Distribution of Diatoms Along the western Antarctic Peninsula

Forename: Wendy Surname: Kozlowski

Authors: Kozlowski, Wendy; Vernet, Maria;

Presentation Allocated: Poster

abstract: Though many studies have examined variability of Antarctic phytoplankton structure and dynamics, our understanding of the large-scale geographic and long-term temporal variability remains weak. Previous studies examining phytoplankton composition and distribution have primarily focused on short term, limited scale sampling. In this study, we analyzed thirteen years of HPLC data collected along the western Antarctic Peninsula between 1995 and 2008, and using the matrix factorization program CHEMTAX, determined distribution of major groups of phytoplankton. Four of the five main phytoplankton groups can, at times, occupy 50% or more of the total biomass in a given location. Of those groups, diatoms were by far the most ubiquitous, comprising 50% or greater of the total population at 35% of the stations sampled and 70% or greater at 17% of the stations sampled. Patterns of diatom distribution over time and with depth are examined and their relationship with primary production and sea ice are evaluated.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Extreme Streams: Hydrologic Controls on Diatom Communities across a Gradient of Intermittent Glacial Meltwater Streams in the McMurdo Dry Valleys, Antarctica

Forename: Diane Surname: McKnight

Authors: McKnight, Diane; Stanish, Lee; Nemergut, Diana;

Presentation Allocated: Oral

abstract: In the McMurdo Dry Valleys of Antarctica, availability of liquid water limits microbial life in the glacial meltwater streams which flow during the summer. Resident diatom communities live within perennial cyanobacterial mats and have adapted to un dependable flow regimes by persisting for long periods in a desiccated state until flow resumes. Studies conducted by the McMurdo Dry Valleys Long-Term Ecological Research program have shown that diatoms from a few aerophilic genera become more abundant during summers of low intermittent flow and that diatom communities are resilient to extreme high flows occurring during warm summers. To understand the response of diatoms to interannual variation in the occurrence of flow, we examined the relationship between diatom community composition and a gradient of flow regularity. The data set includes five streams of relatively regular summer stream flow as well as two highly intermittent streams, an experimentally reactivated abandoned stream channel, and the typically dry Wormherder Creek. We found that the Shannon diversity is greatest in streams with intermediate flow regimes and is largely driven by species richness in the most intermittent Wormherder Creek, while in the most stable flow stream, Canada Stream, Shannon diversity is driven by species evenness. The diatom communities in mats from the streams with intermediate flow regimes were dominated by species of the genus *Hantzchia* and in both highly intermittent streams species of the genus *Luticola* were dominant. Many of the species of both *Hantzchia* and *Luticola* are endemic to the region. We used a multivariate approach to evaluate changes in diatom community composition across this flow gradient and found that community composition correlated with flow occurrence. Comparison of diatom communities in the abandoned channel during both low flow and high flow summers showed that variation in the communities was primarily driven by the abundance of a small species that is transported in the water column, *Fistulifera pelliculosa*. In addition to illustrating that hydrologic regime exerts a strong control on community composition, these results suggest that streams with highly intermittent flow may provide a habitat promoting endemic species radiation. Additionally, streams at high latitudes with irregular flow may serve as refugia for endemic diatom taxa in the future, particularly under a projected warming of the Antarctic.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Growth response and biochemical constituents of Antarctic and Tropical green algae.

Forename: Diana Surname: Latief

Authors: Latief, Diana; Wan Omar, Wan Maznah; Convey, Peter; Wei, Lou;

Presentation Allocated: Poster

abstract: Antarctica is known for its cold and harsh environment which create a unique ecosystem for living organisms to survive. This study was undertaken to determine the growth and biochemical constituents of Antarctic and tropical Chlorophyta. *Chlorococcum* sp. isolated from a small runnel in Barrientos Island, Antarctica and a stream in Penang Island, Malaysia was maintained in enriched Bold's Basal media under different environmental conditions. The growth rate of these two strains isolated from different localities was determined and the changes in carbohydrate and protein contents was measured at each stage of growth profile. Preliminary experiments showed that the Antarctic *Chlorococcum* sp. was able to endure warmer temperature ranging from 20-22°C since they are adapted to produce high content of carbohydrate and protein. Interestingly, the tropical *Chlorococcum* sp. was able to grow in lower temperature of 15°C. This showed that *Chlorococcum* sp. is a cosmopolitan species that can adapt to the changing environmental conditions along the continental gradients.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Host species, fruiting body structure, and substrate dependency of microbial communities in Antarctic lichens

Forename: Chae Haeng Surname: Park

Authors: Park, Chae Haeng; Kim, Ok-Sun; Kim, Kyung Mo; Jeong, Gajin; Hong, Soon Gyu;

Presentation Allocated: Oral

abstract: Lichens are symbiotic association of fungal (mycobiont) and photosynthetic algal or cyanobacterial (photobiont) partners. Contribution of the two major partners has been well known, but composition and role of other microbial components of lichen ecosystems has not been evaluated intensively. In the current study, microbial community composition in *Cladonia*, *Umbilicaria*, *Usnea*, and crustose lichens from King George Island, Antarctica was analyzed by pyrosequencing of eukaryotic LSU rDNA, algal ITS domain of rDNA, and bacterial 16S rDNA. Lichen-associated fungi belonged to Dothideomycetes, Lecanoromycetes, Eurotiomycetes, Leotiomycetes, and Sordariomycetes of Ascomycota, and Tremellomycetes and Cystobasidiomycetes of Basidiomycota. Frequency of LAF (lichen-associated fungi) OTUs was mostly related with mycobiont species. Sequencing results of LSU and ITS regions of nuclear rDNA, and plastid 16S rDNA of algal species indicated that each lichen thalli contain diverse photobionts. The major photobiont genotype of LSU rDNA constituted 78.7% to 100% of total photobiont community and they were split into two closely related ITS rDNA genotype in several cases. Mycobiont was the most important factor in selection of major algal genotype. Proteobacteria, Acidobacteria, Actinobacteria, and Bacteroidetes were predominant phyla in bacterial communities. It was revealed that bacterial community structures were affected by mycobionts, fruiting body structures, and substrates. These results imply that lichen thalli is a complex ecosystem composed of mycobiont, diverse photobionts and microbionts, and they interact dynamically each other and with environments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Ice algal production in seasonally ice-covered regions of Antarctica: observations and modelling

Forename: Ernesto Surname: Molina Balari

Authors: Molina Balari, Ernesto; ralph, peter;

Presentation Allocated: Poster

abstract: Antarctic sea-ice covers approximately 19×10^6 km² of the Southern Ocean each winter and then retracts to 4 million km² over summer. Microalgal mats develop on the underside of the sea ice as it forms, often in higher concentrations than occur in the water column, and then released again when the sea ice melts. The seasonal sea-ice zone is the main foraging region for a large number of air-breathing predators. The main prey is krill, whose life cycle is strongly associated with sea-ice algae. The amount of light available to drive sea-ice algal production depends on variations in the presence of interior algal layers, and the thickness of ice and snow. This project measured a range of bio-optical processes in sea-ice algae under various light climates. Direct measurements and model estimates of light transmission through ice and snow were obtained during fall/winter and spring/summer periods at two seasonal fast-ice sites in the West Antarctic Peninsula (WAP) and in East Antarctica (Casey Station), respectively. Measurements of pigment concentration and optical properties of the sea-ice algae were also collected. A one-dimensional sea-ice model was then developed to predict the rate of photosynthesis of sea-ice algae given specific light conditions. When compared with observations, the model results show that ice algae are light limited at the beginning of the spring bloom, then fluctuated between light and nutrient limitation, finally remaining nutrient limited toward the end of the bloom. Simulated bottom biomass in the WAP represented at most 20% of the total biomass, and this biomass is 2-16 times lower than observed. The sensitivity studies informed about physical and biological factors that can control sea-ice algal growth in various ways. Doubling light intensity or initial sea-ice biomass prompted the bloom to start earlier but the effects lessened near the bloom peak. Doubling initial nutrient concentrations did not produce much difference in the early stage of the bloom but dramatically increased the bloom's magnitude. However, the results are still not sufficient to prove that the model is robust in simulating the termination of the ice-algae bloom. Although there are limitations in the model (i.e. failing in capturing the observed algal biomass in the WAP), these preliminary results provide encouraging estimates of Antarctic ice-algal production and inform about the factors controlling the bottom-ice algal community,

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Influence of resource gradients on microbial communities of a polar desert soil

Forename: Michael Surname: Gooseff

Authors: Gooseff, Michael; Geyer, Kevin; Altrichter, Adam; Barrett, John; Takacs-Vesbach, Cristina;

Presentation Allocated: Oral

abstract: Microbial communities are major contributors to globally-significant ecosystem processes, yet our understanding of controls over community assembly and structure remains limited. This work investigates the role of resource availability in shaping soil bacterial diversity and metabolic activity in energy-limited environments of the McMurdo Dry Valleys, Antarctica. Soils of this region exhibit strong natural gradients in properties such as organic matter content, water availability, and salt composition/concentration, all of which influence the structure of trophically simple communities. Such properties make the Dry Valleys a model ecosystem capable of producing robust relationships between biogeochemical and biological parameters. Soils of the McMurdo Dry Valleys were sampled in the austral summer of 2010 from sites representing a gradient of carbon and water content. Soils were transported to Virginia Tech and analyzed for a variety of properties including microbial biomass, moisture content, soluble ion concentration, and soil organic matter concentration. A terminal restriction fragment length polymorphism (T-RFLP) technique was used to represent community profiles and diversity based upon the 16S rRNA gene. We assessed potential microbial functioning based upon extra-cellular enzyme activities of two common organic matter degrading enzymes (alpha- and beta-glucosidase). Results highlight the importance of moisture availability in predicting levels of organic carbon, exoenzyme activity, microbial biomass, and bacterial diversity in soils. In addition, soil pH appears to be a strong determinant of microbial T-RFLP richness, as has been demonstrated in other recent research. Future work will use pyrosequencing technology to assess variation in microbial community composition that may result from resource availability and yet not be reflected in measures of community diversity examined here.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Nematode (re)colonisation after climate-change induced disturbance events in the Antarctic

Forename: Freija Surname: Hauquier

Authors: Hauquier, Freija; Vanreusel, Ann;

Presentation Allocated: Poster

abstract: Climate change, and its consequences for marine life, is one of today's major issues in scientific debates; however, the impact on benthic communities is not fully understood. In the Antarctic, climate change may induce large-scale melting of ice shelves and increasing iceberg scouring events. Both processes are expected to have considerable effects on the animals living on and in the shelf seafloor, because they may create a spatial and temporal mosaic of patches with changing conditions and newly available habitats open to colonisation. Each of these patches and habitats will then undergo a series of succession steps driven by various biological characteristics (e.g. colonisation ability, (larval) dispersal capacity, reproductive success) of the different organisms. Yet most studies focus on the larger fraction of the benthos, the macro- and megafauna. Data on meiofauna communities and their response to such events are rather scarce, although they form an important component of the benthic food chain. Within the meiofauna, nematodes are often the most abundant metazoan taxon and are therefore likely to play an important role in the community dynamics. Because of their lack of pelagic larval stages and their poor swimming abilities, nematodes have traditionally been regarded as passive dispersers that become suspended into the water column and may get transported over larger distances by ocean currents after which they would also passively settle to the seafloor. Yet, this theory remains largely understudied so that any general conclusions considering nematode dispersal capacity and selection of suitable habitats cannot be made. To understand the success of nematode communities in marine sediments and their possible responses to increased disturbance events in the Antarctic, it is therefore necessary to investigate colonisation rate and selective settlement into more detail. Based on samples recovered during ANT-XXVII/3 cruise with the German research vessel Polarstern during austral summer 2011, we tried to resolve some of these questions. On one hand we analysed nematode community data from the Larsen A/B area at the eastern Antarctic Peninsula, which is characterized by the collapse of large parts of the previously permanent ice shelf. On the other hand, during the same ANT-XXVII/3 expedition, a habitat selection experiment was performed to assess nematode selection capacity for different habitats/food sources after settling in incubation chambers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: NEMATODE BIOMASS IN AN ANTARCTIC CONTINENTAL MARGIN: LACK OF DEPTH DECLINE PATTERNS?

Forename: Paula Foltran Surname: Gheller

Authors: Gheller, Paula Foltran; Campos, Lúcia de Siqueira; Corbisier, Thaïs Navajas;

Presentation Allocated: Poster

abstract: There is a general global trend in benthic standing stocks decrease with increasing water depth. Nematode abundance usually declines for shallow to deep areas, as a result of finer sediments and less food availability. However, in the continental margins off Admiralty Bay (Antarctica) sediments are finer in the shallow and coarser in the deep, so meiofauna biomass was investigated to analyze if a different pattern would occur. Three replicates were sampled at each depth (100, 300 and 500 m in Admiralty Bay, and 700 and 1100 m in the Bransfield Strait) in December 2008 with a box-corer. Meiofauna, mean grain size, organic-matter and phytodetritus were analyzed (top 2-cm only). Around 50 nematodes per sample were measured for biomass by volumetric method (dry weight - DW). Mean nematode individual biomass for each sample was calculated. Total nematode biomass was estimated by multiplying the mean individual biomass by the total density of nematodes in each sample. Mean grain size was greater at 700 and 1100 m. Organic matter and phytodetritus did not differ among depths. Mean individual biomass varied from 0.09 to 0.30 μgDW , and was higher at 1100 m than at 100, 300 or 500 m (ANOVA, $p < 0.01$). At 700m (0.23 μgDW), mean individual biomass was also higher than at the shallower depths, and lower than at 1100m. Mean total biomass increased between 100 to 500m (from 274 to 490 $\mu\text{gDW}/10\text{cm}^2$), dropped sharply at 700 m (50 $\mu\text{gDW}/10\text{cm}^2$), and recovered at 1100 m (240 $\mu\text{gDW}/10\text{cm}^2$). Differences were not significant and showed the same pattern as nematode densities. Nematode total biomass was high, especially inside Admiralty Bay (100 to 500 m). Nematode individual biomass, showed an inverse trend, with an increase in Bransfield Strait (700 to 1100 m). Two possible explanations for this are given. I. Greater grain size results in more interstitial space, so nematodes can grow more. II. More dynamic conditions and bottom currents in the deeper sites make conditions unfavorable for smaller nematodes establishment in the surface of the sediment. Mean nematode individual biomass is rarely investigated, and should receive more attention in future studies because ecological responses were more interesting than total nematode biomass.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Observation on behaviour of Antarctic krill (*Euphausia superba*) in lighting condition

Forename: Guoping Surname: Zhu

Authors: Zhu, Guoping; Xu, Pengxiang; Xu, Liuxiong;

Presentation Allocated: Poster

abstract: Active Antarctic krill (*Euphausia superba*) were collected from the commercial krill trawlers which fishing around the South Orkney Island during January to February 2011. 45 krills (the range of body length 37 to 45 mm) were collected and cultured temporary about 24 hours in a tank after captured and then removed to the experiment tank for observing their behavior. The light intensity of water surface in experiment tank is kept at the level of 220 lx, and the water temperature in the experiment tank is constant at 0 °C. The whole experiment is last for 13 days. There are three preliminary observations can be found, (1) body color of Antarctic krill changes rapidly after taken into experiment tank under lighting; (2) in static condition, Antarctic krill almost keeps in the same position in the corners of the experiment tank; if moved, they could swim from one corner to a neighbor corner along the wall of the tank, and a few times to swim with a higher speed across the center of the test tank; In hydrodynamic conditions, they can swim against the current and aggregate to a schooling in the velocity about 0.5 m s⁻¹, schooling were vanished while current greater than 1 m s⁻¹; (3) Antarctic krill were molted during the experiments, the average body length increased about 5 - 8 mm.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: OPHIUROIDEA (ECHINODERMATA) FROM ADMIRALTY BAY, KING GEORGE ISLAND, ANTARCTICA

Forename: Daniele Surname: Campos Leal

Authors: Campos Leal, Daniele; da Cunha Oackes Souza, Thayane; de Siqueira Campos, Lúcia;

Presentation Allocated: Oral

abstract: Twenty-seven species of Ophiuroidea have been recorded at Admiralty Bay, King George Island so far. This represents 20% of the Antarctic ophiuroids known today. Ophiuroids collected through the Brazilian Antarctic Programme during the Austral Summers of 2002/03 and 2004/05 were analysed here. Samples were taken using an Agassiz trawl, a van Veen and a mini box corer (MBC) in five sampling stations, and from 20 to 60 meters depth. A total of 810 specimens were examined and identified into four species: *Amphioplus acutus*, *A. peregrinator* (Amphiuridae), *Ophionotus victoriae*, and *Ophiura rouchi* (Ophiuridae). The MBC was the most efficient device to sample the ophiuroids compared to the other equipment. Thus, only the data collected with MBC were used for all further analysis on biomass, distribution and density. The high abundance of the first three circumpolar species allowed the evaluation of their size distribution. *O. victoriae* has shown the highest biomass in all stations, but Arctowski. The two *Amphioplus* species were the most abundant ones. Only in Arctowisk *A. acutus* showed a higher biomass than *O. victoriae*'s (36,11 g.m⁻² and 21,17 g.m⁻², respectively). Near the Brazilian Comandante Ferraz Antarctic Station, *A. acutus*' biomass was similar to *O. victoriae*'s, and had its highest density. Despite the more intense human activity at Ferraz, the lowest diversity was found in Botany and Hennequin sampling stations. The highest diversity was found at Arctowisk. *A. acutus* was most abundant in the shallowest zone and *O. victoriae* in the deepest. Nonetheless, further studies would be required on ophiuroid bathymetric distribution in Admiralty Bay, especially in its deepest zones down to 500m. Although, a detailed ecological work, including abiotic data, such as temperature, nutrients, and other biological factors, such as food resource, would be of great interest considering the relevance for the environmental monitoring of this Antarctic Specially Managed Area, this work has shown that *A. acutus* potentially could be used as a bio-indicator of areas affected by sewage input.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Photographic survey provides insights into the Antarctic fish fauna of Marguerite Bay and the Amundsen Sea

Forename: Margaret Surname: Amsler

Authors: Amsler, Margaret; Eastman, Joseph; Thatje, Sven; McClintock, James; Aronson, Richard;

Presentation Allocated: Poster

abstract: The Antarctic benthic fish fauna of 225 species is unique in the marine realm because its diversity is greatly restricted at higher taxonomic levels and is dominated by a large radiation of endemic notothenioids. The continental slopes are among the least sampled habitats of Antarctica, and many components of the fauna are poorly known. A ship-towed camera array captured images of fishes from slope habitats in two infrequently sampled areas of West Antarctica: Marguerite Bay (MB) and the Amundsen Sea (AS). The 1377 images from MB that depicted fishes included representatives of 9 families, 14 genera and 15 species; 35% were notothenioids and 65% were non-notothenioids. Among the notothenioids, nototheniids (47%) and channichthyids (44%) were the most abundant. Species of *Trematomus* (66%) and the deep-living channichthyid *Chionobathyscus dewitti* (74%) were the most abundant taxa in these two families. Among non-notothenioids, the macrourid *Macrourus whitsoni* (74%) and zoarcids (16%) were most abundant. The 351 images with fishes from the AS included 5 families, 6 genera and 6 species, with 87% of the images of notothenioids and 13% of non-notothenioids, the latter exclusively *Macrourus whitsoni*. Among the notothenioids, bathydraconids (38%) and artedidraconids (30%), especially the small *Dolloidraco longedorsalis* (28%), were the dominant elements. Numerous images provide valuable insight to the benthic fauna. A 42-cm *Dissostichus mawsoni*, with a distinctive, barred pigmentation pattern, rests on the substrate at 1277 m in MB, far from any known breeding grounds and in much deeper water than previously suspected for a juvenile. Aggregations of a few *Pleuragramma antarcticum* display neutral buoyancy in the water column a few meters above the seafloor at 720 m. Two species of nototheniids, including *Trematomus nicolai*, are on or near nests of eggs. *Chionobathyscus dewitti*, the most buoyant channichthyid, is seen in the water column and its unique head morphology is clearly visible. Another *C. dewitti* has a possible egg mass on its pectoral fin. A species of *Pogonophryne*, similar to *P. bellingshausenensis*, from 2127 m in MB is the second-deepest record for any artedidraconid. A *P. scotti* occupies a rock nest, possibly containing eggs, at 767 m. Several small (6-cm) zoarcids are concentrated within a community of benthic invertebrates at 1260 m. A *Macrourus whitsoni* is parasitized by a large copepod that is 36% the length of the host.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Phylogeography of Ophiurolepis brittle stars based on mtDNA and microsatellites

Forename: Kenneth M. Surname: Halanych

Authors: Halanych, Kenneth M.; Hunter, Rebecca L.;

Presentation Allocated: Oral

abstract: Antarctica has a complex geological history that has shaped the evolution of marine invertebrates in the region. In more recent times, glaciation events are thought to have played a major role in shaping phylogeographic patterns. Also more recent research has tested long held assumptions of circumpolar distributions and endemism; concepts long thought to be true for marine Antarctic invertebrates in general. Here we examine the recent history of two closely related brittle star species, *Ophiurolepis gelida* and *Ophiurolepis brevirima* along the Antarctic Peninsula region. Phylogeographic analyses of mtDNA data from *O. gelida* and *O. brevirima* resulted in a clear pattern of genetic heterogeneity between geographic regions despite genetic homogeneity within geographic regions. Microsatellite data, which typically provide greater resolution, also provided evidence of breaks. Given that these species likely produce lecithotrophic larva, they could have persisted through the last glacial period (70 kya-10 kya) and subsequently dispersed throughout Bransfield Strait during the present interglacial period, either from an isolated refugia in Bransfield Strait or from the continental slope/deep sea. While our circumpolar sampling is not complete, especially for *O. brevirima*, data from this study suggest that neither *O. gelida* nor *O. brevirima* are genetically homogeneous circumpolar species.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Physicochemical and microbiological characterization of Fildes Bay, King George Island, Antarctica, during Summer 2012.

Forename: Rodrigo Surname: De la Iglesia

Authors: De la Iglesia, Rodrigo; Trefault, Nicole; Egas, Claudia; Henríquez, Carlos; Moreno, Mario; Santibañez, Francisco;

Presentation Allocated: Poster

abstract: Marine microorganisms are a key component of oceanic processes. Both bacterial and eukaryotic microorganisms are involved in the structuring of oceanic food-web, nutrient and biogeochemical cycling. However, the developing and structuring of this type of organisms is highly influenced by the physicochemical characteristics of the water column they inhabit. Temperature, salinity and light are factors that play a direct role in structuring the water column, defining different water masses that can display specific populations of microorganisms. The Fildes Bay at the King George Island (62°12'11.12''S; 58°55'15.3''W), South Shetland Islands, Antarctica, represents a closed Bay, with annual cycles of ice formation and melting. Around these areas there are present some research bases and also some pristine environments like the Collins glacier. The influence those different environments can have over the structure of the water column and on the microorganism present is highly unknown. In order to better understand how the variation of physicochemical characteristics of the bay are and how that parameters modulates microbial communities composition, a detailed characterization was performed at 17 stations inside the Fildes bay, covering for near shore station to more open areas, near the Bransfield Strait. At each station, CTD profiles were obtained (conductivity, salinity, PAR), and samples for flow cytometry characterization for both heterotrophic (bacteria mainly) and autotrophic (both bacteria and eukaryotes) microorganisms and also for culture-independent analysis based on nucleic acid extraction and 16S/18S gene sequences analysis, were taken. Our results indicate that the water masses are influenced by the presence of the glacier, and that these differences have an effect over the microbial component of the Bay.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: PHYTOPLANKTON AND ABIOTIC PARAMETERS AROUND THE ANTARCTIC PENINSULA (SUMMER) AND IN THE PATAGONIAN SEA (SPRING-SUMMER)

Forename: Marcio Silva Surname: de Souza

Authors: de Souza, Marcio Silva; Garcia, Virginia Maria Tavano; Mendes, Carlos Rafael Borges; Garcia, Carlos Alberto Eiras;

Presentation Allocated: Poster

abstract: This work relates the phytoplankton communities from the Antarctic Peninsula and from the Patagonian sea with some physical and chemical variables, during the phytoplankton growth seasons. Surface samples were collected during five oceanographic cruises (in November 2004, October 2007, and January 2009 in the Patagonian sea and February-March 2008 and 2009 in the Antarctic Peninsula) on board the Brazilian Navy R/V Ary Rongel. Phytoplankton species analyses were done in settling chambers under inverted microscope. The number of cells per liter (density) and concurrent biovolume estimates were transformed into phytoplankton carbon biomass, using taxa-specific conversion factors. Temperature and salinity data were used to calculate the upper mixed layer depth. Multivariate statistical analyses were applied in order to summarize the biological data and to examine the relationship between environmental factors and major phytoplankton species. *Thalassiosira* spp. and flagellates <20 µm were dominant in the spring sampling period, contributing 60.77% to the cumulative dissimilarity, in identification of four clusters: 1) two spring cruises to the Patagonia; 2) one summer cruise to the Patagonia; 3) the 2008 summer cruise to the Antarctica; 4) the 2009 summer cruise to the Antarctica. Large microplankton diatom cells, *Odontella weissflogii* in the Antarctic Peninsula and *Rhizosolenia crassa* near the Malvinas Islands, also contributed to the separation of clusters. Temperature, dissolved inorganic nutrients and upper mixed layer depth contributed to explain the variability in the phytoplankton spatial distribution around the Antarctica Peninsula. This work showed that diatoms were the main phytoplankton component in summer in the Antarctic Peninsula and in spring in the Patagonia (smaller, nanoplankton species), whereas the Patagonian summer showed a complex and distinct phytoplankton composition, depending on the region (latitude). In addition, it was demonstrated that some diatom species which are common in the Antarctica also occur in lower latitudes in the southwestern Atlantic Ocean, mainly in the austral spring, suggesting their physiological and/or ecological adaptation to higher temperature environments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Pioneers DNA fingerprint of *S. uncinata* (Hedw.) Loeske: understanding the role of moraines in different migrational events in Antarctica

Forename: Carolina Surname: Galleguillos

Authors: Galleguillos, Carolina; Hebel, Ingrid; Dacasa-Rüdinger, Maria del Carmen;

Presentation Allocated: Poster

abstract: *Sanionia uncinata* is a bipolar moss species. It is widely distributed and very common in ice free areas on the maritime Antarctica and grows in extensive mats (Ochyra et al 2008) tolerating extreme environmental conditions (like glacier winds, low temperatures, snow coverage, etc.). In other cases, they grow in small tufts exposed to geomorphological processes, being affected by unstable strata on recent formation. Occasionally this areas are developed first like ridges surrounded by glacier ice (nunataks) or lateral-frontal glacier forelands (moraines). In this cases, ridges and slopes can provide refuge to this first colonizers helped by the microtopography, the amount of the propagules which are concentrated in micro-habitats like small (shallow) depressions (Matthews 1992) and probably enhanced by better climatic conditions, that we corroborate on the field, where it was found higher temperatures in protected slopes of moraines compared with the coastline. Subsequently, this new migrants are dispersed to lower elevation areas and coast induced by the wind, rain or melting water. The advance and retreat of the ice in Antarctica must have developed this process several times since the last glacial maximum and it is evidenced by fossil records and radiocarbon dates (Hall 2008 and Verkulich et al 2010). The aim of our work it to establish the present migration rate exemplified by small tufts growing on the moraine slopes related to past migrational process exemplified by ancient populations on the coast. It is expected that the present establishment of migrants will hinder the genetic divergence among populations, but in the case of the absence of gene flow among populations in different altitude, the genetic differentiation will be high. During the Chilean Antarctic Scientific expedition in January 2010 and 2011, organized by the Chilean Antarctic Institute (INACH) 458 gametophytes of *S. uncinata* on the South Shetland Island were sampled. We collected fresh material over lateral-frontal moraines and carpets on the coast closer to the Bellingshausen Dome (King George Island), Hannah Point (Livingston Island) and Punta Pereira (Nelson Island) for morphological and molecular analyses. To distinguish organisms based on their genomes we used the Amplified Fragment Length Polymorphism (AFLP) method with 4 different EcoRI and MseI primer combinations. Preliminaries results reveal that it exists an unexpected high genetic diversity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Polar and Alpine Microbial Collection (PAMC): a culture collection dedicated to polar and alpine microorganisms

Forename: Yung Mi Surname: Lee

Authors: Lee, Yung Mi; Kim, GoHeung; Jung, You-Jung; Choe, Cheng-Dae; Yim, Joung Han; Lee, Hong Kum; Hong, Soon Gyu;

Presentation Allocated: Poster

abstract: Microorganisms in polar areas may have important ecological roles in biogeochemical cycles and food chain. They are adapted to polar environments by special physiological adaptation mechanisms including cold-adapted enzymes and cryoprotectants such as exopolysaccharides. Culture collections for polar microorganisms can provide research resources for ecological and physiological studies. The Polar and Alpine Microbial Collection (PAMC) is a specialized culture collection for maintenance and distribution of polar and alpine microorganisms. The database system was developed to share important data fields with DarwinCore2 and OBIS database schemas. Approximately 1,500 out of 5,500 strains maintained in PAMC have been identified and they belonged primarily to the phyla Actinobacteria, Bacteroidetes, Firmicutes, and Proteobacteria. Many of the microbial strains can grow at low temperature and produce proteases, lipases, and/or exopolysaccharides. PAMC provides search tools based on keywords such as taxonomy, geographical origin, habitat and physiological characteristics. Biological materials and information provided by PAMC will be important resources for ecological and physiological studies on polar and alpine microorganisms.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Potential for soil CO₂ emission in different types of cover soil in Admiralty Bay - King George Island

Forename: Daniel Surname: De Bortoli Teixeira

Authors: De Bortoli Teixeira, Daniel; Thomazini, André; Gabrig Turbay, Caio Vinicius; de Sá Mendonça, Eduardo; E.G.R Schaefer, Carlos; La Scala Júnior, Newton;

Presentation Allocated: Poster

abstract: The cryogenic or cryosols are typical polar and subpolar regions and their main characteristic is the presence of a permafrost, which acts as a reservoir or deposit of carbon. However, with global climate change, this stability conditioned by permafrost is reduced, making the soils at soils great sources of carbon to the atmosphere. This study aimed to evaluate the potential of CO₂ emissions (FCO₂) of soils at different cover conditions. Evaluations were conducted following a transect with distances of 1 m between points, comprising 150 m of the side of the Ecology Glacier retreat, covering seven types of soil cover, plus a bare soil condition. Soil conditions were: *Sanionia uncinata*, dead matter *Sanionia uncinata*, *Usnea* sp., *Deschampsia antarctica*, till with a predominance of boulders (Tbou), bare soil, till with pebbly (Tpeb) and loess. FCO₂ was evaluated using a portable analyzer coupled to dynamic soil chamber (Licor 8100). Concomitantly with the evaluation of FCO₂, soil temperature (Tsoil) was evaluated in the same locations. The mean of FCO₂ and Tsoil were evaluated according to Student's t test ($p < 0.01$). Soil covered with *Deschampsia antarctica* showed the largest mean emission (1.06 $\mu\text{mol m}^{-2}\text{s}^{-1}$) differing from the others, while the Tbou had the lowest emissions (0.20 $\mu\text{mol m}^{-2}\text{s}^{-1}$). The highest temperatures were found in areas of Tbou (5.58 °C), loess (5.53 °C), Tpeb (5.39 °C) and bare soil (5.20 °C). Areas without vegetation showed greater heterogeneity, characterized by higher values of the coefficient of variation (CV = 95.00 to 121.00 %), than those with vegetative cover (CV = 45.82 to 77.79%). The lowest average temperature was found from the *Sanionia uncinata* (2.59 °C). Along the transect was observed a significant negative correlation between temperature and FCO₂ of -0.30 ($p < 0.05$), although when evaluating areas separately, only in the area of *Sanionia uncinata* present significant correlation ($r = -0.51$, $p < 0.01$). Possibly the lack of vegetation in the study sites results in greater absorption of solar radiation by the soil, obtaining higher temperatures when compared with local vegetation. Due to respiration of these plants, local with presence of vegetation have higher rates of FCO₂.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: POTENTIAL LIPASE ENZYME PRODUCTION FROM POLAR MICROORGANISMS

Forename: RASHIDAH Surname: ABDUL RAHIM

Authors: ABDUL RAHIM, RASHIDAH; RASOL, RAFIDAH;

Presentation Allocated: Poster

abstract: Psychrophilic and psychrotropic organisms are important in global ecology as a large proportion of the planet is cold. Low temperature active enzymes from these organisms have recently received increasing attention because of their relevance for both basic and applied research. In this study, the work focused on the lipase enzyme which is glycerol ester hydrolase that catalyse both the hydrolysis and the synthesis of esters formed from glycerol and long-chain fatty acids. Isolate named ARB1 was grown at 4°C on screening plates which contained nutrient agar and lipase substrates such as tributyrin, triolein, palm oil, olive oil and fluorescent assay using Rhodamine B to screen for extracellular lipase. The existence of halo zones on the media showed the hydrolytic reaction by lipase activity. The result was further confirmed using colorimetric lipase assay to detect lipase activity. The genomic DNA of ARB1 strain was extracted and the gene encoding lipase was amplified using highly degenerated consensus primers via polymerase chain reaction (PCR). To date, a PCR lipase band with 1.5kb size was amplified and currently undergoing the cloning process using pGEM[®]-T easy vector.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Precise species definition for Southern Ocean Ostracoda (Crustacea) as a solid basis for biodiversity and biogeography estimates

Forename: Simone Nunes Surname: Brandao

Authors: Brandao, Simone Nunes; Moerchen, Julia;

Presentation Allocated: Poster

abstract: Due to their calcified carapace, the Ostracoda have the most extensive fossil record among metazoans, and represent important proxies in palaeoenvironmental reconstructions spanning the last 450 million years. Otherwise, information on recent ostracods, which underlines the palaeontological research, is far from abundant and several questions, like how morphospecies should be defined, remains to be answered. The question on species definition and boundaries is of primary importance because accurate biodiversity and biogeography estimates require sound species concepts. If different workers use different species concepts then their results will not be comparable. In the present paper, we use b-spline morphometrics to study the outline of the valves (i.e. shells) of approximately 200 specimens of the circumantarctic and eurybathic complex *Macrosclapha tensa-opaca* sensu Brandão, 2010 (Podocopa, Macrocyprididae). Finally, we compare the morphometric patterns with previously published data on genetics and classical morphology. The *Macrosclapha tensa-opaca* sensu Brandão, 2010 complex was initially considered as two distinct, widely distributed species. In a previous morphological study, one of us (SNB) showed that specimens with divergent hemipenis morphologies were included in these last two morphospecies and referred to them as the species complex *M. tensa-opaca*. This complex includes at least eight distinct, narrowly defined morphospecies. Otherwise, the systematics of these species remained unresolved, because of a very wide variation in valve shape and size. The samples studied herein were collected from 35 stations in the Ross, Admunsen, Scotia, Weddell and Davis seas, from littoral to abyssal depths. Our results clearly corroborate the usefulness of a narrow morphological species definition. This has two important consequences. Firstly, the Southern Ocean biodiversity is probably underestimated. Secondly, since this narrowly defined species are geographically and bathymetrically segregated, a re-evaluation of the prevailing theories on the circumantarctic and eurybathic distribution of Southern Ocean species is recommended.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Preliminary Cytometric Analysis of Phytoplankton at Martel Intel, King George Island, Antarctica

Forename: Gilberto Surname: Pereira

Authors: Pereira, Gilberto; Gonçalves, José; Coutinho, Ricardo;

Presentation Allocated: Poster

abstract: Preliminary Cytometric Analysis of Phytoplankton at Martel Intel, King George Island, Antarctica. Pereira, G. C.1, Gonçalves, J. E. A., Coutinho, R. Federal University of Rio de Janeiro, Civil Engineering Program (COPPE/UFRJ) and Instituto de Estudos do Mar Almirante Paulo Moreira, Brazil (IEAPM). Abstract: The Southern Ocean is an important component of the global ocean system, linking all major ocean basins and facilitating global distribution of its deep waters. However, as can be found in literature, due the availability of iron and silica it was recognized to be largely low productive and low biomass, although some sites presented enhanced productivity. So, during the late austral summer, we collected samples from the surface seawater in front of the Brazilian Antarctic station Comandante Ferraz at Martel Intel, King George Island, northwestern area of South Shetland Islands in order to investigate the daily and monthly variation of phytoplankton using the CytoSub flow cytometry. Our results demonstrate the occurrence of both picoplankton particles containing red fluorescence, and some curious nanoplankton particles containing higher orange:low red fluorescence generally associated to cyanobacteria. The daily monitoring shows two peaks in abundance and biomass of these particles, one at 7 am and another around 21 am while the monthly variation remained rather stable and no shift occurred in the size and biomass structure. Our data suggest that phytoplankton community was dominated by small autotrophic-eukaryotes and some of these strange nanoplankton particles but our knowledge about abundance, biomass, spatial and temporal distribution of Antarctic phytoplankton taxa is still limited.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: RING FUNGI IN HENNEQUIN POINT, KING GEORGE ISLAND - ANTARCTICA

Forename: Jair Surname: Putzke

Authors: Putzke, Jair; Pereira, Antonio Batista; Putzke, Marisa Terezinha Lopes;

Presentation Allocated: Oral

abstract: Many fungal groups are reported to attack living mosses all around the world including the poles. The parasitism appears to be specific in some species and related only to mosses in others. Up to 300 species (belonging to more than 80 genera) of Ascomycetes were known to grow obligatorily on Bryophyta. In Antarctica, despite two species of flowering plants, mosses are the only terrestrial ones that can serve as source of food for parasitic fungi. Fungi are being isolated from mosses in Antarctica since the beginning of scientific exploration, being examples *Thyronectria antarctica* var. *hyperantarctica*, *Coleroa turfosorum*, *Bryosphaeria megaspora* and *Epibryon chorisodontii*. In antarctic mosses, the fungi grow forming mostly rings or half rings of mycelia that can reach up to 5 m in diameter, killing the moss only in the surface but with rapid recovery of the plant. The colonization of mosses by ascomycetes is a very frequent phenomenon, with some species growing always with their specific parasites. Studying moss carpets in Hennequin Point, King George Island, Maritime Antarctica (South Shetland Archipelago), during the 2011 Austral Summer, we noted the occurrence of ring fungi associated, which were analyzed and are here discussed. The moss carpets surrounding the Ecuadorian Refuge were studied for the occurrence of ring forming fungi. The carpet chosen was entirely photographed, the photos mounted to create a map, drawing all the ring fungi found in its exact point of occurrence. The map was used to understand the fungi distribution. Collections of mosses were taken to laboratory for identification and or maintenance in culture (humid chamber) to evaluation. There were taken 22.000 sequential photos from infected fields to map its distribution over the moss carpets. The study presents data showing relationship of the fungi with bird excrements and orientation of the half ring accordingly to this deposits which are influenced by wind direction. *Thyronectria hyperantarctica* (D. Hawksw.) D.Hawksw. et Spooner was the commonest fungi isolated. The preference to the moss *Sanionia uncinata* was evident in the area but mostly in places away from skua nests, the most frequent bird nesting in Hennequin Point. The relation skua (*Catharacta* spp.)/ring fungi/moss carpets is discussed and comparisons including the study stand and other places in the South Shetland were done. Supported by CNPq, FAPERJ, MMA, MCT and CIRM.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: SEASONAL VARIABILITY OF PHYTOPLANKTON COMMUNITY IN THE SOUTHERN PATAGONIAN SEA

Forename: Marcio Silva Surname: de Souza

Authors: de Souza, Marcio Silva; Gonçalves-Araujo, Rafael; Azevedo, Luciano Costa de Lacerda; Garcia, Virginia Maria Tavano;

Presentation Allocated: Poster

abstract: The composition and abundance of phytoplankton species and environmental parameters were studied during spring (October/2007) and summer season (January/2008) at the southern Patagonian continental shelf (48°S–50°S) on board the Brazilian Navy R/V Ary Rongel. Abiotic variables were collected using a conductivity–temperature–depth (CTD) system. The upper mixed layer depth (UMLD) was derived from density gradient profiles. The concentration of the following nutrients was obtained by spectrophotometry: ammonium+nitrite+nitrate (DIN), phosphate and silicate. Chlorophyll-a concentration was estimated by a non-acidification fluorometric method. Counting, identification and measurement of linear dimensions of the phytoplankton species were done in settling chambers under inverted microscope. The number of cells per liter (density) and concurrent biovolume estimation were transformed into phytoplankton carbon biomass, using taxa-specific conversion factors. Multivariate statistical analyses were applied in order to summarize the biological data and to examine the relationship between environmental parameters and major phytoplankton species. In the springtime, an assemblage of diatoms and dinoflagellates dominated the high-concentration phytoplankton patch over the area, while moderate biomass levels in the summer cruise were characterized by predominance of coccolithophores (mainly *Emiliana huxleyi*) and other flagellates (such as *Phaeocystis antarctica*). Besides temperature differences found in both seasons, the spring bloom depleted the levels of dissolved inorganic nutrients (0.52–4.51 μM of DIN and 0.09–0.37 μM of silicate) and those were fairly similar to levels found in the following summer period (0–4.47 μM of DIN and 0.19–1.35 μM of silicate). In the latter period, a shallower UMLD probably favored a phytoplankton community growth based on regenerated nutrients, albeit the ammonium percentage was not significantly different between both seasons. This work showed that diatoms were the main phytoplankton component in spring in the southern Patagonian shelf, whereas the same region exhibited a complex and distinct phytoplankton composition in summer. This pattern of succession may have influence on the following trophic levels over the region, sustaining high biomass of fisheries, particularly in spring.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: SINGLE-CELL ANALYSIS OF MICROBIAL SYNTHESIS AND TRANSFORMATION OF DISSOLVED ORGANIC MATTER IN GLACIAL ENVIRONMENTS

Forename: Heidi Surname: Smith

Authors: Smith, Heidi; Foreman, Christine; Foster, Rachel; McKnight, Diane;

Presentation Allocated: Oral

abstract: The Cotton Glacier stream, Antarctica, is a supraglacial stream chosen specifically for an extensive investigation of contemporary formation and storage of carbon in glacial ice. Dissolved organic matter (DOM) in this system increases seasonally from the growth of newly established microbial communities. DOM from glaciated systems is of importance because it contributes to the growing carbon pool in marine and freshwater aquatic environments, thereby also playing a role in the global carbon cycle. The Cotton Glacier fluvial water DOM is characterized by unique signatures unlike any DOM derived from freshwater or marine systems globally, including the previously well-studied lakes and streams of the McMurdo Dry Valleys, Antarctica. Fluorescence spectroscopy and XAD purification confirmed that the DOM from the Cotton Glacier is of microbial origin and lacks humic substances. The Cotton Glacier stream environment has an active microbial assemblage. Bulk uptake rates for primary production range from 1.079-4.750 $\mu\text{gC l}^{-1} \text{d}^{-1}$ using ^{14}C -carbonate/bicarbonate incorporation. Bacterial production ranges from 303-675 $\text{ng C l}^{-1} \text{d}^{-1}$ measured using tritiated leucine incorporation. Chlorophyll a concentrations range from 0.3 to 0.53 mg l^{-1} , and bacterial abundances from 2.94×10^{-4} - 4.5×10^{-5} cells ml^{-1} . The dominant microbial assemblages in the Cotton Glacier stream are from Cytophagales and β -Proteobacteria lineages based on 16S rRNA sequence homology. Understanding the transfer of carbon and nutrients between autotrophs and heterotrophs is essential to further our understanding of biogeochemical cycling throughout an ecosystem. In marine and freshwater aquatic environments the production of DOM by extracellular release of photosynthetic exudates by phytoplankton has the potential to contribute up to half of the carbon required to support bacterial growth. Using Halogen In Situ Hybridization-Secondary Ion Mass Spectroscopy (HISH-nanoSIMS) we identified which populations took up specific tracers as well as the heterotrophic uptake of released exudates. Using this method we will directly measure uptake rates and estimate doubling time among different microbial members. Quantification of carbon transfer rates from phytoplankton to heterotrophic bacteria provides information linking the exudates and associated microbial processing to the global carbon pool.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Soil chemical attributes as affected by the presence of skuas and vegetal cover in Punta Hennequin, Antarctic

Forename: Adriano Luis Surname: Schünemann

Authors: Schünemann, Adriano Luis; Costa Beber Vieira, Frederico; Batista Pereira, Antonio; Victoria Albuquerque, Filipe; Pereira de Albuquerque, Margeli; Strassburger de Oliveira, Cássio; Putzke, Jair;

Presentation Allocated: Poster

abstract: The purpose of the study was to evaluate the effect of soil cover by vegetation on the changes of soil chemical attributes in a skua field at Punta Hennequin, Shetland Island, Antarctic. Four locals along a transect were sampled: L1 and L2 consisted of a skua (*Catharacta maccormicki*) field with 5 and 100% of vegetal cover, respectively, distant each other at about 50m, in the same moraine (same level and parent material); vegetation was mainly composed by *Deschampsia antarctica* (Poaceae) and *Colobanthus quitensis* (Caryophyllaceae); L3 was a poor-drained bare alluvium soil; and L4 was a poor-drained moss (*Sanionia uncinata*) field with 100% soil cover. Soil samples were obtained from three layers (0-10, 10-20 and 20-40 cm depth) at three replicates per local and were submitted to chemical and physical analysis. Although both L1 and L2 are in a nesting/breeding field of skuas, the more abundant vegetation at the L2 promoted significant increase ($P < 0.05$) in the total organic carbon (TOC) stocks in the soil (9.03 and 43.08 Mg C ha⁻¹ for L1 and L2, respectively, at the 0-40cm layer). Total nitrogen stocks, in turn, increased from 2.60 to 6.54 Mg N ha⁻¹ for L1 and L2, respectively. Therefore, although the presence of the seabirds represent an important transfer of organic material from marine to terrestrial environment, such increases evidence the importance of the vegetation in order to raise the soil organic matter levels. Despite of the relatively low annual rates of C and N input at the vegetated skua fields, TOC and TN stocks in such soils can be as high as those found in non-polar regions. No significant effect of vegetation was observed for exchangeable P and K contents, but the soil pH was consistently lower in L2 than L1 - about 1.0 unit for the soil layers herein evaluated, which is probably linked to the soil organic matter accumulation. The bare alluvium soil and the moss soil had larger exchangeable K and smaller P contents than L1 and L2. Contrarily to the distribution of TOC and TN contents, exchangeable P and K had no gradient along the soil profile, evidencing that most of the P and K is native from the parent material and their input by seabirds to the soil is negligible. Significant lower soil bulk density was observed for L2 than for the other soils, which is presumably because of the plant roots effect on soil structure.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: SPATIAL AND TEMPORAL VARIABILITY OF THE PHYTOPLANKTON COMMUNITY AND ENVIRONMENTAL FACTORS IN THE BRANSFIELD STRAIT

Forename: Rafael Surname: Gonçalves-Araujo

Authors: Gonçalves-Araujo, Rafael; Maria Tavano Garcia, Virginia; Silva de Souza, Márcio; Alberto Eiras Garcia, Carlos;

Presentation Allocated: Poster

abstract: This study describes the spatial and interannual variability of the phytoplankton community (chlorophyll a biomass index and cell abundance) in relation to environmental conditions along the Bransfield Strait based on both in situ (corresponding to six summer oceanographic cruises) and satellite data from 2002 to 2010. A thermo-haline front was generally observed between cold and saltier waters under influence of Weddell Sea (TWW) in the south and fresher and warmer waters associated with the Bellingshausen Sea waters (TWB) in the north. Canonical correspondence analysis showed that microplanktonic diatoms' dominance was associated to high chlorophyll a levels in the shallow and relatively highly stratified TWB, mainly closer to the South Shetland Islands (SSI). The TWW was characterized mainly by low chlorophyll a related to well mixed water column with little vertical structure and dominated by nannoplanktonic flagellates (including haptophytes and cryptophytes). Sea ice seemed to be important in forming the highly stratified upper mixed layer (mainly near to the SSI) by the input of fresh water through the sea ice melting in those waters. On the other hand, nutrients were not a limiting factor to the phytoplankton development, since high values of dissolved macronutrients were found within the region for all the cruises. Both spatial and interannual (based on in situ and satellite data) variability suggested that phytoplankton community throughout the Bransfield Strait is governed by a combination of processes acting in a kind of synergism: sea ice retreat and vertical processes (mixing and/or upwelling) that probably enhance iron availability, the formation of relatively highly stratified upper mixed layer and, consequently, light availability. Finally, the interannual variability in the phytoplankton community observed in the present study suggests that communities were in different stages of succession.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Stress hormone modulation of reproductive performance within a community of Antarctic penguins (genus *Pygoscelis*)

Forename: Kristen B. Surname: Gorman

Authors: Gorman, Kristen B.; Williams, Tony D.; Fraser, William R.;

Presentation Allocated: Poster

abstract: The vertebrate stress-response is a neuroendocrine pathway critical in maintaining homeostatic energetic balance. In avian systems, corticosterone is the primary glucocorticoid produced during stimulation of the hypothalamic-pituitary-adrenal axis resulting in the mobilization of energy via gluconeogenesis. Thus, corticosterone is considered important in mediating life-history trade-offs, such as survival and reproduction, that result from allocation of limited energetic resources. Many avian studies have demonstrated elevated baseline corticosterone (BC) levels associated with reduced body condition and reproductive output, or skewed investment decisions. Therefore, BC profiles are particularly useful for better understanding proximate mechanisms involved in ecological scenarios where inter-individual variation in survival and reproductive performance is of interest. Within this context, climate-induced shifts in bio-geographic range, which are fundamentally driven by changing natural selection at opposing range margins operating via negative (positive) effects on individual fitness at contracting (expanding) range margins, and/or dispersal tendencies, are now occurring among breeding *Pygoscelis* penguins throughout the southwestern Atlantic sector of the South Ocean including the Bellingshausen Sea west of the Antarctica Peninsula (AP). For example, near Anvers Island, a breeding population decline and range contraction is occurring in the True Antarctic Adélie penguin (*P. adeliae*), while population increases and range expansions by sub-Antarctic chinstrap (*P. antarctica*) and gentoo (*P. papua*) penguins are occurring. However, 400 km south at Avian Island, sea-ice remains a prominent feature of the marine system and numbers of nesting Adélie penguins are thought to have increased in recent decades currently reaching a stable breeding population. In order to better understand proximate mechanisms that mediate body condition with reproductive performance, we examine within and among species variation in body condition as a predictor of the stress hormone corticosterone. Further, we examine corticosterone levels as predictors of primary and secondary reproductive performance. Finally, we also considered latitudinal variation in reproductive performance among Adélie penguins nesting at Anvers Island, as well as Avian Island using data collected over the 2008-2010 austral summers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Testing connectivity of a fully pelagic forage fish, Antarctic silverfish, along the West Antarctic Peninsula and South Orkney Shelf using otolith chemistry and particle-tracking simulations

Forename: Jason Surname: Ferguson

Authors: Ferguson, Jason; Ashford, Julian; Piñones, Andrea; Dinniman, Michael; Torres, Jose; Jones, Christopher;

Presentation Allocated: Poster

abstract: Ocean circulation has been identified as a major process controlling the distribution of biological material in marine systems. Large-scale transport by the Antarctic Circumpolar Current (ACC), the Ross and Weddell Gyres, and the Antarctic Coastal Current can promote spatially complex population structure in the Southern Ocean through advection. Antarctic silverfish (*Pleuragramma antarcticum*), a pelagic, neutrally buoyant notothenioid fish species, are distributed around the shelf systems of Antarctica and are considered a keystone species rivaling krill as prey for many birds, seals, whales, and other fish. We asked whether silverfish are distributed in independent, discrete populations along the West Antarctic Peninsula (WAP) and shelf areas bordering the Weddell Gyre, or whether the large-scale circulation has led to connectivity among populations. Hypotheses were tested by measuring the chemistry in the nucleus of silverfish otoliths, which represents the material laid down during early life, and comparing the chemistry with simulated particle transport using a high resolution circulation model. The results showed that the southern WAP is composed of a single population. It also showed strong heterogeneity between the northern WAP and the South Orkney Shelf, indicating no appreciable connectivity despite strong northward currents associated with the Weddell Front. Using the circulation model, we built spatially explicit predictions of advective supply to areas along the WAP, and examined how interactions between silverfish life history and the Antarctic Coastal Current may structure assemblages over the continental shelf.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: The metabolic and physiological plasticity of the Antarctic fish *Notothenia rossii* (Richardson, 1844) acclimated at high temperatures.

Forename: Danilo Surname: Santos Eugênio

Authors: Santos Eugênio, Danilo; Piechnik, Claudio Adriano; Machado, Cintia; Badeluk Cettina, Luciana; Vaz da Silva, Flávia Baduy; Zaleski, Tania; Forgati, Mariana; Kawall, Helena Gonçalves; Rodrigues, Edson; Donatti, Lucelia;

Presentation Allocated: Poster

abstract: The temperature is an abiotic important factor for marine species and the niches of ectothermic species are biogeographically defined according to the constraints and tradeoffs involved in thermal adaptation. The accelerated warming of the Antarctic Peninsula and adjacent islands has raised questions about the thermal plasticity in the ectothermic species of Antarctica. The objective of this study was to evaluate the physiological and metabolic profile of *N. rossii* against the thermal stress at elevated temperatures. Experiments were conducted in Comandante Ferraz Brazilian Antarctic Station during the winters of 2009 and 2010. The fish were acclimated at temperatures of the 0, 4 and 8°C during 24, 96, 360 and 720 hours. In liver and muscle tissues, we analyzed the percentage of moisture and minerals, the concentration of energy substrates in tissues and enzyme activity representatives of energy metabolism and oxidative, noting also the transcriptional rate and plasma constituents in the liver. As terminal enzyme of gluconeogenesis, the glucose-6-phosphatase (G6Pase) enables the export of glucose to the blood. In the acclimation of *N. rossii* at 8°C there was high levels of G6Pase from the time of 96 h compared to that observed at 0°C and it was accompanied by hyperglycemia at all times analyzed. On the other hand the concentrations of muscle and liver glycogen were lower than reference values (0°C) with minimal difference of 41%. After 96 h of exposure at 4°C the blood glucose was 48% lower than that at 0°C, being respectively 57 and 73% lower at 360 and 720 h. In the same time of acclimatization the concentration of hepatic glycogen at 4°C exceeded 21% that the observed at 0°C and G6Pase activity increased only at 720 h of exposure. The upregulation of G6Pase in the liver levels of *N. rossii* in acclimation to 8°C indicates an increase in the gluconeogenic potential of this tissue and his capacity to export glucose to the blood. However, this effect was not evident at 4°C where the *N. rossii* showed inability to maintain blood glucose levels and gene expression. Although stenothermic, *N. rossii* was able to survive at temperature of 8°C for 30 days demonstrating their thermal plasticity. Despite having evolved under temperatures low and stable, this fish has response mechanisms to the increase in temperature of the environment however these responses vary between 4°C and 8°C.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Transcriptome analyses of Winter/Spring 2011 phytoplankton species succession from Antarctica Peninsula coastal surface waters

Forename: Joseph Surname: Grzymiski

Authors: Grzymiski, Joseph; Neveux, Iva; Karentz, Deneb;

Presentation Allocated: Oral

abstract: The transition from winter to spring in high latitudes is a period of rapid change in incident solar irradiation. In the marine environment, light limited phytoplankton undergo significant changes in an effort to maximize photosynthetic efficiency while adapting to increasing PAR and ultraviolet light, slight increases in temperature and water column stratification. Little is known about how the physical and chemical winter-spring transition period may affect productivity of any of the 80 taxa of phytoplankton found in the late-winter water column. We measured changes in photosynthetic efficiency and the phytoplankton community structure from August 2011-November 2011 off Anvers Island, Antarctica. We sampled the phytoplankton community transcriptome at eight time points over the same period. Variability in the maximum quantum yield of photosystem II increased with day length consistent with a transition from perpetual light limitation to a diel pattern. Here we present a time-series of the transcriptome changes in the phytoplankton community from a period of severe light limitation in August to photoinhibition and UV damage in later spring. Over this period, there was a continuous increase in abundance of the diatom *Corethron criophilum*.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Variations in Bacterial, Archaeal, and Eukaryal Communities during the Polar Night Transition in Lakes of the McMurdo Dry Valleys, Antarctica

Forename: Trista Surname: Vick

Authors: Vick, Trista; Amaral-Zettler, Linda; Priscu, John;

Presentation Allocated: Poster

abstract: Microorganisms dominate the water columns of the permanently ice-covered lakes of the McMurdo Dry Valleys (MCM). During the summer, 24-hours of daily sunlight drives primary production by phytoplankton, providing organic carbon to heterotrophic bacteria and archaea. Changes in microbial activity related to the onset of winter have been previously characterized, showing that heterotrophic bacterioplankton activity slows whereas phytoplankton may encyst or use mixotrophy to survive the polar night. Little is known about taxonomic shifts that might characterize microbial responses to the onset of winter in these lakes. In this study, we used massively-parallel 454 tag sequencing to characterize for the first time all three domains of life in the MCM lakes during the transition from 24-hour sunlight to the polar night. Duplicate samples were collected from two depths each in Lake Fryxell (FRX) and the West Lobe of Lake Bonney (WLB) once during November (summer) and once during March when almost no sunlight penetrated the water columns of the lakes. Evaluation of taxonomic diversity revealed bacterial communities (3% OTU cutoff) dominated by members of the Actinobacteria and Bacteroidetes (65% – 75% relative abundance) with Shannon diversity that ranged from 3.07 to 4.03. Diversity was always higher during November relative to March. Members of either the Cryptophytes or Stramenopiles generally dominated the Eukaryal communities (6% OTU cutoff), and Eukaryal Shannon diversity (range 1.27 – 2.51) typically increased during March relative to November. Marine Crenarchaeota and Euryarchaeota (Group I and Group II, respectively) dominated the Archaea (3% OTU cutoff). Shannon diversity ranged from 0.46 to 2.38 and was greater during March in FRX and during November in WLB. To determine whether microbial taxa co-varied over time, we calculated Pearson's correlations between all relative abundance (Bacteria and Archaea) and presence/absence (Eukarya) data across the sample points. Significant correlations ($P < 0.05$; 12.4% of total; $n = 1519896$) are indicative of similar response to seasonal stimuli. Bacteria accounted for 91.1% of significant correlations, while Archaea and Eukarya accounted for 3.1% and 5.8%, respectively. Grazers were some of the most commonly correlated eukaryotic taxa and their correlations with other groups tended to be negative. Network analysis will be used to reveal more specific interactions between members of the domains.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Vertical Stratification of Bacterial Community in the Ross Sea, Antarctica revealed by 16S rDNA pyrosequencing

Forename: Yung Mi Surname: Lee

Authors: Lee, Yung Mi; Kim, Ji Hee; Chun, Jongsik; Hong, Soon Gyu;

Presentation Allocated: Oral

abstract: Marine microorganisms play significant roles in the biogeochemical cycles. In this study, the prokaryotic diversity in the water column from Ross Sea was analyzed by pyrosequencing method. Seawater samples were collected from ten stations using CTD during the expedition of ice breaker ARAON in 2011. We found there was no significant difference in the bacterial communities and environmental factors among sampling sites. In all stations, phylotypes included in three phyla Bacteroidetes, Alphaproteobacteria, and Gammaproteobacteria were predominant composing 62% to 99% at all depths and the vertical stratification of bacterial communities in the water column was remarkable. As the sampling depth extended, the proportion of Bacteroidetes decreased while that of Gammaproteobacteria increased. The proportion of Alphaproteobacteria was relatively consistent along a vertical profile. Also as the sampling depth extended, relative abundance of phylotypes included in phyla or candidate phyla such as Deltaproteobacteria, SAR406, and Verrucomicrobia that were not found at all or very few were found in the surface community were increased.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Viral dynamics and impacts on the permanently ice-covered McMurdo Dry Valley lakes

Forename: Katherina Surname: Hell

Authors: Hell, Katherina; Priscu, John;

Presentation Allocated: Poster

abstract: The perennially ice-covered lakes in the McMurdo Dry Valleys are microbially dominated systems lacking a complex food-web. This feature, together with the physically stable water column provides a unique system to study microbial and viral processes. Viruses are now recognized as an important component in marine and freshwater planktonic dynamics and can play a significant role in the regulation of microbial community structure, food-web interactions, biogeochemical transformations, and microbial genetic diversity. Limited top-down control as well as the high number of viruses (10^6 viruses mL⁻¹) imply that the relative role of viral particles in these systems may be greater than in temperate and tropical lakes. Virally mediated mortality could be a major factor in regulating bacterial biomass in the dry valley lakes and might also play an important role in the regeneration of nutrients and organic carbon. The high number of lysogenic bacteria (63% of the total population) previously reported in these lakes indicates high potential for introduction of new genetic information into bacterioplankton or progeny viruses, driving the evolution of host and viral assemblages. It has been shown that viral infection of the bacterial population varies on both daily and seasonal time scales. Based on this information, and the fact that these polar desert environments are particularly sensitive to discrete climate events, changes in bacterial diversity due to viral infections could be directly influenced by changing climatic conditions. Our data, in concert with past results, address the importance of virally mediated biogeochemical cycling, food-web interactions and modeling of microbial genetic diversity using a combination of microscopy and flow cytometry, together with burst size experiments, induction assays and genomic analyses.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: What do larval krill eat in winter/early spring?

Forename: Zhongnan Surname: Jia

Authors: Jia, Zhongnan;

Presentation Allocated: Poster

abstract: Background: Antarctic krill (*Euphausia superba*) is the keystone species as it connects phytoplankton with many higher trophic animals (e.g. penguins, seals, whales) in the Southern Ocean ecosystem. Besides, Antarctic krill has been an important fishery target for decades. Critical knowledge gaps of important aspects of krill life history remain unclear, such as, how krill larvae survive over winter under the sea ice. Larval survival rate during the first winter determines the recruitment of the species in the following year, consequently, is one of the most essential questions for the species. It is assumed sea ice algae and under ice crustaceans mainly contribute to larval krill diet in the winter because of the low abundance of phytoplankton in the open water. Therefore, any perturbations in the sea ice thickness and extent may have a big impact on larval krill survival in terms of food availability. Furthermore, it is significant to understand what krill feed on to understand how the food web and entire ecosystem response to the change. Methods: In this research, I use three complimentary methods (Microscopy, Genetic analysis and Stable Isotope analysis) to investigate larval krill diet and quantify components of the diet. Metabolic activities of larval krill from field and laboratory samples; along with dietary information will be used to develop a mathematical model of energy balance of larval krill. Expected outcome: Data on diet of larval Antarctic krill will help further develop our understanding of energy budget of this species in the winter as well as the connection of the under-ice food web. Data will be utilized for krill fishery management. Furthermore, results from this research can be utilized in larger ecosystem models to predict the effects of climate change on larval krill survival during their first winter.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: What do Phytoplankton in the McMurdo Dry Valley Lakes Do When the Sun Sets?

Forename: Amy Surname: Chiuchiolo

Authors: Chiuchiolo, Amy; Priscu, John; Morgan-Kiss, Rachael;

Presentation Allocated: Poster

abstract: The McMurdo Dry Valleys is the largest ice-free area on the Antarctic continent, and is the study site of the Long Term Ecological Research (LTER) program. Research on four perennially ice-covered lakes in the Taylor Valley has been ongoing since 1993, but has been restricted to the austral spring and early summer (~October through January) when logistical support has allowed access to the area. The International Polar Year 2007-2008 (IPY) provided the first opportunity to study biological adaptation/acclimation by plankton to extreme cold and prolonged darkness. During the IPY season, changes in under-ice light photosynthetically active radiation (PAR), primary production (PPR), and chlorophyll-a were measured from early November through mid-April. PAR decreased significantly in March until it was no longer measureable within the water column of the lakes. PPR reflected changes in PAR and ceased by mid-April. During this same period, phytoplankton diversity was determined in-situ using a submersible spectrofluorometer which differentiates the following groups: Cyanobacteria, Chlorophyta, Chrysophyta, Cryptophyta. Measurements of these groups is based on chlorophyll-a fluorescence (683 nm) following excitation of antenna pigments characteristic of the light harvesting apparatus for each group. Chlorophyte and chrysophyte biomass typically peaked in the lower photic zone of the lakes as PAR started to decrease. Cryophytes showed a similar temporal trend but their maximum abundance occurred just below the ice cover. The highest abundance of cyanobacteria occurred in early April and may be the result of fall-out from the permanent ice cover. Importantly, total chlorophyll-a did not decrease in direct response to diminished PPR, indicating that mixotrophy may be an important mechanism for winter survival in these lakes. These data are important to our knowledge of how polar organisms survive and function within high latitude ecosystems characterized by extreme cold and prolonged darkness.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 14

Title: Winter/Spring 2011 Phytoplankton Species Succession in Near Coastal Waters of the Antarctic Peninsula

Forename: Joseph Surname: Grzymiski

Authors: Grzymiski, Joseph; Karentz, Deneb;

Presentation Allocated: Poster

abstract: Understanding biological responses to seasonal warming and increased light during the transition from winter to spring could provide key insights for evaluating ecological implications of climate change. From Aug-Nov 2011 phytoplankton species richness and abundance were quantified (from 0-60m) on the south coast of Anvers Island (64°49'S 64°02'W). Ancillary measurements were made of physical parameters (e.g., temperature, salinity, light) and photosynthetic characteristics of the phytoplankton community (variable fluorescence of photosystem II). Aug surface water temperature of -1.6C increased to -0.6C by Nov, and daylight periods lengthened from 5 to 21h. Ice cover was variable throughout the study, oscillating between states of consolidated sea ice, loose brash ice, and open water. Chlorophyll concentration increased from 0.15 to 1.5 µg/L while phaeophytin:chlorophyll declined from 0.30 to 0.05. Chlorophyll remained low (<0.3 µg/L) from Aug-Oct and began to increase in Nov. Over 80 phytoplankton taxa were observed, but the increase in chlorophyll was strongly correlated ($r^2=0.88$) to the abundance of *Corethron criophilum*, a diatom that reached densities of 11,000 cells/L and comprised >75% of the net phytoplankton. *Corethron* cells varied widely in size with auxospores and dividing cells often present. Other common diatom taxa included *Fragilariopsis kerguelensis*, *Porosira glacialis*, *Chaetoceros* spp. and unidentified tiny (<5µm) pennate diatoms. The prymesiophyte *Phaeocystis antarctica* was seen in many samples as both single cells and colonies. Other small flagellates were regularly observed. The transition of phytoplankton from winter to spring occurred slowly, with little change in species composition and relative abundance of taxa during the four-month study. While light and temperature steadily increased over the winter-spring gradient, weather conditions and persistence of ice reduced availability of light in the water column. This factor may have been the most significant limitation on the short-term phytoplankton dynamics in the region. Samples were collected for analyses of RNA sequences for future study of changes in gene expression as species adapted to the colder darker winter responded to the warmer lighter spring. The characterization of molecular differences between species may provide a more comprehensive understanding of the responses of Antarctic phytoplankton to gradients of environmental change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Acoustic density estimation of leopard seals

Forename: Holger Surname: Klinck

Authors: Klinck, Holger; Constantinou, Nadine; Mellinger, David K.; Rogers, Tracey L.; Dziak, Robert P.; Park, Minkyu;

Presentation Allocated: Oral

abstract: Quantitatively surveying the vast majority of marine mammal populations is problematic using traditional visual methods alone. However, many species frequently produce loud, characteristic, stereotyped, long-range underwater calls. This unique acoustic signature, coupled with the efficient propagation of sound through the ocean, has resulted in acoustic techniques being used to estimate distribution, and more recently abundance, of marine mammal species.

□

The objective of this study is to estimate the density of leopard seals (*Hydrurga leptonyx*) using acoustic data recorded in the Bransfield Strait, Antarctica, between 2005 and 2010. The most prominent vocalization of the leopard seal - the low double trill (LDT) - is used as a proxy for the presence of the species in the vicinity of the recording system. Because of the stereotypic nature and high frequency of occurrence of the LDT, a long-term spectrogram approach can be applied to the data set to reliably detect the presence of this elusive pack-ice seal. Energy levels in the 300 - 350 Hz frequency band as derived by the long-term spectrogram analysis are related to number of manually counted calls extracted for selected periods. A linear regression analysis showed that energy levels are highly correlated with the number of manually counted calls. The number of recorded calls per unit time is converted into number of vocalizing animals per unit time by applying published calling rates for this species. In a last step of the analysis the detection area is defined and leopard seal densities estimated. Potentials and challenges of the developed method to estimate the density of leopard seals and other marine mammals will be discussed. [Work supported by the Korea Polar Research Institute (KOPRI) and the U.S. Navy's Environmental Readiness Division (N45)].

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Antarctic Feeding Ground Confirmed for East Australian Humpback Whales: But Where Do Oceania's Whales Go?

Forename: Rochelle Surname: Constantine

Authors: Constantine, Rochelle; Baker, C. Scott; Childerhouse, Simon; Double, Mike; Gales, Nick; Garrigue, Claire; Robbins, Jooke; Steel, Debbie;

Presentation Allocated: Oral

abstract: Humpback whales (*Megaptera novaeangliae*) in the Southern Hemisphere migrate between Antarctic feeding grounds and tropical breeding grounds. With thousands of kilometers between destinations and multiple breeding and feeding grounds, understanding the dynamics behind this phenomenon is challenging especially with conservation concerns for some populations. We report on the most comprehensive assessment of humpback whale movements between remote Antarctic waters south of New Zealand and east Australia, and their migratory corridors and breeding grounds of Australia and Oceania. A total of 112 individuals were identified; 57 from microsatellites and 61 by fluke with 23% ($n = 26$) matched to sites outside Antarctica. The whales were predominantly linked to East Australia ($n = 24$) despite large datasets from West Australia and Oceania also being compared. The humpback whales of Oceania were decimated by commercial whaling and are listed as endangered by the IUCN. Determining their feeding grounds is crucial in understanding possible reasons for the rapid recovery of East Australian whales whilst Oceania's whales show extremely low levels of population growth. It is unknown how Antarctic feeding grounds and migration paths may influence population recovery but they may provide information on how to improve these whales' conservation status. This work is an output of the Southern Ocean Research Partnership and represents contributions from many different individuals and institutions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: At-sea habitat preferences of male Adélie penguins during their first incubation trip

Forename: Manuelle Surname: Cottin

Authors: Cottin, Manuelle; Raymond, Ben; Kato, Akiko; Amélineau, Françoise; Ropert-Coudert, Yan;

Presentation Allocated: Poster

abstract: Over the past 25 years, the foraging behaviour of seabirds has been thoroughly investigated. Although the Adélie penguin is one of the most studied seabirds, its foraging range during the first, long incubation trip remain poorly known. We examined here for the first time the foraging locations of male Adélie penguins (*Pygoscelis adeliae*) off the Pointe Géologie archipelago (Terre Adélie, East Antarctica) during their first incubation trip using custom-designed GPS tracking units. We observed three foraging strategies: 1) 5 individuals covered large distances to the north (mean maximum distance from the colony: 310 ± 11 km), using the edge of two persistent eddies, and 2) 5 individuals foraged to the northwest, close to the Antarctic slope and at the limit of the pack-ice (254 ± 36 km from the colony). 3) Three other individuals covered much shorter distances, 2 individuals to the north (208 and 240 km from the colony) and one to the east (200 km). In other words, during this first incubation trip that follows an extensive fast at the nest, male Adélie penguins performed long trip in oceanic waters, much further from the colony than during chick's rearing period. We will report here the influence of environmental conditions (such as marine currents, pack-ice, bathymetry, etc.) and body condition on their at-sea geographic ranges.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Circumpolar diversity and geographic differentiation of mtDNA in the critically endangered Antarctic blue whale (*Balaenoptera musculus intermedia*)

Forename: Angela Surname: Sremba

Authors: Sremba, Angela; Hancock-Hanser, Brittany; Branch, Trevor; LeDuc, Rick; Baler, C. Scott;

Presentation Allocated: Oral

abstract: The Antarctic blue whale (*Balaenoptera musculus intermedia*) was hunted to near extinction between 1904 and 1972, declining from an estimated initial abundance of more than 250,000 to fewer than 400. Here, we describe mtDNA control region diversity and geographic differentiation in the surviving population of the Antarctic blue whale, using 218 biopsy samples collected under the auspices of the International Whaling Commission (IWC) during research cruises from 1990-2009. Microsatellite genotypes and mtDNA sequences identified 166 individuals among the 218 samples and documented movement of a small number of individuals, including a female that traveled at least 6,650 km or 131° longitude over four years. MtDNA sequences from the 166 individuals were aligned with published sequences from 17 additional individuals, resolving 52 unique haplotypes from a consensus length of 410bp. From this minimum census, a rarefaction analysis predicted that only 72 haplotypes (95% CL, 64, 86) have survived in the contemporary population of Antarctic blue whales. However, haplotype diversity was relatively high (0.968 ± 0.004), perhaps as a result of the longevity of blue whales and the relatively recent timing of the bottleneck. Despite the potential for circumpolar dispersal, we found significant differentiation in mtDNA diversity ($F_{ST}=0.032$, $p<0.005$) and microsatellite alleles ($F_{ST}=0.005$, $p<0.05$) among the six Antarctic Areas historically used by the IWC for management of blue whales.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Comparison of the foraging ecology of southern and northern elephant seals

Forename: Daniel Surname: Costa

Authors: Costa, Daniel; Robinson, Patrick; Huckstadt, Luis; McDonald, Birgitte; Crocker, Daniel; Goebel, Michael; Muelbert, Monica; Hindell, Mark; Fedak, Michael; Guinet, Christophe;

Presentation Allocated: Oral

abstract: While southern elephant seals (SES) are distributed throughout the southern ocean, northern elephant seals (NES) are limited to the Northeast Pacific Ocean. SES feed at the same latitudes where they breed, while NES feed at higher latitudes than their breeding colonies. The foraging behavior of 167 female northern elephant seals (Año Nuevo and San Benitos Islds) and 121 southern elephant seals from 4 colonies (Livingston, South Georgia, Kerguelen, and Elephant Islands) were compared to see how the behavior varied between these different habitats. While the diving behavior was similar their movement patterns are quite different. NES dive deeper on average (NES 515m 4se SES 400m \pm 3.2 se), but SES made the deepest dives (SES mean max 1609 m vs NES 1190m). Female NES forage primarily offshore (85%) while only 24% of SES do so. Over a foraging trip SES traveled shorter distances than NES (SES 3384 km \pm 425se; NES 6699 km \pm 190se) and both rely on persistent large scale oceanographic features such as the North Pacific Transition zone for NES and the Polar Front for SES. Same time spent in ARS (SES 4.6 \pm 2.5 d; NES 4.3 \pm 2.7 d) SES search over 2X (121 km compared to 61 km) the area, Both species exhibit high site fidelity. Differences in the foraging behavior between the four colonies of SES were primarily associated with the availability of shelf habitat. For example, in the western Antarctic Peninsula where there is an extensive continental shelf SES 86% of the females foraging on the shelf. Given the similarity of foraging behavior of these species it is quite surprising that NES breed at such low latitudes compared to where they forage. While SES forage in the areas more associated with their breeding sites. These differences are probably related to differences in available habitat as well as a greater presence of humans in the habitat of northern elephant seals.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: CORTICOSTERONE AS INDICATOR OF STRESS IN ADULTS AND CHICKS OF ANTARCTIC SKUA (Catharacta spp)

Forename: Erli Schneider Surname: Costa

Authors: Costa, Erli Schneider; Furtado, Priscila Viau; de Oliveira, Cláudio Alvarenga; Alves, Maria Alice S.;

Presentation Allocated: Oral

abstract: Responses to stressful events occur via activation of the sympathetic-adrenal (SA) and hypothalamic-pituitary-adrenal (HPA) axis, through the release of hormones such as glucocorticoids (GCs). The identification of causes and consequences of stress on wildlife populations is a fundamental ecological problem. The first step to correctly understand and interpret the observations and the results obtained in the field and in the laboratory is to understand the circadian and circannual rhythms of GCs (such as corticosterone in birds, CORT) to which animals are subjected in their normal life cycle, compared with levels in stress situations. In order to determine baseline levels of CORT and stress in *Catharacta* spp., this study compared the values of CORT obtained in the birds until 5min after capture (CORT_0) and after 30 minutes of restraint (CORT_30) comparing adults in breeding (BS) and non-breeding stages (NBS), males and females, species (*Catharacta maccormicki* e *C. Lonnbergi*) and CORT_0 also for chicks. The results indicated significant differences between the levels of CORT_0 and CORT_30 among the adults, but no significant difference between species or between sexes. Also significant differences were found between the baseline (CORT_0) of adults in BS (higher levels of CORT_0) compared with adults in NBS, confirming that the reproductive period is a period of increased stress. Altered levels (CORT_30) did not differ significantly between BS and NBS indicating that the maximum production of CORT under stress does not differ between adults. Among young and BS were not found significant differences in the levels of CORT_0 either; but the values of CORT_0 obtained for NBS were significantly lower than for chicks and BS. The results presented indicate that CORT can be used as a measure to identify changes in stress levels in seasonal situations (breeding) and unpredictable situations of stress, such as capture and restraint of individuals.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Decisions, Decisions. Direct measurements of humpback whale feeding in relation to vertically-stratified prey abundance.

Forename: Ari Surname: Friedlaender

Authors: Friedlaender, Ari; Hazen, Elliott; Ware, Colin; Halpin, Patrick; Stimpert, Alison; Tyson, Reny; Nowacek, Douglas;

Presentation Allocated: Keynote 20 mins

abstract: To date, little information exists to explicitly test how cetaceans make decisions regarding where and when to begin feeding. This critical facet of their ecology is necessary to quantify consumption rates and interactions with their prey. Limitations in our capacity to determine both the precise location of individual feeding bouts and the concurrent spatio-temporal availability of prey have limited our ability to examine whether or not foraging decisions are made based on the ecological principles of optimal foraging theory, energetic demands of diving, or a combination of the two. In 2009 and 2010 we deployed 21 digital recording tags on humpback whales (*Megaptera novaeangliae*) for over 350 hours around the Western Antarctic Peninsula and collected concurrent measurements of Antarctic krill (*Euphausia superba*) distribution and abundance using Simrad EK-60 scientific echosounders. Using spatially-explicit analytical tools we test the relationship between feeding behavior and the vertical distribution of prey in the water column. The time, location, and depth of individual feeding lunges were determined based on published methods using accelerometer data. Prey biomass was determined using volume backscatter and target strengths generated from net samples and standard krill models. Prey data were then stratified into 10-meter depth bins throughout the water column. We found that the frequency of lunges on a given dive increases with dive depth, supporting an energetic cost of lunging at depth. Furthermore, we found a significant positive relationship between the density of prey and depth a feeding lunges. Throughout night-time hours, the average depth of feeding lunges changed significantly, following a pattern consistent with diel vertical migration observed in the krill. Our results offer insights into the combination of energetic demands of diving and the vertical distribution of prey in determining where and when whales feed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Demography responses to climate by an Antarctic Southern Giant Petrel Population

Forename: Lucas Surname: Krüger

Authors: Krüger, Lucas; Petry, Maria Virginia; Sander, Martin;

Presentation Allocated: Poster

abstract: Many seabird species have their demography parameters (as consequence their population variation) affected by climate. Several studies evaluate such effects in subantarctic, subtropical and tropical seabirds, while in Antarctic only the penguin responses to climate changes were deeply tested. The objective of this study is to test the effects of Antarctic Oscillation Index (AOI) and temperature over four adult demography parameters of a Southern Giant Petrel (SGP) population breeding in Stinker Point, Elephant Island, Antarctica. We banded the entire population and conducted recaptures during sequent five years. We used a multi-state mark-recapture model to estimate the non-breeder survival (NBS), breeder survival (BS), return rate (RR) and abort rate (AR) using the program MARK. We averaged the parameters from the better 30 models, and entered them in Null Regressions with 10,000 resamplings through program EcoSim ($\alpha=10\%$). We found the NBS is influenced by AOI during the summer ($R=0.61$; $P=0.03$) and winter ($R=0.73$; $P=0.07$), and temperature during winter ($R=0.84$; $P=0.04$) and summer ($R=0.89$; $P=0.02$). BS is only influenced by AOI during summer ($R=0.88$; $P=0.08$). Adult survival increases with increases in AOI and temperature. The RR did not answer to AOI or Temperature, and AR did answer to AOI ($R=-0.71$; $P=0.04$) and temperature ($R=-0.91$; $P=0.04$) in summer. The warmer the less probable a bird will abort breeding, it is, while the survival probability increases, the abort rate decreases. Many large seabird species have the breeding success affected by AOI variations, but few did respond with adult survival rates. Nonetheless, some subantarctic albatrosses have the adult survival rates affected by AOI variations. The adult survival is the most important demography parameter for large k-strategists. But the positive responses of SGPs indicate that the survival rates decreases only with negatives AOI (both summer and winter periods for non-breeders and just in the summer period for breeders). The warmer summers conditions are the most relevant for large seabirds' survival. The tendency of the Antarctic Peninsula to warm may take the SGP population to maintain higher survival rates, henceforth no critical population decreases can be expected.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Detection, differentiation, and abundance estimation of penguin species by high-resolution satellite imagery

Forename: Heather Surname: Lynch

Authors: Lynch, Heather;

Presentation Allocated: Oral

abstract: Due to its high spatial resolution, broad spatial coverage and cost-effectiveness, commercial satellite imagery is rapidly becoming a key component of biological monitoring in the Antarctic. While considerable success in surveying emperor penguins [*Aptenodytes forsteri*] has been facilitated by their large size and the visual simplicity of their habitat, there has been considerably less progress mapping colonies on the Antarctic Peninsula and associated sub-Antarctic islands where smaller penguin species breed on topographically-complex terrain composed of mixed substrates. I will demonstrate that Adélie penguin [*Pygoscelis adeliae*], chinstrap penguin [*P. antarcticus*], gentoo penguin [*P. papua*], and macaroni penguin [*Eudyptes chrysolophus*] colonies can be detected by high resolution (2 m multispectral, 40-50 cm panchromatic) satellite imagery and that under ideal conditions such imagery is capable of distinguishing among groups of species where they breed contiguously. To demonstrate the potential for satellite imagery to estimate penguin population abundance, I will focus on two case studies in which satellite imagery has been used to make quantitative estimates of penguin abundance: (1) an analysis of a panchromatic Worldview-2 image was used to estimate a site-wide population of 115,673 (99,222 – 127,203) breeding pairs of Adélie penguins at Paulet Island (63°35' S, 55°47' W), and (2) a comparative analysis of a 2003 Quickbird-2 panchromatic image and a 2010 Worldview-1 panchromatic image was used to estimate a 39% decline in chinstraps breeding at Baily Head (62°58' S, 60°30' W) since 2002/03.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: DIET OF THE SOUTH POLAR SKUA: COMPARISON OF METHODS OF ANALYSIS

Forename: Maria Mercedes Surname: Santos

Authors: Santos, Maria Mercedes; Juárez, Mariana Alejandra; Rombolá, Emilce; González-Zevallos, Diego; Coria, Néstor Ruben; Doncaster, Charles Patrick;

Presentation Allocated: Oral

abstract: Studies of the opportunistic diet of South Polar Skuas, *Stercorarius maccormicki*, can provide valuable information on the status of marine food resources in the high Antarctic. Most studies to date have been based on collection of pellets from breeding colonies or regurgitates of adults and chicks. We report the first study to compare the contents of pellets and regurgitates of South Polar Skuas, produced across years by identified pairs breeding at two colonies on the Antarctic Peninsula. Samples were taken from Potter Peninsula in sympatry with Brown Skuas, *Stercorarius antarcticus*, and from Cierva Point in allopatry, in order to test the general consensus that penguins feature prominently in the diet at least in the absence of Brown Skuas. We found that penguin remains were much more frequent in samples from the sympatric population than the allopatric population, but only in pellets. Moreover, the high-frequency of penguin feathers was replaced in the pellets of the allopatric population by a high frequency of non-food moss. The rare occurrence of penguins in regurgitates from both sites is consistent with scavenging rather than active predation. The high frequency of feathers in pellets at Potter is consistent with a gut cleansing function similar to that performed by moss, which is abundant only at Cierva. We conclude that evidence for penguins replacing fish in the diet cannot be drawn solely from pellet analysis, and must take account of other non-food functions of ingesting penguin feathers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Does twenty years make a difference? Weddell seal diving behavior in the Ross Sea, 1990 vs 2010

Forename: Jennifer Surname: Burns

Authors: Burns, Jennifer; Goetz, Kimberly; Shero, Michelle; Costa, Daniel; Testa, James Ward;

Presentation Allocated: Keynote 20 mins

abstract: Over the past two decades, there has been a heightened awareness of the impacts of climate change and human activities on polar marine ecosystems, and the top predators that inhabit them. In the McMurdo Sound region of the Ross Sea, Antarctica, marine productivity and reproductive success of penguins and seals has been influenced by both cyclical climate patterns and the transient presence of the B-15 iceberg, which alter ice dynamics and local currents. More recently, there has been a marked increase in fishing pressure in the Ross Sea, especially for several of the prey species preferred by these predators. Unfortunately, assessing the combined impacts of these changes on Antarctic top predators is complicated by the paucity of long term data on foraging ecology. However, the population ecology of Weddell seals (*Leptonychotes weddellii*) has been studied for more than four decades, and in the early 1990s some of the first Argos-linked dive recorders were deployed on 16 adult females in Erebus Bay. Diving and movement patterns collected during the winters of 1990 and 1991 and originally reported by Testa (1994) are compared to more recent data collected from 41 (6M, 35F) adult Weddell seals outfitted with satellite-linked dive recorders and monitored during the austral winters of 2010 and 2011. Preliminary analyses suggest that adult seals in both periods utilized similar foraging depths and locations, although bottom time and post-dive surface intervals differed slightly. The broad-scale similarity in adult behavior across two decades suggests that seals are behaviorally resilient to the changes in the Eastern Ross Sea ecosystem that have occurred to date.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Foraging behaviour of Weddell seals during winter according to environmental parameters : a study using high resolution dive and movement data.

Forename: Heerah Surname: Karine

Authors: Karine, Heerah; Virginia, Andrews-Goff; Christophe, Guinet; Mark, Hindell; Jean Benoit, Charrassin;

Presentation Allocated: Oral

abstract: We studied the winter foraging strategy of Weddell seals in two Antarctic locations (Adélie Land and Mc Murdo Sound) and the influence of environmental abiotic parameters on their foraging behaviour in the horizontal and vertical dimensions. Temperature-light-time-depth recorders (TDR) and GPS were used to collect winter-long high resolution data to study the fine scale foraging behaviour of two Weddell seals. The diving behaviour was recorded each second and every 30 s for the Dumont D'Urville and the Mc Murdo individual, respectively. TDRs simultaneously recorded water temperature and ambient light and the Dumont D'Urville seal was also fitted with a GPS logger providing accurate locations. To our knowledge, this is the first dataset on the detailed diving behaviour of Weddell seals covering the whole winter season.. A comparison was made with results of a previous study conducted using low resolution conductivity-temperature-depth-satellite relayed data loggers (CTD-SRDL) at Dumont d'Urville (~67°S, 140°E) during winter in 2007 and 2008. The dives were classified according to behavioural parameters such as ascent and descent rates, maximal diving depth, dive duration, wiggles characteristics, and bottom time using a cluster analysis. We then studied the correlations between environmental parameters (light, temperature, bathymetry) and these behavioural parameters both vertically and horizontally when possible. These results were compared between the two locations and to results obtained previously using CTD-SRDL tags. That latter study showed that there were significant environmental influences on seal diving behaviour and habitat use. Seals dived deeper, longer and had a better feeding success (as inferred from dive bottom time residuals) when light intensity increased. Maximum dive depth decreased during winter associated with an increase in dive duration but with no effect on the feeding success. Foraging success was higher in shallow waters associated with relatively smooth bathymetry and dominated by Antarctic Surface Water. Here we use direct light measurements to further study the influence of ambient light on the diving behaviour and its seasonal change throughout winter. We also use fine scale dive parameters to derive new proxies of feeding success and to determine the influence on local bathymetry and hydrography on the diving behaviour.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Foraging effort of Antarctic fur seals in relation to mesoscale circulation patterns in the Southern Ocean

Forename: Mary-Anne Surname: Lea

Authors: Lea, Mary-Anne; Arthur, Ben; Cotté, Cedric; Bester, Marthan; Goebel, Michael E.; Oosthuizen, Chris; Sokolov, Sergej; Trathan, Phil;

Presentation Allocated: Oral

abstract: Foraminiferal assemblages are reported for the first time from Oligocene strata of West Antarctica. They occur in the glacio-marine Polonez Cove Formation (PCF), best exposed in coastal cliffs and ledges on the Bransfield Strait side of King George Island (South Shetlands) between Low Head and Lions Rump, as well as on Magda Nunatak. The PCF was formed during the glacial episode i.e. the Polonez Glaciation (Birkenmajer 2001, Troedson & Smellie 2002). The formation is up to 60 m thick and comprises six lithostratigraphic members. The lowest, Krakowiak Glacier Mb consists of continental tillites, while the succeeding Bayview Mb, Low Head Mb, Siklawa Mb, Oberek Cliff Mb, and Chlamys Ledge Mb are glacio-marine strata represented by conglomerates and sandstones interbedded with mudstones. These strata were initially considered to be Pliocene in age. Later works (Troedson & Smellie 2002) proved the Oligocene age of this formation. Foraminifera were found in 25 samples, collected from the Low Head, Siklawa, and Chlamys Ledge members. Several samples contain abundant and diverse benthic assemblages. Only few planktonic forms were encountered. Benthic assemblages are dominated by calcareous Cibicides, Globocassidulina, as well as miliolids and unilocular foraminifera, showing affinities with assemblages of the same age described from the Ross Sea region (e.g. Leckie & Webb 1985). Agglutinated foraminifera are practically absent. Strong variability in foraminiferal abundances, high scores of Cibicides, and very low numbers of planktonic forms indicate shallow-water, near-shore, turbid conditions. This stays in agreement with sedimentological analyses, interpreting the Low Head Mb in part as storm deposits (Gaździcki 1984). Birkenmajer K. 2001. Mesozoic and Cenozoic stratigraphic units in parts of the South Shetland Islands and Northern Antarctic Peninsula (as used by the Polish Antarctic Programmes). Stud. Geol. Pol. 118: 5-188. Gaździcki A. 1984. The Chlamys coquinas in glacio-marine sediments (Pliocene) of King George Island, West Antarctica. Facies 10: 145-152. Leckie R.M. & Webb P.N. 1985. Late Paleogene and early Neogene foraminifers of DSDP Site 270, Ross Sea, Antarctica. Init. Repts DSDP 90: 1093-1142. Troedson A.L. & Smellie J.L. 2002. The Polonez Cove Formation on King George Island, Antarctica: stratigraphy, facies and implications for mid-Cenozoic cryosphere development. Sedimentology 49: 277-301.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Home range: can existing models be applied to the Antarctic marine environment?

Forename: Marlee Surname: Tucker

Authors: Tucker, Marlee; Ord, Terry; Rogers, Tracey;

Presentation Allocated: Poster

abstract: Home range: can existing models be applied to the Antarctic marine environment? Marlee A. Tucker, Terry J. Ord & Tracey L. Rogers. Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW, Australia Data from models are often used to base management decisions. We explore how current spatial models perform in explaining the spatial behaviour of Antarctic marine mammals. Understanding what drives the relationship between mammalian home range size and body mass has been studied for over 50 years; however the models developed have been based predominantly on terrestrial species and lack the inclusion of marine mammals. We predicted that marine species would have larger home ranges than terrestrial mammals of the same body size, due to differences in the physical environment, resource distribution and altered energy expenditure. In addition, Antarctic marine mammals are likely to have larger home ranges due to the high variability within this environment driven by the expansion and contraction of ice. To examine this, we used a phylogenetic generalized least squares regression of body size and home range data from 34 marine mammals—six of which are Antarctic species—and 279 terrestrial species. Home range was calculated from satellite tracking data or obtained from published literature. We found that marine mammal home ranges were up to 60 times larger than terrestrial mammals and that five of the Antarctic marine mammals sit within the top 20 species with the largest home range size of all mammals. These findings imply that an ecological release has accompanied the transition to marine environments and that this has facilitated the evolution of larger home ranges in mammals. The outcomes of this research will be beneficial for the greater understanding of broad ecological processes such as animal abundance within the ocean. Furthermore, the new model derived from our analyses will aid with the development of improved management strategies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: How a Weddell seal "PQs": resistance to physiological wasting after prolonged inactivity

Forename: Michelle Surname: Shero

Authors: Shero, Michelle; Pearson, Linnea; Goetz, Kimberly; Robinson, Patrick; Huckstadt, Luis; Costa, Daniel; Burns, Jennifer;

Presentation Allocated: Poster

abstract: Adult Weddell seals (*Leptonychotes weddellii*) haul-out on the ice in Oct/Nov for the breeding season and remain relatively inactive for ~4 months until their molt in the austral fall (Jan/Feb). Typically, inactivity leads to reduced production of oxygen (O₂) storage proteins and muscular atrophy. If this occurs in Weddell seals, they would have greatly reduced diving and foraging capabilities following the annual molt. This study compared O₂-storage capacity and muscular efficiency in 32 pre-breeding female Weddell seals in Oct/Nov to 64 post-molt seals in Jan/Feb in McMurdo Sound, Antarctica. To assess muscle structure, myosin heavy chain (MHC) composition was determined in the longissimus dorsi skeletal muscle. Preliminary analyses show that the oxidative MHC I and IIA proteins were dominant in all animals, with no observed changes between pre-breeding and post-molt seals (all $P > 0.05$). Similarly, aerobic ATP production potential, as indicated by citrate synthase and β -hydroxyacyl CoA dehydrogenase activities, did not change (all $P > 0.05$), yet O₂-storing myoglobin (Mb) concentrations increased by the end of the molt (Oct/Nov: 75.1 ± 3.2 vs Jan/Feb: 88.9 ± 2.8 mg g tissue⁻¹; $P = 0.005$). At the simplest level, O₂ stores and their use rates are reflected in the calculated aerobic dive limit (cADL) time, which also differed by season ($P = 0.042$). Corresponding with their shorter cADLs, seals handled in Oct/Nov were better able to generate ATP under anaerobic conditions as shown by lactate dehydrogenase kinetics ($P = 0.006$). Moreover, these muscle parameters showed significant relationships with different aspects of diving behavior in the 8 weeks after tagging (all $P < 0.05$). Of the Jan/Feb study animals, individuals with larger Mb loads also achieved greater depths during dives, and animals with higher anaerobic enzyme activities exceeded their cADL more often than animals with lower anaerobic capacity. In combination, these findings support the hypothesis that Weddell seals may be naturally-resistant to the negative physiological effects of inactivity in order to forage effectively following their summer haul-out period. Funding for this work was provided by NSF (ANT-0838892).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Identification and characteristics of Areas of Ecological Significance (AES) during the winter migration of Antarctic fur seals

Forename: Benjamin Surname: Arthur

Authors: Arthur, Benjamin; Lea, Mary-Anne; Bester, Marthan; Goebel, Mike; Trathan, Phil; Hindell, Mark;

Presentation Allocated: Poster

abstract: The Antarctic fur seal (*Arctocephalus gazella*) is a numerous and key Southern Ocean predator. During the non-breeding austral winter, female Antarctic fur seals make long distance migrations. This project assessed the winter migratory movements of female Antarctic fur seals from three circum-polar breeding colonies (Marion Island, South Georgia and the Antarctic Peninsula) over four years (2008-2011). The role of regional oceanography and key environmental features in determining the winter foraging movements was assessed. During the latter part of the lactation period in Mar/Apr of each year females at the three sites were equipped with miniaturized geolocation tags (GLS) to track at-sea movements. Since 2008, over-winter tracks have been collected for ~160 adult females. State-space modeling was employed to identify areas of 'likely' foraging for individuals from the three populations, allowing the identification of Areas of Ecological Significance (AES). These areas were then assessed in relation to oceanographic features such as frontal zones and eddies. Initial results indicate distinct AES for the populations as well as differences in the duration and distance traveled of migratory movements between the three populations. Antarctic Peninsula animals made a single northwards migration to forage on the Chilean and Patagonian shelves, whilst animals from Marion Island made shorter repeat trips south to forage in the Antarctic Polar Frontal Zone. Animals from South Georgia either foraged locally or completed northward migrations to the Patagonian Shelf. Several animals from the Antarctic Peninsula also closely followed the ice-edge. Early assessment of the oceanographic features of these areas clearly suggests that the processes affecting individuals differ markedly between populations and these will be presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Impact of an extreme, large-scale natural perturbation on the dynamics of a Weddell seal population in the southern Ross Sea

Forename: Thierry Surname: Chambert

Authors: Chambert, Thierry; Rotella, Jay; Garrott, Robert;

Presentation Allocated: Oral

abstract: The current and future impacts of climate change on natural ecosystems have become a topic of major concern, especially in Polar Regions, which seem to be the most affected. However, the necessary data are often lacking for improving our understanding of changes that may result as average environmental conditions change and/or as climate extremes become more frequent or intense. The southwestern Ross sea ecosystem recently experienced an extreme environmental perturbation: the occurrence of one of the largest icebergs ever recorded (B-15; ~10,000km²) that disturbed ice dynamics and ecological processes in the region for several years. Using data prior to, during, and after the iceberg event, we investigated the impact of this extreme event on annual abundances and vital rates for an intensively studied population of individually marked Weddell seals breeding in Erebus Bay. As predicted, we found a substantial reduction of seals abundance at breeding colonies for 4 of the 5 iceberg years. Reduced colony attendance was accompanied by a strong and consistent reduction in recruitment and reproduction probabilities during the entire iceberg event. In accordance with theory of life-history evolution in stochastic environments and the demographic buffering hypothesis, which predict that long-lived species should favour survival over reproduction when facing challenging conditions, we found that adult survival was not affected. Accordingly, the population quickly achieved high levels of pup production after the iceberg period. Breeding rates were likely reduced by lowered food availability due to modifications of the sea-ice dynamics induced by the presence of icebergs. We suggest that adult females achieved high survival rates by skipping reproduction and moving to better foraging areas away from breeding colonies during the spring. The Erebus Bay population of Weddell seals was clearly able to maintain itself during this unusual iceberg event. However, if such events were to occur more frequently, as predicted by some climate change models, the long-term growth rate and the chance of persistence of the population would be expected to be negatively affected by frequent years of low reproductive output.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: In sync? Humpback whale (*Megaptera novaeangliae*) mother and calf foraging behavior in the Western Antarctic Peninsula

Forename: Reny Surname: Tyson

Authors: Tyson, Reny; Friedlaender, Ari; Ware, Colin; Stimpert, Alison; Nowacek, Douglas;

Presentation Allocated: Oral

abstract: Mother and calf humpback whale (*Megaptera novaeangliae*) pairs migrate to the coastal waters of Antarctica where they typically remain and forage on euphausiids from late spring through late autumn. In these regions, the mothers must replenish energy reserves diminished from lactation and migration, while the calves must acquire energy for growth and migration. To date, the fine-scale foraging behaviors of these pairs and the structure of their relationship in these regions have not been examined. In this study, we attached high-resolution digital acoustic recording tags (Dtags), which incorporate accelerometers, magnetometers, pressure and sound recording, to both an adult humpback whale and her calf in Wilhelmina Bay (Western Antarctic Peninsula) to examine concurrently their fine-scale diving and foraging behavior. Dtags logged over 20 hours of concurrent recordings. We used TrackPlot to visualize and analyze the pair's three-dimensional orientations (depth, pitch, roll, and heading) simultaneously in space and time and to identify feeding lunges executed by each whale. Both animals executed feeding lunges; however, the mother foraged more intensively than the calf (792 and 118 lunges over 246 and 30 feeding dives, respectively). Also, the mother fed consistently once she initiated feeding at 16:22 until the tag came off, whereas the calf executed 95.76% of its lunges between 17:00 and 19:28, local time. We used cross-correlation analyses to quantify synchrony between the pair. Dive depth was positively correlated for the duration of the concurrent record and was highest when the calf's track lagged behind the mother's by 4.5 sec, suggesting that the calf was 'following' its mother. Pitch and heading were also positively correlated but to a lesser degree. Correlation coefficients calculated per dive were highest when both animals were feeding and lowest when only the mother was feeding. In addition, 84.26% and 79.63% of the calf's lunges were performed within ± 20 sec and ± 20 m of its mother's lunges, respectively. These findings suggest that the calf benefited from synchronizing its behavior to its mother when feeding. While our findings only represent ~20 hrs of one humpback whale mother-calf pair, they provide insights into the energetic demands and energetic costs associated with foraging and synchronous behaviors of humpback whale mother-calf pairs in the Western Antarctic Peninsula.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Indirect effects in sub-Antarctic systems: climate change, predation and competition among terrestrial vertebrates on the Prince Edward Islands

Forename: Gregory T W Surname: McClelland

Authors: McClelland, Gregory T W; Chown, Steven L;

Presentation Allocated: Oral

abstract: The Black-faced Sheathbill (*Chionis minor marionensis*) is a shorebird endemic to Marion and Prince Edward Islands, in the Southern Ocean (46°46' S, 037°51' E). The species forages in penguin colonies during the breeding season but on average 63% of the population foraged on terrestrial invertebrates in winter when first studied in 1976. In 1994 a marked change in Sheathbill winter foraging ecology was recorded on Marion Island, where only 17.5% of birds made use of terrestrial invertebrates. This decline coincided with a low population estimate and led to the hypothesis that invasive house mice (*Mus musculus*) were out-competing Sheathbills for invertebrate prey and in so doing having a detrimental effect on the population. Mouse densities on Marion Island are largely regulated by the sub-Antarctic climate. It has been suggested that mice are reaching higher peak densities as the island increasingly becomes warmer and drier as the result of global climate change, thus increasing their ecological impact. To test the hypothesis that invasive mice are out-competing Sheathbills for terrestrial invertebrate prey we initiated a 3-year study of Sheathbills, mice, and invertebrates in 2008. We found current invertebrate biomass in the main terrestrial habitats on Marion Island to be two orders of magnitude lower than baseline estimates from 1976. At the same time, peak population densities of mice increased by over 40% in the past 10 years, and over 60% in the past 20. Sheathbill foraging behaviour continued to change significantly, with less than 2% of birds foraging for terrestrial invertebrates on average. However, contrary to prediction and despite the loss of a major foraging resource, the Marion Island Sheathbill population appears to be stable. Annual population estimates from 2008 to 2011 averaged $4,034 \pm 227$ individuals, on par with the 1976 baseline estimate of 3,602.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Marine habitats of juvenile southern elephant seals from Marion Island

Forename: Cheryl Surname: Tosh

Authors: Tosh, Cheryl; Bornemann, Horst; van den Hoff, John; Stewart, Brent; Plötz, Joachim; Bester, Marthán;

Presentation Allocated: Poster

abstract: Marine mammals forage in dynamic environments characterized by variables that are continuously changing in relation to large-scale oceanographic processes. The ability of naïve animals to forage in these conditions poses interesting questions about how they might perceive their environments. By analysing the tracks of juvenile southern elephant seals (n=16) from Marion Island (46°54'S, 37°45'E), Southern Indian Ocean, we see that the proximity to frontal zones has a positive influence on the probability of searching behaviour and that bathymetric features such as the South West Indian Ridge increases the probability of transiting behaviour. State-space modelling techniques are used to interpolate tracks over regular time intervals and predict behavioural states for locations based on variations in turning angle and speed. A mixed modelling approach is used to analyse the behavioural response of juvenile southern elephant seals to sea-surface temperature, sea-surface height anomalies as well as proximity to frontal and bathymetric features. This research highlights the importance of frontal features and sea-surface height anomalies for potential juvenile southern elephant seal feeding areas, and provides further evidence of the importance of the area west of Marion Island for higher trophic level predators.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Modeling thermoregulation in a changing environment

Forename: Allyson Surname: Hindle

Authors: Hindle, Allyson; Horning, Markus; Mellish, Jo-Ann;

Presentation Allocated: Poster

abstract: Thermoregulatory costs of free-living pinnipeds are largely unknown. Water conducts heat 25X more effectively than does air, promoting disparate thermoregulatory strategies. Ice-obligate pinnipeds must balance the conflicting demands of both water and air environments. Given the uncertainties of local and large scale high latitude habitat due to changing climate, understanding the energetic requirements of thermoregulation is more important than ever. We are using the Weddell seal (*Leptonychotes weddellii*) as a model polar pinniped species in which to empirically define thermoregulatory physiology. In a novel approach, we have ventured to monitor the thermal interface between animal and environment in both water and air via skin surface heat flux sensors and infrared thermography (IRT, see Mellish, Hindle and Horning). From these initial data we described representative hot and cold spots on Weddell seal as: axilla (hot), head (variable hot), flank (variable cold) and neck (cold). We are next developing a heat budget model using photogrammetric wire-frame models, skin surface heat patterns and core body temperature (via stomach temperature sensor) in air and water. Data collected from short-term (2-7 days) telemetry deployments on free-ranging seals will be used to parameterize this model for large/small body size (adults vs pups/yearlings) and good/lean body condition (non vs post-reproductive adult females, pups vs yearlings). We present the preliminary parameterizations of this model under varied biological and environmental scenarios.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: MODELLING ANTARCTIC AND SUBANTARCTIC SEABIRDS DISTRIBUTION THROUGH SPECIES AND ENVIRONMENTAL ASSOCIATIONS

Forename: Lucas Surname: Krüger

Authors: Krüger, Lucas; Petersen, Elisa; Petry, Maria Virginia;

Presentation Allocated: Poster

abstract: The distribution of Antarctic and Subantarctic seabirds at sea is explained mostly by food distribution and species foraging strategy. Variations on climate are very influential in the demography of seabirds, hence can affect their movements when foraging. The present study relates the distribution of Antarctic and Subantarctic seabirds with sea abiotic factors. The sampling was conducted during the dislodgment of the Polar Ship Almirante Maximiano from Southern South America (40°19'25"S; 57°11'35"W) until the Elephant Island (61°13'20.5"S; 55°21'35.3"W). Ten minute censuses were conducted at each one hour and a half during daytime. All birds inside a 300 meters threshold from ship were counted, ship-following birds were excluded from analysis. Environmental data were taken through ship's equipment. We grouped species and environmental variables through Categorical Principal Component Analysis. The environmental PCA axis 1 (ENV-PC 1) is explained by higher water / air temperature, pressure and visibility and lower depths and showed a marked latitudinal gradient (Regression with latitude: Linear $R^2 = 0.88$, $F = 325.5$, $P < 0.001$, $Y = 7.84 - 0.16 * X$). The Species Principal Components (SP-PC 1 and 2) explained the total of 40% of data variance. One group of birds (Southern Giant Petrel, Royal Albatross and Wilson's Storm Petrel, positive association with SP-PC1) seems to respond mostly to the distance from Malvinas/Falkland Islands (Regression between SP-PC1 and latitude: Quadratic $R^2 = 0.2$, $F = 4.9$, $P = 0.01$; $Y = -34.48 + 1.41 * X - 0.014 * X^2$), the second group (Black Browed Albatross, Cape Petrel, Wandering Albatross, White-chinned Petrel and Sooty Shearwater – positive association with SP-PC2) is distributed off temperate waters, and the third (Northern Giant Petrel and Southern Fulmar – negative association with SP-PC2). The SP-PC 2 also showed a clear latitudinal gradient (Regression between PC-SP2 and latitude: Linear $R^2 = 0.23$, $F = 12.5$, $P = 0.001$, $Y = 4.03 - 0.08 * X$), what is a reflection of the environmental gradient. The distance from the breeding grounds can explain the distribution of some species, as during breeding they tend to forage closest to the colonies. However, weather can explain in a great deal the seabird dislodgements, further models and further samplings are intended to develop a complete model of seabird distribution and extrapolate it to larger ocean regions and detect large-scale trends on seabird distribution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Modelling Habitat Suitability of Humpback and Minke Whales in the Atlantic Sector of the Southern Ocean

Forename: Annette Surname: Bombosch

Authors: Bombosch, Annette; van Opzeeland, Ilse; Wisz, Mary S.; Frickenhaus, Stephan; Richter, Claudio; Boebel, Olaf;

Presentation Allocated: Oral

abstract: Monitoring the recovery of cetacean stocks in the Southern Ocean has been at the core of IWC activities during the past three decades. Data collection in this area is particularly difficult due to the region's remoteness, limited seasonal accessibility and presence of sea ice. As a result, distribution patterns and habitat affinities, which are necessary to design population surveys for robust stock assessments, are still insufficiently described. Early attempts to study habitat preferences of cetaceans in the Southern Ocean used descriptive techniques, such as overlaying cetacean sightings with maps of habitat variables and simple correlation analyses. Advances in statistical modelling techniques now provide a promising approach for more sophisticated analyses of habitat requirements by relating sighting data to various environmental variables. While most models developed for the Southern Ocean rely on presence-absence data from line-transect surveys, latest improvements of modelling algorithms extend their applicability to different types of data including presence-only data. Here, we present a habitat suitability model using ship-based presence-only data collected from the Atlantic Sector of the Southern Ocean. Opportunistic sightings of cetaceans have been systematically logged by the nautical officers on board the research icebreaker RV Polarstern during expeditions to the Southern Ocean since 2005. A custom-built software tool "WALOG" is used to ensure a standardized protocol to log cetacean sightings and associated metadata. A maximum entropy approach, Maxent, which is specifically designed to analyse presence-only data and ranks amongst the highest performing modelling algorithms, was used to model summer distributions of humpback (n=73) and minke (n=81) whales. The environmental parameters such as water depth, sea surface temperature, sea ice concentration, as well as their derivatives and isopleths were obtained from remote sensing data providers. Probability of presence was modelled using 25% of the data as test data and the remaining 75% as training data. We present distribution patterns and habitat affinities of humpback and minke whales in the Atlantic Sector of the Southern Ocean and discuss whether oceanographic data are representative proxies in describing cetacean distribution in our study area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Movements and foraging behavior by brown skuas (*Catharacta antarctica lonnbergi*) at Bird Island, South Georgia during the breeding season

Forename: Ana Paula Surname: Carneiro

Authors: Carneiro, Ana Paula; Manica, Andrea; Phillips, Richard;

Presentation Allocated: Poster

abstract: Recent advances in technology have allowed the development of a range of electronic devices that are small enough to be attached to birds. With these advances, it has since become possible to study seabird movements and foraging behavior. Brown skuas (*Catharacta antarctica lonnbergi*) are opportunistic predators and scavengers in both marine and terrestrial environments of the Southern Ocean ecosystems. Besides providing the first tracking study of movements of brown skuas during the breeding season, the aims of this study were to identify changes in distribution, produce home ranges maps, and to determine the proportion of time spent away from the territory, in transit, club and feeding sites. Data was compared between breeding stages and sexes. Individual variation was also examined regarding its consistency in time budgets/activity patterns and fidelity to particular foraging areas on successive days. The study was carried out at Bird Island, South Georgia in the austral summer of 2011/2012. A total of 37 GPS loggers for 5-6 days were deployed on each adult during the late incubation and early chick-rearing. From the 37 GPS loggers, 31 were retrieved. Results showed that 25 out of 31 birds (80%) visited beaches on the mainland South Georgia to feed (most within 10km of Bird Island, and the furthest to 25km), and five birds (16%) visited the Willis island to the west of Bird Island. On the basis of the proportion of the >18,000 GPS locations that were collected, only approx. 3.5% and 1.5% of time was spent on mainland South Georgia and the Willis islands. The rest of the time was spent at Bird Island, mainly on the territory. Skuas at Bird Island (c. 450 pairs) probably represent 20-25% of the South Georgia breeding population, so there must be a lot of local intra-specific competition for resources and as a whole, these birds are a key part of the local population. It was noteworthy that none of the tracked birds foraged at sea, which is perhaps surprising given they are highly pelagic during the winter, but confirms the small amount of available conventional and isotopic diet data from other studies that indicate that skuas in South Georgia feed predominantly on Antarctica fur seal (*Arctocephalus gazelle*) placenta and carrion, and to a lesser extent on burrowing petrels during the breeding season. High fur seal abundance is probably the reason for this very dense breeding aggregation. Differences among sexes and individuals are still being analyzed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Multitrophic interactions mediated by chemical cues: dimethyl sulphide detection in a krill-eating Antarctic penguin

Forename: Luisa Surname: Amo

Authors: Amo, Luisa; Rodriguez-Girones, Miguel Angel; Barbosa, Andres;

Presentation Allocated: Oral

abstract: In response to zooplankton grazing, phytoplankton release dimethylsulfoniopropionate in the seawater that is transformed into dimethyl sulphide (DMS) that is emitted to the air. Up to now detection of this compound has been described in several species of procelariiform seabirds, albatross and non Antarctic fish-feeding penguins. However, there is no evidence of DMS detection by penguin krill-feeding penguins. The mechanisms of krill detection by its predators are especially relevant in Antarctica, where trophic webs are mainly based on krill. We explore for the first time whether a krill-feeding penguin species, the chinstrap penguin *Pygoscelis antarctica*, is able to detect DMS. We examined whether chinstrap penguins could detect DMS by locating DMS or control recipients in pathways that penguins used when moving between the colony and the sea. We also analysed the attraction of nestling penguins to DMS in a T-shaped enclosure. Our results showed that both adult and nestling chinstrap penguins are attracted to DMS.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Nest Site Selection Affects Breeding Success and Chick Survival in Gentoo and Chinstrap Penguins

Forename: Jin-Woo Surname: Jung

Authors: Jung, Jin-Woo; Kim, Jeong-Hoon; Ahn, In-Young; Choi, Han-Gu; Cho, Sam-Rae;

Presentation Allocated: Poster

abstract: To assess whether nest site selection was impacting breeding success and chick's survival rate of penguins, the breeding populations of the gentoo penguin and the chinstrap penguin were investigated at Narebski Point designated as an Antarctic Specially Protected Area (No. 171), Barton Peninsula, King George Island, the Antarctic in 2011/12. Predation pressure was a main factor affecting breeding success and chick's survival rate in the study site. The major predators of penguins were brown skuas, south polar skuas and southern giant petrels breeding near penguin rookery. The Gentoo penguin select higher rocky site near shore with abundant pebble in the study site. And also slope and vegetation cover of nest sites were lower than those of random sites. However, the chinstrap penguin select higher rocky and sloped site with no vegetation cover. There were significant positive correlation between subcolony size and breeding success in gentoo penguins. The comparisons of survival rate of chicks with subcolony size and nest position in the subcolony showed similar patterns in both species. Survival rates of chicks in the large subcolony were higher than in the small subcolony. There was a tendency that nests located near the center of colony were safer than nests located near the periphery. Our results showed that colony size and nest position in the colony were key factors of nest site selection affected breeding success and chick's survival in penguins.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: New found Adenovirus from South Polar skua (*Catharacta maccormicki*) in Antarctica

Forename: Min-Goo Surname: Lee

Authors: Lee, Min-Goo; Park, Yon Mi; Kim, Jeong-Hoon; Gu, Se Hun; Lee, Sook Young; Kang, Yoon Kyoo; Kang, Sung-Ho; Kim, Hak Jun; Song, Jin-Won;

Presentation Allocated: Poster

abstract: Adenoviruses have been isolated from a wide range of host species and are thought to be strictly host specific. Here, we report the entire genome sequence and characterization of new adenovirus from south polar skua (*Catharacta maccormicki*). New adenovirus by PCR was examined in various organ samples of nine south polar skua carcasses collected in Lake King Sejong, King George Island, Antarctica from 2007 to 2009. Adenovirus genes from six of nine skuas were detected and sequenced. The entire 26,340 bp genome of adenovirus from south polar skua (SPSAdV) was identified. The DNA polymerase, penton base, hexon and fiber gene of the SPSAdV exhibited 68.3%, 75.4%, 74.9% and 48.0% nucleotide sequence similarity with their counterparts in turkey hemorrhagic enteritis virus. Phylogenetic analysis based on entire genome sequence revealed that the new SPSAdV belonged to genus *Siadenovirus*, family *Adenoviridae*. This is the first evidence of a novel adenovirus, SPSAdV, from a large polar seabird (family *Stercorariidae*) in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: O' SEAL, WHERE ART THOU? OVERWINTER MOVEMENT, HABITAT, AND NAVIGATION OF WEDDELL SEALS IN THE ROSS SEA

Forename: Kimberly Surname: Goetz

Authors: Goetz, Kimberly; Robinson, Patrick; Shero, Michelle; Burn, Jennifer; Costa, Daniel;

Presentation Allocated: Oral

abstract: Weddell seals are one of the top predators in the Southern Ocean yet very little data exist on their movements and diving behavior during the cold, dark winter when heavy ice cover prevails. While Weddell seals have previously been satellite tagged in the Erebus Bay region, prior tracking data rarely extend into the winter months due to tag failure. To gain insight into Weddell seal ecology during the winter, we instrumented 41 animals (6M, 35F) around Ross Island and up the Victorialand coast with Conductivity Temperature Depth - Satellite Relayed Data Loggers (CTD-SRDL). To date, these tags have recorded over 200,000 dives and 7,800 CTD casts. On average, Weddell seals dived 139 m deep across seasons and years; this dive depth appeared to be independent of bathymetry and the seals typically foraged benthically while near shore and pelagically while away from shore. It is likely that Weddell seals have the greatest foraging success at depths between 100-200 m despite traveling across waters exceeding 1000 m in depth. Looking at the intrusion of circumpolar deep water (CDW) onto the continental shelf at 150 m via a Regional Oceanographic Model (ROMs) model, we found that many of the Weddell seals travel to the margins of this water mass. The CDW brings minerals and nutrients from the deep water to the surface layer creating massive phytoplankton blooms and hotspots of productivity. We ran a 'hotspot' and First Passage Time (FPT) analyses on the movement data to identify important foraging areas across seasons as indicated by increased time spent in area or increased diving density. The spatial scale of operation was only 4 km, remarkably small relative to the total displacement. Tagged animals spent more time by the coast during the summer as they travelled north and they moved further from land as fall and winter progressed. The northern reaches of identified hotspots were located between the two main CDW intrusions on the western shelf; areas where forging success may be greater. The north-south movements of seals during the winter may be triggered by celestial cues such as sun zenith angle. This study illustrates the importance of long term tracking to reveal important and previously undiscovered movement patterns and diving behavior of a predator that exploits vast regions of Antarctic waters.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Ocean temperature alters elephant seal dive behaviour: climate change implications for a marine predator

Forename: Trevor Surname: McIntyre

Authors: McIntyre, Trevor; Ansorge, Isabelle; Bornemann, Horst; Plötz, Jochen; Tosh, Cheryl; Bester, Marthán;

Presentation Allocated: Oral

abstract: The potential effects of ocean warming on top predators are largely unknown, though the impact on the distribution of prey in vertical space may have far reaching impacts on diving predators such as southern elephant seals. We used data from satellite-tracked southern elephant seals from Marion Island (46° 54'S; 37° 45'E) to investigate the relationship between their dive characteristics (dive depths, dive durations and time-at-depth index values) and environmental variables (temperature at depth, depth of T_{max} below 100m, frontal zone and bathymetry) as well as other demographic and behavioural variables (migration stage, age-class, track day and vertical diel strategy). While other variables, such as bathymetry and vertical diel strategy influenced dive depth, our results also consistently indicated a significant influence of temperature at depth on dive depths. This relationship was positive for all groups of animals, indicating that seals dived to deeper depths when foraging in warmer waters. Female seals adjusted their dive depths proportionally more than males in warmer water. Dive durations were also influenced by temperature at depth, though to a lesser extent. Results from time-at-depth indices showed that both male and female seals spent less time at targeted dive depths in warmer water, and were presumably less successful foragers when diving in warmer water. Continued warming of the Southern Ocean may result in the distribution of prey for southern elephant seals shifting either poleward and/or to increasing depths. Marion Island elephant seals are expected to adapt their ranging and diving behaviour accordingly, though such changes may result in greater physiological costs associated with foraging.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: PLASMA AND SERUM BIOCHEMISTRY FROM THREE DIFFERENT SPECIES OF ANTARCTIC PENGUINS

Forename: Carla Surname: Di Fonzo

Authors: Di Fonzo, Carla; Spotorno, Matías; Demichelis, Sandra; Ansaldo, Martín;

Presentation Allocated: Poster

abstract: The aim of this study is to analyze the physiological status of three Antarctic penguins species, *Pygoscellis antarctica* (Chinstrap), *Pygoscellis papua* (Gentoo) and *Pygoscellis adeliae* (Adelie), at Potter Cove (Isla 25 de Mayo/ King George Island). Blood samples were taken from 15 chicks and 15 adults. Levels of uric acid, triglycerides, calcium, inorganic phosphate and glucose were measured in plasma samples, as well as iron levels in serum samples. Results showed that glucose and calcium levels registered significant differences (ANOVA, $p < 0.05$) in both Adelie and Gentoo penguins. While these values were higher in Adelie's chicks than in adults, the opposite relation was observed for Gentoo where adults penguins had higher levels compared to chicks. The Chinstrap chicks had significantly lower (ANOVA, $p < 0.05$) triglyceride values than adults. Iron levels of three studied penguin species were higher in adults compared to the chicks but these differences were only statistically significant (ANOVA, $p < 0.05$) in Gentoo penguins. Adelie and Chinstrap adults, also showed phosphorus plasma levels significantly higher (ANOVA, $p < 0.05$) than the chicks, while Gentoo did not evidence significant differences. Additionally, the uric acid levels were similar between chicks and adults for the three studied species. The present study proposes a biochemical study of the blood as a noninvasive indirect method very useful for understanding the physiology and adaptation of penguin species to the changing environment in the Antarctic Peninsula.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: RECEDING ICE FIELDS PROVIDE HABITAT TO ENCOURANGE INCREASE IN COLONY SIZE OF ADELIE PENGUINS AT BEAUFORT ISLAND, ROSS SEA

Forename: Michelle Surname: LaRue

Authors: LaRue, Michelle; Ainley, David; Dugger, Katie; Ballard, Grant; Lyver, Phil; Swanson, Matt;

Presentation Allocated: Poster

abstract: The adage is that there will be winners and losers as global climate change alters the habitats of polar organisms. At Beaufort Island, Ross Sea, receding glaciers have provided more nesting habitat, allowing the Adélie penguin (*Pygoscelis adeliae*) colony to increase during recent years. Previously its size had been limited by ice fields, but once increased breeding habitat became available, fewer natal penguins visited elsewhere and emigration from Beaufort Island declined significantly. To understand long-term emigration patterns of Adélie penguins from Beaufort Island to other metapopulation colonies on nearby Ross Island (i.e., Capes Royds, Bird, and Crozier), Antarctica, during 1996-2010, we combined aerial photo and satellite image data with nesting density and population estimates, and resightings of marked birds. We marked 400 Beaufort Island chicks per year from 1996 to 2005, and looked for them at nearby colonies in subsequent years. We then overlaid air photos of the Beaufort Island colony taken during November in 1983 and 1993 (0.2-0.4m resolution), onto satellite images (0.6m resolution; 2004, 2005, and 2010) and calculated colony area per year. We then compared areas to total population and density estimates, and determined relationships between variables using regression analysis. We also calculated the correlation between glacial retreat and population size. Finally, we analyzed air temperature change in the vicinity. Colony area at Beaufort Island increased 21% and ice fields retreated 250 meters during 1983-2010. We found a positive correlation between colony area and population counts of the Adélie penguin colony during 1996-2005. We also found a relationship between glacier loss and colony area and population size. Our results indicate that: 1) integration of spatial data with available population counts can be a useful tool for understanding the population ecology of Adélie penguins in the Ross Sea; and, 2) climate change has affected penguin metapopulation dynamics: movement rates from Beaufort Island to other nearby colonies have declined significantly in the latter part of the study period, as glacier loss added more available nesting habitat for penguins. Implications of these results include the possibility of increased nesting habitat available for Adélie penguins in the Ross Sea, as air temperature increases and glaciers recede.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Seasonal changes in fatty acids in Weddell seal (*Leptonychotes weddellii*) blubber and muscle

Forename: Linnea E Surname: Pearson

Authors: Pearson, Linnea E; Trumble, Stephen J; Costa, Daniel P; Burns, Jennifer M;

Presentation Allocated: Oral

abstract: During the austral summer (Oct-Feb) Weddell seals haul out to pup, breed, and molt, spending up to 4 months with limited food intake, relying mainly on endogenous fat stores in muscle and blubber to fuel metabolism. After this prolonged period of reduced food intake, animals return to normal foraging behavior, and replenish body fat reserves over the following winter. We examined seasonal changes in the fatty acid (FA) composition and total lipid content in blubber and muscle. Blubber and muscle (longissimus dorsi, LD) biopsy samples were collected from adult Weddell seals in February (Feb) and October (Oct). Four animals were sampled in both Feb and Oct, with an additional 14 animals sampled in Feb and 7 in Oct. In both Feb and Oct, there was no significant difference in the FA profile of muscle or blubber between the paired and non-paired animals, thus animals were grouped for seasonal comparisons. Total lipid content and the 10 most abundant FAs in each tissue (72% of total in LD and 93% of total FA in blubber) were compared between tissues and seasons. Despite significant seasonal changes in mass and blubber volume, ($p=0.002$ mass; $p=0.000$ % blubber by volume), there was no significant difference in lipid content of blubber ($p=0.096$) or muscle ($p=0.816$). In both Oct and Feb, monounsaturated FAs (MUFA) made up the majority of the blubber layer ($61.16\pm 0.9\%$ of the total FA in Oct and $64.33\pm 0.5\%$ in Feb), while saturated (SFA; $17.63\pm 0.5\%$ Oct, and $18.08\pm 0.6\%$ Feb;), and polyunsaturated FAs (PUFA; $20.94\pm 0.6\%$ Oct, and $17.51\pm 0.7\%$ Feb) found in similar proportions. The proportion of MUFA increased slightly from Oct to Feb ($p=0.004$), while SFA remained unchanged and PUFA declined ($p=0.002$). The FA profile of skeletal muscle was more evenly split among classes, and there was no seasonal variation: MUFA ($36.43\pm 6.3\%$ Oct, and $28.70\pm 3.4\%$ Feb, $p=0.416$), SFA ($35.28\pm 3.2\%$ Oct, and $37.47\pm 2.8\%$ Feb, $p=0.604$), and PUFA ($27.98\pm 6.7\%$ Oct, $31.61\pm 5.5\%$ Feb, $p=0.621$). The difference in FA profile between muscle and blubber in Feb and Oct ($p=0.001$) suggests the primary role of lipids in each tissue differs. The FA composition of blubber reflects its role in thermoregulation and energy storage. In contrast, the larger variation in muscle FAs likely reflects the many roles fats play in metabolic processes within this tissue. Differences in FAs between seasons are likely due to the differential rates of biosynthesis and degradation, during summer, when FA intake is reduced.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: SEASONAL VARIATION IN THE NUMBER OF BREEDING FEMALES OF SOUTHERN ELEPHANT SEAL, AT ISLA 25 DE MAYO/ KING GEORGE

Forename: Jorge Augusto Surname: Mennucci

Authors: Mennucci, Jorge Augusto; Negrete, Javier; Márquez, María Elizabeth; Juárez, Mariana Alejandra; Santos, Mercedes; Coria, Néstor Rubén;

Presentation Allocated: Poster

abstract: The effects of global warming on pinnipeds populations are evident mainly during the breeding season or the preceding months, due to variations in the availability of breeding sites or wintering habitats, or related to changes in the abundance and distribution of its principal prey-items. Between 1980 and 1990, the breeding population size of Southern Elephant Seals at Isla 25 de Mayo, South Shetland Islands has declined. The number of females that attend to reproduce represents an index of pup production and the potential recruitment in subsequent years. Given that this species is polygynic, it provides a partial but accurate estimation of the population trend. Between 1995 and 2010 seasons, at Stranger Point, Isla 25 de Mayo, surveys of females were conducted during the breeding haul-out period. Available data reflects an inter-annual fluctuation in the maximum number of females through the seasons, and an intrinsic rate of natural change (r) = -0.025. The number of females breeding at Stranger Point and the extent of sea ice recorded in the west of the Antarctic Peninsula (average from July-September) show a significant positive linear relationship ($R^2= 0.52$, $P=0.004$, $N=14$). Possible causes of the found results are discussed in the light of the environmental variability recorded as consequence of global climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Short- and Long-term foraging niche specialization in albatrosses

Forename: Filipe Surname: Ceia

Authors: Ceia, Filipe; Phillips, Richard; Vieira, Rui; Richard, Pierre; Ramos, Jaime; Xavier, Jose;

Presentation Allocated: Poster

abstract: Wandering albatrosses (*Diomedea exulans*) are regarded as a generalist seabird species foraging over vast areas of southern oceans. However, can they be specialists at an individual level? The aim of this study was to evaluate foraging niche specialization in wandering albatrosses, using stable isotope analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) of blood (i.e. plasma and red blood cells), breast feathers and flesh from regurgitations, in order to identify individual foraging specialization at short- and long-term periods (from 2-3 weeks to 5-6 months). Data were collected monthly at Bird Island, South Georgia, between May and October 2009, from 35 adult individuals of both sexes. Blood (plasma and red blood cells) and breast feathers were sampled for stable isotopic analyses. Regurgitates were also sampled in order to infer albatrosses' diet. Positive significant linear correlations were found ($p < 0.001$) between plasma and red blood cells of individual adults for both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$. These results suggest consistency in short-term foraging niche specialization in relation to both oceanic water masses and prey items consumed. Moreover, a positive significant linear correlation was also found ($p < 0.05$) between plasma and feathers on $\delta^{13}\text{C}$, which suggest long-term individual foraging niche specialization at specific oceanic water masses. The next step is to check relations between $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of diets found in albatrosses' regurgitates with individual adults, in order to analyze the possible individual specialization in particular prey items. This study provides an approach into individual foraging consistency of a species considered as a generalist and highlights the importance of studies at the individual level.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Sources of variation in breeding-colony attendance by female Weddell seals in a highly variable environment

Forename: Glenn Surname: Stauffer

Authors: Stauffer, Glenn; Rotella, Jay; Garrott, Robert;

Presentation Allocated: Poster

abstract: It is common in long-lived colonial species for non-reproductive individuals to skip attendance of breeding colonies (temporarily emigrate) during the reproductive season. However, some individuals do attend breeding colonies prior to first reproduction or in years when reproduction is skipped, and in some species such attendance can enhance future reproductive success. But attendance also can result in reduced foraging success or increased intra-specific conflict, which immediately suggests trade-offs between attendance and non-attendance which may vary depending on individual life-history strategies or annual environmental conditions. We investigated temporary emigration rates and probability of breeding for a population of female Weddell seals (*Leptonychotes weddellii*) in Erebus Bay, Antarctica. Temporary emigration rates varied considerably with age and across years, and also were dependent on whether seals did or did not attend colonies the previous year. We found similar patterns of variation in breeding probabilities. Our results suggest that 1) motivation to emigrate or breed varied temporally depending on environmental conditions, 2) as seals grow older they had increased motivation to attend reproductive colonies even before they are ready to recruit, and 3) some seals appear to always be more likely than others to emigrate. We suggest that temporary emigration may be a condition-dependent strategy that allows seals to buffer variability in survival rates, and we discuss possible environmental correlates influencing temporary emigration and breeding rates.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Testing the applicability of an optimal central place foraging model to Adélie penguin foraging in the Ross Sea

Forename: Glenn Surname: Ford

Authors: Ford, Glenn; Ainley, David; Lescroël, Amelie Lescroël; Lyver, Phil; Toniolo, Viola; Ballard, Grant;

Presentation Allocated: Oral

abstract: During the breeding season, Adélie penguins (*Pygoscelis adeliae*) in the Ross Sea regularly make long foraging trips away from the colony, searching for concentrations of fish and krill, in order to provision themselves and their chicks. Central place foraging theory, originally developed by Orians and Pearson, has been widely used to interpret the behavior of such animals based on the assumption that their goal is to maximize their rate of energy acquisition. We investigated central place foraging (CPF) in Adélie penguins of Ross Island using satellite tracking and time-depth recorders to explore foraging at two scales: within the micro-/day-to-day (single foraging trip) and the entire foraging area (mesoscale: 50-100 km)/ season (trips by multiple individuals). We examine whether or not three basic CPF model assumptions, some of which are met in other CPF species, are appropriate: 1) within a patch, the rate of prey acquisition declines monotonically with time spent in that patch; 2) food is distributed in discrete patches and is not available between those patches; and 3) foragers have knowledge of the potential feeding rate within their universe of patches, or at least know the average feeding rate within that area, and use this information to determine their foraging strategy when planning or engaged in a foraging trip. We found that prey consumption by penguins does not decline during intense foraging bouts, that penguins forage to some degree at nearly all times, and that the rate of foraging (dives/unit time) peaks in, but is not confined to, the outer part of the foraging area for large but not small colonies. While food availability is predictable within a day at a given location, predictability breaks down after 2 days or at distances greater than 10 km away. This unpredictability is exacerbated by constant changes in resource distribution as the season progresses and prey are depleted in the vicinity of the colony. We conclude that the Orians-Pearson model assumptions do not apply to Ross Sea penguins owing to constantly changing ocean conditions and inter- and intraspecific alteration of prey abundance. Application of the CP model to these circumstances will require that the predictability of prey resources be explicitly considered. Development of a realistic foraging model for Adélie penguins will help us understand the way in which future changes in the prey base will alter the status of their populations

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: The study of the correlation between morphology and nucleus anomalies in two marginal populations of *Pygoscelis papua*

Forename: Sergey Surname: Litvinov

Authors: Litvinov, Sergey;

Presentation Allocated: Oral

abstract: The study of the correlation between morphology and cytogenetic instability in populations of indicator species of Antarctic ecosystems can provide valuable information about the biological significance of abrupt changes in living conditions for the survival of Antarctic species. Some researchers propose to use as an indicator species Gentoo penguin (*Pygoscelis papua*). Two populations of the southern subspecies of the penguin became the object of our study. We evaluated cytogenetic instability by estimating various types of nuclei anomalies of Gentoo peripheral blood erythrocytes. Morphological characteristics measurement and blood samples were made by Assist. Prof. V. Bezrukov in 2002-2004. within the framework of the VII-VIII Ukrainian Antarctic expeditions. We observed significant differences in the frequencies of anomalies between the group of Gentoo chicks in comparison with adults. In chicks knowing to have an active erythropoiesis, micronuclei frequency (median 0,1 ‰) overkills on the order versus adults (micronuclei frequency median 0,01‰), but in adults nuclei with cavity are relatively common (median 0,06‰). Probably it reflects the processes of accumulation of age-related lipid peroxidation damage of the nuclear membrane. The differences between local population are also significant ($p < 0,01$). In the group of penguins from the colony on the Peterman island (65°10'S 64°10'W) cytogenetic instability is higher than that of a Gentoo colony from the Wiencke island (64°54'S 63°43'W). These interpopulation differences had been found to underlie the correlation of morphological features and the level of cytogenetic instability in adult birds. Thus, in the studied *Pygoscelis papua* dimorphism was detected for the average of the third toe's length. There are a «long-toed» massive bird with a slightly shorter beak, and "short-toed" penguins with less weight and a long beak. This feature is related to the total frequency of nuclear anomalies – the "long-toed" individuals have more anomalies. This pattern reflects the nature of the settlement of two morphologically different groups of Gentoo. "Long-toed" penguins live on the Peterman island and "short-toed" birds live on the Wiencke island. In the case of chicks, we followed some of the other researchers found a significant inverse correlation between the cytogenetic instability and body mass.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Thermoregulation in polar phocids: Portrait perfect Weddell seals

Forename: Jo-Ann Surname: Mellish

Authors: Mellish, Jo-Ann; Hindle, Allyson; Horning, Markus;

Presentation Allocated: Poster

abstract: Our understanding of thermoregulation in marine mammals is ambiguous at best, particularly due to their conflicting need to effectively manage homeostasis in both air and water. Infrared imaging (IRT) has become increasingly applied to wildlife research due to the non-invasive nature of the technology, which is particularly desirable for work with species that are at risk and/or difficult to handle. Our previous work on captive northern phocids and otariids has shown that IRT can identify species-specific patterns of surface heat loss related to season and body condition. However, these data are only useful when environmental parameters are incorporated, and there is some knowledge of the physiological and physical state of the animal (e.g., distance from subject, resting versus active, dry versus wet). As part of a larger comprehensive model of thermoregulation in Weddell seals (Hindle, Horning & Mellish), we are applying this technology to determine: 1) baseline surface heat patterns in animals of known condition (blubber depth via ultrasound), 2) variation in surface heat patterns of immediately hauled out (wet/active) versus resting (dry) animals, and 3) late term pregnancy detection. Initial analysis shows that Weddell seals are similar to other phocids with consistent temperature patterns at the axilla and head (hot), as well as the flank and neck (cold). Surface temperature patterns upon emergence from water may allow for identification of hot spots due to physical activity despite the assumption that heat transfer to the environment should be minimized. Preliminary encounters suggest that IRT may be a useful tool to identify late-term pregnant females prior to handling.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Trophic interactions and variation in reproductive performance within a community of Antarctic penguins (genus *Pygoscelis*)

Forename: Kristen B. Surname: Gorman

Authors: Gorman, Kristen B.; Ruck, Kate E.; Williams, Tony D.; Fraser, William R.;

Presentation Allocated: Oral

abstract: The southwestern Atlantic sector of the Southern Ocean, including the Bellingshausen Sea west of the Antarctica Peninsula (AP), is now strongly influenced by ocean-climate warming. Over recent decades, this region has experienced more frequent El Niño-Southern Oscillation and positive Southern Annular Mode (SAM) events, with SAM having direct anthropogenic linkages to ozone depletion. These climate phases are coupled with physical oceanographic forcing of relatively warm water derived from the Antarctic Circumpolar Current onto the continental shelf, delivering oceanic heat and influencing sea-surface temperature variability. Average winter air temperature has increased 6°C in association with a severe reduction in regional winter sea-ice formation, particularly within the northern sector of the western AP. Marine community responses to regional warming are now evident. Especially marked are breeding population responses by *Pygoscelis* penguins including the sea ice-obligate Adélie penguin (*P. adeliae*), in addition to the sea ice-intolerant chinstrap (*P. antarctica*) and gentoo (*P. papua*) penguins, all of which are demonstrating pole-ward shifts in bio-geographic range mediated by environmental effects on demographic parameters. Using data collected over the 2008-2010 austral summers, we examine nutritional correlates of within and among species variation in individual reproductive performance of *Pygoscelis* penguins nesting near Anvers Island; an ecotone now shifting from a cold, dry polar climate to a warm, moist sub-Antarctic system. Also, we consider latitudinal variation in reproductive performance among Adélie penguins nesting at Anvers Island, as well as 400 km south at Avian Island and 700 km south at Charcot Island, regions where sea ice remains a prominent physical feature. Analyses utilize naturally occurring ratios of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) stable isotopes as proxies of marine trophic structure. Using information-theoretic methods, (1) $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ signatures of red blood cells (RBC) obtained from pairs of adults at the one-egg stage are coupled with data of body condition to examine nutritional correlates of primary reproductive effort. (2) RBC isotope signatures of penguin chicks at day 5, 15 and 5 weeks into chick rearing, also coupled with body condition data, are used to examine nutritional correlates of secondary reproductive effort. Finally, (3) we develop models of latitudinal variation in marine trophic structure.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Using high-resolution satellite imagery to monitor changes in distribution and status of Weddell seals in Ross Sea areas

Forename: Michelle Surname: LaRue

Authors: LaRue, Michelle; Rotella, Jay; DeVoe, Jesse; Garrott, Robert; Siniff, Donald;

Presentation Allocated: Oral

abstract: Several populations of Weddell seals have been studied extensively (e.g., Erebus Bay in the Ross Sea), but knowledge of the status and distribution of Weddell seals around much of the continent and within the pack ice regions is less well-known. Traditional methods of population assessment include ship-based transect or aerial survey methods, both of which require large logistic commitment and high costs. We have been investigating a new method of assessing Weddell seal populations on a large scale, by analyzing high-resolution satellite imagery (0.6m resolution) in a GIS and applying a correction factor for diurnal activity patterns. We gathered 25 high-resolution images (QuickBird-2 and WorldView-1) of Erebus Bay, Antarctica spanning 2004-2007, and 2009-2010 and manually counted seals in the images at 10 known haul-outs. Given that satellite images are acquired over the study area between 1000-1300 hours, we also continuously gathered images every 15 minutes from remote cameras at 2 haul-out locations during October-December 2010. We then constructed a correction factor for to account for seasonal and daily variation in seal haul-out patterns and applied it to count data derived from satellite imagery. We compared those results to population estimates derived from mark-recapture studies in Erebus Bay. We counted a total of 5,165 adult Weddell seals across all years from satellite images, which constituted approximately 80% of the total counted on the ground during the same time. We found a strong, positive correlation ($r = 0.98$, $df = 3$, $P < 0.003$) between ground and satellite counts, and detection rates ranged from 30-88%. Comparisons between time-of-day corrected counts from satellite images and estimates of population from mark-recapture studies were similar. Our results display the utility of combining remote sensing techniques, high-resolution imagery, and correction factors that account for the activity patterns for accurate population assessment. We have moved forward and are applying these methods to monitor population distributions and population trends of the Weddell seal within the larger Ross Sea region. The ability to document changes in the population status of the Weddell in the Ross Sea is most important with the current pattern of environmental change, both natural and human induced, that are taking place in this region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Variation in Weddell Seal Pup Mass: Maternal Investment in Offspring

Forename: Jennifer Surname: Mannas

Authors: Mannas, Jennifer; Garrott, Robert; Rotella, Jay; Proffitt, Kelly; Irvine, Kathi;

Presentation Allocated: Poster

abstract: Life history theory predicts that individuals face physiological tradeoffs between current and future reproduction. These tradeoffs ultimately lead to reproductive costs which can affect survival, fecundity, condition of the female and offspring survival. Reproduction itself is costly and involves a number of sequential physiological processes that require different levels of energetic investment. In mammalian species gestation and lactation require the most energy and the amount of energy invested in reproduction is reflected in litter size at birth and by offspring growth through weaning. The object of this study was to describe variation in Weddell seal (*Leptonychotes weddellii*) pup mass at birth and during several ages of the lactation/nursing period, and to evaluate the ability of several maternal traits to explain this variation. Mass measurements were collected from 887 pups at parturition and throughout lactation in Erebus Bay, Antarctica during the 2004 through 2010 field seasons and maternal traits were taken from a long term database. Analysis demonstrated high individual variation in pup mass within a season and modest variation among seasons which suggests that pup mass may be correlated with individual animal attributes rather than annual variation in environmental conditions. Maternal age, a female's reproductive status the previous season and their interaction were found to be the most influential maternal traits. Pup body mass at parturition and during lactation showed maternal age-related variation with evidence of senescence during pre-partum investment and terminal investment during post-partum investment. A female's reproductive status in one season affected her reproductive investment during lactation in consecutive seasons but that effect was correlated with age. Younger females who pupped in consecutive seasons weaned larger pups than those females who were of the same age and did not give birth in consecutive seasons. The opposite was found to be true for older females. The variation in the affect of maternal traits on maternal investment may be due to the increased energy requirement of lactation, age specific changes in reproductive costs, and a senescent decline in physiological function.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: WAP Antarctic top predator behaves differently: whiskers reveal WAP leopard seals are krill-feeding specialists

Forename: Tracey Surname: Rogers

Authors: Rogers, Tracey; Ciaglia, Michaela; O'Connell, Tamsin; Slip, David; Meade, Jessica; Carlini, Alejandro; Márquez, Mária;

Presentation Allocated: Oral

abstract: Apex predators are assumed to be dietary generalists but there is increasing evidence that individual-level dietary specialization may be common in many species. It is important to understand dietary patterns of marine apex predators because, as they are near the top of many marine food webs, there is the possibility that their foraging behaviour can affect populations of their prey and induce trophic cascades. The leopard seal is considered to be an Antarctic generalist and is reported to use a diverse prey base including seals, penguins, fish and krill. We examined whether this was the case. We used stable isotope signatures of the keratin of seal whiskers to examine foraging behaviour. As whiskers grow progressively and are isotopically inert, they reflect an individual's dietary choice over the period of growth, which in this instance is several years. Using linear mixed-effects models we examined the influence of sex, region and individual on the variance in stable isotope signatures ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) of serially sampled whisker segments from 75 individual seals. We found a wide species-level isotopic niche breadth but showed that this was explained by variation among specialist individuals; for any individual seal the isotopic values showed remarkably stable patterns across whisker segments, that is, across time. There was enormous difference in dietary specialization between populations, the Eastern Antarctic leopard seal population was composed predominantly (26/29) of warm-blooded prey specialists, with few individuals specialising on krill, while the Western Antarctic Peninsula (WAP) population were almost entirely (41/46) krill specialists with few individuals specialising on warm-blooded prey. Thirty one of these seals were satellite-tracked and foraging patterns of individuals were characterised using first-passage-times and other path-based metrics. The environmental changes occurring off the WAP are well documented and it is tempting to speculate whether the krill-specialisation of the WAP leopard seals is a behavioural shift in response to the recent events occurring in the region. Our findings show that using archived keratinous tissues, like whiskers, can open up the study of progressive changes in behaviour over periods of many years. This could be an important tool in understanding trophic dynamics of highly mobile marine top predators in environments that are logistically difficult to work within, such as the Antarctic.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Wing shape variation in relation to foraging and migration patterns in sympatric Antarctic seabirds

Forename: Jeong-Hoon Surname: Kim

Authors: Kim, Jeong-Hoon; Cho, Hyunjun; Shin, Eun-Soon; Ahn, In-Young; Choi, Han-Gu; Kim, Jin Sung;

Presentation Allocated: Poster

abstract: Pointed and convex wings are considered as suitable wings for long-distance migrants, because these shapes are able to reduce the energy cost of flight. To test this hypothesis in the Antarctic seabirds observed on King George Island, South Shetland Islands, Antarctica, we compared wingtip shape between Procellariiform and Charadriiform species. And also, we investigated the variations of wingtip shape within families and species showing the different foraging and migration patterns. Wing pointedness and convexity were estimated by size-constrained component analysis (SCCA) using the length of successive eight primaries from the outermost flight feather. Procellariiform species which are pelagic feeders had more pointed and convex wings compared with Charadriiform species which are inshore feeders. Small size birds belonging to Hydrobatidae had more convex wings than medium and large size species belonging to Procellariidae, although there was no significant difference in the wing pointedness between families in Procellariiformes. Wing pointedness varied among the families of Charadriiformes. Extremely Sternidae birds had the most pointed wings, while the Chionidae birds had the most rounded wings. Wing pointedness and convexity also varied between the skua species belonging to Stercorariidae. South polar skuas which are long-distant migrants had more pointed and convex wing compared with brown skuas which are short-distant migrants. There were also significant differences between skua species in wing span, area and load. Our results supported that wing shape of Antarctic birds was reflected in foraging and migration patterns.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 15

Title: Winter foraging hot spots of southern elephant seal males from King George Island and oceanographic features

Forename: Horst Surname: Bornemann

Authors: Bornemann, Horst; de Bruyn, PJ Nico; Reisinger, Ryan R.; Schröder, Michael; Fillinger, Laura; McInyre, Trevor; Tosh, Cheryl A.; Márquez, Maria E.I.; Bester, Marthán N.; Plötz, Joachim;

Presentation Allocated: Poster

abstract: Deployments of ARGOS satellite transmitters on adult southern elephant seal males at King George Island in 2010 represent a follow-up study of an earlier project in 2000/2001. Males had either moved along the Bransfield Strait and around the tip of the Antarctic Peninsula or deep into the winter pack ice of the southern Weddell Sea. The latter finding could not be reproduced, though seals travelled on comparably extended latitudinal gradients between King George Island / Isla 25 de Mayo and South Georgia or the southern Bellingshausen Sea. The recent movements seem to contradict patterns of sexual segregation interpreted from earlier studies, suggesting more overlap between foraging grounds of adult males and females than previously assumed. As far as we could track individuals, most post-moult movements were oriented to South Georgia towards the breeding season and back thereafter. The seals' long and straight line movements at distances of more than 1500 km allowed for cross sectional analyses of hydrographic features and revealed information on the temperature and salinity regime during winter. All seals showed extended residence times at specific circumscribed at-sea locations, considered as foraging hot spots. These spots were widely distributed within the Bellingshausen and northern Weddell Seas and seem to be linked to bathymetric features, such as slopes, seamounts or plateaus. The study involves scientists from South Africa (MRI), Argentina (IAA) and Germany (AWI) in a synoptic approach of the investigation of the movement behaviour of southern elephant seals from King George Island and Marion Island, and highlights our long-time collaboration within the "Year of Science" of South Africa and Germany in 2012/13.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: A FOUR CENTURY FIRN CORE RECORD OF PERSISTENT ORGANIC POLLUTANTS AT TALOS DOME, VICTORIA LAND (ANTARCTICA)

Forename: Roger Surname: Fuoco

Authors: Fuoco, Roger; Giannarelli, Stefania; Onor, Massimo; Ghimenti, Silvia; Abete, Carlo; Termine, Marco; Francesconi, Sandro;

Presentation Allocated: poster

abstract: Antarctica is a very unique continent and acts as an unparalleled natural laboratory for research into the problems of global pollution and an ideal place both for performing baseline studies of the environmental contamination, and for reading the natural archives of information contained in the ice and sediment relating to chemical changes in the atmosphere over the ages. A very important environmental issue concerning the presence of Persistent Organic Pollutants (POPs) is related to the correct evaluation of the pollution sources. Two main POP source categories might be considered in a simplified model: whether POPs are intentionally produced or accidentally formed in combustion and industrial processes. The evaluation of the net contribution of anthropogenic activities to the global environmental pollution, which is widely considered as the final aim of such studies, could be performed on the basis of suitable temporal records. This paper describes the most significant findings on the concentration profiles of PAHs and PCBs in snow/firn cores collected at Talos Dome (Antarctica) during the 2003-04 and 2004-05 Italian expeditions, which cover about four centuries, i.e. 1600-2002. Our data highlighted the presence of several PAH maxima which correlated with the major volcanic eruptions in the period 1600-1900, as expected. Surprisingly it also revealed the presence of synchronous PCB maxima. After about 1930 PCBs showed the tendency to increase as a direct effect of the industrial PCB production and use : the PCB "industrial maximum" was observed around in 1990, sixty years later.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: A Time-Series of Dissolved Trace Element Concentrations in Glacial Meltwater Stream, Taylor Valley, Antarctica

Forename: Sarah K Surname: Fortner

Authors: Fortner, Sarah K; Lyons, W. Berry;

Presentation Allocated: Oral

abstract: We present, to our knowledge, the first seasonal time series of dissolved (<0.4 micromolar) trace element concentrations in an Antarctic stream. In the 2006-2007 austral summer Andersen Creek, Taylor Valley, Antarctica (~78°S) was sampled for twenty-three days from 02 December through 10 January. Samples were collected using ultra clean techniques within ~1 hour of each other, filtered and acidified. These samples were later analyzed via ICP-MS for Cd, Cu, Mo, Pb, U and V. Mean concentrations were 1.3, 0.72, 0.14 and 4.5 nML⁻¹ for Cu, Mo, U and V, respectively. Cd and Pb concentrations were below our filter blank limits (0.4 and 0.06 nML⁻¹). Dissolved concentrations of Mo, U and V generally decreased through the flow season. Mean concentrations of Cu, Mo and U in Andersen Creek are more than an order of magnitude lower than values from North American rivers such as the Ohio River. Cu concentrations in Andersen Creek are ~60% lower than values observed in pristine rivers in the Southern Hemisphere. These data will be discussed in terms of their potential sources and impacts on their ultimate sink, Lake Hoare.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: ANALYSIS OF VOLATILE ORGANIC COMPOUNDS ON THE ADMIRALTY BAY, KING GEORGE ISLAND, ANTARCTIC PENINSULA

Forename: Anne Caroline de Surname: Lima

Authors: Lima, Anne Caroline de Medeiros; Alencar, Alexandre Santos de; Corrêa, Sergio Machado; Sodré, Eduardo Delfino; Evangelista, Heitor;

Presentation Allocated: poster

abstract: In order to identify the atmospheric concentration and investigate the possible source-areas of volatile organic compounds (VOCs) near the Brazilian Antarctic Station Comandante Ferraz (EACF), air samples were collected during the late austral summer of 2011 in different sites of Admiralty bay at King George Island, where is located the EACF. Using 1.8L stainless steel RESTEK® canisters, atmospheric samples were collected in six different sites: five near the EACF (62°05'S - 058°23.5'W; 8 m above sea level) on Keller Peninsula and one close to the Polish Antarctic Station Arctowski (62°09.5'S - 058°28.3'W; 2 m above sea level) The procedures of sampling and analysis followed the TO-15 methodology of the US Environment Protection Agency (US EPA). In laboratory, after cryogenic concentration, atmospheric samples were analyzed using a gas chromatography-mass spectrometry system (GC/MS). Weather data from the studied area were provided by the Automatic Weather Station (AWS) from the EACF and we also used the scientific tool for analysis of atmospheric trajectories NOAA-HYSPLIT re-analyses to investigate the local and regional atmospheric transport. The results showed the occurrence of 49 COVs from biogenic and anthropogenic emission over the analyzed sites (Alkanes 45%, Alkenes 29% and Aromatics 26%). Among the COVs identified at this work, the Isopentane showed the highest concentration with 16.2 µg/m³, followed by the Benzene with 16.0 µg/m³. The results found at the present work were compared with previous data provided by other authors to different Antarctic areas.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Anthropogenic microbial contamination of Antarctic terrestrial soils

Forename: Don Surname: Cowan

Authors: Cowan, Don; Katurji, Marwan; Zawar-Reza, Peyman; Cary, Craig; Chown, Steven; Convey, Peter; Hughes, Kevin; Tuffin, Marla; Pointing, Steve; Vincent, Warwick;

Presentation Allocated: poster/short oral

abstract: The Antarctic is frequently cited as containing the last pristine environments on Earth. However, this is an over-simplification. First, although much of the continent is not or is rarely exposed to human activities, those areas which are impacted include the most sensitive, i.e. the ice-free coastal regions. Second, there has been a rapid increase in visitors to Antarctica in recent decades, with large increases at research bases and their environs, in the overall footprint of national operations, and to sites of major tourist interest (e.g., historical sites, concentrations of megafauna). Third, although substantial efforts are now made to avoid physical disturbance and contamination by chemical, human and other wastes at these sites, little has been done to prevent the introduction of non-indigenous microorganisms. Here we present a simple method for estimating and comparing human impact in terms of the deposition of non-indigenous microorganisms. Little if anything is known of the local or regional dispersal of anthropogenic microbial contamination. Using a climatological data record from the maritime Miers Valley meteorological station in the McMurdo Dry Valleys, we present results from a preliminary particulate dispersion model of microbial contaminants, showing the range and intensity of contamination from a point source as a function of background surface winds. We calculate that, in a low biomass habitat (such as an Antarctic Dry Valley soil ecosystem), human occupation over a relatively short period may contribute a localized exogenous microbial load which is a significant fraction of the extant biomass. This anthropogenic input represents a potential nutrient source and contribution to the genetic diversity of the impacted site. We conclude that, while such inputs are unlikely to have any immediate gross impact on microbiological community structure or function, increased efforts are required to protect Antarctica's unique ecosystems from microbial and genetic contamination.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Atmospheric processes feeding natural aerosol at Dome C as proxies of zonal and meridional transport of pollutants to inner Antarctica.

Forename: Roberto Surname: Udisti

Authors: Udisti, Roberto; Becagli, Silvia; Busetto, Maurizio; Dayan, Uri; Frosini, Daniele; Lanconelli, Christian; Lucarelli, Franco; Lupi, Angelo; Mazzola, Mauro; Scarchilli, Claudio; Severi, Mirko; Traversi, Rita; Vitale, Vito;

Presentation Allocated: poster/short oral

abstract: In order to understand the main atmospheric processes possibly leading anthropic aerosol components in inner Antarctica, a multi-year aerosol data-base of natural compounds in size-segregated aerosol samples collected all-year-round at Dome C (East Antarctica; 75° 60' S, 123° 200' E, 3220 m a.s.l. and 1100 km away from the nearest coast) was discussed. The aerosol data-set includes samples collected in the period November 2004 to November 2007 by PM10 and PM2.5 samplers and multi-stage impactors (4 stages: < 1.0, 1.0-2.5, 2.5-10, > 10 ; 8-stages from 0.7 to 10 µm). Sea spray showed a sharp seasonal pattern, with winter (Apr-Nov) concentrations about ten times larger than summer (Dec-Mar). Besides, in winter, sea spray particles are mainly sub micrometric, while in summer size-mode is 1-2 µm. Meteorological analysis on a synoptic scale and air mass back trajectory reconstructions allowed the identification of two major air mass pathways, reflecting different size distributions: micrometric fractions for transport from the closer Indian-Pacific sector, and sub-micrometric particles for longer trajectories over the Antarctic Plateau. Methanesulphonic acid (MSA) and non-sea-salt sulphate (nss-SO4²⁻) were chosen as markers of oceanic biogenic emission (as end-products of the atmospheric oxidation of dimethylsulphide). The two species exhibit a seasonal cycle with summer maxima (Nov-Mar). SO4²⁻ and MSA size distributions show two modes (0.4- 0.7 µm and 1.1-2.1 µm) in early summer and only one sub-micrometric mode in full summer. The two modes are related to different transport pathways from oceanic areas to the central Antarctic Plateau. In early summer months, air masses came primarily from the Indian Ocean and lingered for a long time over the continent. The transport of sulphur compounds is related to sea spray aerosols and the resulting condensation of H2SO4 and MSA over sea salt particles form sodium salts. Conversely, in the other summer months a rapid transport of H2SO4 and MSA formed above the boundary layer over oceanic areas leads to higher concentrations of the acidic species in the fine fraction of aerosols reaching Dome C. Non-sea-salt calcium was used as a continental dust marker. Besides the seasonal pattern, single dust inputs were observed. A large transport event of dust coming from Patagonia was studied with a combined and complementary use of satellite retrievals, transport model simulation and surface observations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Chemical composition of marine aerosols over the Indian Sector of Southern Ocean

Forename: Roseline Cutting Surname: Thakur

Authors: Thakur, Roseline Cutting; Thamban, Meloth; Tiwari, Anoop;

Presentation Allocated: poster

abstract: Marine aerosol is the major component of the global atmospheric aerosol and their specific physical and chemical properties influence the atmospheric processes. Ten sets of size segregated (diameter range, 0.7 μm -10 μm) aerosol samples were collected between 7°N to 65°S during the Indian Southern Ocean expedition (January 2010- February 2010) through the continuous operation cascade impactor. These samples were analyzed through Ion exchange chromatography to study the discrete sources of the ions as well as the process involved. Cl⁻, Na⁺, SO₄²⁻, NO₃⁻ and Mg²⁺ were found to be the most abundant ionic components in the marine aerosols. Na⁺ contributed over 85% in the total ionic composition, indicating sea salt is the primary component of the marine aerosols, followed by the SO₄²⁻ as the secondary ionic component. The Cl⁻/Na⁺ ratio was significantly low (0.08) much less as compared to sea water ratio, which indicated a strong depletion of Cl⁻. Na⁺ and NO₃⁻ are equally distributed in the coarse and fine modes. Nearly 56% of total SO₄²⁻ is present in coarse particles whereas >90% of other sea salt species NH₄⁺, K⁺, Mg²⁺ and Ca²⁺ are present in the coarse fraction. Among the halogen species 85% of Cl⁻ and 60% of F⁻ is associated with the coarse fraction. The secondary marine aerosol like nssSO₄ and MSA are dominantly associated with fine fraction (78.2 % and 68% respectively). Higher MSA concentrations in fine particles indicate that the gas to particle conversion process is responsible for the accumulation of alkyl ammonium salts in the fine mode. An average mass concentration of 3 $\mu\text{g}/\text{m}^3$ of coarse particles was found over the study area, with highest concentration of 7.3 $\mu\text{g}/\text{m}^3$ was seen over 61°S. An increasing sea salt influence was observed towards coastal Antarctica. Source investigation indicate that Cl⁻, Na⁺, K⁺, Mg²⁺ and Ca²⁺ are predominantly derived from sea spray whereas MSA has marine biogenic sources. However it appears that F⁻, NO₃⁻ and SO₄²⁻ are also influenced by anthropogenic sources.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Criosfera 1 – Designing the future of atmospheric monitoring in Antarctica

Forename: Marcelo Surname: Sampaio

Authors: Sampaio, Marcelo; Evangelista, Heitor; Simões, Jefferson; Passos, Heber Reis; Alencar, Alexandre; Aquino, Francisco;

Presentation Allocated: poster

abstract: Uninterrupted atmospheric monitoring is a key-factor for better understanding recent climate changes in Antarctica. Although many scientific stations are dedicated to monitoring physical-chemical and meteorological parameters during both summer and winter, most of these are located at the continental margin. Here we present the basic design and up to date climate database of the research module CRIOSFERA 1, established at West-Central Antarctica (S84o,00'; W79o,30') by the Brazilian Antarctic Program, and which started operation during the early 2011/2012 summer period. This new scientific platform uses only wind and solar power sources to run atmospheric research and meteorological instrumentation as well as to collect and transmit data via the ARGOS satellite system. Inside module temperature and power generator current are also stored and sent to the satellite link. Installed meteorological instrumentation allows monitoring of the air temperature, wind speed/direction, relative humidity and atmospheric pressure, besides carbon dioxide atmospheric concentration and the continuous observation of the snow deposition. Fast time resolution data are stored in loggers and hourly averaged values are transmitted to Brazil. In addition an automatic aerosol monthly integration system, using Nuclepore Track-Etch Membrane filters (0.4 micro meter porosity), was installed in order to measure the elemental and ionic composition of aerosols. For the energy system, CRIOSFERA 1 uses four 160 Watts wind turbines (at wind speed of 12.5 m.s-1) and four 175 Watts solar panels (1000 W.m-2 at 25oC). These power generators are used to charge an 8 kW-hour of AGM lead acid stationary batteries unit. During the winter this battery set is able to maintain the system for up to 4 days without wind.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Cyanobacterial consortia in [14C]naphthalene biodegradation

Forename: Débora M. Surname: Corrêa

Authors: Corrêa, Débora M.; Albuquerque, Miriam A.; Schaefer, Carlos E. G. R;

Presentation Allocated: poster

abstract: Bioremediation can be a low cost and ecologic alternative to solve hydrocarbon contamination problems in Antarctic soils. The ability of three cyanobacterial strains in degrading [14C]naphthalene was tested under 15°C. Cyanobacterial lineages *Phormidium autumnale* UFV-ANT01, *Nostoc* sp. UFV-ANT22 and *Tolypothrix* sp. UFV-ANT21 was selected due its important contribution to Antarctic microbial mats. Cyanobacteria was investigated in monoclonal cultures and in consortia with heterotrophic bacteria, in comparison with bacterial and abiotic controls. After 200 hours of exposure to labeled hydrocarbons, treatments corresponding to consortia proved to be more effective in [14C]naphthalene than the monoclonal treatments and controls. Cumulative mineralization rates were 41%, 40% and 31%, for *Nostoc* consortia, *Phormidium* consortia and *Tolypothrix* consortia respectively, while bacterial control mineralized 11% of the added hydrocarbon. Monoclonal treatments degraded 2,6 to 4% of naphthalene added and were considered less effective than bacterial control, but did not differ from abiotic control (1,9%). Degradation kinetics was similar to those previously reported by other authors for low hydrocarbon concentrations models, in which microbial hydrocarbon attack begins shortly after the contaminant was added to treatments. The rates of hydrocarbon degradation observed to consortia treatments were superior to the sum of individual monoclonal ones and the bacterial control, indicating that cyanobacteria had played a important role in the biodegradation process, providing moisture, nutrients, oxygen and immobilizing the biodegraders microorganisms.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Determination of heavy metals in an Antarctic firn core using ICP-MS

Forename: Franciele Surname: Schwanck Carlos

Authors: Schwanck Carlos, Franciele; Cardia Simões, Jefferson;

Presentation Allocated: poster

abstract: Snow and ice deposited annually in the polar ice sheets provide detailed records of the history of air pollution by heavy metals. Concentrations measurements of these contaminants indicate aerosol sources, allowing an assessment on the human and volcanic impact in the atmospheric composition. The Inductively Coupled Plasma Sector Field Mass Spectrometry (ICP-MS) has been widely used in this kind of analysis because it can detect several elements simultaneously at extremely low concentrations (in the order of ppt) in very small volumes of melted samples. The firn core IC-6 (35.06 m long) was collected in the West Antarctic Sheet (at 81°03'10"S, 79°50'09"W, 750 m above sea level) in the 2004/05 Austral summer. This core was sub sampled using a continuous melting system at the Climate Change Institute (CCI, University of Maine, Orono, Maine, USA) under a Class 100 room conditions. The concentration of heavy metals (arsenic, bismuth, cadmium, lead, chromium and manganese) was determined using an ICP-MS Element 2 at CCI (measured in low, middle and high resolutions) in 1378 samples. The core records 68 years (1934 – 2002) of snow accumulation, as dated by seasonal variations of Na and Mg elements and Cl⁻, Na⁺ and Mg²⁺ ionic concentrations. The calculated mean annual accumulation is 0.30 m yr⁻¹ (in water equivalent). Mean concentrations of As (1.88 ppt), Bi (0.34 ppt), Cd (0.28 ppt), Pb (5.03 ppt), Cr (3.92 ppt) and Mn (15.44 ppt), are low and similar to the ones found in other Antarctic firn and ice core studies. These concentrations are controlled by seasonal climatic variations (summer/winter), transport distance and by natural and anthropogenic sources of aerosols. Enrichment factors were used to determined probable regional and continental sources of the measured heavy metals. Natural continental dust and soil from the Patriot Hills region (85 km away) are the main source for the elements chromium and manganese. Marine aerosols have little contribution to the concentrations of these metals. On the other hand, global and regional volcanic emissions (Mount Erebus and Deception Island) are important sources of lead and manganese (about 20%) and cadmium and bismuth (up to 70%). Natural deposition of lead, cadmium, bismuth and arsenic, represent only a small fraction of the total amount deposited in the firn core. For these metals, human activities are the main factor responsible for their mobilization and transport.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Do penguins breeding colonies create pollutants hot spots?

Forename: Larissa Surname: Cunha

Authors: Cunha, Larissa; Costa, Eri; Guida, Yago; Meire, Rodrigo; Torres, João Paulo;

Presentation Allocated: poster

abstract: Seabirds are considered good indicators of persistent pollutants contamination in the environment. As other top food chain predators, seabirds are more susceptible to the accumulation of chemicals such as PCBs and organochlorine compounds clearly indicating the pollutants present in the environment. Seabirds can also act as a pollutant dispersal agent carrying them in their bodies to great distances through their migration routes, as it has been shown in the Arctic region. But how much do seabirds that reproduce in large colonies contribute to the concentration of pollutants at their breeding site soil? Do they create pollutants hot spots? Soil samples were collected at breeding colony sites (Admiralty Bay – King George Island) early in the reproductive cycle of Chinstrap Penguin (2010-2011). Organochlorine pesticides (OCs) and polychlorinated biphenyls (PCBs) were analyzed by gas chromatography with electron capture detection (Shimadzu 2010, 20i CG-ECD) Preliminary results show intermediate levels of PCBs and OCs that ranged from tens to thousands of picograms per grams (w.w.). Further analysis comparing the breeding soils from the Chinstrap Penguin, Gentoo Penguin and Adelie Penguin (*Pygoscelis antarctica*, *P. papua* and *P. adeliae*) during different reproductive stages, will help to better understand the main impact that these target species, with different migratory habits, have on their breeding sites. (This work was supported by The National Council for Scientific and Technological Development, Brazilian Antarctic Program and Ministry of Science and Technology (CNPq/MCT 557049/2009-1).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Environmental Aspects & Impacts of Drilling Technology in Antarctic Ice Sheet

Forename: Pavel Surname: Talalay

Authors: Talalay, Pavel; Xu, Huiwen; Yu, Dahui; Han, Lili;

Presentation Allocated: poster

abstract: Drilling in Antarctic Ice Sheet is planned by various national and international projects (Dome A, Gamburtsev Subglacial Mountains, The Oldest Ice Coring, and others) for the study of climate change, glacier dynamics, ancient life, subglacial environment, etc. Modern ice drilling technology (drilling and auxiliary equipment, drilling fluid, diesel power station, power lines, etc.) is very harmful for Antarctic environment where nature recovery takes much longer time than in regions with temperate and open climate. From the environment point of view ice drilling technology should be improved significantly. The authors suggest to update ice drilling technology by (a) safe isolation of permeable snow-firn layers from drilling fluid, fuel and other spills, (b) restoration of snow-firn layers, (c) careful collection of wastes, (d) developing of self-automatic closed station for preparation and dumping of drilling fluid, (e) recycling of drilling fluid, (f) recovering and storing of ice cuttings, (g) using of new environmental-friendly drilling fluid, (h) introduction of ecological monitoring measuring vapor concentration of drilling fluid in drilling trench, wastes of drilling fluid, composition of snow and firn inside and outside of drilling trench, etc. The main pollutant of drilling technology is drilling fluid because it can contaminate large quantities of air, surface- and near-surface snow and firn layers, ice cuttings, and subglacial water resources. The possibility of impact on subglacial water biota from the drilling fluid can occur at almost any inland drilling site. Subsequent effects of drilling fluid are particularly important if the fluid is to be left in the hole: because of the movement of the ice, fluid in the hole will eventually reach the sea after a period of many thousands of years. All recent low-temperature drilling fluids cannot be qualified as intelligent choices because of the safety, environmental, and other technological standpoints. The new direction of drilling fluids research is connected with testing and using of ESTISOL™ 140, -165 and -F2887 esters. All of them are considered non-hazardous due to the calculation procedure of the "General Classification guideline for preparations of the EU". They are low-toxic, relatively cheap, readily biodegradable, are not classified as hazardous for transport by road or air cargo, and do not present an explosion hazard.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Environmental pollutant monitoring in Antarctic air: Persistent organic pollutants (POPs) monitoring at the Norwegian Troll station

Forename: Sabine Surname: Eckhardt

Authors: Eckhardt, Sabine; Kallenborn, Roland; Breivik, Knut; Schlabach, Martin;

Presentation Allocated: Oral

abstract: As a part of an integrated global monitoring program for persistent organic pollutants (POPs) in the Antarctic atmosphere, a year around atmospheric POP monitoring program at the Norwegian Antarctic Troll Research (72°00'06"S 02°32'02"E) was initiated in 2007 based on continuous weekly high volume atmospheric sampling. Today, four complete annual data sets for weekly atmospheric POP monitoring are available and allow a comprehensive scientific elucidation of background levels, atmospheric long-range transport as well as potential local contamination. In total, 33 polychlorinated biphenyl (PCB) congeners and 14 organochlorine pesticides (incl. OCPs like hexachlorocyclohexane isomers = HCHs, chlordanes, and dichlorodiphenyltrichloroethane (DDT) related derivatives) have been quantified in these Antarctic high volume air samples. Chemical pattern evaluation in combination with meteorological air mass modelling (FLEXPART model) were used for the elucidation of atmospheric long-range transport events. In addition potential source regions and emission profiles were identified and discussed. Furthermore, the data comparison with the simultaneously performed POP monitoring program at the Zeppelin atmospheric research station (Ny-Ålesund, Svalbard, Arctic) revealed surprising concentration and pattern differences between the two polar sampling locations. These findings will also be included in the presentation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Generalist and specialist foraging strategies influence mercury (Hg) exposure in sympatrically breeding *Pygoscelis* penguins.

Forename: Michael Surname: Polito

Authors: Polito, Michael; Brasso, Rebecka; Trivelpiece, Wayne; Patterson, William; Emslie, Steven;

Presentation Allocated: poster

abstract: We evaluated mercury (Hg) concentrations and stable isotope signatures ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) in the blood and feathers of sympatrically breeding Adélie (*Pygoscelis adeliae*), Chinstrap (*P. antarctica*) and Gentoo (*P. papua*) penguins at Admiralty Bay King George Island, South Shetland Islands, Antarctica in the austral summer of 2010/11. While concentrations were low in all three species, blood and feather Hg concentrations were positively correlated with $\delta^{15}\text{N}$ values suggesting increased Hg exposure in individuals feeding at higher trophic levels. In addition, we found species-specific differences in tissue Hg concentrations that appear to be driven by species, sex and age related-differences in foraging ecology. Gentoo penguins had the most variable tissue Hg concentrations and diets as indicated by both $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values. Tissue $\delta^{15}\text{N}$ values suggest that male gentoo penguins consume greater amounts of fish and have higher tissue Hg concentrations relative to females and one-year olds of both sexes, as their larger size may allow them to exploit benthic foraging habits. In addition, while Adélie and Chinstrap penguins appear to foraging at the same trophic level, Chinstrap penguins have consistently higher tissue Hg concentrations. This may be due to Chinstrap penguins targeting mid-water myctophids which have similar tissue $\delta^{15}\text{N}$ values, but higher Hg concentrations, relative to the pelagic prey fish commonly consumed by Adélie penguins.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Guidance on appropriate response to fuel spills in Antarctica: developments of relevance to the Liability Annex to the Madrid Protocol

Forename: Ian Surname: Snape

Authors: Snape, Ian; Snape, Martin; McIvor, Ewan;

Presentation Allocated: Oral

abstract: In 2010 the Antarctic Treaty Consultative Meeting (ATCM) discussed the possible need for further rules and procedures relating to liability for damage arising from activities taking place in the Antarctic Treaty area and covered by the Environmental Protocol. Through Decision 4 (2010), it requested the Committee for Environmental Protection (CEP) to 'consider environmental issues related to the practicality of repair or remediation of environmental damage in the circumstances of Antarctica'. Australia's response was to emphasise that: 1. Avoiding environmental damage is highly preferable in all cases. 2. Timely recording and reporting of environmental damage is important. 3. The environmental issues related to the practicality of repair or remediation of environmental damage will need to be assessed on a case-by-case and site-specific basis 4. Standard environmental risk management processes can be applied, with due consideration to the circumstances of Antarctica 5. Objectives for repair or remediation should reflect the objectives and provisions of the Environmental Protocol, and be appropriate to Antarctic conditions 6. Consideration should be given to whether repair or remediation of environmental damage by any practical option will result in greater adverse environmental impact. 7. Assessment of options for repair and remediation will also need to consider operational feasibility 8. Generally applicable standards, guidelines and techniques relevant to the Antarctic context will assist. We present research findings relating to fuel spill response that support and guide this 8-point approach to the 'repair' and remediation of environmental 'damage' in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Highly Enriched Modern Concentrations of Cd, Pb, Bi, As, and Li across Antarctica

Forename: Daniel Surname: Dixon

Authors: Dixon, Daniel; Mayewski, Paul; Korotkikh, Elena; Sneed, Sharon; Handley, Michael;

Presentation Allocated: poster/short oral

abstract: We present trace element, heavy metal, and rare earth element data from a series of surface snow samples and shallow firn sections collected along four US ITASE traverses across East and West Antarctica. In each sample we measure total concentrations of Sr, Cd, Cs, Ba, La, Ce, Pr, Pb, Bi, U, As, Al, S, Ca, Ti, V, Cr, Mn, Fe, Co, Na, Mg, Li, and K using inductively coupled plasma sector field mass spectrometry. The elements Cd, Pb, Bi, As, and Li are enriched across Antarctica relative to both ocean and upper crust elemental ratios. Global volcanic outgassing accounts for the majority of the Bi measured in East and West Antarctica and for a significant fraction of the Cd in East Antarctica. However, despite potential contributions from local and global volcanic sources, significant concentrations of Pb, Cd, and As remain across much of Antarctica. This study provides a baseline from which changes in the chemistry of the atmosphere over Antarctica can be monitored under expected warming scenarios and continued intensification of industrial activities in the Southern Hemisphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Historical Contaminants in Winter Quarters Bay, McMurdo Station, Antarctica

Forename: Terry Surname: Wade

Authors: Wade, Terry; Sweet, Stephen; Sericano, Jose; Kennicutt, Mahlon; Klein, Andrew; Palmer, Terrance;

Presentation Allocated: Oral

abstract: Environmental studies (Risebrough et. al. 1990) found locally high concentrations of PCB contamination at McMurdo Station's Winter Quarters Bay (WQB). Contamination by PCB, petroleum, combustion hydrocarbons and trace metals has been found in marine sediments, organisms and soils in proximity to the station. The U.S. Antarctic Program initiated a long-term monitoring program in response to Antarctic Treaty obligations to monitor contaminants at McMurdo Station, Antarctica. The program's objectives are to establish the extent and trends of station-associated impacts. Sediments and organisms were collected from the marine environment from 2000 to 2010 for analysis of contaminants (PCB, PAH and trace elements) to assess temporal and spatial trends, bioavailability and bioaccumulation. Samples were collected by divers at three depths along transects located in WQB, at the former waste disposal outfall, and at control sites. The total PAH dry weight concentration ranged from background to 12 ug/g and from background to 0.72 ug/g for sediment and tissue samples; respectively. PAH concentration in both matrices decreased with distance from WQB. The PAH distribution indicated a mixture of both petrogenic (e.g. alkylated naphthalenes and phenanthrenes) and pyrogenic (e.g. fluoranthene and pyrene) sourced material. The dry weight concentration of total PCB ranged from background to 7 ug/g and to 57 ug/g, in sediment and biota samples; respectively. The PCB congener distribution for most samples was similar to historically reported Aroclor 1260 contamination. Some tissue concentrations at control sites are elevated (>.25 ug/g) compared to anticipated background levels. These non-background concentrations at a distance from Winter Quarters Bay could indicate a spatial spreading of the PCB contamination sourced in the vicinity of WQB related to movement of the organisms or their prey. Trace element concentrations are at or near background levels. There is no apparent increasing or decreasing contaminant temporal trends detected in sediment or biota over the last decade of monitoring. PCBs appear to be stable in WQB sediments as no major new additions have occurred since the 1980s. There are still potential sources of PAH (e.g. petroleum, crankcase oil) but concentrations have not increased appreciably indicating that control strategies have minimized inputs. It is also interesting to note that the highest PAH concentrations are found in sediments

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Hydrocarbon degrading bacteria isolated from maritime Antarctica soil could be associated with horizontal gene transfer elements

Forename: Verónica Surname: Antelo

Authors: Antelo, Verónica; Batista, Silvia;

Presentation Allocated: poster

abstract: Human activity in Antarctica is controlled and there are protocols for environmental impact evaluation. Inevitably, however, these actions have incorporated hydrocarbons and other pollutants at specific sites on the continent (Aislabie et al 2001). Microbes may acquire genetic information by horizontal gene transfer (HGT) mechanisms involving both closely related and phylogenetically distinct species in a given community. This genetic information could enable the recipient organism to better survive under specific conditions (Van der Meer et al 1992). In bacteria, HGT is widely recognized as a mechanism responsible for the distribution of antibiotic resistance genes and gene clusters encoding biodegradative pathways (De la Cruz et al 2000).

□

Integrons are assembly platforms that incorporate exogenous open reading frames (ORFs) by site-specific recombination and convert them to functional genes by ensuring their correct expression (Mazel 2006). Previous studies have shown that these elements could carry genes cassette encoding for biodegradation of specific compounds (Koenig et al 2009). We are developing a physiological study of microorganisms isolated from specific sites on King George Island (South Shetland Islands). In particular, we are analyzing the presence of hydrocarbon assimilation genes and we wish to determine if they are associated with elements like class I integrons. A collection of 50 bacterial isolates from hydrocarbon contaminated soils was obtained. The isolation of bacteria was done using HI, a minimal medium (Lanfranconi 2003) supplemented with 0.4% Antarctic tank diesel as sole carbon source. Twenty Trimr bacteria positive for the amplification of int11 gene were evaluated for the presence of genes encoding naphthalene dioxygenase (ndo). From ten isolates, I could amplify a fragment of 500 bp, a size consistent with the results obtained previously by Ma et al. 2006). Aminoacidic analysis of the fragments amplified confirmed the presence of ndo gene in six clones. We wish to know if an integron-like genetic structure could be involved with HGT of diesel fuel degradation ability.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Identification of volatile organic compounds in two sites of West Antarctica

Forename: Alexandre Santos Surname: Alencar

Authors: Alencar, Alexandre Santos de; Evangelista, Heitor; Corrêa, Sergio Machado; Sampaio, Marcelo; Simões, Jefferson Cardia;

Presentation Allocated: poster/short oral

abstract: Atmospheric samples were collected in the context of the Criosfera Expedition during 2011/2012 austral summer season, as part of activities related to CASA (Climate of Antarctica and South America) project, a scientific cooperation among Brazil, Chile and USA. Air samples were collected in two different sites of West Antarctica, one region of high scientific interest, in order to identify the Volatile Organic Compounds (VOC) occurrence and its possible sources, as well as to better understand the local atmospheric transport. Sampling sites were located at Glacier Union situated in the southern Ellsworth Mountains (79°46'S - 082°50'W, 700 m a.s.l.) where is installed the Antarctic Logistics and Expeditions (ALE) camp and at 84°00'S - 079°29'W, 1270 m a.s.l., where was installed the camp site of Criosfera Expedition, about 500 km from the South Pole. Climatological data of the two sites were respectively provided by the weather station from ALE camp site and the AWS (ID9018 ARGOS) of Criosfera 1, the Brazilian scientific standalone module installed at 84°S. Atmospheric samples in these two sites were collected between December/2011 and January/2012 using eight 1.8 L stainless steel canisters prepared under high vacuum and in laboratory they were analyzed using a gas chromatography-mass spectrometry system (GC/MS). NOAA-HYSPLIT trajectories re-analyzes were applied to better understand the atmospheric transport on regional scale. VOC from biogenic and anthropogenic emission (e.g. free acids, cycloalkanes, alkanes, alcohols) were positively identified at the two sites analyzed, while in Glacier Union, VOC from anthropogenic origin showed relatively high concentration. These VOC concentrations were related with the logistics in the ALE campsite. The occurrence of VOCs measured in this work was compared with previous data from other studies accomplished in the West Antarctica region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Investigation of soil pollution near five Antarctic research stations using sequential extraction procedure and chemometric tools

Forename: Marcelo Surname: Braga Bueno Guer

Authors: Braga Bueno Guerra, Marcelo; de Freitas Rosa, Paula; Gonçalves Reynaud Schaefer, Carlos Ernesto; Ferreira Machado Michel, Roberto; Carreiro Almeida, Ivan; Rodrigues Pereira Filho, Edénir;

Presentation Allocated: poster

abstract: We applied the chemometric tools: PCA (Principal Component Analysis) and PARAFAC (Parallel Factor Analysis) for data treatment derived from Cu, Mn and Zn determination in Antarctic soil samples in the fractions of a Sequential Extraction Procedure (SEP). Soil were collected in places under strong anthropogenic impact, near five Antarctic research stations: Chilean (Escudero and Eduardo Frei Montalva); Chinese (Great Wall); Russian (Bellingshausen) and Uruguayan (Artigas). From our knowledge, this is the first attempt to report results about chemical data interpretation from soil fractionation with chemometric tools related to soil samples from areas under anthropogenic impact in Antarctica. Soil samples collected in sites with minimal human impact, far away from the stations were used as control samples. The SEP procedure based on the BCR (Community Bureau of Reference) protocol was applied for Cu, Mn and Zn determination. With the help of PCA and PARAFAC meaningful information were extracted from the raw data obtained from the SEP procedure. The soil samples affected by the stations are associated with high heavy metals contents, especially Cu and Zn, among the investigated metals, in the most labile fractions of the applied SEP. Based on the PARAFAC plot, an increasing order of magnitude of pollution (F2 fraction) was the following: Control sites < Artigas < Bellingshausen = Great Wall < Frei and Escudero, which match closely with the diesel consumption by these stations. The chemometric tools PCA and PARAFAC were adequate approach to extract useful information from data obtained by sequential extraction procedure application. Copper and Zn deposition is strongly correlated with diesel burning by the scientific stations of the area. Acknowledgment: FAPESP and CNPq.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Levoglucosan as a proxy for cellulose-based materials burning at King George Island-Antarctica

Forename: Eduardo Surname: Sodré

Authors: Sodré, Eduardo; Brito, Lavínia; Evangelista, Heitor; Eberlin, Marcos; Corrêa, Sergio; Alencar, Alexandre;

Presentation Allocated: poster/short oral

abstract: The monosaccharide anhydrides have their origin on biomass burning and the most important, from the point of view of the atmospheric tracer, is Levoglucosan and in a few extend Galactosan and Manosan. Levoglucosan is a pyrolysis product from cellulose and have an impact on the climate by absorbing solar radiation becoming a radiative forcing or acting as cloud condensation nuclei, affecting the local or regional climate. This compound is an excellent marker for biomass combustion transport due to the amount produced during combustion and its stability in the atmosphere. It were estimated Levoglucosan emissions from Antarctic Station Comandante Ferraz (EACF) – Brazil from biomass burning inventory in the period 2001-2008, applying the methodology proposed by LOCKEE (1988) and compared with concentrations found by filters sampled in 1998 at King George Island and re-analyzed. The analyses were performed by high performance liquid chromatography coupled to mass spectrometry via electrospray (HPLC-ESI-MS). Analyses were performed on filters sampled during 1998 in EACF. Results showed that higher Levoglucosan concentrations found are out of phase with of forest fires activity, not only in South America and Africa, but also in a global scenario, according to Agency-ESA database. Higher Levoglucosan levels coincide with the greatest human activity period at EACF, when the incinerator is used more frequently, indicating organic waste incineration at EACF as the main source. This hypothesis can be understood looking further inventories of waste incineration of EACF. It is possible to observe that Levoglucosan data found in air samples in 1998 may be unique to the biomass burning at EACF. Any Levoglucosan sign derived from large fires which occur seasonally in South America or Africa can be masked by local production, invaliding this type of study near EACF.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Long-term Environmental Monitoring of the Macrobenthic Communities at McMurdo Station, Antarctica

Forename: Terence Surname: Palmer

Authors: Palmer, Terence; Montagna, Paul; Hyde, Larry; Sericano, Jose; Sweet, Stephen; Klein, Andrew; Wade, Terry; Kennicutt, Mahlon;

Presentation Allocated: Oral

abstract: Monitoring of human impacts has been conducted by our team in the near-shore marine environment adjacent to McMurdo Station, Antarctica for 11 years. The monitoring program collects marine sediment from two transects in historically contaminated (disturbed) areas which are compared to control (undisturbed) transects. Each transect consists of three stations, at 12, 24 and 36 meters. Diver collected cores of sediment are analyzed for chemical contaminants, toxicity and macrobenthic community structure. Epifaunal megafauna (invertebrate and fish) species were also collected for determining whole-body contaminant concentrations (bioaccumulation). Chemical contamination has remained largely the same at the contaminated stations since 2000, when monitoring was initiated. Contaminated stations are high in PCBs, DDT, petroleum hydrocarbons and heavy metals relative to the control stations. The toxicity test results have been compromised due to interference with naturally occurring sponge spicules at the reference transect. The macrofaunal community structure is distinctly different between the two contaminated transects and the control transect. Macrofauna community structure has changed directionally over time, however the changes do not correlate with contaminant history and thus appear to primarily the result of natural variability at the study sites. Epifauna tissue contamination is elevated relative to at control sites in many taxa groups, most notably by PCBs.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Partitioning of Persistent Organic Pollutants between Sediments and Benthic Deposit Feeders in Western Antarctic Peninsula

Forename: Lin Surname: Zhang

Authors: Zhang, Lin; Lohmann, Rainer; Dickhut, Rebecca; Pohl, Kari; DeMaster, David;

Presentation Allocated: poster/short oral

abstract: Partitioning of Persistent Organic Pollutants between Sediments and Benthic Deposit Feeders in Western Antarctic Peninsula
Lin Zhang, Rainer Lohmann, Rebecca Dickhut, Dave DeMaster, Kari Pohl
Studies have shown that previously deposited persistent organic pollutants (POPs) are being released from glaciers due to global warming. The melting glaciers are believed to be the secondary source of POPs to the Western Antarctic Peninsula (WAP) coastal regions. These POPs have been found to bioaccumulate along the food web into Antarctic penguins in which body levels of DDTs have not declined since 1970s. Hydrophobic POPs should not only be present in the pelagic food web, but also be transported downward with sinking particulate organic matter into sediments. Thus, it is important to investigate the concentrations of POPs in the sediments of the WAP and their transfer along the benthic food web. Benthic biota can take up POPs through contact with porewater and/or via ingestion of sediment particles. As part of an ongoing collaborative research to study the impact of climate change on the transport of POPs in the Antarctic marine food web, surface sediments (0-5 cm depth) and subsurface/ surface deposit feeding holothurians samples were collected at five different locations selected from the Palmer Station regional grid. The $\delta^{13}\text{C}$ of labile sedimentary organic carbon (OC) were -25‰ which is similar to the value of phytodetritus, whereas the $\delta^{13}\text{C}$ of black carbon (BC) was -15‰ suggesting atmospheric input of terrestrial C4 plant residues. The PCB concentrations in the sediment normalized to OC, in porewater, and in biota normalized to lipid percentage were, 3.5-448 $\mu\text{g PCB/Kg OC}$, 6-21.6 pg/L , and 1.5-13.2 $\mu\text{g PCB/Kg lipid}$ respectively. The partitioning model with only the OC domain underestimated the observed partitioning of PCBs between sediments and porewater, which can be better explained by the model with both the OC and BC domains. The body burdens of PCBs in deposit feeders in the sediments of WAP were at equilibrium with PCBs in the porewater rather than those in the sediments. This study provides insights on the pathway of incorporating PCBs into the Antarctic benthic food web as well as serves as a baseline investigation for future evaluation of climate change impacts on PCBs behavior in the benthic food web of WAP.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: State of the art of element distribution and behavior in Antarctic lakewaters

Forename: Ornella Surname: Abollino

Authors: Abollino, Ornella; Webster-Brown, Jenny; Lyons, W. Berry; Malandrino, Mery; Giacomino, Agnese; Capodaglio, Gabriele;

Presentation Allocated: Oral

abstract: In this work we review the existing knowledge on trace, minor and major element distribution and behavior in Antarctic lakewaters. Lacustrine ecosystems have been less extensively studied than other environmental compartments. Nevertheless, information is available about the following subjects: sources and pathways of the elements; distribution and interactions between soluble and particulate forms; relationships with biota and with sediments; effect of geographical and geochemical features of the surrounding area (altitude, presence of ice, mineralogy, biological activity...); spatial and temporal variations in concentrations; presence of contaminations by potentially toxic metals. The following areas of Antarctica have been considered: i) the McMurdo Dry Valleys, in Southern Victoria Land, West Antarctica, with major emphasis on Lake Vanda but taking into account other lakes, such as Bonney, Hoare, Fryxell and Wilson; ii) the zone around Terra Nova Bay, Northern Victoria Land, in which data on Carezza Lake, Edmonson Point, Inexpressible Island and Tarn Flat, but also on many other small lakes and ponds, are available; iii) the Larsemann Hills, in Princess Elizabeth Land, East Antarctica, where more than a hundred small lake exist and extensive human activities are being carried out; iv) other areas less widely studied (from the point of view of lakes), such as Darwin Valley, Southern Victoria Land. The knowledge of the characteristics of Antarctic lakes can be of use for several purposes. First of all, they have few input and output mechanisms, so the study of biogeochemical cycles is relatively simpler and more informative than in lakes affected by human activities and/or located in more complex environments. Secondly, the collection of historical data series on the concentrations present in Antarctic lakes is helpful both to detect future contaminations and to monitor climate changes, since temperature levels and to the presence or absence of ice have a deep influence on the content of nutrients and other elements in waters. A critical discussion of analogies and differences among lakes enables to better understand the role of different parameters, such as lake location, pH, salinity, biological activity, composition of surrounding soil and rocks.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: Temporal Trends in soil contamination at McMurdo Station, Antarctica, from 1999-2010

Forename: Andrew Surname: Klein

Authors: Klein, Andrew; Sweet, Stephen; Wade, Terry; Sericano, Jose; Kennicutt, Mahlon;

Presentation Allocated: poster

abstract: Historic operations at McMurdo Station have left a legacy of environmental impacts and current station operations continue to have the potential for inadvertent releases of petroleum hydrocarbons and other materials into the local environment. Beginning in 1999, a long-term environmental monitoring program has collected and analyzed over 2,500 surface soil samples for total petroleum hydrocarbons and a selected suite of metals. From these samples, the spatial pattern of petroleum hydrocarbon and metal contamination has been mapped in detail across the station. However to date, temporal changes in soil contaminant concentrations have not been analyzed in detail. From 1999 through 2010 soil samples were collected across the station to assess overall levels of soil contamination. At locations where ongoing operations have the greatest potential for inadvertent release of materials into the environment, such as vehicle refueling/maintenance areas and the helicopter landing pad, a more intensive spatial sampling was performed. Using approximately seventy samples collected randomly across McMurdo Station each year, soil concentrations of total petroleum hydrocarbons (TPH) and lead, the two most commonly occurring contaminants, have been found to remain relatively static over the past decade. The mean and geometric means of soil TPH were below 82 and 12 ppm, respectively, over the study period. This compares to a mean soil TPH of less than 10 ppm measured at three control sites over the same period. For the same period, mean soil lead concentrations at McMurdo Station varied between 5 and 8 ppm, which also exceeded control site means (typically 2-4.5 ppm). However, for both TPH and lead, no temporal trends were found. No increases in soil TPH or lead concentrations were apparent for the more intensively studied sites. Tracking temporal changes in contamination at McMurdo Station remains challenging due to its spatial patchiness.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 16

Title: TRACE ELEMENTS IN SOFT-TISSUES OF THE ANTARCTIC BIVALVE LATERNULA ELLIPTICA

Forename: Cristian Surname: Vodopivec

Authors: Vodopivec, Cristian; Curtosi, Antonio; Mac Cormack, Walter Patricio; Pelletier, Emilien;

Presentation Allocated: poster

abstract: Human activities in Antarctic stations cause continuous low-levels contamination events. For this reason there exists an international consensus about the implementation of environmental monitoring programs in the Antarctic research stations. Although several previous studies have analyzed the presence and levels of different trace elements in soils, sediments and waters, investigation about the levels of these elements in biological matrixes are already scarce. The circumpolar bivalve mollusk Antarctic clam (*Laternula elliptica*) have been proposed as a suitable biomonitor for assessing both, natural and anthropogenic impacts. In this work, the levels of the trace elements Cd, Cr, Cu, Zn and Pb were measured in several soft-tissues (gills, digestive gland and kidney) of the Antarctic clam specimens collected from shallow sheltered areas at Potter Cove, King George Island (Isla 25 de Mayo), Antarctic Peninsula. Levels of Cd, Cr, Pb and Zn were significantly higher in the kidney than in the other tissues, while Cu level was significantly higher in digestive gland. Moreover, the levels of trace elements in all examined tissues increased with the body side (shell length). However the only one positive relationship with body side was found for Cd in gill. Our results regarding trace elements levels in *L. elliptica* were close coincident with those previously reported for Antarctica Peninsula, and could be considered as baseline levels. On the contrary, the relationship between trace element levels and body side was not matched with the trends observed for bivalves from King George Island. The results suggest that *L. elliptica* could be a useful as biomonitor for assessing changes in trace element in Antarctic coastal waters, but the effect of body side on trace elements accumulation need to be investigated in a more detailed way.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: A comparison of grounding zone flexure in two geometries over a 12-hour tidal cycle

Forename: Matthew Surname: Siegfried

Authors: Siegfried, Matthew; Fricker, Helen; Beem, Lucas; Christianson, Knut; Horgan, Huw; Tulaczyk, Slawek;

Presentation Allocated: Poster

abstract: The grounding zone of an ice shelf, where ice from the fully grounded ice sheet transitions to freely floating, is a critically sensitive location where land ice interacts with the ocean. The floating ice is in constant vertical motion with the ocean tides, and since the grounded ice does not respond to ocean tides, ice flexure occurs in the grounding zone. This flexing action can pump relatively warm, saline seawater upstream beneath the ice sheet. While the grounding zone can be mapped on large spatial scales using satellite data (SAR imagery or repeat-track laser altimeter profiles collected at different stages in the tidal cycle), the temporal sampling is limited and grounding zone flexure has never been studied continuously over a full diurnal tidal cycle. Here, we describe a high-rate, kinematic Global Positioning System (GPS) survey that acquired repeat surface elevation profiles over a 12-hour tidal cycle of two approximately 20 km, along-flow transects across the grounding zone of the Whillans Ice Stream, West Antarctica. One transect crosses a bedrock promontory, representing a “typical” (i.e. orthogonal to ice flow and roughly uniform in the cross-flow direction) grounding zone, while the second is over a bridged embayment. We combine these kinematic GPS surveys with GPS data from nearby permanent continuous stations to compare and contrast ice flexure mechanics between these two types of grounding zones. By improving our understanding of ice flexure on short timescales in different geometries, we can significantly improve our models of ice-ocean interactions both in the grounding zone and upstream.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Assessing microbial life in extreme subglacial Lake Vostok, East Antarctica from accretion ice-lake water boundary samples

Forename: Sergey Surname: Bulat

Authors: Bulat, Sergey; Marie, Dominique; Petit, Jean Robert;

Presentation Allocated: Oral

abstract: The objective was to estimate microbial content of accretion ice originating from frozen water of the subglacial Lake Vostok buried beneath 4-km thick East Antarctic ice sheet as well as first samples of the lake water (RAE57) with the ultimate goal to discover the life in this extreme icy environment. As a result, the DNA study constrained by Ancient DNA research criteria along with cell enumeration by flow cytometry pointed out that the deepest closest to the ice-water boundary accretion ice (3714m and deeper) contains the very low microbial biomass generating no reliable DNA signals and is comparable with background contamination level (a few cells per ml). The preliminary analyses of the first lake water samples being frozen on a drill bit at 3769.3m depth upon the subglacial Lake Vostok entry (February 5, 2012) are still in a progress, thus, leaving the possibility the life exists in the most upper water horizon of the lake water column. The findings will be reviewed in the context of what we expect to discover as well as in terms of astrobiology since the subglacial Lake Vostok settings are thought to be analogous to extraterrestrial icy moons and planets.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Distribution of fossil foraminifera from a middle shelf grounding zone wedge in Ross Sea, Antarctica: implications for the interpretation of the radiocarbon dates

Forename: Laura Surname: Coquereau

Authors: Coquereau, Laura; Bart, Philip; Warny, Sophie;

Presentation Allocated: Poster

abstract: Three back-stepping Grounding Zone Wedges (GZWs) occupy the axis of the Glomar Challenger Basin, a paleotrough of the WAIS in eastern Ross Sea, Antarctica. The chronology of GZW deposition is uncertain. Bart and Cone (2011) proposed that the middle shelf-grounding event terminated at 27.5 k.y. 14C BP as opposed to a previous estimate, which inferred that the grounding event occurred at 7.8 ky 14C BP. We conducted a detailed analysis to consider the possibility that the forams isolated by Bart and Cone (2011) are reworked. Sixteen species examined via Scanning Electron Microscope (SEM) were found to be benthic, one was planktonic (*Neogloboquadrina pachyderma*) and two were agglutinated (*Trochamina* sp. and *Textularia* sp). The benthic assemblage was dominated by *Globocassidulina sudglobosa* and *Epistominella exigua*. The diversity of forams is consistent with the view that these forams co-occurred in one microenvironment. The surface appearance of the planktonic foram indicates chemical alteration, which we attribute to a longer interval of diagenesis, i.e., the planktonic foram is reworked from older sediment. Minimal physical damage to the benthic forams primarily occurs on the last growth chamber, which is usually the weakest point or on sharp edges on some of the foram shells. Intact agglutinated forams suggest that they have not been recycled, i.e., recycling would have destroyed the fragile agglutinated shell. In addition to these analyses of the assemblage and damage, $\delta^{13}\text{C}$ data of in-situ and modern forams will be generated to provide information on the chemical properties of water masses existing at the time that the forams lived. If the forams are indeed from the Last Glacial Maximum (LGM) there should be a significant difference in the $\delta^{13}\text{C}$ value from the forams that lived in the modern ocean versus those that lived in the LGM ocean. The $\delta^{13}\text{C}$ of forams should therefore be usefully to assess whether the forams are in situ from the last glacial or reworked from a pre-LGM interglacial. As of present, the careful ongoing analysis supports the view that the WAIS retreated from the eastern Ross Sea middle shelf at 27.5 ky 14C BP.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Geophysical characteristics of Subglacial Lake Whillans and the ice stream grounding zone, West Antarctica

Forename: Robert Surname: Jacobel

Authors: Jacobel, Robert; Christianson, Knut; Horgan, Huw; Anandakrishnan, Sridhar; Alley, Richard; Muto, Atsuhiko; Petersen, Benjamin; Gobel, Rebecca; Keisling, Benjamin; Snyder, Lauren;

Presentation Allocated: Oral

abstract: Landscape evolution of the Southern Transantarctic Mountains is important for understanding the overall geomorphic history of the Transantarctic Mountains (TAM) as well as past ice sheet dynamics within these southern ice-free valleys. We are studying long term erosion rates of regolith in Moraine Canyon and Ong Valley, located at 86 and 83 degrees south in the Southern Transantarctic Mountains. Compared to the relatively well-studied coastal McMurdo Dry Valleys (MDV) located at 77 degrees south, the Southern Transantarctic Mountains have fewer biota and are expected to be colder and dryer. These colder and dryer conditions are expected to facilitate some of the slowest erosion rates on Earth. We present observations from our 2011/2012 field season. Exposure age dates are calculated with quartz and pyroxene from depth profiles of sample pits and glacial erratics. This study uses Be10, Al26 and He3 exposure ages to model rates of surface change and deglaciations in these interior valleys over the last several million years. Climate data was recorded from December 2011 to February 2012 using temperature probes and anemometers to characterize current environmental processes and also provide first records of hourly environmental conditions from these seldom visited areas.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Grounding Zone Heterogeneity on Whillans Ice Stream, West Antarctica

Forename: Knut Surname: Christianson

Authors: Christianson, Knut; Jacobel, Robert; Horgan, Huw; Anandakrishnan, Sridhar; Alley, Richard; Muto, Atsuhiko; Petersen, Benjamin;

Presentation Allocated: Oral

abstract: Grounding zones of ice sheets are critical to understanding marine ice sheet dynamics as processes here determine the mass flux from grounded to floating ice, and thus eventually to the ocean. Furthermore, basal hydrological processes at the grounding zone are critical to understanding inland ice sheet hydrology and the flux of subglacial water and sediment to the ocean. Despite this importance to ice sheet dynamics, comprehensive ground-based geophysical data over ice sheet grounding zones are sparse. Here we present the most comprehensive ground-based geophysical survey ever collected across an ice sheet grounding zone. Our data consist of over 1000 km of kinematic GPS data, over 650 km of ice-penetrating radar data, and approximately 50 km of active-source seismic data collected over the grounding zone of Whillans Ice Stream. These data show that grounding zones that have significantly different surface expressions (in the form of either differing surface slopes, recent grounding line behavior, or grounding zone width) also have significant differences in basal features and processes which are important to capture in ice flow models. Here we contrast a grounding zone embayment (an area where subglacial water from several subglacial lakes is suspected to drain to the ocean) with a grounding zone promontory (characterized by steep surface slopes). Our results indicate that the embayment is characterized by less dramatic surface and basal slopes and less basal reflectivity contrast across the grounding zone. This suggests that there is less of a barrier to seawater intrusion into, and possibly, upstream, of the low-tide grounding line. In contrast, data collected over the promontory depict steep surface slopes, dramatic ice thinning across the grounding line, and a strong contrast in basal reflectivity. This indicates that the grounding zone in this promontory is likely a strong barrier to seawater intrusion and thus to grounding zone retreat. These results suggest the need to include better parameterization of grounding lines into ice sheet models based on the most salient processes operating at the ice/bed interface in a specific geographical area. Thus current ice sheet models that use a single depiction of an ice sheet grounding zone over a wide geographical area are likely inadequate to simulate accurate ice sheet behavior, especially in response to a warming ocean or wind-induced changes in ocean circulation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Grounding Zone Structure and Bathymetry from Active Source Seismic Surveying, Whillans Ice Stream, West Antarctica

Forename: Huw Surname: Horgan

Authors: Horgan, Huw; Anandakrishnan, Sridhar; Christianson, Knut; Jacobel, Robert; Alley, Richard;

Presentation Allocated: Oral

abstract: Grounding zones mark the potentially unstable junction between an ice sheet and its ice shelf. The stability of a grounding zone is determined by the interplay of ice thickness, sub-ice topography and bathymetry, and sea level. Wedges of sediment deposited at the grounding zone can temporarily stabilize the system against migration. Despite recent improvements in grounding zone modeling, observational data from modern grounding zones remain scarce; current understanding has mainly been gleaned from remotely sensed data, a few ground based observations, and marine geophysical observations of paleo grounding zones. Here we present approximately 50 km of high resolution active source seismic data acquired across the grounding zone of Whillans Ice Stream as part of the Whillans Ice Stream Subglacial Access Research Drilling (WISSARD) program. We contrast two grounding zone settings: (1) an embayment and proposed subglacial water outlet, and (2) an adjacent promontory. The data clearly show the extent of subglacial and ocean water, and reveal sedimentary structures indicative of active deposition. The grounded ice stream overlies soft sediments with deeper geological structures influencing the grounding zone location at the promontory location. Beneath the floating ice shelf the water column is thin with thicknesses of less than 15 m observed throughout the survey region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Local Variability in Basal Reflectivity Across the Grounding Zone of Whillans Ice Stream from Ice Penetrating Radar

Forename: Ben Surname: Keisling

Authors: Keisling, Ben; Christianson, Knut; Horgan, Huw; Jacobel, Robert; Anandakrishnan, Sridhar; Petersen, Benjamin;

Presentation Allocated: Poster

abstract: Here we present several adjacent ice-penetrating radar profiles collected parallel to ice flow across the grounding zone of Whillans Ice Stream. The grounding zone in this area is oriented roughly orthogonal to ice flow. Basal reflectivity changes by ~5 dB across the grounding line in both profiles, but the most dramatic change in basal reflectivity is located down-glacier of the low-tide grounding line (identified from satellite imagery). As the ice transitions from grounded to floating, the basal power roughness also decreases in amplitude; this shift in basal power roughness coincides with the low-tide grounding line. Although both profiles show that the ice thins as it flows across the grounding zone, the amplitude of the thinning varies by a factor of two between profiles. The variability in subglacial reflectors (inferred to be off-nadir echoes from basal crevasses) indicates significant local variation (over an area of ~10 km²) in the ice stream's basal stress across the grounding zone. This suggests that it may be necessary to include spatially variable treatment of grounding lines in ice sheet models. In addition to the radar profiles, we also present continuous GPS data collected along these profiles and use these data, in combination with the radar data, to calculate changes in the basal hydropotential, stress, and ice velocity in response to tidal forcing.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Microbial life in the iron-rich, anoxic cryobrine of Lake Vida, Antarctica

Forename: Emanuele Surname: Kuhn

Authors: Kuhn, Emanuele; Murray, Alison E.; Dugan, Hilary; Ichimura, Andrew S.; Edwards, Ross; Peng, Vivian; Fritsen, Christian H.; Kenig, Fabien; Young, Seth; Doran, Peter;

Presentation Allocated: Poster

abstract: Lake Vida, situated in the Victoria Valley, East Antarctica, is the largest of the lakes in the McMurdo Dry Valleys. Most of the Dry Valleys lakes are perennially covered with 3 to 6 m of ice, but Lake Vida is a 27+ meter thick block of ice permeated by brine channels below 16 m and intercalated by thick sediment layers below 21 m. The interstitial, anoxic brine (20% salinity) is among the coldest, stable liquid cryohabitats known on Earth, which has been isolated from the atmosphere and light for over 2800 years. Field expeditions in 2005 and 2010 to sample the ice and interstitial brine have revealed a unique ecosystem with a temperature of -13.4°C , pH of 6.2, and high solute concentrations [e.g. Fe ($>300\ \mu\text{M}$), NH_4^+ (3.6 mM), N_2O ($>58\ \mu\text{M}$), and dissolved organic carbon ($580\ \text{mg L}^{-1}$)]. The brine contains a Bacteria dominated microbial community ($10^7\ \text{cells mL}^{-1}$) composed of two cell size classes: $\geq 0.5\ \mu\text{m}$ ($10^5\ \text{cells mL}^{-1}$) and $0.2\ \mu\text{m}$ ($10^7\ \text{cells mL}^{-1}$). According to 16S rRNA genes analysis, eight bacterial phyla are present in the brine: Proteobacteria (Gamma, Beta, Epsilon and Delta), Lentisphaerae, Firmicutes, Spirochaetes, Bacteroidetes, Actinobacteria, Verrucomicrobia, and candidate Division TM7. Eukarya and Archaea have not been detected, as of yet. Energy-dispersive x-ray spectroscopy combined with electron microscopy of the environmental samples indicates the presence of an iron oxide layer on the majority of cell surfaces, and an uncharacterized matrix linking many of the cells. Incorporation of ^3H -leucine, showed very low rates of protein biosynthesis at the in situ temperature of -13.4°C . Moreover, the ratio of DNA:RNA extracted from biomass collected was very high (100:1). These results are consistent with an active microbial brine population being mixed with a potentially inactive microbial population. It is hypothesized that the sediment layers in the lower ice represent periods of time when the climatic regime in the Victoria Valley led to low glacial melt and fluvial input, which caused a lowering of the lake level and gradual accumulation of sediment deposits. Thus, the anoxic, near-freezing, salty, iron-rich environment of Lake Vida not only provides an ideal model for the study of life in icy worlds, but may also act as a proxy for microbial ecosystems which existed in the Dry Valleys under altered climatic conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Modeling hydrologic connections between Subglacial lakes in Kamb and Whillans ice streams.

Forename: Sasha Surname: Carter

Authors: Carter, Sasha; Siegfried, Matthew; Fricker, Helen;

Presentation Allocated: Oral

abstract: Subglacial water transfer from upper Kamb Ice Stream (KIS) to lower Whillans Ice Stream (WIS) is believed to provide some of the lubrication that allows lower WIS to slide despite widespread freezing conditions at its base. The combined rates of volume increase for largest subglacial lakes within lower WIS (inferred from ICESat laser altimetry) appear to require more meltwater input than can be provided from upper WIS alone, and are evidence in support of the hypothesized water piracy from upper KIS. Most of the water generated in upper KIS passes through one of two subglacial lakes that we call "Kamb 1" and "Kamb 5"; therefore, the evolution of these upper lakes impacts the subglacial hydrology of lower WIS. Kamb 1 is of particular interest due to its proximity to a hydraulic divide that currently prevents water generated in upper KIS from reaching lower KIS. Here we combine ICESat-derived estimates of the lake volume changes with a model for subglacial hydrology to better understand the co-evolution of subglacial lakes in upper KIS and lower WIS. With a model for subglacial lake drainage we predict assess how the time scales of lake drainage in upper KIS in relation to ongoing field work in lower WIS. Our initial results suggest that subglacial lakes and the pathways that connect them may change position over timescales of years to decades rather than centuries.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Nature of microbial life in a former Antarctic subglacial lake environment

Forename: Gavin Surname: Burns

Authors: Burns, Gavin; Pearce, David; Hodgson, Dominic; Cockell, Charles;

Presentation Allocated: Oral

abstract: Antarctic subglacial lake ecosystems have the potential to be one of the most extreme and interesting environments on Earth, with combined stresses of high pressure, low temperature, permanent darkness, low-nutrient availability and variable oxygen concentrations, where the predominant mode of nutrition is most likely to be chemoautotrophic. Direct exploration of subglacial lakes buried deep under the Antarctic Ice Sheet has yet to be achieved. However, at retreating margins of the ice sheet, there are a number of locations where former subglacial lakes are emerging from under the ice but remain perennially ice covered. Here we present a study of one of these lakes, Hodgson Lake (72° 00.549'S, 068° 27.708' W) and the microbial life it contains. With three ambitious projects likely to access subglacial Antarctic lake ecosystems for the first time during the next two years, an opportunity now exists to address some fundamental scientific questions about their microbial ecology.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Prediction of sedimentary succession in Lake Vostok

Forename: German Surname: Leychenkov

Authors: Leychenkov, German; Popkov, Anatoliy;

Presentation Allocated: Oral

abstract: In early February 2012, the drill hole at the Vostok Station encountered the Lake Vostok water. This step is important to study the lake composition including possible microbial life and to model subglacial environments however the next ambitious target of the Vostok Drilling Project is sampling of bottom sediments which contains the unique record of ice sheet evolution and environmental changes in central Antarctica for millions of years. In this connection, the forecast of sedimentary succession based on existing geophysical data, study of mineral inclusions in the accretion ice cores and tectonic models is important task. Interpretation of Airborne geophysical data suggests that Lake Vostok is the part of spacious rift system which exists at least from Cretaceous. Reflection and refraction seismic experiments conducted in the southern part of Lake Vostok show very thin (200-300 meters) stratified sedimentary cover overlying crystalline basement with velocity of 6.0-6.2 km/c. At present, deposition in southern Lake Vostok is absent and similar conditions occurred likely at least last 3 m.y. when ice sheet above Lake Vostok changed insignificantly. It can be also inferred that from the Late Miocene the rate of deposition in Lake Vostok was extremely low and so the most of sedimentary section is older being possibly of early to middle Miocene age when ice sheet oscillated and deposition was more vigorous. If so, the sampling of upper few meters of this condensed section is very informative in terms of history of Antarctic glaciation. Small thickness of sedimentary cover raises a question about existence of lake (rift) depression during preglacial (and/or sin-early glacial) times. Seismic data indicate that no accommodation space for sediments (bedrock depression) occurred likely before the Miocene. The composition of bottom sediments can be tentatively proposed from rock/mineral inclusions found in cores of the accreted ice (these inclusions were entrapped by ice from the shallow lake floor in the south-western part of the lake). Ten inclusions have been investigated using state-of-the-art analytical techniques. Six of them comprise soft aggregates mainly consisting of clay-mica minerals and micron-sized quartz grains and accessories, while four others contains subangular to semi-rounded lithified clasts (0.3 to 4.5 mm in size) identified as siltstones and sandstones. These rock clasts are thought to be the products of ice erosion of the Paleozoic platform

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Sediment Characteristics of Subglacially Drained Sediments from Pine Island Bay, West Antarctica

Forename: Alexandra Surname: Kirshner

Authors: Kirshner, Alexandra; Anderson, John; Branecky, Carolyn; Szczuciński, Witold;

Presentation Allocated: Poster

abstract: Subglacial fluvial networks and sedimentary deposits interpreted as having been derived from subglacial water discharge have been identified in two locations in Antarctica where large paleo-ice streams existed during the Last Glacial Maximum, Marguerite Bay and Pine Island Bay (e.g. Kennedy and Anderson, 1989; Lowe and Anderson, 2003; Kirshner et al, 2012). These now ice-free regions allow for unobstructed views of the basal conditions, quantification of storage potential for subglacial water and mapping of transport pathways, as well as sediment acquisition and analysis. Swath bathymetry records from the inner part of Pine Island Bay show a particularly well-organized (convergent seaward) sub-glacial drainage network sculpted in bedrock. Deep channels connect otherwise isolated basins where considerable volumes of water could have been stored. As the grounding line receded, water within these basins would have been discharged. The bay floor is carpeted in a unique glacimarine sedimentary facies composed of moderately sorted silt that is virtually lacking in fossils and ice-rafted material. It is a draping unit that thickens landward, indicating widespread dispersal by sediment-laden plumes emanating from beneath the ice stream. Grain shape analyses are used to better understand the mode of transport. Radiocarbon ages and ^{210}Pb profiles are used to calculate the rate of deposition for the meltwater silt unit and to estimate sediment flux. We use this information for a more complete reconstructed glacial history and assess the feedback between changes in meltwater storage, ice thickness, hydrologic head and ice stream activity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: SEEKING FOR THE SEDIMENTARY RECORDS IN SUBGLACIAL BASINS IN GROVE MOUNTAINS, INTERIOR EAST ANTARCTICA

Forename: Xiaohan Surname: LIU

Authors: LIU, Xiaohan; JU, Yitai; HUANG, Feixin; WANG, Zemin; ZHOU, Xuejun;

Presentation Allocated: Poster

abstract: SEEKING FOR THE SEDIMENTARY RECORDS IN SUBGLACIAL BASINS IN GROVE MOUNTAINS, INTERIOR EAST ANTARCTICA. Liu Xiaohan¹, Yitai Ju², Feixin Huang², Zemin Wang³ and Xuejun Zhou¹. ¹Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China; ²Mineral Resource Institute of China Metallurgical Geology Bureau, Beijing, China; ³Mapping College of Wuhan University, Wuhan, China. xhliu@mail.iggcas.ac.cn. **Keywords:** hidden sedimentary records of the EAIS; ice-radar exploration; frontal outwash basin. The Grove Mountains emerge as a group of 64 isolated nunataks scattered over an area of ~3 200 km² within the EAIS (72°20'S to 73°10'S, 73°50'E to 75°40'E). These nunataks consisted of 5 subglacial ranges as a ridge-valley set in NNE trend. The regional ice flows north-westwards, away from the central part of the EAIS (i.e., Dome Argus), perpendicular to such rocky ranges. Land based multi-disciplinary study of past ice surface elevations in Grove Mountains, including the glacial geology, the cold desert soils, the depositional environment of younger moraine sedimentary boulders and their spore pollen assemblages, and the bed rock cosmogenic nuclide exposure ages, imply a possible significant shrinkage of the Ice Sheet around Pliocene Epoch, with the Ice Sheet margin retreated to south of the Grove Mountains (~450 km south from its present coastal position). Such a dramatic history of the EAIS should have left over some of complex set of frontal outwash basins system, as the paleo-margin of the EAIS behind the Grove Mountains during its collapse. The key records which describe such scenario might be hidden up in such basins. The snow-ledge ice-radar exploration looking for the subglacial topography has been carried out, and the preliminary results show some trends in central part of the Grove Mountains. It is planning, base on the ice-radar data, to actualize the ice-geological core drilling at such palaeo-sedimentary basins (a different sort of sub-glacial lake) in the Grove Mountains in next step of CHINARE.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Thermobaric Conditions in Antarctic Subglacial Reservoirs

Forename: Pavel Surname: Talalay

Authors: Talalay, Pavel; Markov, Alexey;

Presentation Allocated: Poster

abstract: Prediction of the thermobaric conditions in Antarctic subglacial reservoirs is one of the most important challenges in relation to study gas hydrate formation, water circulation, unique habitat for life, accretion processes on the bottom side of the ice sheet, etc. Estimation of the thermobaric conditions is especially important in a view of the planning projects to access and to directly sample subglacial lakes. The borehole temperature measurements from Vostok, Dome C, Base Kohnen, and Dome F deep boreholes were carefully analyzed and converted to the polynomial approximation. These equations give the opportunity to predict temperature conditions at the bed of ice sheet taking into account that the basal ice temperature above subglacial reservoirs is equal to the pressure melting value. The shape of temperature profile and temperature gradient obtained in different boreholes are compared and interpreted. Calculations indicate that the geothermal heat flux on ice sheet bed at Dome C, Base Kohnen, and Dome F sites varies in between 51.1-62.7 mW m⁻². The geothermal heat flux at Vostok on the boundary ice – subglacial water is lower and equal to 46.2 mW m⁻². The temperature at the ice sheet bed at Vostok is estimated at –2.9 deg. C accounting pressure melting point and Clapeyron temperature-pressure slope for hydrate-ice. Typically the pressure on the boundary of ice sheet and subglacial reservoir is estimated by employing the main hydrostatic equation $P = \rho gh$, where g is gravity, ρ is ice density, and h is ice thickness. First of all, it is necessary to account the ice density varieties with depth. Then the ice thickness should be taken as average thickness of ice lying over the total surface of the enclosed subglacial reservoir. As an example, the thickness of ice over Lake Vostok is varied from 3600 m on the south to 4350 m on the north. The average ice thickness here is 4 091 m estimated due to the total ice volume located over lake and surface of the lake. Under an assumption of hydrostatic equilibrium on the boundary of ice sheet – Lake Vostok the pressure should be the same and equal to approx 36.7 MPa.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 17

Title: Whillans Ice Stream Subglacial Access Research Drilling (WISSARD) Project: Progress and Plans

Forename: Slawek Surname: Tulaczyk

Authors: Tulaczyk, Slawek; Powell, Ross; Priscu, John; Fricker, Helen; Behar, Alberto; Anandakrishnan, Sridhar; Christner, Brent; Fisher, Andrew; Holland, David; Horgan, Huw; Jacobel, Robert; Mikucki, Jill; Scherer, Reed; Schwartz, Susan; Severinghaus, Jeff; Skidm

Presentation Allocated: Oral

abstract: The Whillans Ice Stream Subglacial Access Research Drilling (WISSARD) project is an integrative study of ice sheet stability and subglacial geobiology in West Antarctica, funded in 2009 by the Antarctic Integrated System Science Program of National Science Foundation's Office of Polar Programs, Antarctic Division. The overarching scientific objective of WISSARD is to assess the role of water beneath a West Antarctic Ice Stream in interlinked glaciological, geological, microbiological, geochemical, and hydrological systems. The WISSARD's important science questions relate to (1) the role that subglacial and ice shelf cavity waters and wet sediments play in ice stream dynamics and mass balance, with a focus on the possible future of the West Antarctic Ice Sheet and (2) the microbial metabolic and phylogenetic diversity in these subglacial environments. The study area is the downstream part of the Whillans Ice Stream on the Siple Coast, specifically Subglacial Lake Whillans. We will give an overview of scientific progress of the project, based on the preliminary results of the first two field seasons of geophysical investigations and modified plans for borehole sampling and measurements in 2012-13 and 2013-14 seasons.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 18

Title: Biochemical analyses and foraminiferal assemblages in an active methane seep environment, Seymour Island (Marambio), Archipelago of James Ross, Weddell Sea, Western Antarctic: Preliminary results

Forename: Wania Surname: Duleba

Authors: Duleba, Wania; Teodoro, Andreia; Gubitoso, Silas; Debenay, Jean-Pierre; Braga-Silva, Juliana; Rocha-Campos, Antonio;

Presentation Allocated: Poster

abstract: The collapse of a significant portion (12,500 km²) of Larsen ice shelf, together with the increase of the atmospheric temperature in western Antarctic during the last decades, raised the question of the impact of methane seeps on the benthos in cold waters. It is reported that the rapid heating of the Weddell Sea would induce thermal dissociation of gas hydrate in the area of Admiralty Sound, between Seymour and Snow Hill islands. Studies carried out in the area revealed gas seeps (mostly methane) in shallow areas (10-12m). A sampling campaign was carried out around one of these seeps in March 2011. Nineteen stations were sampled off Seymour Island, between Boadman Point and Arguindeguy Strait. At each station, physico-chemical parameters were measured in surface, bottom, and intermediate waters. Superficial sediments were collected for grain size analysis, biogeochemical analyses, and analyses of the meiofauna (foraminifera). The study area is shallow (5.7 to 10.15m) and weakly stratified. Water temperature and salinity ranged from -1.16°C to -1.58°C and from 30.8 to 32.6, respectively. The pH is slightly alkaline (7.98 - 8.62). Values of Eh (39 - 211mV) and of dissolved oxygen (6.21 - 13.53 mg l⁻¹) indicate an oxic water column. Sediments are mostly lithoclastic (CaCO₃ < 30%), muddy, with negative values of Redox potential and high concentrations in S (0.2 - 0.4%). Concentrations of total organic carbon (0.4 - 0.8%) and total nitrogen (0.01 - 0.07) are low. The values of C/S ratio (0.5 - 3) indicate a sediment deposition in hypoxic to anoxic conditions, under a water column mostly oxic, with periodic hypoxia. The values of C/N ratio (4 - 52) suggest organic matter predominantly of continental origin, secondarily mixed with organic matter of marine origin. Assemblages of stained (living) foraminifera are dominated by monothalamous species (*Gloioquillmia* sp., *Psammophaga* sp., *Micrometula* sp.) followed by agglutinated species (*Astrammmina rara*, *Crithionina* sp., *Lagenammmina arenulata*, *Reophax* sp.), with rare calcareous specimens. These assemblages have strong similarity with assemblages reported from Admiralty Bay (King George Island, South Shetland Islands, Antarctica), but are different from assemblages of temperate regions subjected to methane seep. Projeto PROANTAR (557036-2009-7)

SCAR OSC 2012 - Portland July 16th-19th

Session number: 18

Title: The ESR hydrothermal vent ecosystems

Forename: Katrin Surname: Linse

Authors: Linse, Katrin; Tyler, Paul; Rogers, Alex; Consortium, ChEsSO;

Presentation Allocated: Poster

abstract: Since 2009 the NERC ChEsSO consortium and their WHOI collaborators have explored two segments of the East Scotia Ridge. In each segment we located deep-sea hydrothermal vents hosting high-temperature black smokers up to 382.8 °C and diffuse venting. The chemosynthetic ecosystems hosted by these vents are dominated by a new yeti crab (*Kiwa* n. sp.), stalked barnacles, limpets, peltospiroid gastropods, anemones and a predatory sea star. Abundant taxa from vent ecosystems in other oceans, including polychaete worms (*Siboglinidae*), bathymodiolid mussels, and alvinocarid shrimps are absent from the East Scotia Ridge vents. Evidence from the distinctive micro- to megafauna of the Antarctic vent ecosystems, their unique community structure and multivariate analyses suggest that they represent a new vent biogeographic province. However, multivariate analyses of species present at the East Scotia Ridge and other deep-sea hydrothermal vents globally indicate that vent biogeography is more complex than previously recognised. Here we present data on the topology, geochemistry, microbiology and biology of the ESR hydrothermal vents.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: A landscape on the threshold of change: The McMurdo Dry Valleys

Forename: Andrew G. Surname: Fountain

Authors: Fountain, Andrew G.; Pettersson, Rickard; Levy, Joseph;

Presentation Allocated: Oral

abstract: The McMurdo Dry Valleys are projected to warm in the next 30-50 years as the first mode of the Antarctic Oscillation weakens due to the global effects of climate warming. Dramatic landscape changes in the valleys are expected due to the melting of ice-cemented permafrost and particularly to the melting of subsurface deposits of excess ice (ice volumes exceeding soil pore space). We have already witnessed this future in Garwood Valley where thermal erosion of buried glacier ice has caused large scale changes in stream morphology resulting in bed erosion of more than 5 m in places. Permafrost is a recognized and ubiquitous feature in the McMurdo Dry Valleys, however, the distribution of subsurface excess ice is not well known. To locate hidden subsurface ice and to associate surface morphology with such deposits, we used ground-penetrating radar and remote sensing imagery to survey multiple valleys. Results point to pervasive deposits of excess ice associated with a range of geomorphic. The spatial extent and thickness of the massive ground ice varies considerably and ranges from $\sim 10^2$ thick ice covering extensive areas in some valley mouths to thin deposits (10^1 - 10^0 m thick) associated with local alpine glaciers and streams. The source of the excess ice, however, is not always obvious. We offer a qualitative model for the distribution of subsurface ice on or near the valley floors. Thick deposits of laterally extensive (10^3 m) subsurface ice in valley bottoms result from the intrusion of the East Antarctic Ice Sheet into coastal valleys during the last glaciation. Alpine glaciers deposit ice locally, lateral extents of 10^2 m, because they probably have not enlarged significantly over the last $\sim 10^6$ years. Stream icings are generally laterally short (10^0 m) and localized to the current channels and pools. In all cases, the ice has to be covered with either rock debris or sediment to reduce ice ablation. The ice may ablate significantly if exposed by erosion or by lake formation. The bottom waters of the Dry Valley lakes are known to warm to temperatures well above freezing by trapping solar energy thus providing a significant heat source for melting subsurface ice. The optimal location for preserving buried is high on the valley walls where debris avalanches on to the ice and paleo-lake levels do commonly not reach. This model can explain the general distribution of subsurface ice in the valley bottom of Garwood, Taylor, and Wright valleys.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Active Layer Thermal Regime at Fumarola Bay, Port Foster, Deception Island

Forename: Bruno Surname: Resck

Authors: Resck, Bruno; Michel, Roberto; Schaefer, Carlos; Francelino, Márcio; Simas, Felipe;

Presentation Allocated: Poster

abstract: Deception Island is located in the South Shetland Archipelago at 62°43'S, 60°57'W. The climate at sea level is cold oceanic, with frequent summer rainfall in low areas and a moderate annual temperature range. Air temperature data taken around Livingston and Deception Islands reflect a mean air temperature range of -3.2 °C to -1.6 °C. This paper describes the active layer thermal regime over 22 months, of a site located at Fumarola Bay, Port Foster. The active layer monitoring site was installed in February 2009, and consist of thermistors arranged as a vertical array with probes monitoring air and soil temperature at different depths (P1-5 cm, P2-10 cm, P3-50 cm and P4-70 cm) down to the permafrost table; all probes are connected to a Campbell Scientific CR 1000 data-logger, recording data at hourly intervals. We calculated the thawing, freezing, isothermal and freeze-thaw days; the thawing degree days and the freezing degree days, all according to Guglielmin et al. (2008). Daily estimations of soils apparent thermal diffusivity (ATD) were made, according to McGaw et al. (1978). The active layer thermal regime at Fumarola Bay is characterized by low temperature fluctuations around 0 °C (11 °C difference between max and min at P1). Apparent thermal diffusivity (average of the winters from 2009 and 2010) shows elevated buffer capacity starting at P3 (1,03E-05 m² s⁻¹ and -1,60E-0,4 m² s⁻¹ ATD for P2 and P3). The highest daily average soil temperature was 4.26 °C and occurred in February, while the highest hourly temperature recorded was 6.25 °C, both at 5 cm depth. Temperatures averaged 1.85 °C, 0.52 °C, 0.37 °C, 0.22 °C and 0.10 °C for air, P1, P2, P3 and P4 respectively during the studied period. All depths presented a frozen or Isothermal daily regime predominantly (277, 224, 75 and 0; 282, 360, 591 and 671 for P1, P2, P3 and P4 frozen and Isothermal days respectively). Total thawing degree days were limited, specially in depth (211.33 °C, 98.13 °C, 10.18 °C and 0.00 °C for the increasing depths), on the other hand freezing degree days were considerable reaching -567,88 for P1 and -588.12 at P2, in depth values were -234,30 (P3) and -138,02 (P4). The active layer thermal regime at Fumarola Bay in the studied period, shows little temperature variation around the freezing point of water, influenced by low ATD values, specially at lower depths.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Active Layer Thermal Regime over Patterned Ground at Fildes Peninsula, King George Island

Forename: Roberto Surname: Michel

Authors: Michel, Roberto; Schaefer, Carlos; Simas, Felipe; Guerra, Marcelo; Almeida, Ivan;

Presentation Allocated: Poster

abstract: Permafrost-affected soils normally present an active layer, which is defined as the portion of the soil which experiences seasonal thawing and freezing (Brown et al., 2000). The active layer and permafrost are key components of the terrestrial cryosphere due to their high sensitivity to climate change (Kane et al., 2001; Smith and Brown, 2009). This study presents soil temperature regime from March 2009 to January 2011 for one active layer monitoring (CALM-S) site at King George Island, Maritime Antarctica. The monitoring site was installed at the Meseta Norte (where patterned ground is present) and consist of thermistors (accuracy of ± 0.2 oC), installed in the center and edge of a low-centered polygon at different depths. We calculated the thawing, freezing, isothermal and freeze-thaw days; the thawing degree days and the freezing degree days, all according to Guglielmin et al. (2008). Daily estimations of soils apparent thermal diffusivity (ATD) were made, according to McGaw et al. (1978). The active layer thermal regime in the studied period for both conditions (center and edge) was typical of periglacial environments, with extreme variation in surface temperature and more buffered conditions in depth. Temperatures averaged -1.8 °C, -1.8 °C, -1.7 and -1.9 °C, -1.8 °C and -1.8 °C for 10 cm, 30 cm and 50 cm center and edge respectively during the studied period. The great majority of the soil temperature readings was negative, near freezing point, resulting in low values of thawing degree days (210.55 oC, 88.44 oC, 12.04 oC and 239.10 oC, 81.52 oC, 8.92 oC; for 10 cm, 30 cm and 50 cm center and edge respectively). Both conditions have poor thermal apparent diffusivity ($-1.8E-5$ and $-2.0E-5$, center and edge) but values were higher for the center of the polygon. Considering the thawed, frozen, isothermal and freeze-thaw days, contrasts show a preponderance of frozen and freeze-thaw days in depth for the edge of the polygon and more isothermal days in the center of the polygon. The temperature profile of the studied soil indicates colder conditions with slightly smaller ATD. Longer data sets are needed for more conclusive analysis.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Characterizing spatiotemporal dynamics of wetted soils across a polar desert landscape, McMurdo Dry Valleys Antarctica

Forename: Zachary Surname: Langford

Authors: Langford, Zachary;

Presentation Allocated: Poster

abstract: The McMurdo Dry Valleys is a landscape characterized by open expanses of bare soils, alpine and piedmont glaciers, and ice-covered lakes on the valley floors, all underlain by permafrost. There is contemporary evidence of changes to the near-surface hydrology of the Dry Valleys as extensive wet soil patches are being observed extensively throughout the valleys. The availability and movement of water across this landscape may drive important shifts in the interactions among meteorology, hydrology and biogeochemical processes. Wetted soils are generally found adjacent to streams and lakes, but have also been observed far from lake shorelines and channels. The relative contributions of water to the development of wetted zones from glaciers, ablated snow patches and melted permafrost has not been established. We evaluate the spatio-temporal variability of retrieved near surface soil moisture using high resolution optical data from Quickbird and Worldview satellites to document the occurrence, dimensions, and growth of wet spots during the 2010-11 and 2011-12 austral summers over Taylor Valley. The patterns on the distributed estimates of soil moisture are extracted from the satellite imagery based on an artificial neural network (ANN). The ANN is trained with field derived estimates of soil moisture and reflectance from a portable radiometer. Additionally, we compare patterns in surface moisture to those in snow accumulation and ablation as well as proximity to glacier termini.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Chemical and mineralogical characteristics of acid sulfate soils from Seymour island, Weddel Sea, Antartica

Forename: Katia Karoline Surname: Delpupo Souza

Authors: Delpupo Souza, Katia Karoline; Nogueira Bello Simas, Felipe; Noses Spinola, Diogo; Daher, Mayara; Gonçalves Reynaud Schaefer, Carlos Ernesto;

Presentation Allocated: Poster

abstract: Seymour Island is located in the Weddel Sea and is formed by marine sediments dated from the Cretaceous to the Lower Tertiary, cut by basaltic dykes. The presence of sulfides formed in this estuarine sedimentary paleoenvironment strongly influence soil genesis. We characterized acid sulfate soils from Seymour regarding their morphological, chemical and mineralogical properties. Soil samples were air dried and passed through 2 mm sieves. After removal of water soluble salts, the samples were submitted to chemical and physical analyses such as: pH in water, potential acidity (H + Al), exchangeable bases, total organic carbon, electric conductivity, soil texture and color. Clay fraction mineralogy was assessed by X-ray diffraction. The studied soils are deeply affected by the oxidation of sulfide-bearing sediments in a semi polar desert condition, resulting in low pH values and formation of secondary minerals. Most soils have a yellowish, oxidized, strongly acidic horizon in the upper part of the profile with a sharp transition to the underlying greyish, alkaline, horizon which usually coincides with the dry permafrost. These two clearly different horizons have distinct chemical and mineralogical characteristics. In oxidized horizons high levels of H +Al are observed. Since organic carbon is extremely low, the pH-dependent charges are attributed to poorly crystalline iron oxides (ferrihydrite) which are formed during the oxidation of sulfides to sulfate. Despite the acid pH, soils are also salic and natric which is a widespread characteristic of soils under such semi polar desert conditions. Exchangeable Al³⁺ is relatively high in these yellowish horizons when compared alkaline soils of the same region. The clay fraction is composed by chlorite, quartz, jarosite, natrojarosite and anidrite. Double layered clays are also present but X-ray diffractions indicate that these minerals are less ordered in these acidic pedoenvironment in relation to 2:1 clays in the alkaline horizon. In the latter, basic sulfates such as alunite and gypsum are present along with iron sulfides (pyrite). Soil CEC is due exclusively to permanently charged 2:1 minerals as indicated by the extremely low values of H + Al. Soils affected by sulfates show the highest degree of chemical weathering in Seymour. Apparently, the oxidation of sulfides is retarded in depth in the permanently frozen ground.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Classification of Antarctic soils under bird-guano influence by cluster analysis

Forename: Carlos Ernesto G. Surname: Schaefer

Authors: Schaefer, Carlos Ernesto G. R.; Souza, José João Lelis Leal; Souza, Kátia Karoline Del Pupo; Lopes, Davi do Vale; Simas, Felipe Bello Nogueira;

Presentation Allocated: Poster

abstract: Birds play an important role in sea nutrients return by guano to the land area. Several studies show that significant changes are marked in mineralogical, chemical, physical and morphological original characteristics in soils nested by birds in Marine Antarctic. Considering the different lithologies and climate conditions presented, this study aimed to evaluate the success of distinction and clustering of ornithogenic and not ornithogenic soils of Marine Antarctic by routine methods of soil analysis. It was collected 163 soil profiles distributed through King George Island, Deception Island, Penguin Island and Livingston Island during the austral summers of 2002 and 2010. Properties related to particle size, to the exchange complex, to the content of organic matter and the reactive components of the soil were tabulated for the study. The variables were analyzed using principal component analysis (PCA), whose estimates were based on variance and covariance matrices of standardized data and weighted by the respective coefficients of variation, with mean zero and variances different from one. The clustering was performed using the Ward method, using Euclidean distance as dissimilarity measure. To determine the final number of groups, after the construction of the dendrogram according to the defined matrix, it was adopted, as a criterion, a level of at least 80% of similarity among the soil profiles of the same group. Cluster analysis allowed us to distinguish five groups of soils according to the intensity of occupation of birds and mammals on them, with high percentage of success. The correct classification of Marine Antarctic profiles between ornithogenic and not ornithogenic soils can be effectively performed based on the content of extractable P by Mehlich-1 and total acidity. Values above 50 mg.dm⁻³ of P and acidity above 10 cmolc.dm⁻³ indicate ornithogenesis.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Clay fraction mineralogy of cryogenic soils from Fildes Peninsula, Maritime Antarctica

Forename: Thiago Surname: Mendonca

Authors: Mendonca, Thiago; de Freitas Melo, Vander; Goncalves Reynaud Schaefer, Carlos Ernesto; Ferreira Machado Michel, Roberto; Nogueira Bello Simas, Felipe;

Presentation Allocated: Poster

abstract: Studies on clay fraction mineralogy of soils from maritime Antarctica are relatively scarce. In order to contribute for a better understanding of mineralogical transformations in soils of Antarctica, we characterized and compared the clay mineralogy of four representative soils from Fildes Peninsula, the largest ice-free area in maritime Antarctica, with different degrees of ornithogenic influence. Soil samples were air-dried and the clay fraction was separated. Untreated clay samples were subjected to the following sequential extraction: 0.1 mol L⁻¹ sodium pyrophosphate; 0.2 mol L⁻¹ Ammonium Oxalate; 0.5 mol L⁻¹ NaOH. Before and after each extraction the samples were submitted to X Ray Diffraction (powder method) and Difference x-ray diffraction. The low intensity of chemical weathering in the studied soils is evidenced by shallow pedogenetic horizons, low degree of structure development, low clay content and presence of easily weatherable primary minerals in the clay fraction such as pyroxene, plagioclase, feldspar and mica. Ornithogenic activity (by penguins and skuas) accelerates soil genesis, enhancing the formation of clay minerals and intense phosphatization, with neogenesis of crystalline phosphates such as leucophosphite, metavariscite and minyulite. The uniqueness of these Antarctic soils is the widespread occurrence of poorly crystalline minerals, which represent from 20.9 to 65.6% of the clay fraction. These poorly crystalline phases are associated with organic matter (organo-metallic complexes) or as Al and Si-rich oxides (allophane and imogolite) and Fe oxides. This may compensates the low clay content of these soils and increase the retention of ionic pollutants, which may be introduced in Antarctica by the increasing touristic and research activities. **Key words:** ornithogenic soils, poorly crystalline minerals, phosphatization, chemical weathering

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Driving factors for nitrous oxide and methane emissions from soils in Punta Hennequin, Shetland Island, maritime Antarctic

Forename: Frederico Surname: Costa Beber Vieira

Authors: Costa Beber Vieira, Frederico; Batista Pereira, Antônio; Bayer, Cimélio; Schunemann, Adriano Luis; Victoria Albuquerque, Filipe; Pereira de Albuquerque, Margéli; Strassburger de Oliveira, Cássio; Putzke, Jair;

Presentation Allocated: Poster

abstract: The study aimed at determining the magnitude of the methane (CH₄) and nitrous oxide (N₂O) flux rates in soils at Punta Hennequin, Antarctic, under different slope positions and vegetal covers, as well as to evaluate the main soil and climate factors that are involved with the flux of such gases. In situ gas sampling were taken by using the closed chamber method, in four places along a transect in Punta Hennequin: L1 and L2 consisted of a nesting/breeding skua field with 5 and 100% of vegetal cover, respectively, in which *Deschampsia antarctica* and *Colobanthus quitensis* predominated; L3 was a poor-drained bare alluvium soil; and L4 was a poor-drained moss field with 100% soil cover. Climate and soil attributes were evaluated concomitantly. Flux rates ranged from -0.86 ± 0.45 to 2.75 ± 1.52 $\mu\text{g N}_2\text{O-N m}^{-2} \text{ h}^{-1}$ and -12.26 ± 3.05 to 1.42 ± 1.31 $\mu\text{g CH}_4\text{-C m}^{-2} \text{ h}^{-1}$. These ranges are similar to previous studies in moss soils of the region, but are smaller than those reported for ornithogenic soils with penguins (Sun et al., 2002; Zhu et al., 2005). The soil under presence of skuas and 100% soil cover by vegetation (L2) had the largest CH₄ influx rates, but this benefic effect was counterbalanced by the greatest N₂O efflux rates, resulting in the largest contribution to the global warming potential among the soils evaluated. In equivalent C, the contribution of N₂O fluxes in all the soils of the transect was relatively more important for the net global warming potential than that from CH₄. Flux rates of both N₂O and CH₄ were closely related to the soil temperature ($P < 0.05$), but no significant relation was observed with water-filled pore space and with soil mineral N contents. However, the accumulated CH₄ and N₂O emissions were closely related to the total N and total organic C stocks in the soil. Net CH₄ influx predominated even in the poor-drained soils, suggesting that the coarse soil texture avoided critical anaerobic conditions. No significant changes in daily flux rates from the soils were observed. Sun L, Zhu R, Xie Z, Xing G (2002) Emissions of nitrous oxide and methane from Antarctic Tundra: role of penguin dropping deposition. *Atmospheric Environment*, 36, 4977-4982. Zhu R, Sun L, Ding W (2005) Nitrous oxide emissions from tundra soil and snowpack in the maritime Antarctic. *Chemosphere*, 59, 1667-1675.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: DYNAMICS OF ACTIVE LAYER OF A CRYOSOL IN A SORTED PATTERNED GROUND PHASE IN BYERS PENINSULA, LIVINGSTON ISLAND

Forename: Marcio Rocha Surname: Francelino

Authors: Francelino, Marcio Rocha; Adnet Moura, Pedro; G. R. Schaefer, Carlos Ernesto;

Presentation Allocated: Poster

abstract: The polar regions in both hemispheres are recognized as key regions for evaluation and monitoring of the impacts of climate change, particularly in the periglacial zones. In Antarctica these changes are evident with impacts on abiotic and biotic components of ecosystems. In the last five decades, a warming trend of 0.56 °C per decade, and 1.09 °C per decade in winter, was recorded at Faraday / Vernadsky station, almost four times higher than the global average. Permafrost and active layer have been demonstrated to be highly susceptible to climate changes in Criofera, so the thermal regime of the soil has been considered a good indicator of changes in the environment. Information on the thermal regime of active layer are scarce in the maritime Antarctic. Thus, the objective was to present and analyze data of the first year of the monitoring site, installed in Byers Peninsula aiming to provide initial information about the thermal regime of the active layer of a cryosol in a sorted patterned ground phase in Byers Peninsula that may contribute to the understanding of key processes and for monitoring periglacial climate changes in maritime Antarctica. Temperature sensors were installed at depths of 10 cm, 30 cm and 50 cm. A moisture sensor was installed at 50 cm of depth at the center and the edge of the circle. For the analysis of the data, thawing days (TD), isothermal days (ID), freezing days (FD), freeze-thaw cycles (FTD), freezing degree days (FDD) and thawing degree days (TDD), were analyzed. To study the structure of the permafrost table, the site was studied with a Ground Penetration Radar, TerraSIRch model SIR-3000 with 900 MHz antennas and 400 MHz. The data was processed with the software, Radan 6.6. The edge of the feature had fewer days of melting at depths of 10 cm and 30 cm and higher value at the interface of the active layer with permafrost (50 cm). Because of the fewer water at the edge of the feature, isotherm days and curtain zero regime does not occur. Freezing was more prominent in the center than at the edge. The center presented slight cooler temperatures than the rocky edge. The GPR was adequate to identify the structure of the permafrost table, revealing her character is a more wavy surface in the central region of the feature. It can be concluded that this behavior is due to the accumulation of water in the center because of higher storage capacity provided by the fine material from the center.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Genesis and distribution of Cryosols from Barton Peninsula, maritime Antarctica

Forename: Felipe Surname: Nogueira Bello Si

Authors: Nogueira Bello Simas, Felipe; Daher, Mayara; Delpupo Souza, Katia Karoline; Senra, Eduardo; Gonçalves Reynaud Schaefer, Carlos Ernesto;

Presentation Allocated: Oral

abstract: The soil maps for ice-free areas of Antarctica are important goal of international groups studying soils from high latitudes. In the present work we report the main soils occurring in Barton Peninsula, King George Island, maritime Antarctica. Most of the area is formed by andesite and basaltic-andesite lava, tuffs and volcanic conglomerates. Plutonic extrusion of acid magma also occur as well as quartz-pyrite veins. Basaltic dykes occur only in one small area. We described 31 soil pedons in February 2012, representing the major geomorphological units according to a pre-existent map in 1:10.000 scale. Although at present we still lack analytical data as the sample proceed to the laboratories, field observations, soils morphology and correlation with other areas of King George island allowed a good understanding of soils distribution, taxonomy and landscape relationships. As in other areas of King George Island cryoturbation is a widespread phenomenon resulting in intense cryoclastic weathering and patterned ground, forming sorted circles, stripes and gelifluxion lobes. According to previous works and field observations, the active layer varies from 80 to 200 cm depth depending on substrate composition, vegetation cover and topographic factors. Apart from soils on low-lying marine terraces and rock outcrops, where permafrost is absent, most soils keyed out in the Turbel Suborder according to the Soil Taxonomy (Turbic Cryosols in the WRB). Most soils inside the SSSI no.171 have thick histic epipedons composed of fibric materials, with frozen ground at a depth of approximately 70 cm being keyed out in the Histels Suborder (Histic Cryosols in the WRB). Soils formed influenced by the quartz-pyrite veins show typical yellowish hue and high chroma values, being similar to acid sulfate soils found in Keller Peninsula, also in King George Island. These soils are not properly classified in the Soil Taxonomy and we suggest the inclusion of the Thionic Haploturbel subgroup. Soils of Barton Peninsula occur on several stable geomorphological compartments and show variable characteristics varying from hyperskeletal to loamy materials according to the parent material, presenting higher content of fines in acid sulfate soils. The present survey allowed the preparation of a first draft of the soils map for Barton Peninsula in a 1:10.000 scale. Soil associations and the main chemical, physical and mineralogical aspects of representative soils will be presented and discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Geomorphological studies on Union Glacier area, Ellsworth Mountains, West Antarctica

Forename: Rosemary Surname: Vieira

Authors: Vieira, Rosemary; Arigony Neto, Jorge; Borges Fernandez, Guilherme; Jaña, Ricardo; Cardia Simoes, Jefferson;

Presentation Allocated: Poster

abstract: According to images and verbal information to researchers who visit the area over the past 35 years, King George Island is suffering strong mass loss of ice of its glaciers. This work focuses on three glaciers studied in the summers of 2011 and 2012, which developed the terminal portions of the ice sheet that covers the interior of the island. The first two are within the Admiralty Bay: Ecology and Sphinx glaciers. The third is located in the outer portion of the bay, facing the Brasfield Strait: the Wyspianski Icefall. Ecology and Sphinx glaciers had retractions front 400 to 800 meters in relation to the coastline. In the Wyspianski Icefall information about the magnitude of decline is uncertain, probably in close range to the others. The retreat of these glaciers exposed geomorphological features, comprising mainly: a) Lateral moraines complex; b) Terminal moraines; c) Deposits of basal till; d) Deposits of filling crevasses; e) Thrust fault deposits in iced core; f) Eskers deposits; g) Flutes h) Wash over plains intersected by channels; i) Lakes j) Moutonné Rock. Distinct from the others, the Glacier Ecology developed a lagoon in front of the glacier. In Sphinx a large median moraine was formed in response to its coalescence with Baranowski Glacier. In Ecology and Sphinx, in the domain of lateral moraines, the sediments show a predominance of pebbles and blocks sub rounded to sub angular, with low to medium sphericity. To the vicinity of the rocky walls the angularity of the clasts increased and roundness and sphericity diminished substantially. Terminal moraines deposits show till better selected in relation to the lateral moraines, with sub rounded clasts, medium to low sphericity, striated, and with dominance of local lithologies. The clasts from area of the lateral moraines are composed predominantly by local lithologies, while toward the bottom of the valley the clasts composition is dominated by lithologies locals or exotic. Most moraines deposits showed no internal structure, with a predominance of clay fractions in the first 10 cm depth, suggesting washing process and mechanics infiltration of clay. In the proglacial area of Wyspianski Icefall, the clasts appear to be predominantly angular, with low to medium sphericity, rarely faceted or striated, showing the predominance of plucking process. Deposits formed in channels, lakes and flushing fans showed stratification and the best selection of grains compared to the others.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Geomorphology and regolith erosion rates from ice-free valleys in the Southern Transantarctic Mountains

Forename: Jaakko Surname: Putkonen

Authors: Putkonen, Jaakko; Bibby, Theodore; Morgan, Daniel; Balco, Greg; Giusti, Collin; Matheney, Ronald;

Presentation Allocated: Poster

abstract: Geomorphological and sedimentological studies were carried out by the Brazilian Expedition at Union glacier (79°45.666' S / 83°15.895' W), and surrounding hills, trunk valleys and tributary glaciers: Connell Canyon (79°49.238' S / 83°06.402' W), Elephant Head (79°49.298' S / 83°20.426' W), Mount Dolence (79°49.313' S / 83°11.811' W) and Rossmann Cove (79°47.849' S / 82°53.536' W), during the 2011/2012 field season. Union Glacier basin, located at the southeastern sector of the Ellsworth Mountains, flows into the Constellation Inlet of the Ronne Ice Shelf, and has been stable in recent decades, according to glaciological research conducted in the area. Dead-glaciers, morainic ridges and subglacial deposits were surveyed with GPS and GPR equipments in order to map the main geomorphological features. Microscale (striations and sichelwannen) and mesoscale (streamlined bedrock and giant stoss and lee) landforms of glacial erosion were found mainly in Rossmann Cove area. Subglacially derived deposits with large numbers of striated and polished boulders and clasts indicate abrasion and quarrying of former beds of active wet glaciers. Ice-cored moraines predominate as continuous ridges on the ice margins, and their morphological characteristics, mechanisms of formation and glaciological significance are being investigated. To advance on the understanding of the West Antarctica Ice Sheet behavior, information about the processes of formation and distribution of surface deposits and landforms, besides the dynamics of the glaciers are being documented in a geomorphological and glaciological mapping, which covers the Union glacier area. The mapping combines multisensor and multitemporal approach based on recent ASTER, LANDSAT ETM, COSMO and QUICKBIRD satellite data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Hyper-saline “wet patches” in Taylor Valley, McMurdo Dry Valleys: Groundwater formation in the absence of precipitation

Forename: Joseph Surname: Levy

Authors: Levy, Joseph; Fountain, Andrew; Welch, Kathy; Lyons, W. Berry;

Presentation Allocated: Poster

abstract: Recent geomorphic observations in Taylor Valley, one of the McMurdo Dry Valleys, have led to the identification of spatially isolated, dark-toned, damp soil patches. These “wet patches” are associated with neither perennial or seasonal snowbanks, nor with shallow groundwater or seasonal streams. Instead, they are surrounded by dry soil suggesting a lack of hydrological connectivity with surface/near-surface waters. Wet patches are typically found on topographic highpoints (small knolls) or on isolated hillslopes. They do not overlie buried excess ice (ground ice exceeding soil pore volume) in the upper 50 cm of the soil column, and form early in austral spring when snowmelt does not occur. Wet patches have not been formally described before, however, they have been observed by several field parties working in Pearse and Wright Valleys, MDV. Direct (non-precipitation) condensation of water vapor to form saline brines has been proposed to occur at high elevations in the MDV, a process termed “humidity separation.” This mechanism pulls moisture from the air during high humidity events, resulting in the hydration of hygroscopic salts (notably CaCl_2 and MgCl_2). A similar process occurs in warm deserts (e.g., Atacama). This process has not been previously observed at low elevations in the MDV. Here, we test the hypothesis that direct atmospheric deposition of water vapor into low-water activity saline intergranular fluids results in the growth and maintenance of seasonally wet patches of soil. Wet patches” are sites of elevated salt content and soil moisture. The soil pore fluids are hypersaline and have average water activity of 0.74 (the water activity of a solution determines the equilibrium vapor pressure of that solution), and are an order of magnitude more saline than average soils in the Dry Valleys. These salty soils are 3-5 times more water rich than average soils. Geochemical and meteorological analyses show that these wet patches are sites of direct vapor emplacement into soil pore fluids that ultimately be sourced by the deliquescence of soil salts. These wet patches represent a non-precipitation, non-groundwater source for water into Antarctic permafrost.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Ice free areas and ancestral Niche modeling of *Sanionia uncinata* moss on the South Shetland Island, Antarctica

Forename: Inti Surname: González

Authors: González, Inti; Jaña, Ricardo; Hebel, Ingrid; Aravena, Juan Carlos;

Presentation Allocated: Poster

abstract: During the last 15.000 years on the South Shetland Island and Antarctic Peninsula are recognized eight climatic stages since the last glacial maximum. These imply warm and cold phases conditioning the advance and retreat of ice, and thus modification of distribution, size and boundaries of the ice-free areas. Particularly, the warmer conditions have generated ice-free areas where conditions are suitable for colonizing organisms. One of the pioneering plant species living in the extreme environmental conditions is *Sanionia uncinata* moss. This specie is widely distributed throughout the region of the South Shetland Islands, Antarctica. On the other hand, it has not been know if the non-endemic species have only colonized Antarctica through propagules dispersed by the wind, or if there is the possibility that they have survived in refuges or ancient niches during the last glaciations. In this scenario of changes on ice-free areas, an ancestral niche and conservation patterns analysis developed through the Maximum Entropy algorithm is implemented in the MAXENT software (Maximum Entropy model), which identified and map spatially the potential distribution of the species in the ice-free areas. The maximum entropy model uses bioclimatic variables systematized and represented spatially under the project WorldClim- Global Climate Data, topographic curves and samples locations indicating the presence of the species, which act as support for applications running MAXENT. Nevertheless, because of the lack of some of the bioclimatic variables set in Antarctica required by the model, the discussion of this work will focus on the validation of the prediction of potential distribution of specie in current ice-free areas, using bioclimatic variables based only on temperature and topographic parameters.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Landscape evolution and ice-sheet behaviour in a semi-arid polar environment: James Ross Island, NE Antarctic Peninsula

Forename: Bethan Surname: Davies

Authors: Davies, Bethan; Glasser, Neil; Carrivick, Jonathan; Hambrey, Michael; Smellie, John; Nyvlt, Daniel;

Presentation Allocated: Oral

abstract: This paper provides a modern analogue to aid the interpretation and understanding of ancient cold environments, and to present new data regarding the behaviour of the Antarctic Peninsula Ice Sheet through the Last Glacial Maximum (LGM) and Holocene. This is achieved through the development of a process-based landsystem model for the semi-arid polar Ulu Peninsula, James Ross Island, northeast Antarctic Peninsula. Six sediment-landform assemblages are described and interpreted: 1) the glacier ice and snow assemblage. 2) The glacial assemblage, which relates to LGM sediments and comprises both erratic-poor and erratic-rich drift. Erratic-rich drifts in coastal regions were deposited under the lateral margins of Prince Gustav Ice Stream, which emanated from Trinity Peninsula at the LGM. Erratic-poor sediments were deposited under cold-based ice. 3) The boulder train assemblage was deposited during a mid-Holocene readvance of "IJR-45". 4) The ice-cored moraine assemblage occurs in front of small contemporary cirque glaciers and abandoned cirques. 5) The paraglacial assemblage includes scree, pebble-boulder lags formed through aeolian deflation, and glacial sediments reworked by littoral currents and braided streams. 6) The periglacial assemblage includes rock glaciers, protalus ramparts, block fields, solifluction lobes and extensive patterned ground. The interplay between glacial, paraglacial and periglacial processes in this semi-arid polar environment is of crucial importance in understanding polygenetic landforms. Crucially, cold-based ice was capable of sediment and landform genesis and modification. This landsystem model can aid the interpretation of past environments, but also provides new data to aid the reconstruction of the thermal regime of the last ice sheet to overrun James Ross Island.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Micromorphology and microchemistry of Ornithogenic Cryosols of Hope Bay, Antarctic Peninsula

Forename: Thiago Surname: Torres Costa Perei

Authors: Torres Costa Pereira, Thiago; Ernesto G. R. Schaefer, Carlos; Carlos Ker, João; N. B. Simas, Felipe; Calhau Almeida, Cecília; C. C. Almeida, Ivan;

Presentation Allocated: Poster

abstract: Micromorphological investigations of Antarctic soils are comparatively scarce, and could help understand the genesis of cryogenic soils under extreme conditions of low biotic inputs. In most areas of Maritime Antarctica, the microstructure is greatly influenced by the local lithology and deposition of bird guano. The present study was carried out in Hope Bay, in the northern part of the Antarctic Peninsula, possibly one of the oldest sites of penguin occupation in the region. We aimed to describe and analyze the most important micro and sub-microscopic features of selected Ornithogenic Cryosols from this part of Antarctic Peninsula, representing a transitional climatic zone between the humid South Shetlands and the much drier Weddel Sea sector. Nine pedons representing the main ornithogenic soils found in ice-free areas of Hope Bay were selected for the micromorphological study. Undisturbed soil blocks were sampled at different depths, ranging between 0 and 30 cm. In all carbon-coated soil thin-sections, the microstructure and sub-microstructure were further investigated using a JEOL 8200 and a Zeiss scanning electron microscopes, both coupled with an Oxford energy dispersive X-ray detector (SEM/WDS). These pedons have a limited surface accululation of organic matter formed by mosses and lichens, changing abruptly to a mineral phosphatic horizon of bleached colours, and usually cemented. A small to medium-sized granular structure is generally observed, with ovoidal, subrounded forms, including several well-defined ornithogenic materials, such as P-rich organic remains, nodular phosphates forms and minute fragments of bone apatite. The chemical composition of several features indicates the presence of discrete forms of taranakite, minyulite and leucophosphite, typical of phosphatization process in this zone. The process enhances chemical alteration of the substrate and is one of the main soil-forming process in ornithogenic soils, resulting in P-rich ovoidal aggregates. P-rich solutions penetrate desiccation fractures and cleavage planes in large clasts and react preferably with feldspars. P reacts with Al and Fe to form various amorphous and crystalline P phases. Permafrost cementation of deeper phosphate layers indicate that warmer conditions occurred in the past, during which P was leached downwards and reacted with the rock substrates.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: N₂O and CH₄ emissions in permafrost-affected soils of King George Island, maritime Antarctica

Forename: Diego Surname: Campana Loureiro

Authors: Campana Loureiro, Diego; Nogueira Bello Simas, Felipe; V. Locatelli, Marcos; De-Polli, Helvécio; José Rodrigues Alves, Bruno; Ernesto Gonçalves Reynaud Schaefer, Carlos;

Presentation Allocated: Poster

abstract: Changes in N₂O and CH₄ emissions are important indicators of natural or anthropic environmental impacts, with direct consequences on global climate change. The objective of the present work was to evaluate the fluxes of N₂O and CH₄ in permafrost-affected soils under different vegetation covers in King George Island, Maritime Antarctica. We compared five different vegetation types along an altitudinal sequence: moss carpet; mixed community with bryophytes, lichens and grass; *Deschampsia antarctica* Desv. (Poaceae) community with mosses; Soils covered with green algae (*Prasiola crispa*) and soils with guano from *Pygoscelis adeliae*. N₂O and CH₄ emissions were measured using static chambers in four different times in February 2011 and analyzed by gas chromatography. Soil temperature and moisture was measured at each chamber using thermocouples and moisture probes connected to a datalogger model CR1000 of Campbell Scientific. The mean fluxes of N₂O varied from 3 to 516 $\mu\text{g of N m}^{-2} \text{ h}^{-1}$ with the highest values being in areas covered with *Prasiola crispa*. Regarding CH₄, the mean fluxes ranged from -82 to 4933 $\mu\text{g of CH}_4 \text{ m}^{-2} \text{ h}^{-1}$, with the highest values being found for areas with guano. Possibly, the high amounts of guano promote anoxic conditions and is used as substrate to increase the production of CH₄. This reducing environment formed by guano deposition is in agreement with the low fluxes of N₂O in this areas. In the area covered with *Prasiola crispa*, methane fluxes were very low suggesting a redox potential which favours the formation of N₂O. In general, N₂O and CH₄ fluxes were low for all the studied vegetation communities, indicating that the highest emissions of such gases in terrestrial ecosystems of maritime Antarctica are related to recent guano deposits. The fluxes of N₂O and CH₄ are not correlated with soil temperature. However, soil water content was positively correlated with CH₄ but did not influence N₂O fluxes. The present study is a contribution for increasing the database regarding basic information about the magnitude of N₂O e CH₄ emissions for permafrost-affected areas in Antarctica which is very important to better understand climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: New data to the holocene glacial geomorphology and stratigraphy of Caña Quemada Bay and Stoneley Beach, James Ross Island, Antarctic Peninsula

Forename: Pablo Surname: Heredia Barión

Authors: Heredia Barión, Pablo; Strelin, Jorge Adrián; Astini, Ricardo;

Presentation Allocated: Oral

abstract: Is presented here innovative results achieved on the geomorphology and chronostratigraphy of Caña Quemada Bay (CQB) and Stoneley Beach (SB), localities situated NW of James Ross Island (JRI). Associated probably with a marine terrace located on South side of CQB, were recognized glacial-marine and deltaic sediments with remains of marine shells. The lower half of the outcrop, which reaches 4 m thick, is composed of a facies association linked with intertidal and glacial-marine deposits. Remains of shells contained in diamictitic levels provided radiocarbon ages which allowed to limit the accumulation of the basal deposits between 5810 and 5710 cal years BP. Mediating a disconformity, these deposits are covered by 3 m thick sediments, associated with glacial-deltaic and glacial-fluvial deposits clearly prograding, associated with the proximity of a glacial front which enters the sea (tidewater glacier). All the above reflects probably the progressive advance of a glacier front, expressed in a thickening-upward stratigraphic sequence. Covering the glacial-marine sequence is located a marine terrace that reaches an altitude of 11.8 m asl. In SB, there are the remnants of a high gravelly paleodeltaic deposit, showing on its top surface a terraced one located at an altitude that varies between 16 and 23 m asl. Unlike the outcrop in Caña Quemada Bay, was not found here datable material for radiocarbon dating, nor clear evidence about the kind of environment, glacial-marine or glacial-lacustrine. The outcrop profile consist of a basal unit of approximately 3.5 m thick interpreted as a glacial-genetic unit, that would be linked to the proximity of a retreating glacial that probably face marine or lacustrine waters. The upper unit of the outcrop, of 7 m thick, is constituted by a coarsening-thickening upward succession that would represent the progradation of a deltaic front out of the reach of direct glacier activity. From the interpretation of these outcrops the sedimentary sequence of CQB would be linked to the Neoglacial II glacier advance (Strelin et al. 2002), which occurred between 5410 and 4850 cal years BP (Hjort et al. 1997), and the 11.8 m terraced level would have been worked between 5700 and 5100 cal years BP (Strelin et al. 2006). In an attempt to correlate the height of the surface in SB, if it was marine, was developed during the occurrence of the first Holocene marine transgression of the JRI, between 8200 and 7400 cal years BP (Hjort et al. 1997).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: New Geomorphological Map of Fildes Peninsula, King George Island, South Shetland Islands, Antarctica

Forename: López-Martínez Surname: Jerónimo

Authors: Jerónimo, López-Martínez; Enrique, Serrano;

Presentation Allocated: Poster

abstract: In the South Shetland Islands they exist several geomorphological maps that have provided information about the landforms and surface processes distribution, which has been useful for different geological, hydrological, permafrost and ecological studies in ice free areas. In this work we present a preliminary version of a new geomorphological map of Fildes Peninsula, which has been compiled by means of field work, aerial photographs and satellite imagery interpretation. Fildes Peninsula is located at approximately 62° S-58° W in the south-western end of King George Island, being mainly occupied by Cenozoic volcanic rocks partially covered by Quaternary surface deposits. With about 30 km² this is the third most extensive ice-free area in the South Shetlands archipelago. The geomorphological map has been initially compiled at 1:15,000 scale, which allows representing a great number and variety of individual relief features. The legend has been organized following a similar way that other existing geomorphological maps of the South Shetlands archipelago, as those of Byers Peninsula, Livingston Island; Deception Island; and Barton and Weaver peninsulas, King George Island. In this case, a total of 45 symbols have been used to indicate different types of landforms and deposits, classified according to their origin. The morphogenetic systems differentiated in the legend are: litho-structural, glacial, periglacial, fluvial, marine and human. Main geomorphological features in the studied area include two massifs of 142 and 139 m a.s.l. respectively, separated by a central depression where the airport and some of the existing stations in the peninsula are located. A series of raised beaches and marine erosive platforms, the drainage network and existing lakes and pools are also represented in the map, as well as the different landforms associated to fluvial and slope processes. The most represented landform system by surface in Fildes Peninsula is the periglacial one, and the map contains 15 different periglacial landforms types. These features occupy about 30 % of the surface, being patterned ground and stone fields the most common landforms. Other significant landforms as protalus lobes, rock glaciers or debris lobes indicate the extensive presence of permafrost. The geomorphological map of Fildes Peninsula can be useful to the ongoing studies about soils and permafrost distribution in this interesting ice-free area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Ornithogenic soils of Seymour Island, Weddel Sea, Antarctica

Forename: Katia Karoline Surname: Delpupo Souza

Authors: Delpupo Souza, Katia Karoline; Noses Spinola, Diogo; Daher, Mayara; Cardoso Alves, Lillyan; N. B. Simas, Felipe; G. R. Schaefer, Carlos Ernesto;

Presentation Allocated: Poster

abstract: The influence of penguins on the development of terrestrial ecosystems in coastal ice-free areas of Antarctica is relatively well studied. In Maritime Antarctica, percolation of P-rich solutions through the soil results in the chemical weathering of primary rock minerals and formation of crystalline and poorly crystalline phosphates. On the other hand, in drier parts of Antarctica, a sharp boundary occurs between the guano layer and the mineral substrate evidencing little interaction and mineral alteration. In the present work we report morphological, chemical and mineralogical characteristics of ornithogenic soils from Seymour island, located in the Weddel Sea. Soil samples were air dried and passed through 2 mm sieves. After removal of water soluble salts, the samples were submitted to chemical and physical analyses such as: pH in water, potential acidity (H + Al), exchangeable bases, total organic carbon, electric conductivity, soil texture and color. Clay fraction mineralogy was assessed by X-ray diffraction. The ornithogenic soils of Seymour island have an upper layer usually deeper than 40 cm, with alkaline pH and extremely high levels of P. No crystalline phosphates typically found in alkaline guano layers were detected and most of the clay fraction is composed of poorly crystalline phases, as indicated by the XRD patterns. This alkaline, P-rich horizon overlies an acid sulfate horizon, with low P levels, low pH and presence of jarosite and natrojarosite along with 2:1 clay minerals. These characteristics indicate that the dry climate of the Weddel Sea region slows guano mineralization by microorganisms in relation to Maritime Antarctica and the guano layers have not been transformed and acidified. The deposition of fresh guano over the acid sulfate soil possibly resulted in the destabilization of both the minerals normally found on alkaline guano (apatite and K-urates) and the sulfates present in the soil, resulting in an alkaline horizon, enriched in P and composed mostly by poorly crystalline phases. Only one ornithogenic soil had an acid P-rich upper layer with traces of crystalline phosphates (eg. minyulite), suggesting that this is possibly an older ornithogenic soils in which the phosphatization of the mineral substrate is in fact occurring. However, in general the ornithogenic soils of Seymour are much different from all other ornithogenic soils of Antarctica due to the presence of acid sulfate soils before the occupation by penguins.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Permafrost conditions at Terra Nova Bay (Northern Victoria Land, Antarctica)

Forename: Mauro Surname: Guglielmin

Authors: Guglielmin, Mauro;

Presentation Allocated: Oral

abstract: Permafrost monitoring have been undertaken since november 1999 at Oasi (74° 42'S—164°06'E at 80m a.s.l.) with a first borehole 15 m deep and later with a borehole 31 m deep. The two boreholes were drilled at less than 5 m far each other on the same flat, light pinky granitic outcrop just some hundred meters far from the Italian Antarctic Station (Mario Zucchelli). Between 1999 and 2007 the 15 m borehole was monitored not continuously due to several logistic problems (mainly related to power supply) while since January 2008 the deeper borehole was continuously monitored. The new thermistors chain is composed by 20 P107 sensors made by Campbell Scientific (accuracy $\pm 0.1^\circ\text{C}$) at the depths of 0.3;0.6;1;1.6;3.6; 5,7,10,12,14,15,16,17,18,20,23,25,27,29,31 m. The data are recorded with different time span according the depth (minimum, maximum and average temperature hourly at the surface and down to 1m and daily below). In addition since 2010 snow heigth and air temperature (at 1.6 m above the ground) are also recorded. Analysing the more recent and continuous record ZAA (zero annual amplitude where temperature amplitude is $< 0.1^\circ\text{C}$) is at 25 m where mean annual ground temperature is -13.3°C . The permafrost table (maximum depth of 0°C isotherm) ranges between 139 and 165 cm, quite 1 m more than in the surrounding sediments. Mean annual ground surface temperature (at 2 cm of depth) ranges between -14.6 (2010 on the rock) and -12.1°C (2011 on loose sediments). The granite core was homogeneous along all the borehole and thermal conductivity, diffusivity and heat capacity of one sample collected at 6.2 m of depth were also determined in laboratory and gave respectively $1.997 \text{ Wm}^{-1}\text{K}^{-1}$, $0.957 \text{ 10}^{-6} \text{ m}^2\text{s}^{-1}$ and $0.806 \text{ Jg}^{-1}\text{K}^{-1}$ at the temperature of -15°C . Permafrost base considering a heat flux ranging between 0.066 and 0.114 Wm^{-2} should be at a depth between 240 and 420 m. The thermal conductivity here obtained is much lower than what found for the granite of the Wriugh Valley or normally considered for a generic granite, in fact if we take account the thermal conductivity of Wriugh Valley ($4.176 \text{ Wm}^{-1}\text{K}^{-1}$) permafrost thickness would be the two times greater. Thermal offset on this granite outcrop is extremely low ranging between 0.1 and 0.7°C and the rock GST is well correlated with the air although little less respect to the GST measured on the two different sediments surfaces and the air.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Permafrost-Volcano interactions: a case-study in Deception Island (Maritime Antarctic)

Forename: Gabriel Surname: Goyanes

Authors: Goyanes, Gabriel; Goncalo, Vieira; Caselli, Alberto; Cardoso, José Miguel; Marmy, Antoine; Bernardo, Ivo; Hauck, Christian;

Presentation Allocated: Poster

abstract: Deception Island is a strato-volcano located in Bransfield Strait (Maritime Antarctica) with recent eruptions in 1842, 1912, 1917, 1967, 1969 and 1970. In this work the main focus is at an alluvial fan dominated by debris-flow processes located behind the Argentinean Base "Decepción". It is one of the areas with ground geothermal anomalies. Surface temperatures have been measured in summer 2010-2011 with a hand digital thermometer at 5, 50 and 70 cm depth. Miniature dataloggers were installed at 5, 10, 20, 40 and 80 cm depth at two sites in the alluvial fan. Air temperature dataloggers were installed at 1.5 m. Thaw depth was measured with a probe. Nine geoelectrical profiles were carried out. Data shows that the temperatures increase with depth near the lagoon. Maximum values are found near to the lagoon where permafrost is absent and, in proximal alluvial fan and in the debris cones, temperatures reach minimum values. Here, the probe confirmed permafrost presence at approximately 70 cm depth. The shallow borehole located in proximal alluvial fan shows a good agreement between air and subsurface temperature and it also supports permafrost presence. On the contrary, the borehole at the distal site shows a thermal stratification all year-round and only the first 20 cm show a response to air temperature. The lowest sensor reached temperatures of 12 °C. The electrical resistivity tomographies point two distinct zones: (1) the distal alluvial fan, where the resistivities are low, excluding the presence of ice and (2) the proximal alluvial fan and debris cones where the high resistivities show the presence of permafrost. Profiles of resistivity evidence the presence of a conductive wedge of marine water corresponding to the lagoon that penetrates under the alluvial fan with hot water. Due to its high temperature, it inhibits permafrost development, although the air temperature descends under 0°C. But, water temperature and the borehole located at proximal alluvial fan show that the effect of thermal anomaly is extremely restrict to a narrow area near to the beach. In the electrical resistivity tomographies the transition between conductive and resistive zones is very abrupt, also indicating the local character of the thermal anomaly. For this, results show that the thermal anomaly controls the permafrost distribution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Physical and biological investigations of supraglacial and ice-marginal lakes in the western Dronning Maud Land

Forename: Matti Surname: Leppäranta

Authors: Leppäranta, Matti; Arvola, Lauri; Keskitalo, Jorma;

Presentation Allocated: Poster

abstract: Seasonal glacial lakes form in the western Dronning Maud Land. Ice-marginal lakes form on nunatak bare ground areas and at their foot, and supraglacial lakes form in blue ice regions in the immediate vicinity of nunataks. These lakes have been investigated in summer expeditions for their physics, geochemistry and biology based on the Finnish station Aboa. For supraglacial lakes, physical observations include cross-sectional drilling of their structure, ice and water sampling, solar radiation transfer, and heat budget. Structural and thermodynamical models are presented for the supraglacial lakes. Ice-marginal lakes have been examined by taking water samples. All the glacial lakes in the research area are seasonal. The geochemistry results classified them ultra-oligotrophic. Conductivity was mostly in 0.1–10 mS m⁻¹ (25°C) and pH ranged in 6–11. Phosphorus concentrations were extremely low (<5 mg m⁻³) except in a few samples taken from shore areas and in one pond. The first results are presented on plankton in the glacial lakes of the research area. Phytoplankton biomasses were low (in most cases <10 mg m⁻³) and in many samples only a few specimen were detected. Cyanobacteria dominated the biomass in several lakes. A few single diatoms were also found. In addition, some macroalgae, including an unidentified red alga, as well as one rotifer, one ciliate, and one Tadigrada taxon were found. Altogether some 25 taxa were discovered.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Physico-chemical and isotopic characteristics of different types of waters in Livingston Island, South Shetland Islands, Antarctica

Forename: López-Martínez Surname: Jerónimo

Authors: Jerónimo, López-Martínez; Juan José, Durán; José Antonio, Cuchí; Luis, Moreno;

Presentation Allocated: Poster

abstract: Sixty in situ measurements and 30 laboratory chemical analyses of water samples have been carried out to characterize different types of waters in two of the biggest ice free areas in Livingston Island: Byers and Hurd peninsulas. Samples of rain and snowfall, lakes and ponds, streams, glacial melting waters, springs and permafrost waters were taken in January-February 2003. The sampling sites are located at altitudes between 1 and 100 m a.s.l. Temperature of the studied waters show values between 1.2 and 13.5°C, being in springs and a lake the highest temperatures. Electric conductivity of waters ranges from 4.8 to 1441 $\mu\text{S}/\text{cm}$; on most of the waters don't exceed 329 $\mu\text{S}/\text{cm}$. Rain and snow show the lower values and a lake with possible connection to sea water the highest one. The chemical facies of most of the waters are sodium or calcium-sodium chloride or chloride-bicarbonate. Geochemical characteristics and hardness varies according to the water origin. Oxygen and hydrogen stable isotopes show values of $\delta^{18}\text{O}$ ranging from -11.01 to -5.1 ‰ and δD from -100.8 to -42.1 ‰. The results point out differences according to the water provenance and lithology. Lakes and ponds have different types of water according to their relative position with respect to other water bodies, particularly the sea. Electric conductivity values measured along some streams allow detecting possible underground water discharges to the creeks. The presence of permafrost and the active layer, jointly with the summer ice melting play an important role in the water flow. The results allow to identify different types of waters and to point out the complexity of the hydrological cycle in summer in these very sensitive areas to global change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Polar Desert soils from Patriot Hills, Ellsworth Mountains: Chemistry and mineralogy

Forename: Carlos Ernesto Surname: Schaefer

Authors: Schaefer, Carlos Ernesto; Bremer, Ulisses; Del Pupo Souza, Katia Karoline;

Presentation Allocated: Poster

abstract: Knowledge on Antarctic soils from the Ellsworth Mountains, and the Heritage Range in particular, are patchy comparatively with Dry Valleys soils from the Transantarctic Mountains, and could help understand the genesis of cryogenic soils under extreme dry, cold desert conditions. In this work we report some chemical and mineralogical attributes of a sequence of soils from the Patriot Hills area (81° 40' S, 80° 30' W; 850-1000 m), in the southernmost part of the Ellsworth Mountains, where soil studies are virtually none. Six pedons representing the main soils found in ice-free areas were selected and sampled. All soils are alkaline in reaction, with pHs at the range between 8-8.9, and show discrete patches of salt on the surface, and salt crusts beneath the rock fragments. Cryptogamic (lichens or mosses) crusts are absent, and the organic matter contents were invariably very low, ranging between 0.13 and 0.25%. Permafrost is continuous and occurs close to the surface, at between 5-15 cm down the top. The available P background is also very low (< 5.3 mg/kg), exchangeable K and Na levels are surprisingly low for Polar Desert soils. Soils are all skeletal, with a predominance of coarse materials. CEC is medium to high, and Ca-dominated, as a result of a strong limestone influence in the moraine parent materials. The main salts present are Ca and Na- sulphate forms, and less chloride forms, and clay sized materials are dominated by salts in all soils, especially below 5 cm depth.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: POTENTIAL OF CO₂ EMISSION ALONG THE FRONT OF GLACIER RETREAT SPHINX IN ADMIRALTY BAY - KING GEORGE ISLAND

Forename: André Surname: Thomazini

Authors: Thomazini, André; De Bortoli Teixeira, Daniel; Vinícius Gabrig Turbay, Caio; Ernesto Goncalves Reynaud Schaefer, Carlos; La Scala Júnior, Newton; de Sá Mendonça, Eduardo;

Presentation Allocated: Poster

abstract: In maritime Antarctic regions, due to higher temperature in summer, biological activity and degradation of organic matter experiences an increase, as the photosynthetic rate of plant communities. Another factor contributing to this is the observed retreat of glaciers, which consequently affects the soil CO₂ emissions (FCO₂). It is estimated that the Sphinx Glacier over the past 35 years has suffered a decline of approximately 32 meters per year. The objective of this study was to evaluate the FCO₂ along the front of the glacier retreat in Sphinx. The study was conducted in front of the glacier retreat located near the tip Sphinx Demay, in Admiralty Bay, King George Island, South Shetland CO₂ emissions were measured using a portable analyzer coupled to a dynamic camera LI-8100 (Licor, USA). This camera has been placed 10 cm diameter PVC collars that was previously inserted in the soil. Soil temperature in the 0-0.12 m layer, was evaluated using a handheld thermometer. Emissions were measured at the top of the front where local moraines with and without vegetation conditions. Throughout the retreat were evaluated vegetation cover of *Deschampsia antarctica* and/or *Sanionia uncinata*. At each site were performed 03 replications, lasting 1.5 min each. Means were compared by the Student t test ($\alpha = 0.10$). FCO₂ ranged from 0.87 to 9.67 $\mu\text{mol m}^{-2}\text{s}^{-1}$ for sites with presence of vegetation and from 0.02 to 0.40 $\mu\text{mol m}^{-2}\text{s}^{-1}$ for locations without vegetation. The temperature ranged from 8.00 to 9.77 °C for sites without vegetation and from 5.53 to 10.33 °C for sites with vegetation. There were no significant correlations ($p = 0.10$) between temperature and FCO₂ along the front of the glacier retreat in the two conditions. In both conditions, soils exposed most recently issued lower CO₂ concentrations than those with longer exposure time. The gradient along the FCO₂ decrease was explained by an exponential decay in distance fitting, with R² values of 0.83 and 0.67 for soils with and without vegetation cover, respectively. In places where there is presence of vegetation the CO₂ balance is positive, that is more pronounced pedogenesis and plant respiration promote higher rates of carbon fixation than sites without vegetation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Preliminary analysis of atmospheric parameters that influence the soil temperature in Maritime Antarctic: a case study in Keller Peninsula, King George Island

Forename: SAMARA Surname: SALAMENE

Authors: SALAMENE, SAMARA; FRANCELINO, MARCIO ROCHA; LYRA, GUSTAVO BASTOS; SCHAEFER, CARLOS ERNESTO GONÇALVES; SETZER, ALBERTO;

Presentation Allocated: Poster

abstract: The soil temperature in Antarctica is an efficient indicator of climate change that has occurred in that region, being influenced by several factors of landscape and atmosphere. This study aimed to analyze the main atmospheric factors that have significant correlation with soil temperature, using data from the weather station of the National Institute for Space Research (INPE), Brazil, located in Keller Peninsula, King George Island, Maritime Antarctic. Data were collected every 3 hours in period of summer (1-7 February) and winter (1-7 August) of 2008 year. The atmospheric variables were analyzed: atmospheric pressure (hPa), air temperature (°C), relative humid (%), wind speed (ms-1), solar radiation (wm-2), cloud cover (okta), horizontal visibility (km) and precipitation (mm). These parameters have been correlated with data from soil temperature (°C) at different depths: 0, 5, 10 and 20 cm. For this analysis we used the Pearson correlation index. The atmospheric variables that showed a correlation above 0.8 with the soil temperature were: air temperature, cloud cover and visibility. Of these factors, only the cloudiness showed a linear increase with the depth of the soil, i.e., the interference of the cloudiness was increased in increased depth of the soil. The positive correlation with soil temperature is caused by greater cloud cover present in the summer, where air temperatures and soil consequently are higher. It was expected highest correlation with solar radiation, but the values obtained were low, with the higher value of 0.67 obtained on the soil surface (0 cm). Future analyzes should be performed using only the atmospheric variables most correlated with soil temperature, in order to develop a regression model to explain the soil temperature changes depending these variable.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Preliminary results of the new permafrost and snow monitoring site at Rothera (Adelaide Island).

Forename: M.Roger Surname: Worland

Authors: Worland, M.Roger; Guglielmin, Mauro;

Presentation Allocated: Oral

abstract: Since February 2009 a permafrost monitoring station has been established close to the British Antarctic Station of Rothera (67.57195S 68.12068W) at 31 m asl on granodiorite knob with scattered lichen cover. The borehole was drilled with a compressed and refrigerated air hammer with the sampling of the cuttings to measure thermal properties of the rock. The rock was apparently homogenous along all the borehole. The temperatures measured hourly (minimum, maximum and mean) in three different rock surfaces, 2 horizontal but with different snow cover and 1 on a subvertical face and at 0.3; 0.6, 0.8, 1 and 1.3 m of depth. The other 18 thermistors (p107 made by Campbell with ± 0.1 °C accuracy) placed at depth of 1.6, 2.6, 5, 7, 9, 10, 11, 12, 13, 14, 15, 16, 18, 21, 24, 26, 28, 30 m recorded minimum, maximum and mean daily values. In addition air temperature in a ventilated shield screen at 1.5 m above the ground is also hourly measured and snow cover is visually monitored on 5 stakes around the borehole weekly. The data serie is too short to have any trend evaluation but active layer depth ranged between 1.01 and 1.42 m and the mean annual ground surface temperature (MAGST) during the only complete year (2010) ranged between -1.4 (subvertical face) and -2.9°C (horizontal face more snowy). On the same year the mean annual permafrost temperature (MAPT) was -2.7°C exactly the same values of the mean annual air temperature (MAAT). The thermal offset was very limited (0.2°C) while the zero annual amplitude is around 18 m of depth with a mean annual temperature of -3°C. The annual amplitudes of the ground surface temperature are extremely high with the vertical face that reaches 55°C with a maximum temperature recorded of + 31.5°C against an amplitude of 45.9°C and a maximum of +23.1°C just a couple of meters far away but on the horizontal surface. These results suggest that as expected at high latitude vertical surfaces suffer more severe thermal weathering. On the other hand, considering the two different horizontal surfaces, the more sheltered point recorded almost 6°C of amplitude more than the more windy exposed point and this difference is related mainly to the winter and to the thinner snow cover at this more exposed point.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Recent Development of Thermokarst on Previously Stable Streambanks in Taylor Valley, Antarctica

Forename: Michael Surname: Gooseff

Authors: Gooseff, Michael; Van Horn, David; McKnight, Diane; Welch, Kathy; Lyons, Berry;

Presentation Allocated: Oral

abstract: Streams in the McMurdo Dry Valleys run down fairly stable channels. During high flow conditions, sediment transport is expected and channel evolution occurs. However, in the 20 years of monitoring 1st and 2nd order streams in Taylor and Wright Valley, these changes have been fairly small. In January 2012, we discovered substantial channel erosion (both lateral and vertical downcutting), and subsurface thermomechanical erosion undercutting banks in Crescent Stream, Taylor Valley. We sampled stream water above and below one particular undercut flowpath and compared concentrations of major ions and nutrients to the long term averages of these concentrations on this stream (~20 years of record). Thermokarst impacted stream water demonstrated much higher electrical conductivity, and concentrations of chloride, sulfate, sodium, magnesium, and nitrate. These results suggest that this new mode of lateral permafrost degradation will substantially impact stream solute loads and fertilize stream and lake ecosystems.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Russian Antarctic permafrost monitoring network.

Forename: Andrey Surname: Abramov

Authors: Abramov, Andrey; Gilichinsky, David;

Presentation Allocated: Oral

abstract: The permafrost studies have been organized in the vicinity of coastal Russian stations in Antarctica: Novolazarevskaya (Shirmaher Oasis), Molodejnaya (Thala Hills), Progress (Lanserman Hills), Oasis (Bunger Hills), Leningradskaya, Russkaya and on King George island (Bellingshausen). This work is a part of Russian Antarctic Program. Several boreholes (2-11 m deep) have been drilled and equipped with loggers and sensor strings for year-round monitoring of ground temperatures. MAGT is ranged from - 0,6 C at Bellingshausen to -10,4 C at Russkaya station. This temperature range is quite close to the one, usual for the same latitudes in Arctic areas. At Progress, Novolazarevskaya and Bellingshausen stations the sites for monitoring of active layer dynamics have been organized. The active layers depth ranged from 20 to 140 cm, with mean values around 50-80 cm. In next few years we're planning to develop this network with deeper boreholes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Soils and landforms at Potter Peninsula, King George Island, Maritime Antarctica

Forename: Everton Luís Surname: Poelking

Authors: Poelking, Everton Luís; Schaefer, Carlos Ernesto; Fernandes Filho, Elpídio Inácio; Andrade, André Medeiros; Michel, Roberto;

Presentation Allocated: Poster

abstract: Pedological and geomorphological studies can help elucidate past climates and trends in ecosystem's evolution. In this work, we investigated chemical and physical properties of soils in ice-free areas of Potter Peninsula, describing, analyzing and classifying soil profiles, coupled with a soil and landform mapping of the whole area, based on the soil classification system of WRB. Soils are generally shallow, coarse-textured (Sandy to medium), and with more than 70% of particles greater than 2 mm diameter, and close association with parent material. The main soils are, as follows: Turbic Cryosols (Eutric) in old moraines, Follic Leptic Cryosols in cryoplanated surfaces, Follic Fluvic Cambisols in marine terraces. Although slow pedogenetic processes on a larger scale of time was possible formation of these soils in Potter from the glaciers retreat and ground stabilization. Recently exposed grounds, such as stable moraines, are being progressively occupied by patchy of lichens and mosses communities. In Potter soils are formed predominantly from basaltic and andesitic, volcanic rocks. There, physical weathering dominates, although chemical alteration of parent material also occurs, with the mineral substrate being an important source of K and Ca. Waterlogged areas normally show higher contents of soluble nutrients due to their accumulation via melting water channels during the summer. The soils with the greatest development are ornithogenic Haplic Cambisols, under strong bird guano deposition higher amounts of P, TOC, N, and lower pH, similar to other ornithogenic soils from King George island previously described. Ornithogenic soils are related to marine terraces uplifted abandoned penguin rookeries. Organic-matter rich ornithogenic soils of former penguin rookeries have greater plant biomass. Despite restricted areas, the ornithogenic soils are the considerably C and P stocks in soil of Potter Peninsula.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Soils from Lions Rump, Maritime Antarctica

Forename: IVAN CARLOS Surname: CARREIRO ALMEI

Authors: CARREIRO ALMEIDA, IVAN CARLOS; SCHAEFER, CARLOS ERNESTO; BRAGANÇA ALVES FERNANDES, RAPHAEL; TORRES PEREIRA COSTA, THIAGO;

Presentation Allocated: Poster

abstract: Soil formation in Antarctica is restricted to an area of about 0.32%, or 45,000 km² of the continent, in ice-free regions of coastal areas and glacial valleys between mountain ranges. Despite increased research on soils in recent years, most studies on Maritime Antarctica focused on Ornithogenic soils. In addition, few soil maps were produced throughout the history of pedology in Antarctica. The aim of this study was to classify and map the soils according to the WRB and USDA classification systems in association with geomorphological features. Twenty-six soil profiles from Lions Rump (LR), King George Bay, Maritime Antarctica were described, sampled and analyzed for their physical, chemical and mineralogical properties; as a result, a soil map was produced. Results showed that soils in LR are most formed from weathered basalt-andesitic rocks, naturally rich in apatite, with high P background. Typic Dystrogelepts ornithic and Typic Gelorthents ornithic are the main soils in LR, which possibly represents one of the first ice-free areas colonized by penguins in Maritime Antarctica. Typic Dystrogelepts ornithic from LR represent the deepest, most structured and reddish soils so far described from Maritime Antarctica. Typic Haplogelepts ornithic are the main soils on first and second moraine levels from the White Eagle Glacier. Typic Haplorthels and Lithic Haplorthels are present just above 80 m a.s.l., especially on the top areas and paraglacial spots, and represent LR Gelisols, with gelic materials within 100 cm of the soil surface and permafrost within 200 cm of the soil surface. Despite their occurrence only at higher altitudes, they represent the greatest soil cover in the studied area. Turbic Haplogelepts and Typic Haplorthels are situated between 40 and 80 m a.s.l., without bird nesting influence and absent of permafrost within 200 cm in the profile. Vitrandic Cryopsamments and Oxyaquic Cryopsamments dominated the terraces and former beaches along the coastal area. Other soils classified are present in very limited areas: Lithic Cryorthents ornithic, present on the sea stacks rock outcrops (basaltic plugs) close to the beach, and Typic Gelifluvents ornithic represent a small area on glacial, alluvial fans. Overall, the distribution and classification of local soils allowed the separation of two main soil domains in LR: (1) Ornithogenic soils (without permafrost) and the Gelisols (above 80 m a.s.l.).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: SPATIAL CHARACTERIZATION OF SOIL CO₂ EMISSION ALONG GLACIER RETREAT IN ADMIRALTY BAY, KING GEORGE ISLAND

Forename: André Surname: Thomazini

Authors: Thomazini, André; De Bortoli Teixeira, Daniel; Vinícius GabrigTurbay, Caio; Ernesto Goncalves Reynaud Schaefer, Carlos; La Scala Júnior, Newton; de Sá Mendonça, Eduardo;

Presentation Allocated: Poster

abstract: Soils at the Antarctic continent are considered an important organic carbon reservoir of the planet having a great potential for CO₂ emissions (FCO₂), as temperature on that region increases. Climate change has promoted changes in the distribution of vegetation and soil formation in western Antarctic, directly influencing not only the magnitude but also the FCO₂ spatial variability. This work aimed to evaluate the FCO₂ spatial variability in three sites all located at the side of the Ecology Glacier retreat in Admiralty Bay, King George Island, South Shetland, near the Polish Antarctic station Henryk Arctowski. The soil at site 1 is a turbic histic cryosol previously affected by penguin guano and abundant vegetation of *Deschampsia antarctica*, distant about 210 m from the latest line of moraines of the glacier. The soil of the sites 2 and 3 are leptic cryosols with no vegetation cover. The site 2 is distant about 110 m from the line moraines latest whereas site 3 represents this moraine. CO₂ emissions were measured using a portable analyzer coupled to a dynamic camera LI-8100 (Licor, USA). Soil temperature was monitored by using a 12 cm depth probe (thermistor based) inserted into the soil close to the collars. FCO₂ were measured on three 60 points grids installed in each of those site, with distance of 0.30 m between points, covering an area of 2.7 x 1.5 m. Site 1 had the highest mean FCO₂ values (0.87 $\mu\text{mol m}^{-2}\text{s}^{-1}$) differing from site 2 (0.21 $\mu\text{mol m}^{-2}\text{s}^{-1}$) and 3 (0.25 $\mu\text{mol m}^{-2}\text{s}^{-1}$). There were no significant correlations between FCO₂ and soil temperature. Spherical models (site 1 and 2) and pure nugget effect (PNE) (site 3) were fitted to experimental FCO₂ variograms. The PNE model indicates that the values of range, distance limit of spatial dependence, are smaller than the smallest interval sampled (0.30 m). For locations 1 and 2 the ranges were 1.96 and 0.92, respectively. Thus, it was found that in areas with longer exposure of soil at glacier retreats the FCO₂ spatial variability models were more heterogeneous compared to newly exposed areas. In addition, our results show that areas with longer exposure of the soil at the retreat have higher soil CO₂ emission when compared with areas exposed for lesser time.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Spatial variability of soil respiration and soil temperature along retreat of the Ecology Glacier, King George Island.

Forename: Daniel Surname: De Bortoli Teixeira

Authors: De Bortoli Teixeira, Daniel; Thomazini, André; Gabrig Turbay, Caio Vinicius; de Sá Mendonça, Eduardo; E.G.R Schaefer, Carlos; La Scala Júnior, Newton;

Presentation Allocated: Poster

abstract: The polar regions are among the regions with the greatest influence global temperatures increases. As a consequence of this scenario, the glaciers of the Antarctic Peninsula are passing through the process of retreat. It is estimated that the Ecology Glacier, the object of this study, has suffered a retreat of 450 m in its central part, in the last 50 years, resulting in an average retreat of 30 m yr⁻¹ in the last decades. This process directly affects the soil physical, chemical and biological properties which related to the soil CO₂ emission (FCO₂). The objective of this study was to study the the spatial variability of FCO₂ and soil temperature (Tsoil), as well as their spatial correlation described by means of cross-variogram. Evaluations were made in transect with distances of 1 m between points, including 150 m of retreat from the line of older moraine in one day. FCO₂ was evaluated using a portable analyzer coupled to a dynamic chamber (Licor 8100). Concomitantly with the evaluation of FCO₂, the Tsoil was monitored punctually beside the evaluation of FCO₂. The variability was described using descriptive statistics and geostatistics. Tsoil initially presented variograms with trend, however this was withdrawn by means of an adjustment of a surface quadratic. After such procedure it was calculated the variogram for data on waste. Spherical models were fitted to the data FCO₂ (R² = 0.59) and Tsoil (R² = 0.62), with ranges from 28.82 and 21.58 m. The higher range value found for FCO₂ indicates that this property presents a higher heterogeneity in area compared with the Tsoil. The Tsoil showed a negative linear correlation ($r = -0.30$, $p < 0.01$) with FCO₂. This may be due to higher temperature in areas with less vegetation cover, resulting in lower emissions. For the cross-variogram was fitted Gaussian model show strong degree of spatial dependence and a negative correlation in space. These findings confirm the existence of spatial dependence between Tsoil and FCO₂ not found in other studies. This way the Tsoil can be used as information secondary for interpolation of FCO₂, improving the quality from estimates.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Spatial variations in glacier runoff in the McMurdo Dry Valleys

Forename: Matthew Surname: Hoffman

Authors: Hoffman, Matthew; Fountain, Andrew; Liston, Glen;

Presentation Allocated: Poster

abstract: In the McMurdo Dry Valleys, Victoria Land, East Antarctica, melting of glacial ice is the primary source of water to streams, lakes, and associated ecosystems. We used a spatially distributed surface energy model that includes subsurface absorption of solar radiation to investigate the role of below surface ice melt and melt from 25 m high glacier terminal cliffs in glacier runoff. According to the model, subsurface melt between 5 and 15 cm depth was extensive and lasted for up to six weeks in some summers. When applied spatially, the model successfully predicted proglacial streamflow at seasonal and daily time scales. This was despite omitting a routing scheme, and instead assuming that all melt generated exits the glacier on the same day, suggesting refreezing is not substantial. Including subsurface melt as runoff improved predictions of runoff volume and timing, particularly for the recession of large flood peaks. Because overland flow was rarely observed over much of these glaciers, these model results suggest that runoff may be predominantly transported beneath the surface in a partially melted permeable layer of weathered ice. According to the model, topographic basins, particularly the low albedo basin floors, played a prominent role in runoff production. Smooth glacier surfaces exhibited low melt rates, but were important during high melt conditions due to their large surface area. Estimated runoff contributions from cliffs and cryoconite holes was somewhat smaller than suggested in previous studies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: The climate significance of surface and englacial debris in Mullins Glacier, Quatermain Mountains: potential manifestations of orbital variations during the last 400,000 yrs

Forename: Sean Surname: Mackay

Authors: Mackay, Sean; Marchant, David; Lamp, Jennifer; Head, James;

Presentation Allocated: Oral

abstract: Antarctic debris-covered glaciers potentially represent long-term archives of climate change. In addition to preserving ancient atmosphere, the surface topography and distribution of internal debris point to temporal and spatial changes in ice accumulation, ablation, and rock-fall processes at valley headwalls. For the first time, we show that the spacing and geometry of englacial debris bands and surface ridges on Mullins Glacier, purportedly the oldest alpine glacier in the world, are related to cyclical variations in ice accumulation and ablation. Existing chronological control suggests that these changes are most likely related to 100-ky eccentricity cycles, documenting changes in sub-freezing conditions in the Dry Valleys that extend back at least 400 ky. Data gathered from Ground Penetrating Radar, shallow-ice cores, soil excavations, and high-resolution topographic imagery are used to assess the distribution of englacial and supraglacial debris within the Mullins debris-covered glacier. The first 3.5-km of Mullins Glacier displays a series of well-defined, englacial debris bands that originate ~5-20 m above the ice-bedrock interface. These debris bands exhibit non-linear dipping angles, and where they intersect the ground surface they correspond with the location of arcuate surface ridges that dominate Mullins Glacier. Examination of 22 shallow ice cores, as well as visual inspection of numerous debris bands exposed at the buried-ice surface, show that in detail the debris bands are comprised of aligned layers of gravel-and-cobble sized clasts separated by clean glacier ice. The pattern and spatial distribution of arcuate surface ridges and internal debris bands within Mullins Glacier corresponds well with those of adjacent Friedman Glacier, suggesting an origin related to regional factors, rather than to local variability within each glacier. We describe a geomorphic model that links observed surface and subsurface structures to long-term climate change. In this model, the internal debris bands represent (1) the accumulation of rockfall at the glacier head during times of reduced ice accumulation and (2) subsequent burial and englacial transport during rapid periods of renewed ice accumulation. The data suggest that long-term climate records may be gleaned from the surface morphology of debris-covered glaciers, and by extension advocates the possibility of deducing long-term climate change on Mars through analyses of analogous features.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Thermal Active Layer Monitoring under Sorted Circular Patterned Ground, Byers peninsula, South Shetlands Islands, Maritime Antarctic.

Forename: Pedro Adnet Surname: Moura

Authors: Moura, Pedro Adnet; Schaefer, Carlos Ernesto R.; Francelino, Marcio Rocha; Simas, Felipe Nogueira Bello; Mendonça, Bruno Araújo; Senra, Eduardo Osório;

Presentation Allocated: Poster

abstract: The polar regions in both hemispheres are recognized as key regions for evaluation and monitoring of the impacts of climate change, particularly in the periglacial zones. In Antarctica these changes are evident with impacts on abiotic and biotic components of ecosystems. In the last five decades, a warming trend of 0.56 °C per decade, and 1.09 °C per decade in winter, was recorded at Faraday / Vernadsky station, almost four times higher than the global average. Permafrost and active layer have been demonstrated to be highly susceptible to climate changes in Criofera, so the thermal regime of the soil has been considered a good indicator of changes in the environment. Information on the thermal regime of active layer are scarce in the maritime Antarctic. Thus, the objective was to present and analyze data of the first year (2009-2010) of the monitoring site, installed in Byers Peninsula aiming to provide initial information about the thermal regime of the active layer of a Cryosol in a sorted patterned ground phase in Byers Peninsula that may contribute to the understanding of key processes and for monitoring periglacial climate changes in maritime Antarctica. Temperature sensors were installed at depths of 10 cm, 30 cm and 50 cm at the center and the edge of the circle. A moisture sensor was installed at 50 cm of depth at the center and the edge of the circle. For the analysis of the data, thawing days (TD), isothermal days (ID), freezing days (FD), freeze-thaw cycles (FTD), freezing degree days (FDD) and thawing degree days (TDD), were analyzed. The edge of the feature had fewer days of melting at depths of 10 cm and 30 cm and higher value at the interface of the active layer with permafrost (50 cm). Because of the fewer water at the edge of the feature, isothermal days and curtain zero regime does not occur. Freezing was more prominent in the center than at the edge. The center presented slight cooler temperatures than the rocky edge.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Toposcale snowpatch detection using TerraSAR-X imagery (Fildes Peninsula, King George Island, Antarctica). Applications for permafrost research.

Forename: Carla Surname: Mora

Authors: Mora, Carla; Vieira, Gonçalo; Pina, Pedro;

Presentation Allocated: Poster

abstract: Snowpatches are important phenomena in the marginal permafrost environment, since they maintain the ground insulated from summer heat fluxes, allowing for the maintenance of permafrost in otherwise warmer terrain. They are also a continuous source of melt water and are well known to promote the occurrence of a set of geomorphic processes framed within the concept of nivation. In order to evaluate the use of high resolution (ca. 1 m) X-band imagery for the identification and mapping of snowpatches at a detailed toposcale, two TerraSAR-X Spotlight mode scenes have been acquired January 2012 for the Meseta Norte area in Fildes Peninsula, King George Island. At the same time miniloggers were installed in 12 snowpatches with different aspects to measure snow temperature, an important factor due to dependence of radar backscattering on the water content of snow. Snowpits were dug in the snowpatches in order to characterize snow stratigraphy, with a focus on grain size and type and snow density. A DGPS system was used to map snowpatch borders, as well as other water surfaces, such as lakes. Different types of terrain units were also mapped in order to better characterize the discriminating capacity of the radar signal. Results show that TerraSAR-X Spotlight scenes show very good discrimination of snow in the maritime Antarctic environment at very detailed scales. They can, therefore, be of high value for the detailed mapping and modelling of permafrost distribution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Toposequence of subantarctic soils and C-CO₂ emissions at the Glacier Martial retreat zone, Ushuaia, Argentina.

Forename: Mariana Médice Surname: Firme Sá

Authors: Firme Sá, Mariana Médice; G. R. Schaefer, Carlos Ernesto; Sá Mendonça, Eduardo; C. Loureiro, Diego; R. Panosso, Alan; B. Figueiredo, Eduardo; N. B. Simas, Felipe;

Presentation Allocated: Poster

abstract: In the last century the Terra del Fuego glaciers suffered an intensive retreat process, and the Martial Glacier, in the southernmost part, lost the greatest extension, with more than 80% area loss. Today, these areas are covered by *Nothofagus* forests and subantarctic tundra. The tundra environments have higher soil carbon stock for world standards, and possess great potential of greenhouse gases emissions. The aim of our work was to study the impact of glacier retreat on soil genesis and the rate of C-CO₂ emissions. We described and sampled three soil profiles along a toposequence. The emissions of C-CO₂ were determined at three sites, chosen in accordance to the period of glacier retreat: the first site is characterized by deciduous forestry of *Nothofagus pumilio* and *Nothofagus Antarctica* (600 m), representing the oldest retreat site; and two sites in Tundra Fueguina environments, one with high developed vegetation (700 m), representing the intermediate stage of glacier retreat, and the other in the periglacial environment with incipient cryptogamic Tundra vegetation (770 m), representing the most recent retreat site. The C-CO₂ emissions were measured during six days in November 2011 with an IRGA (Infra Red Gas Analysis). In each C-CO₂ sampled point we also measured the soil temperature and moisture with data logger Campbell CR1000 model. The C-CO₂ emissions were 5,05, 4,86 and 2,29 $\mu\text{mol m}^{-2} \text{s}^{-1}$ in the sites 1, 2 and 3, respectively. The C-CO₂ emissions were higher in the site with greatest organic matter input and were the soil is more developed. The lowest C-CO₂ emissions were obtained to the sites with most recent glacier retreat, being related to anaerobic conditions of this site that reduce the oxidative process of organic matter. Soil temperature presents positive correlation with the C-CO₂ emission, indicating that these subantarctic soils have a great potential to emit greenhouse gases with increasing global warming. The Martial Glacier soils present low CTC, but have high organic matter content, decreasing with altitude to the most recent glacier retreat sites.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: USE OF GROUND PENETRATING RADAR (GPR) TO PERMAFROST AND ACTIVE LAYER STUDIES IN DECEPTION ISLAND, ANTARCTICA

Forename: Marcio Rocha Surname: Francelino

Authors: Francelino, Marcio Rocha; Oliveira, Juliana Toste; G. R. Schaefer, Carlos Ernesto;

Presentation Allocated: Poster

abstract: We studied the depth of permafrost and active layer in Deception Island through the use of GPR and in situ observations, evaluating their distribution in four selected sites following a topographic gradient. For that purpose, we used a Ground Penetrating Radar TerraSIRch model SIR-3000, with central frequency antennas of 200 and 900 MHz. Equipment was programmed to explore and detect permafrost from 1 to 7 m below the surface. We performed three scans at each site, with lines 30m long at sites 2, 3 and 120 length at site 1, spaced at 1 m apart between the scan lines. The depth of the permafrost and the active layer was recorded continuously along each transect. Site 1, at 25 m altitude, showed irregular and discontinuous permafrost interlayered between sedimentary structures in the vicinity of a talus, gradually disappearing towards the beach level. At site 2, located 78 m a.s.l., we also detected an irregular and discontinuous permafrost, with broken horizons along the transect, indicating strong cryoturbation. The third site, at 115 m altitude, showed regular and continuous permafrost, at depths of between 45 to 70 cm. Concerning the altitudinal variation, the GPR detected a tendency of an erratic occurrence of permafrost, and its gradual disappearance with decreasing altitude. The 200 MHz antenna allowed the identification of reflectors and the behaviour of deeper soil layers, but was not capable of detecting the permafrost table or any deeper layer. Conversely, the 900MHz antenna was well suited for the permafrost and active layer identification, showing the variable position of the permafrost top layer and the erratic behavior of shallow permafrost in Deception Island. This antenna was also particularly useful for analyzing the active layer through the identification of gravel deposition, permafrost thawing and subsidence. The ground penetrating radar is an effective tool for determining the interface between soil and permafrost thawing, allowing its in situ monitoring in the face of climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Variation of $\delta^{18}\text{O}$ and δD in Glacial Meltwater Streams, Taylor Valley, Antarctica

Forename: Deborah L Surname: Leslie

Authors: Leslie, Deborah L; Lyons, W. Berry; Welch, Kathleen A.;

Presentation Allocated: Poster

abstract: The McMurdo Dry Valleys (MCM) provide relatively simple glacier-stream channel systems that are disconnected from groundwater aquifers and overland flows. Discerning seasonal water sources should be accomplished easier in MCM than in a temperate setting because there are no vascular plants on the landscape, and the stream channels are the only water flow pathways. Although the ultimate path of water goes from the glaciers into the closed-basin lakes, stream water does undergo evaporation and hyporheic exchange. This research examines the $\delta^{18}\text{O}$ and δD of stream water in Taylor Valley on a temporal and spatial scale to address isotopic controls (e.g. evaporation, hyporheic mixing, glacier source area) that reflect trends within a season and over a diel period. During the 2010-2011 austral summer with the onset of glacial melt, continuous stream water and hyporheic zone sampling occurred at Von Guerard Stream and Andersen Creek during their daily high flow periods; two diel sampling also occurred at the beginning and middle of the flow season. Overall, stream water was isotopically more depleted at the beginning of the season, and more enriched at the end of the season. During higher flow periods, stream water was more depleted, and at lower flow periods, stream water was more enriched. Once the hyporheic zone was wetted, Von Guerard stream water's isotopic behavior resembled Andersen Creek, in which isotopic characteristics of the stream water were influenced by discharge and varying hyporheic exchange. During the first diel sampling at Von Guerard, the hyporheic zone response of more enriched flow was evident during the first 12 hours of flow. The mid-season diel at Andersen Creek displayed little variation in isotopic values with higher ion concentrations. A multi-component isotopic mixing model using stable water isotope values and water chemistry will be presented to quantify the relative fraction of flow contributed by each end-member water source (glacial ice, hyporheic zone, and surface snow) to the total discharge. Overall, these measurements will elucidate changes in meltwater sources and/or processes such as evaporation that have an effect on the temporal variation in isotopic signatures.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Vegetation Distribution at Fildes Peninsula, King George Island and Ardley Island, Maritime Antarctica

Forename: André Surname: Andrade

Authors: Andrade, André; Roberto, Michel; Carlos, Schaefer; Jorge, Arigony; Elpidio, Fernandes Filho; Felipe, Simas;

Presentation Allocated: Poster

abstract: Fildes Peninsula is located at King George Island, representing the largest and oldest ice-free areas of the island. The climate is considered South Hemispheric Polar Oceanic (Koppen, 1936), characterized by mean annual temperatures of -20°C and precipitation between 350 and 500 mm per year (Ovstedal & Smith, 2001). It has an ice-free area of 29 km² being connected to Ardley Island (1.2 km²) by a 400 m isthmus, exposed during low tide. This study evaluates the sensitivity and efficiency of the infrared and green bands of the QuickBird Satellite image together with the Normalized Vegetation Index (NDVI) for determining the distribution and diversity of the vegetation from Fildes Peninsula and Ardley Island. We used the Maxver classifier (maximum verossimilarity) to analyze the spectral response of the mentioned composition, against 48 in situ sites sampled during detailed soil survey. The automatic classification using the QuickBird image allowed a clear distinction of the main vegetation groups, specially lichens and mosses subformations, with a Kappa index of 0,988. The vegetation cover at Fildes Peninsula is concentrated in the lower landscape position, specially along coastal ecosystems influenced by present or past faunal colonies (penguins, skuas, seals, among others), but can be found even at the recently exposed paraglacial environment at high altitudes. The vegetation cover at Ardley Island differs considerably from Fildes Peninsula; the coastal landscape is protected by two bays being colonized by breeding penguins since the early ice retraction. Communities are more complex and diverse specially when located at the uplifted marine terraces, at abandoned rookeries. Vegetation distribution suggest a model based on the location of present and past bird colonies (penguin, skuas and petrels); influenced by water regime and soil type. The vegetated areas represent 15.94 % (680.57 ha) of the ice-free area covered by the satellite image (4269,47 ha) for Fildes Peninsula while Ardley Island has 66.88 % of its terrestrial ecosystems with some type of vegetation. The use of the NDVI index to compose the image together with the green and infrared bands is a powerful tool for vegetation monitoring purposes at Maritime Antarctica. It should only be used in association with detailed surveys and intensive field work for quantitative estimates of the distribution of the main plant communities.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: VOLCANIC SOILS FROM DECEPTION AND PENGUIN VOLCANOS, MARITIME ANTARCTICA

Forename: Bruno Surname: Resck

Authors: Simas, Felipe; Schaefer, Carlos; Resck, Bruno;

Presentation Allocated: Poster

abstract: In the Maritime Antarctica, higher humidity, radiation and temperature favor vegetation development and warrant some degree of chemical weathering and bases leaching. In addition, the presence of large bird populations result in physical and chemical changes (soil phosphatization) not usually described in most of the continent. Studies seeking to understand the processes and the relationships between pedogenesis and ecosystem evolution are scarce, especially in the volcanic islands of the South Shetlands Archipelago. This study examined chemical and physical characteristics of the volcanic soils of different ages and the influence guano to soil formation in ornithogenic sites at the volcanic islands of Deception and Penguin, both of recent age. We collected five soil profiles on Deception Island and three on Penguin Island during the summer of 2008. The soils were classified as Cryosols and Leptosols (WRB) and Gelisols and Inceptisols (Soil Taxonomy). Invariably, both soils had high amounts of coarse materials, as gravels, and low clay contents, due to its young nature. Soils are incipiently developed and with very low contrast between horizons, keeping a strong relationship with the subjacent, parent volcanic rock. From a chemical standpoint all soils are eutrophic with high pH values, except the P3 of Penguin Island under greater acidification by bird guano. The values of P extracted by Mehlich-1 are low for the profiles without influence of seabirds (ornithogenesis). The direct influence of recent volcanic material to the chemical composition of soils is illustrated by X-rays analysis of the clay fraction, which showed a mineralogical assemblage composed mainly of plagioclase, potassium feldspar, and pyroxene in addition to some smectite. The presence of primary minerals in the clay fraction indicates little chemical weathering degree and strong physical weathering. According to chemical extractions and values of oxalate extractable Feo, Alo and Sio, all soils have the presence of allophone, while in Deception Island we also observed the presence of some crystalline minerals, but in lesser proportions. Unlike the soils in areas of influence of birds in other parts of Antarctica, the profiles analyzed showed no evidence of phosphatization, but it is clear the strong influence of seabirds in the development of vegetation, accumulation of organic matter and development of soil fauna.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Water Track Control of Active Layer Thermal Properties and Ecosystem Structure in Taylor Valley, McMurdo Dry Valleys, Antarctica: Hydrological Connectivity Along Permafrost Hillslopes

Forename: Joseph Surname: Levy

Authors: Levy, Joseph; Fountain, Andrew; Welch, Kathy; Lyons, W. Berry;

Presentation Allocated: Oral

abstract: Water tracks are linear zones of high soil moisture that route shallow groundwater downslope in permafrost dominated soils through broad depressions in the permafrost ice table. Water tracks are hydrogeological features that mediate sedimentation, solute transport, carbon cycling, and permafrost thermal properties. In Antarctica, water tracks are only beginning to be understood. Our observations suggest that they occupy ~5% of the soil-covered land area of the McMurdo Dry Valleys (MDV), suggesting that they may be the next most voluminous hydrological pathway in the MDV after seasonal streams. We present physical, hydrological, and geochemical evidence collected in Taylor Valley, McMurdo Dry Valleys, Antarctica, which suggests that previously unexplored water tracks provide structure to Antarctic soil ecosystems and provide landscape connectivity from highlands to valley bottoms. Water tracks are some of the most salt-, nutrient-, and silica-rich waters in the MDV. We present major ion and stable isotope data that indicate that water tracks are sourced by a range of fluid and salt sources, including snowmelt and ground ice melt, dissolution of wind-blown marine aerosols, and combined salt deliquescence/high-elevation brine formation and flow. These multiple fluid sources ultimately deposit water track solutions into Taylor Valley lakes, and may have implications for lake chemical evolution models. As in the Arctic, water tracks are shown to significantly affect the distribution of soil moisture, heat, soil salinity, soil pH, soil carbon, and phosphate in permafrost affected soils. These results suggest that water tracks are ecological hotspots in Taylor Valley, providing long-range (km to multi-km) structure to Antarctic hillslope ecosystems through physical control on soil moisture and nutrient content. Finally, monitoring of multi-year active layer thaw records associated with water tracks illustrates a strong dependence of permafrost thermal properties and heating history/hysteresis on soil water content. Wet soils are found to be icy soils in the winter, but are also shown to be warm soils in the summer. As a result, deep active layer thawing is associated with wet soils. These results suggest that additions of soil moisture to MDV soils (through increased snowfall/snowmelt, glacier runoff, or ground ice melt) will result in a deepening of active layer thaw in the Dry Valleys, potentially resulting in rapid, landscape change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Weathering Rind Detachment via Thermal Stress Weathering in Antarctica: Implications for Polar Surface Processes and Cosmogenic Nuclide Dating

Forename: Jennifer Surname: Lamp

Authors: Lamp, Jennifer; Marchant, David; Head, James; Mackay, Sean;

Presentation Allocated: Oral

abstract: In order to quantify physical weathering of Ferrar Dolerite, we collected morphological and temperature data for surface clasts along a multi-million-year-old soil chronosequence in Mullins and Beacon Valleys, Quartermain Mountains (78°S, 160°E). The data show that clasts with exposure histories > 45,000 years exhibit disintegration via flaking of mm-scale surface fragments (altered crusts) at a rate of ~4 cm/Ma. To assess the likelihood of thermal fatigue in this process, we collected high-frequency (15-second intervals) temperature data at the surface and at depth on multiple dolerite clasts. Allied meteorological data, also collected, included on-site atmospheric temperature and relative humidity, wind-speed and direction, as well as solar intensity. Vertical temperature gradients across the 1-to-2-mm thick flakes of altered rock surpassed 8°C during the 28-day study interval (11/2010-12/2010) and maximum rates of surface temperature change exceeded 5°C/min. The latter value greatly exceeds the accepted value for producing thermal fracture in igneous rocks [1]. The production of altered rinds likely modifies thermal properties at the rock surface and may help facilitate thermally-induced fracture at the interface between altered and unaltered material. Our field measurements also imply that the detachment of altered material in the area represents a dynamic equilibrium process that may have important implications for rates of landscape evolution in the McMurdo Dry Valleys (MDV). The detached flakes add to the surrounding regolith, increasing in abundance with inferred soil age. Overall, this process modifies clast shape and promotes self-burial, which in turn reduces the overall surface area exposed to solar radiation and provides a negative feedback to repeated thermal spallation. These data will also be applied toward the study of cosmogenic nuclide dating in the MDV by improving erosion rate estimates for hyperarid, upland regions. [1] Richter, D. and G. Simmons, Thermal-Expansion Behavior of Igneous Rocks. International Journal of Rock Mechanics and Mining Sciences, 1974. 11(10): p. 403-411.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 19

Title: Winter patterns of snow in Fildes Peninsula using multiproxy data (King George Island, Antarctica).

Forename: Gonçalo Surname: Vieira

Authors: Vieira, Gonçalo; Mora, Carla; Pina, Pedro; Schaefer, Carlos;

Presentation Allocated: Oral

abstract: Snow cover distribution during the cold season is one of the main controls on ground thermal regime and can be a determinant factor for the presence of permafrost. In the South Shetlands, an archipelago located at the climatic boundary of permafrost the role of snow is still poorly understood. Ground temperature data from Livingston Island shows that slight differences in winter snow thickness induce significant differences in ground temperatures, with coldest sites occurring where snow is thinner. During the warm season, snow insulates the ground from warming and therefore seems to favour permafrost presence, at least in the sporadic permafrost belt. In this contribution we study the spatial distribution of winter snow cover targeting at the distribution of the convex relief snowfree areas. These same areas are dominated by dense covers of *Usnea* lichens and our working hypothesis is that by mapping them we will be able to map snowfree surfaces. In January 2012 we have conducted a detailed ground truthing survey of vegetation and geomorphology at the Meseta Norte in Fildes Peninsula and used it to produce a map of the *Usnea* spp. dominated areas. This map is then compared with a QuickBird early spring scene in order to evaluate the ability to use *Usnea* maps as snow thickness proxies. The final map is also compared with field observations on nivo-aeolian corrasion features on rock surfaces that support the occurrence of repetitive patterns of ice-free areas during the cold season.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: Antarctic Cloud Properties retrieved from the Interferometric Monitor for Greenhouse Gases (IMG) for Dec. 1996 – June 1997

Forename: Penny Surname: Rowe

Authors: Rowe, Penny; Walden, Von; Lubin, Dan;

Presentation Allocated: Oral

abstract: The polarity of the southern annular mode (SAM) has changed from being generally negative in the 1970s to more positive values over the last decade. Different generations of satellite data can be used to retrieve cloud phase, which can be correlated with the polarity of the SAM over this time period. Cloud phase retrievals over Antarctica are possible from the Infrared Interferometer Sounder (IRIS), launched in 1970, and the Atmospheric Infrared Sounder (AIRS) and Infrared Atmospheric Sounding Interferometer (IASI), both currently in operation. Between these time periods, the Interferometric Monitor for greenhouse Gases (IMG) operated aboard the polar-orbiting Advanced Earth Observing Satellite (ADEOS) from October 1996 through June 1997. The IMG measured upwelling infrared radiance at the top of the atmosphere from 3.3 to 14 micron at fine spectral resolution (0.1 inverse centimeter). IMG overpasses coinciding with IGRA radiosoundings at 8 stations along the Antarctic coast have been selected. Using IMG spectra in the wavelength regions from 8 to 12 micron and near 3.5 microns, cloud properties can be retrieved, including cloud height, thickness, particle size, and, sometimes, cloud thermodynamic phase. Preliminary results are presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: Antarctic precipitation and climate change

Forename: Cyril Surname: Palerme

Authors: Palerme, Cyril; Genthon, Christophe; Nicolas, Champollion; Picard, Ghislain; Claud, Chantal;

Presentation Allocated: Poster

abstract: Antarctic precipitation and climate change. Palerme, C. Genthon, N. Champollion, G. Picard, Laboratoire de Glaciologie et Géophysique de l'Environnement, CNRS / Grenoble University, Saint Martin d'Hères, France. Claud, Laboratoire de Météorologie Dynamique, CNRS / Ecole Polytechnique, Palaiseau, France. Genthon et al. (2009, Ann. Glaciol., 50, 55-60) show that all but one of the climate models that run the SRESA1B forcing scenario for the 4th IPCC report, predict that Antarctic precipitation will increase by the end of the century. However, the increase ranged from 0 to 50%, translating in a 2-3 mm/yr uncertainty on the contribution of Antarctica to sea-level change. A look into the CMIP5 climate change simulations archive produced for the 5th IPCC report confirms a predicted Antarctic precipitation increase. The inter-model uncertainty has somewhat reduced yet is still significant. The ICE2SEA programme (<http://www.ice2sea.eu/>) from the European Union 7th Framework Programme (grant number 226375) aims at delivering the best possible predictions of the contributions of continental ice to future sea-level rise. Although for Antarctica much of the effort focuses on the dynamical instabilities of the ice sheet, the surface mass balance issue remains a significant source of uncertainty. Unfortunately, there is no reliable observation of precipitation quantities to evaluate the models in the current climate. A method is developed to detect and count precipitation events using microwave radiance from satellites. Because different models differ with respect to the simulated statistics of precipitation, it is expected that building a satellite-based climatology of such statistics will help better assess the models and increase confidence in the prediction. In situ observation to validate the detection algorithm remains a challenge, and various instrumental approaches are being tested.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: Evidences of 1991 explosive Hudson volcanic eruption over Northern Antarctic Peninsula

Forename: Heitor Surname: Evangelista

Authors: Evangelista, Heitor;

Presentation Allocated: Oral

abstract: It is estimated that the 1991 explosive Hudson volcano eruption in Southern Chile produced approximately 2.7 km³ of basalt and trachyandesite tephra into the troposphere between August 8–15. In Antarctica Hudson signal has been detected at both the East Sector and at the South Pole snow. Nevertheless, since Hudson and Pinatubo eruptions have occurred within a short time interval of about one year, in some cases it is hard to make a deconvolution of each signal contribution in an ice core analysis. In this work we consider the impact of Hudson at the Northern and Western Antarctica. We have tracked the Hudson volcanic plume, using the Hysplit volcanic mode, together with re-analyzed weekly aerosol database from King George Island and from a high resolved ice core analysis from Detroit Plateau at the Antarctic Peninsula. Aerosol elemental composition of Ca, Fe, Ti, Si and Al has increased from 2 to 3 orders of magnitude from background in the days following the eruption at Southern Chile. Simultaneous increase was also observed from the Antarctic Peninsula ice suggesting the major contribution of Hudson eruption. Zn and Pb fallout detected in shallow lake sediments, of corresponding dating, at King George Island, corroborated the Volcanic impact of the period 1991-1992.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: Implications of new indices of refraction of water for simulated thermal emission from supercooled clouds in Antarctica

Forename: Penny Surname: Rowe

Authors: Rowe, Penny; Neshyba, Steven; Walden, Von;

Presentation Allocated: Oral

abstract: Proper representation of cloud radiative properties has long been recognized as critically important for the purpose of global climate modeling as well as atmospheric remote sensing. As an example of the latter, simulations and measurements of thermal emission from clouds can be used to discriminate ice clouds from supercooled liquid clouds, both of which are known to occur in the Antarctic. Important parameters required as inputs to such simulations include the shape of liquid and ice particles, cloud optical depth, the cloud temperature, as well as the complex index of refraction (IOR) of water and ice. Currently, simulations use measurements of liquid water IORs at temperatures above freezing, made in 1996 and earlier. Measurements of the imaginary part of the IOR (IIOR) differ by as much as 17% between 10 and 25 micron. In addition, new measurements of the IIOR of supercooled water (between 238 and 273K) have a strong temperature dependence; the IIOR at 273K differs from that at 240 K by ~30%. These large differences may be significant when compared to the uncertainties in retrieval algorithms. In this work, we undertake a survey of available indices of refraction of liquid water and assess the impact of those differences on downwelling and upwelling Infrared radiance relevant to remote sensing and climate modeling of Antarctic clouds. We explore the implications of the new temperature-dependent IIOR for simulations of cloudy-sky Infrared radiances in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: In situ measurements of clouds made over the Antarctic Peninsula

Forename: Tom Surname: Lachlan-Cope

Authors: Lachlan-Cope, Tom;

Presentation Allocated: Oral

abstract: During the 2009/10 and 2011/12 Antarctic season measurements were made of the microphysical properties of a number clouds on both sides of the Antarctic Peninsula using the British Antarctic Survey's instrumented Twin Otter. The properties of the clouds on either side of the Peninsula are compared and these measurements allow us to draw some basic inferences on the sources of cloud condensation and ice nuclei in clouds observed. The observed clouds were predominately mixed phase clouds and in many clouds evidence was found of secondary ice production. Very few in situ observations have been made of Antarctic Clouds and yet evidence exists from comparisons of surface based measurements of broad band radiation with model radiation values that Antarctic clouds are not well represented by the cloud parametrisations within these models. This work attempts to identify some of the major faults with existing parametrisations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: Particulate and chemical composition of snow after an anomalous weather event in the Windmill Islands, East Antarctica

Forename: Amy Surname: Budgeon

Authors: Budgeon, Amy; Gasparon, Massimo; Adams, Neil;

Presentation Allocated: Oral

abstract: Chemical composition and origin and distribution of particles in snow are useful indicators of the source area of the air mass associated with the snow precipitation event. Anomalous particles and elemental concentrations can provide information on how much the different sources (marine, crustal, anthropogenic) are influencing snow composition. Unusual particles and a distinctive chemical composition were found in snow collected from Wilkins Aerodrome, near Casey Station, East Antarctica, in February 2009. Snow was sampled following an anomalous weather event that consisted of north-westerly wind of 10 ms⁻¹, in contrast to the usual easterlies normally observed at the site. The snow samples collected after the weather event were filtered and analysed using a Scanning Electron Microscope and were found to contain large numbers of marine diatoms and a pseudomorph of the sea-ice mineral ikaite [CaCO₃.6H₂O]. Marine diatoms were individually identified and a sea-ice connection alongside open water summer conditions was identified as source environment. Trace element analysis was performed on an Inductively Couple Plasma Mass Spectrometer. Chemically the snow had a strong sea water signature, and anomalous concentrations of Cr and to a lesser extent V. Both elements show a strong positive correlation with Mg (Cr r²=0.9899; V r²=0.9925), our reference element for sea water. Back trajectory modelling shows a large change in the source area of the air mass for the anomalous weather event compared with normal precipitation events. Snow sampled in previous and subsequent years had negligible numbers of diatoms and relatively low seawater affinity, reflecting the difference in source area. The excess Cr and V have not been attributed to any enrichment mechanism, such as sea salt aerosol or frost flower production, and highlight the lack of understanding around heavy metal deposition to ice sheets. The presence of diatoms and sea ice mineral ikaite has the potential to be used as a source region indicator in ice cores.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: STUDY OF THE VARIABILITY OF MICROORGANISMS IN FRESH SNOW KING GEORGE ISLAND/ SOUTH SHETLAND ISLAND AND ITS ASSOCIATION WITH THE ELEMENTAL COMPOSITION OF AEROSOLS.

Forename: Daniela Kozlowsky Surname: Kozlowsky

Authors: Kozlowsky, Daniela Kozlowsky; Cataldo, Márcio Cataldo Gomes da Silva; Evangelista, Heitor Evangelista da Silva; Godoi, Ricardo Henrique Moreton Godoi; Zé Augusto, José Augusto Adler Pereira; José Manoel, José Manoel dos Reis Neto;

Presentation Allocated: Poster

abstract: The atmospheric aerosol study in the Antarctic Continent has been the subject of great interest due to the importance of this continent on the global climatology, geographical isolation, and its low anthropogenic influence. The analysis of elemental composition and mineralogy of rare earth aerosols have allowed to identify potential sources of continental influence on Antarctica and characterization of advections of masses to higher latitudes. In this paper we extend this analysis to the association between bacteria in lower atmosphere and aerosols (mainly terrigenous) that reach the Antarctic Peninsula by atmospheric transport, depositing it in King Georg Island, South Shetland Islands. The collection of the samples were held at King George Island, in the Fildes Peninsula, on February 23 and 24 on 2010, and in the Keller Peninsula, near the Antarctic Station Comandante Ferraz (ASCF)/ Admiralty Bay, between the months may to October 2010, continuously, between December 2010 to February 2011. Aiming the microbiological analysis the fresh snow samples and those collected directly by a BioSampler[®] were seeded with sample volume of 500 μ L and inoculated with 1mL in R2A medium. The same samples were incubated at 2°C, 12°C e 28°C. Aliquots of the samples were analyzed by flow cytometry for viewing size and quantity of life and death organisms (concentration N/ μ L) with the use of fluorochromes propidium iodide (PI) and SYTO 13, respectively. In addition, each sample of fresh snow was filtered and the membrane filters were analyzed by X-Ray Fluorescence (XRF). As a complement, a SEM+EDS analysis was performed to obtain the relative abundances of individual particles. For periods of sampling and analysis of atmospheric dispersion HYSPLIT model were performed with retrospective to collection days. Microbiological results were obtained from 33 isolated from cultures of 2°C and 12°C, indicating mostly Gram-positive cocci, and only 3 isolates with characteristics of Gram-negative. In cytometry analyzes were obtained counts ranging between 113 and 2066 events in FL1, and 29 and 660 events in FL2 and 46 to 1648 events FL3, indicating a greater number of viable microorganism, since they are stained with PI and visualized in FL1 and FL3. The results suggest a seasonal pattern in the number of microorganisms deposited on snow with low concentration of events in the months corresponding to the austral winter and spring, increasing the austral summer.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 20

Title: Variabilities of temperature and water vapour above Dome C (Antarctica) from the lowermost troposphere to the lowermost stratosphere

Forename: Philippe Surname: Ricaud

Authors: Ricaud, Philippe; Carminati, Fabien; Plazolles, Bastien; Courcoux, Yann; Genthon, Christophe; Pellegrini, Andrea; Attie, Jean-Luc; El Amraoui, Laaziz; August, Thomas; Warner, Jying;

Presentation Allocated: Oral

abstract: The H₂O Antarctica Microwave Stratospheric and Tropospheric Radiometer (HAMSTRAD) is a radiometer dedicated to sound tropospheric humidity at 183 GHz (water vapour line) and temperature at 60 GHz (oxygen line) over the Dome C, Concordia station, Antarctica (75°06'S, 123°21'E, 3233 m amsl). HAMSTRAD has successfully and permanently been deployed in January 2010 with the goal to study long-term trends in the tropospheric humidity and temperature. To assess the temperature and water vapour measurement of the radiometer, HAMSTRAD data were compared to measurements from in-situ sensors, local radiosondes, the space-borne instruments Infrared Atmospheric Sounding Interferometer (IASI) and Atmospheric Infrared Sounder (AIRS) and the European Centre for Medium-Range Weather Forecast (ECMWF) analyses. With its 7-min temporal resolution, HAMSTRAD measurements show a vertical resolution from 10 to 1000 m from the lowermost troposphere to the upper troposphere/lower stratosphere (UTLS), respectively. The analysis of the temperature and water vapour variabilities at different scales will be explored regarding: 1) diurnal variations caused by shortwave radiation in summer, mainly in the planetary boundary layer, 2) seasonal variations induced by the influence of incoming solar radiations in the troposphere and in the UTLS from winter to summer, and finally 3) intra-seasonal variations mainly attributed to the origin of air masses (cold and dry continental or warm and wet oceanic air masses) producing, within few days, large variations in the troposphere, and also affecting, to a lesser extent, the UTLS.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: Characteristics of temperature inversions over Dronning Maud Land, Antarctica

Forename: Priit Surname: Tisler

Authors: Tisler, Priit; Kilpeläinen, Tiina; Vihma, Timo; Palo, Timo; Kouznetsov, Rostislav;

Presentation Allocated: Poster

abstract: Temperature inversions, which are prominently found in the Antarctic, are usually associated with the largest errors in near-surface variables in numerical weather prediction models. This study addresses the characteristics of the low-level tropospheric temperature inversions in the vicinity of the Finnish Antarctic station Aboa, in western Dronning Maud Land. In-situ measurements were performed during austral summer, December 2010 – January 2011, using Vaisala Digicora tethered sonde system and a sodar. Altogether 66 tethered sonde soundings, yielding 132 vertical profiles, were made in the lowest 1800 m, mostly at evening and nighttime. To complete these vertical temperature profiles near the surface and at the snow surface, measurements from a 10 m weather mast and a longwave radiation sensor were used. In this study, temperature inversion characteristics such as the inversion strength, depth, base height and base temperature are analysed. Special attention is also paid to the temporal occurrence of inversions, the development of the inversion layer in the evening, and the factors controlling the variability of the inversion characteristics. Furthermore, surface-based inversions are examined in more detail.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: Developing a Greater Understanding of the Near-Surface Wind Field of the Ross Island Region

Forename: Mark Surname: Seefeldt

Authors: Seefeldt, Mark; Avallone, Linnea; Kalnajs, Lars; Lazzara, Matthew;

Presentation Allocated: Oral

abstract: An evaluation of automatic weather station (AWS) and archived numerical weather prediction output is completed to develop a greater understanding of the near-surface wind field of the operationally critical Ross Island region. A network of ten AWS sites with observations covering up to ten years will be evaluated to establish an observationally based understanding of the region. Additionally, three years of output from the Antarctic Mesoscale Prediction System (AMPS) 1.67 km domain covering the Ross Island region will be studied to better identify the high-resolution features for the area. The combination of the AWS observations and the AMPS output provides a robust dataset analyzing the local features for the region. The method of self-organizing maps (SOMs) will be presented with the AWS data and the AMPS output to provide a clustering of the dominant patterns for the region. In particular, this study is focused on providing a greater understanding of the atmospheric influences and circulations related to near-surface ozone observations that are being measured at five of the AWS sites.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: Improving Polar WRF forecasts of Antarctic cyclones using data assimilation techniques

Forename: Francis Surname: Otieno

Authors: Otieno, Francis; Bromwich, David;

Presentation Allocated: Oral

abstract: The temperature field of the ice sheet is an important parameter in ice sheet modelling, since it largely determines the ice viscosity, hence becomes important to determine the initialisation of prognostic ice sheet models. Antarctic englacial and subglacial conditions can be elucidated through several techniques. However, since direct measurements are only limited to a few deep drillings to the bed, there is always a substantial amount of ice sheet and thermodynamical modelling involved. This can either be done based on a fully coupled thermomechanical ice sheet model, or a thermodynamical model coupled to present-day ice sheet geometry and environmental conditions. The latter technique was recently employed by Pattyn (2010) in an attempt to determine the likelihood of basal conditions of the Antarctic ice sheet using a series of existing data sets on mass balance and geothermal heat flux. Here, we made an update of this estimate using new data on bedrock elevation and ice thickness (ALBMAP; Le Brocq et al., 2010) and observed surface velocities obtained from interferometric analysis (Rignot et al., 2011). The latter were further constrained by a hybrid ice sheet/ice shelf model to correct for the interior ice flow where observations are lacking, and for correcting the ice flow across subglacial lakes. The new estimates are compared to the initial basal temperature calculation and a new assessment of Antarctic subglacial melt rates is presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: In Memoriam of Neil Adams - A Tribute

Forename: Shelley Surname: Knuth

Authors: Knuth, Shelley; Tsukernik, Maria;

Presentation Allocated: Oral

abstract:

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: Strong Accumulation Event at Princess Elisabeth station in Dronning Maud Land, East Antarctica: a closer look at the synoptic forcing

Forename: Maria Surname: Tsukernik

Authors: Tsukernik, Maria; Gorodetskaya, Irina V.;

Presentation Allocated: Poster

abstract: Changes and variability in the surface mass balance signify one of the most puzzling questions of the present and future changes in Antarctica. Previous studies showed that the atmospheric moisture transport is primarily controlled by transient eddies, signified as synoptic and meso-scale cyclones, originating in the Antarctic coastal seas. Measurements by an automatic weather station (AWS) installed at the northern foot of the Sør Rondane mountain range (at the Princess Elisabeth station, 71057' S, 23021' E, 1392m asl, 173 km inland) showed a particularly strong accumulation event on 19 May 2009. The mean sea level pressure maps and isentropic analysis of specific humidity based on the European Center for Medium Weather Forecast reanalysis (ERA-Interim) data showed that this event was associated with a deep cyclone blocked on the east by a high pressure ridge directing high amounts of moisture into the continent along the 60E meridian. Satellite data of water vapor from SSMI and infra-red cloud composite images from AMRC confirm the moisture transport pattern revealed by ERA-Interim.

☐

We perform detailed analysis of May 2009 accumulation event utilizing Polar Weather Research and Forecasting (WRF) model – a state-of-the-art regional model - forced with ERA-Interim data as boundary conditions. The model is used to examine the effects of increased horizontal resolution and nesting on the moisture transport pathways and precipitation amounts. We also perform observational nudging experiment including measurements from the AWS into our simulation. The results are compared to those from the Antarctic Mesoscale Prediction System (AMPS) output. Upon completion of these validations, we perform sensitivity experiments to determine the role of the large scale atmospheric flow and surface boundary conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: Utilization of Research Networks for Operational Purposes

Forename: Lee Surname: Welhouse

Authors: Lazzara, Matthew; Welhouse, Lee; Keller, Linda;

Presentation Allocated: Oral

abstract: In the data sparse Antarctic, the operational observational network is insufficient in spatial or temporal resolution for logistical applications. For example, operational weather observations are available at staffed stations, but these are located mainly around the coast. Research observation networks such as the Antarctic Automatic Weather Station (AWS) network and other associated networks that also have weather observations such as the Automatic Geophysical Observatories (AGO), Polar Earth Observing Network (Polenet), and the Long Term Ecological Research (LTER) can help to fill the gaps in data sparse areas. The real-time availability of data from research networks is a difficulty that must be addressed as well as how this can limit the usefulness of certain networks from an operational view. Also outlined are the potential impact to operations that is associated with reconfiguration of research networks to meet science objectives and how these changes can affect operational needs. Overall, operational and logistical needs must leverage existing research network assets to achieve greater future success.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: Verification of Antarctic forecasts from ACCESS-P

Forename: Phillip Surname: Reid

Authors: Adams, Neil; Reid, Phillip;

Presentation Allocated: Oral

abstract: TBC

SCAR OSC 2012 - Portland July 16th-19th

Session number: 21

Title: WRF Model Experiments on the Atmospheric Boundary Layer over the Ronne Polynya

Forename: Torge Surname: Lorenz

Authors: Lorenz, Torge; Vihma, Timo; Weiss, Alexandra; Lüpkes, Christof; Lachlan-Cope, Tom; Hartmann, Jörg; Birnbaum, Gerit; Ladkin, Russ; King, John;

Presentation Allocated: Oral

abstract: The Weather Research and Forecasting (WRF) Model ARW V3.3 was applied to simulate the atmospheric boundary layer (ABL) modification over the Ronne Polynya in March 2010. The model results were validated against airborne observations from two research aircrafts. These observations were made during the campaign Joint Airborne Study of the Peninsula Region (JASPER) by the British Antarctic Survey and the Alfred Wegener Institute. Throughout the 36-h-long simulation period on 1-2 March, there was a south to south-westerly mean flow, coming from the ice shelf towards the polynya, which was approximately 10 km wide. Three model experiments were made, all of them receiving boundary conditions from the ECMWF operational analyses. The only difference between the model runs was in the sea ice concentration. The first model run was conducted with the sea ice concentration of the ECMWF operational analysis, which was available in a resolution of 16 km. For the second model run, a sea ice dataset with a much finer resolution was used, the AMSR-E dataset refined by the ARTIST Sea Ice algorithm, in a resolution of 6.25 km. In the third model run the polynya was manually replaced by a compact sea ice cover. Thereby the sensitivity of the ABL modification over the polynya to the sea ice data was analyzed. It is shown that the finer spatial resolution of the AMSR-E sea ice data allows a better simulation of the local polynya effects on the ABL, especially an increase in air temperature, humidity, and near-surface wind speeds. The validation against the observations revealed a cold temperature bias in the model within the ABL under stable to near-neutral conditions, and above the ABL regardless of stratification. The surface fluxes of heat and moisture and the ABL height were investigated along three cross-sections across the polynya. Additionally, an ice breeze from the sea ice surrounding the polynya towards the center of the polynya, and back to the sea ice at higher altitudes, was found in the WRF simulation with the AMSR-E sea ice dataset.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 22

Title: Remote Sensing of Antarctica's Atmosphere with GOME, GOME-2 and SCIAMACHY

Forename: Manfred Surname: Gottwald

Authors: Gottwald, Manfred;

Presentation Allocated: Oral

abstract: Space-borne remote sensing is a suitable method for exploring the rather remote polar atmosphere. Owing to the orbital properties of Earth Observation missions, the sensors on-board the spacecraft platforms cross the polar regions in every orbit thus providing long and continuous coverages. The absorption spectrometers GOME, GOME-2 and SCIAMACHY were embarked on the European Earth Observation missions ERS-2, MetOp and ENVISAT. They provide high-quality atmospheric data since 1995 when the ERS-2 mission was launched. Measuring reflected and scattered sunlight occurs from the ultraviolet via the visible and near-infrared (GOME, GOME-2 and SCIAMACHY) up to the shortwave infrared (SCIAMACHY) wavelength range. A variety of viewing geometries is exploited including nadir, limb and solar and lunar occultations. This permits retrieving geophysical parameters from the bottom of the atmosphere (troposphere) up to its top (lower thermosphere). The instruments have explored the status of Antarctica's atmosphere in the past 17 years in great detail. Highlights include tropospheric halogen oxides such as BrO and IO, ozone hole episodes and corresponding stratospheric chemistry including enhanced Polar Stratospheric Cloud (PSC) occurrence as well as upper atmosphere phenomena such as e.g. Noctilucent Clouds (NLC), the mesopause temperature, thermospheric NO and metal layers. Since the polar atmosphere is considered to be highly sensitive to anthropogenic impacts on the Earth system, and thus to climate change, the record of polar geophysical parameters from GOME, GOME-2 and SCIAMACHY contributes to the understanding of our changing environment. This presentation describes how the European spectrometers can be used to study Antarctica's atmosphere. It outlines the various sensors, their operational in-orbit lifetime together with results of retrieved properties of the polar atmosphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 22

Title: The Concordiasi field experiment over Antarctica: First results from innovative atmospheric measurements

Forename: T. Surname: Deshler

Authors: Deshler, T.; Hertzog, A.; Rabier, F.; Avallone, L.; Cocquerez, P.; Hock, T.; Vargas, A.; Danis, F.; Haase, J.; Cohn, S.;

Presentation Allocated: Keynote 40 mins

abstract: In 2010, 19 long duration balloons were released from McMurdo Station, Antarctica (78°S), between 8 September and 26 October, with mean flight duration 69 days. The balloons drifted on isopycnic surfaces near 18km, circling Antarctica in the winter vortex, and providing a unique set of profile and in situ measurements. Profiles below the gondolas included temperature, pressure, humidity, and winds from both dropsondes and GPS radio occultation. In situ measurements included position, temperature, pressure, ozone, and particles. The scientific issues to be addressed include: satellite validation, performance of global weather prediction models, testing GPS radio occultation, atmospheric gravity waves, photochemical ozone loss, and polar stratospheric cloud formation. The 13 NCAR driftsonde systems provided high-quality, high vertical resolution upper air observations from float level to the surface, returning 644 profiles. Co-locations with the MetOp satellite were dedicated to calibrate IASI data assimilation in numerical models. Co-locations with radiosonde stations checked the dropsonde measurements, and enriched the study of the boundary layer over the plateau. Further profiles targeted gravity wave-prone regions and areas of high sensitivity for numerical weather predictions of tropospheric flow. A proof-of-concept balloon-borne GPS radio occultation system, deployed on two flights, provided 711 occultations. These refractivity measurements are used to derive temperature profiles, comparable to the number of dropsonde temperature profiles. The observed excess phase delay profiles agreed with those simulated from model and data from dropsondes. Due to the quasi-Lagrangian behavior of long-duration balloons, the in situ measurements provide gravity-wave intrinsic frequencies and momentum fluxes, photochemical ozone loss rates, and the temperature dependence of particle nucleation. Position, pressure, and temperature were measured on all balloons, ozone on 6, and particles on 4 balloons. Mountain waves above the Antarctic Peninsula, and significant wave activity above the ocean were measured. Observations every 30 s enabled resolution of the whole spectrum of gravity waves. Near-instantaneous ozone loss rates were determined to be up to 10 ppb per sunlit hour, slightly larger than published values. Two particle flights suggested a nitric acid trihydrate nucleation barrier, while on one flight the balloon drifted within a cloud for a long time period.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 22

Title: Total ozone in Antarctic spring and sea surface temperature variations in the Tropical Pacific

Forename: Gennadi Surname: Milinevsky

Authors: Milinevsky, Gennadi; Evtushevsky, Olexandr; Kravchenko, Volodymyr;

Presentation Allocated: Poster

abstract: Results of analysis of the total ozone column (TOC) values in the Antarctic region in spring response to the sea surface temperature (SST) variations in the Tropical Pacific are discussed. The monthly mean data from the Version 8 Merged Ozone Data Sets and NCEP-NCAR Reanalysis have been used for analysis. Detrended time series over the period 1980-2010 were used for the correlation analysis. Variations of the TOC anomalies in October were considered (i.e., in the month, when the highest ozone depletion is observed) and their response to the SST variations during the 18 preceding months was analyzed. It has been revealed that the highest response is observed in the TOC variations over the Western Antarctica to the SST anomalies in the central part of the Tropical Pacific (30N–30S, 160E–200E). The maximum positive correlation $r = 0.69$ is between the TOC anomalies in October and the SST anomalies in June, four months earlier. Statistically significant response ($r = 0.4–0.5$) is seen also to the SST variations during about one year before the TOC anomalies in October. Over the Eastern Antarctica, the weaker negative TOC response dominates and the correlations are generally lower for the standard climate indices which describe the SST variability in the Tropics, particularly for ENSO. The TOC response exhibits the stationary wave number 1 pattern with the east-west asymmetry caused the climatological ozone hole displacement from the South Pole to Western Hemisphere. The results agree with the previous studies showing that the teleconnections between the Tropical Pacific and Antarctic stratosphere could influence the spring ozone depletion. The results indicate also that the delayed response to the tropical SST could give contribution to the interannual TOC variations in the ozone depleted area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 22

Title: Tropical tropopause layer processes driving stratospheric composition - focus on polar ozone relevant species

Forename: Robyn Surname: Schofield

Authors: Schofield, Robyn; Lane, Todd; Wohltmann, Ingo; Rex, Markus;

Presentation Allocated: Keynote 20mins

abstract: The composition of the stratosphere is driven by transport, temperatures and processes in the tropical tropopause layer – this has implications for ozone, radiation, and surface climate. The properties of the tropical tropopause layer have changed in recent decades, e.g. increases in greenhouse gases (GHGs), and associated changes in dynamics, have cooled the tropical tropopause layer, and the Brewer Dobson Circulation strength has increased. From 1984 to 2005, ozone in the tropical tropopause layer declined, affecting radiative forcing in the tropical tropopause layer region. Water vapour in the tropical tropopause layer modulates much of the chemistry that affects ozone, sulfur and halogen compounds. As a result, understanding water vapour transport through the tropical tropopause layer, its chemical interactions with trace species, and associated aerosol and cloud formation, is a prerequisite to understanding the processing of short-lived substances in the tropical tropopause layer. Here, we compare models for their description of the dehydration processes through the tropical tropopause layer and the influence of convection. Convective treatments are compared - considering models with convective parameterization to those that include cloud-resolving regimes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 22

Title: Use of Tracer-tracer correlations for reconstructing chemical data in the polar stratosphere

Forename: Satheesan Surname: K

Authors: K, Satheesan;

Presentation Allocated: Oral

abstract: The chemical and radiative balance of the stratosphere is dependent on many long lived chemical species. The spatial distribution of long lived chemical species in the stratosphere is dependent on both chemistry and transport. Chemistry-climate models need to be validated against observations for checking how well they represent the processes in order to have confidence in the model predictions of climate change and different scenarios. Unfortunately, sufficient number of observations of many chemical species are not available for validation of the models. Satellite observations of chemical species are useful for validating these models even though the observations are not homogeneous in space and time. Sufficiently long lived species exhibit compact correlations which eliminate day-to-day variations and gives a means to provide a robust constraint on models. The correlation between O₃ and N₂O is a commonly used diagnostic in model comparisons. Similar strong correlations exist for all long-lived tracers due to their transport by the general circulation of the atmosphere even if they are not related chemically. The tight relationships between different constituents have led to many analyzes where measurements of one tracer are used to infer the abundance of another tracer. In other words, we can model the abundance of one tracer in terms of another tracer and making use of their spatial and temporal correlations. In this work, the potential of Fuzzy logic combined with subtractive clustering is used for finding a robust relationship between O₃ and N₂O in the Antarctic stratosphere using satellite data. and O₃ is predicted in terms of N₂O, latitude, longitude, altitude and day of the year. The model for O₃ using this approach has been validated with independent observations. This model, based on fuzzy logic, has been found to be superior to those based on autoregressive technique. This method has the potential to generate long time series of chemical species data from different satellite sensors in a self consistent manner. This has use in model evaluations and data assimilation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 22

Title: UTLS Satellite measurements of chemical trace gases in the context of multiple tropopauses and upper-tropospheric jets.

Forename: Michael J. Surname: Schwartz

Authors: Schwartz, Michael J.; Manney, Gloria L.; Daffer, William H.; Hegglin, Michaela I.; Walker, Kaley A.;

Presentation Allocated: Oral

abstract: UTLS Satellite measurements of chemical trace gases in the context of multiple tropopauses and upper-tropospheric jets. The extra-tropical tropopause region is dynamically complex, with frequent occurrences of multiple tropopauses and of a "tropopause inversion layer" of enhanced static stability just above the tropopause. This tropopause structure is zonally-asymmetric and time-varying and, along with the UT jets and the stratospheric polar night jet, it defines the barriers and pathways that control UTLS transport. Mid-latitude secondary tropopauses are typically extensions of the tropical tropopause across the subtropical jet. They can cover a large region, at times extending poleward beyond 60 degrees latitude and may reach the polar subvortex, particularly during SSW events. In the upper part of these inter-tropopause layers, above the layer of enhanced static stability, air is found to have characteristics suggesting low-latitude, often tropospheric, origin. Averages of trace gases that do not account for tropopause structure (such as zonal or equivalent latitude means) can obscure features of trace gas distributions, thus obscuring both the role of different transport processes in determining these distributions, and the impact of UTLS composition on climate. In this work we examine MLS, HIRDLS and ACE-FTS UTLS trace gas profiles including H₂O, O₃, CO and HNO₃ in the context of extra-tropical tropopause and UT jet structure seen in GEOS-5 fields, to gain understanding of UTLS trace gas distributions and transport barriers. Trajectory analysis provides insight into the origins and destinations of parcels in the inter-tropopause layer. Copyright 2012, California Institute of Technology, All rights reserved.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Analysis of the solar radio emission: Focus on the activity forecasting

Forename: Emilia Surname: Correia

Authors: Correia, Emilia; Corazza, Lia Camargo; Souza, Rodney Vicente;

Presentation Allocated: Poster

abstract: The solar events are very complex phenomena and can impact the interplanetary medium and the Earth's magnetic field. In order to predict the triggering of these phenomena, we present three case studies of the radio emission characteristics observed before X-ray events GOES-class type M, which have relatively strong counterpart at 7 GHz (radio flux between 200 and 400 sfu). All activity period were accompanied by CME (Coronal Mass Ejection), which can occur in association with the intense events. The radio data at 7 GHz was detected with the Solar Radio Polarimeter operating in ROI (Itapetinga Radio Observatory). This equipment has sensibility of 0.5 sfu and best temporal resolution of 10 ms. The data was analyzed using wavelet application, which identified the shorter and longer periods (between 0.1s and 1000s). The objective is to find a pattern in the behavior of the signal that precedes the main events. Once determined, the pattern should be identified in other similar events, so they can be used for solar activity forecasting from short to long term (from hours to days). The analysis shows that the X-ray activity started at least two days before the stronger events, presenting many small X-ray events, which have no excess of emission at 7 GHz but showing an increase in the radio signal noise. The wavelet analysis shows that this radio noise was associated with the appearance of period components in the range between 1 and 300 seconds, which the power increased few hours before the strongest events. More events must be analyzed to verify this behavior, and if it is real could be used for solar activity forecasting. This analysis will be complimented with the solar emission at THz.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Characterization of Mesospheric Gravity Waves observed above King George Island (62°S) during 2010-2011

Forename: Jose V. Surname: Bageston

Authors: Bageston, Jose V.; Batista, Paulo P.; Fritts, Dave; Gobbi, Delano; Wrasse, Cristiano M.; Paes Leme, Neusa M.;

Presentation Allocated: Oral

abstract: The atmosphere above the Sub-Antarctic Islands and Drake Passage is abundant in gravity waves from the troposphere, passing through the stratosphere, and up to the mesosphere. Satellite data and ground base instruments have demonstrated this high gravity wave activity in these regions. Since 2010 an all sky airglow imager observes gravity waves through the OH NIR airglow emission (~ 87 km height) over Comandante Ferraz Antarctic station (62°S) on King George Island. A new-generation meteor radar was installed on that site in 2010 and has been operated simultaneously with the airglow imager. The data set of images of small-scale gravity waves from 2010 and 2011 was partially characterized. The initial results showed similar characteristics for the waves reported in a campaign carried out in 2007. The hourly mean winds inferred from a co-located meteor radar are used to access the intrinsic gravity wave parameters, and also to characterize the vertical propagation conditions together with satellite temperature profiles. This work will present the full observational results for the gravity waves observed in 2010 and 2011 above King George Island. These results are composed by the observed and intrinsic wave parameters distribution, the preferential propagation directions, and a review on the ray tracing technique, with examples of background atmospheric data, which is applied to the observed gravity waves in order to find out their likely sources in the lower atmosphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Comparison of Antarctic riometer radio wave absorption and THEMIS mission energetic electron fluxes

Forename: Sergio E. Surname: Vidal

Authors: Vidal, Sergio E.; Ovalle, Elias M.; Foppiano, Alberto J.; Weatherwax, Allan T.; Stepanova, Marina V.;

Presentation Allocated: Oral

abstract: Simultaneous observations of in situ plasma properties in the tail of the Earth's magnetosphere and of ground based instruments, lying on the same geomagnetic field lines, have recently proved to yield significant new results. In most cases magnetosphere ionosphere interactions during the night-time northern hemisphere conditions are studied. Here, observations of energetic electrons in the tail of the Earth's magnetosphere made by the THEMIS mission satellites are compared with auroral radio wave absorption determined by riometers in the Antarctic for sunlit conditions. Days for which satellites and riometers are connected by the same geomagnetic field line are selected using a geomagnetic field model. The simplest analysis shows clear associations between fluxes and absorptions in some cases. However, these do not necessarily correspond to conjugacy intervals. A further attempt is then made considering the properties of the plasma where the satellites are at the conjugacy time. Ways to determine whether the plasmas correspond to the magnetosphere lobes or the plasma sheet proper are then suggested. Also, the use of different geomagnetic models to determine conjugacy is discussed. The sensitivity of the association between fluxes and absorptions to models is shown and further studies proposed usages.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Evaluating AMPS forecasts of precipitable water using new ground-based GPS measurements in West Antarctica

Forename: David H. Surname: Bromwich

Authors: Bromwich, David H.; Nicolas, Julien P.; Thomas, Ian;

Presentation Allocated: Poster

abstract: The Antarctic Mesoscale Prediction System (AMPS) project provides real-time high-resolution numerical weather forecasts for the Antarctic. These forecasts are generated with the polar-optimized version of the Weather Research and Forecasting mesoscale model (Polar WRF). One important area of potential improvement in AMPS remains the prediction of low-level moisture and cloud cover. Previous studies have demonstrated the benefits of assimilating zenith tropospheric delay (ZTD) data from ground-based GPS measurements in operational models to improve the analysis and forecasting of moisture. During the recent International Polar Year, a large number of GPS receivers have been deployed in West Antarctica, including as part of the POLENET project, providing a valuable new observational dataset for this region otherwise devoid of radiosounding observations. Our previous work compared AMPS precipitable water (PW) estimates and GPS-based PW retrievals with radiosonde observations at McMurdo, the logistical hub of U.S. operations in Antarctica, where AMPS forecasting performance has important operational impact. This preliminary study found in particular a dry bias in AMPS in the lower atmospheric levels. Taking advantage of the new array of GPS measurements, the results presented here extend our investigation to West Antarctica, an area where AMPS does not benefit from the constraint of atmospheric radiosoundings. Because of the persistent moisture convergence to Mary Byrd Land and the local wind pattern over the Ross Ice Shelf, the West Antarctic sector is indeed key to the moisture advection to the McMurdo region. Our presentation concludes on the potential impacts expected from using GPS ZTD data for data assimilation in the AMPS forecasting model. Finally, these results further highlight the interest of GPS observations for atmospheric studies in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Experimental evidence of upstream wave transmission to high latitude through the geomagnetic tail

Forename: Mauro Surname: Regi

Authors: Regi, Mauro; Francia, Patrizia; De Lauretis, Marcello; Villante, Umberto;

Presentation Allocated: Poster

abstract: We conducted a statistical analysis on the upstream wave transmission in the magnetosphere, using magnetic field measurements recorded on the ground and in the magnetospheric tail, during the years 2005-2010. We analyzed ground data at Dome C (DMC), in Antarctica close to the geomagnetic pole ($\lambda \sim 88.84^\circ$ S), and magnetospheric data from Cluster satellites. The analysis was restricted to time intervals during which Cluster was located in the geomagnetic tail on a field line with the footprint close to DCM. The multiple coherence γ^2 between each geomagnetic field component and the magnetospheric field components has been computed as a function of frequency and time; it shows the highest values in the 30-50 mHz frequency range, i.e. at typical upstream wave frequencies, during the time interval 22-08 MLT, when the geomagnetic field line of DMC is stretched in the geomagnetic tail lobes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Gravity wave activities in the upper stratosphere - lower mesosphere observed by Rayleigh lidar at Syowa, Antarctica

Forename: Mitsumu K. Surname: Ejiri

Authors: Ejiri, Mitsumu K.; Nakamura, Takuji; Suzuki, Hidehiko; Abo, Makoto; Tsutsumi, Masaki;

Presentation Allocated: Oral

abstract: The deposition of energy and momentum in the upper stratosphere and lower mesosphere (USLM) by gravity waves propagating upward from lower atmospheric sources strongly decelerates the polar night jet. The transfer of momentum into the background atmosphere induces large scale meridional circulation from the summer pole towards the winter pole. The existence of a stratopause over the winter pole is itself indicative of strong gravity wave dynamical forcing. A Rayleigh lidar was installed at Syowa, Antarctica (69°S, 39°E) in January, 2011. It has been operational since February and has measured temperature profiles between approximately 25 and 70 km for 115 nights in 2011. In this study, gravity wave activity in the USLM is investigated using the temperature data. The temporal and height variabilities of potential energy per unit mass of gravity waves with vertical wavelengths between 4 km and 20 km are analyzed. Gravity waves dissipate above 40-45 km during winter, while there is no dissipation in March-April and August in the USLM. As a result, the seasonal cycle of gravity wave activity shows single peak observed during winter in the upper stratosphere and double peaks observed in March-April and August in the lower mesosphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: INTER-HEMISPHERIC ANALYSIS OF DAYTIME IONOSPHERE BEHAVIOR BETWEEN 2007 AND 2011

Forename: Emilia Surname: Correia

Authors: Correia, Emilia; Raulin, Jean Pierre; Kaufmann, Pierre; Bertoni, Fernando; Fernandez, Jose Henrique; Quevedo, Maria Tereza;

Presentation Allocated: Oral

abstract: The present paper presents 5-year study of the lower ionosphere obtained from VLF sounding done simultaneously at Comandante Ferraz Brazilian Antarctic Station and Atibaia/Brazil. The results show the D-region presents the well known control by solar forcing. In addition, the VLF paths mostly located in one hemisphere show clearly that during the local wintertime the lower ionosphere was strongly affected by the 16-day planetary waves, reinforcing the influence of 'meteorological processes'. On the other hand, in VLF paths with comparable extension in both hemispheres, the PWs are observed during both winter and summer months, suggesting their possible inter-hemispheric penetration.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Long-Term Dependencies of Annual and Semiannual Components of NmF2 over Argentine Islands, Antarctica and Concepción, Chile

Forename: Manuel A. Surname: Bravo

Authors: Bravo, Manuel A.; Foppiano, Alberto J.; Abarca del Río, Rodrigo;

Presentation Allocated: Oral

abstract: An attempt is made to determine whether the annual and semi-annual components of NmF2 observed over Argentine Islands (65.2°S; 64.3°W), Antarctica, and Concepción (36.8°S; 73.0°W), Chile, exhibit long-term trends. Monthly median hourly values of NmF2 determined from ionosonde observations for three solar cycles are used. For each hour, the annual evolutions of monthly mean NmF2 were Fourier analysed to determine the amplitudes and phases of 6 components. Then NmF2 annual evolutions were reconstructed using only annual and semi-annual components. For all cases the goodness of fit of the two components model is assessed by the explained variance. For most cases the explained mean and median variances computed using the components for all 24 hours are well above 90%. The model is significantly better at night and for high solar activity level. The annual component is more significant around midnight, while the semi-annual is more significant around noon for high and low solar activity. The significance of the two components changes systematically with time of day. The trends for amplitudes and phases of both annual and semi-annual components were determined separately for all hours, using a simple regression analysis and also using the standard Mann-Kendall algorithm (<http://ewr.cee.vt.edu/environmental/teach/smprimer/sen/sen.html/>). Moreover, the dependencies of NmF2 and of the annual and semi-annual component amplitudes of F10.7 were also determined, and the corresponding anomalies computed. Trends of these computed anomalies were determined as well. Although the assessed trends for NmF2 and for the semi-annual and annual components of NmF2, are hardly significant by any statistical test, they exhibit a systematic diurnal evolution. NmF2 trends for Concepción are almost null during night time and negative from around noon to the early evening. The same can be said for trends of the amplitudes of the semi-annual component. On the contrary, trends for the annual component are always positive and exhibit a rather irregular diurnal pattern. Trends similarities and differences between Argentine Islands and Concepción are then discussed, taking into account the large latitude separation of the two locations, and the small differences of the length and span of the two time series. It seems reasonable to particularly look for an explanation of the semi-annual components long-term changes when concerned with long-term changes of NmF2.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: New ground-based observations of the middle atmosphere over Syowa, Antarctica (69S, 39E)

Forename: Takuji Surname: Nakamura

Authors: Nakamura, Takuji; Ejiri, Mitsumu K.; Sato, Kaoru; Tsutsumi, Masaki; Yamanouchi, Takashi; Abo, Makoto; Suzuki, Hidehiko; Mizuno, Akira; Tomikawa, Yoshihiro; Nagahama, Tomoo; Isono, Yasuko;

Presentation Allocated: Oral

abstract: The polar middle atmosphere is located in the downward/upward stream of the meridional circulation in winter/summer, and shows a significant seasonal change of temperature in the upper region. The cold mesopause in summer and related phenomena such as PMC (polar mesospheric clouds), NLC (noctilucent clouds), and PMSE (polar mesospheric summer echo) are the most outstanding signals caused by such large amplitude seasonal variations. However, observations of the dynamics and chemistry in the Antarctic middle atmosphere are still very limited. The National Institute of Polar Research (NIPR) is leading a six year prioritized project of the Antarctic research observations since 2010. One of the sub-project is entitled "the global environmental change revealed through the Antarctic middle and upper atmosphere." Profiling dynamical parameters such as temperature and wind, as well as minor constituents is the key component of observations in this project, together with a long term observations using existent various instruments in Syowa, the Antarctic (39E, 69S). Active remote sensings such as a large atmospheric radar (PANSY) and a lidar, as well as profiling of minor constituents by a millimeter wave spectrometer are being installed in Syowa, Antarctica. In this paper, we overview the instrumentation of this project, and results from the first season will be reported. PANSY radar is an MST/IS radar with 47 MHz VHF frequency and 500 kW peak transmission power. The antenna array consists of 1045 crossed Yagi antennas. The lidar system installed in early 2011 is a Rayleigh/Raman lidar, at 355 nm transmission with 6 W average power. The receiver telescopes are with 82 cm and 35.5 cm diameters. A millimeter-wave spectroscopic radiometer for continuous profiling of minor constituents at Syowa Station has been developed as a low electric power consumption system. These new additional instruments for profiling the middle atmosphere are expected to provide valuable information for the study of Antarctic and global atmosphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Study of Seasonal Variations of Quiet time Geomagnetic field at the Indian Antarctic station Maitri.

Forename: Arun Surname: Hanchinal

Authors: Hanchinal, Arun; Vichare, Geeta; Rawat, Rahul;

Presentation Allocated: Poster

abstract: The quiet-time daily variations of the Geomagnetic field components H, D and Z observed at the Indian Antarctic Station Maitri (geographic.70.75 S, 11.73 E ; geomagnetic. 66.84 S, 56.29 E) are discussed. Quiet days ($\Sigma Kp \leq 3$) of each month during year 2009 and 2010 are chosen for the present investigation. Magnetic field variations in all three components clearly indicate that during quiet time Maitri station is under the influence of Sq current loop in the southern hemisphere. It is also observed that seasonal variation of the strength of Sq current system is strongest during summer months and weakest during winter months. In addition, time of peak of Sq current is found to be varying with the season.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Surface radiation balance and radiometric properties at the Brazilian Antarctic station – preliminary results of the ETA Project

Forename: Caio Surname: Ruman

Authors: Ruman, Caio; Soares, Jacyra; Oliveira, Amauri; Targino, Admir; Codato, Georgia;

Presentation Allocated: Poster

abstract: Measuring all components of the surface energy balance in the Antarctic region is important for diagnostic and prognostic studies of climate change and for environmental monitoring. The seasonal and diurnal variations of the surface radiation balance components are described here using in situ observations carried out continuously since March 2011, in the Brazilian Antarctic Station on King George Island (62°05'S, 58°23'W). Radiometric properties of the surface (albedo) and of the air (transmissivity) are also discussed here. The radiation balance, at the surface, was estimated from the radiation components using a pyranometer (model CPM11), a pyrgeometer (model CGR3) and a net radiometer (model CNR4) from Kipp-Zonnen at a sampling rate of 0.05 Hz. These radiometers were set in a 12 meter tower (South Tower) at 1.85 m (CPM11, CG3) and 3.4 m (CNR4) from the surface. This work is running within the framework of the “National Institute of Science and Technology for Environmental Antarctic Research (INCT-APA)”. The data is part of the ETA Project (Estudo da Turbulência na Antártica) and its real-time visualization is available on <http://bit.ly/antarctic-eta>. The ETA Project main objective is to obtain the surface energy balance with the surface turbulent fluxes estimated by the covariance method, during short-duration campaigns (direct measurement) and using different parameterisation formulae, during long-duration campaign (indirect measurement). Funding agency: CNPq and INCT-APA.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 23

Title: Transmission of solar radiation in snowpack in Dronning Maud land, Antarctica

Forename: Onni Surname: Järvinen

Authors: Järvinen, Onni;

Presentation Allocated: Poster

abstract: Snow and ice covers 98% of all surfaces in Antarctica and it is one of the principal components of our global climate system. Therefore understanding the evolution and spatial variations of the optical properties of Antarctic snow cover is crucial. Antarctica also provides a unique environment to study the geophysics of the snow cover. We present here results from FINNARP 2009 expedition which took place during austral summer 2009-10. Most of the measurement sites were within radius of 50 km from the Finnish research station Aboa (S73 02.5'S, W013 24.4') with one longer transect from Aboa to Swedish station Svea. Transect was approximately 180 km in length. The radiation transfer measurements were conducted using a spectroradiometer. From these measurements transmittance and extinction coefficient were calculated. In addition to the radiation measurements, physical characterization of snow stratigraphy was done, including thickness, density, hardness (hand test), and grain size and shape (photographs from crystals). Also Snow Fork designed and manufactured by Toikka Oy was used to measure the liquid water content (wetness). Cloudiness was observed directly in site visits and indirectly from the absolute level of the solar radiation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: A project for a Large Synoptic Astronomical Infrared Survey from the Antarctic Plateau

Forename: Nicolas Surname: EPCHTEIN

Authors: EPCHTEIN, Nicolas; Abe, Lyu; Vauglin, Isabelle; Langlois, Maud; Moretto, Gil;

Presentation Allocated: Poster

abstract: The Antarctic Plateau is the sole place on the Earth where sensitive large scale thermal IR astronomical surveys can be carried out thanks to the unique atmospheric and environmental properties it can offer such as the special turbulence profile (image quality), the low opacity and the reduced thermal background emission of the sky. Large synoptic astronomical surveys exploring the time domain will be key elements of next generation observational facilities and highly complementary to the unique breakthroughs that major future international astronomical facilities such as ALMA, the James Webb Space Telescope and the E-ELT will produce. The thermal IR range is particularly well suited, i) to study the earlier and later stages of stellar evolution and populations, ii) to identify and monitor transient events such as gamma ray-bursts and Type Ia supernovae, chiefly those occurring in dust obscured areas of galaxies, and iii) to monitor the transits of extra-solar planets. Moreover, deep IR surveys can single out and characterize galaxies at very large distance, and thus provide new important clues about the mysteries of dark matter and energy. The main objective of the project would be to map periodically sky areas of a few hundreds of square degrees with an infrared camera featuring an outstandingly large field-of-view attached to a so called Polar Large Telescope (or PLT) of 2 to 3-metre aperture that would carry out repeated deep diffraction limited images in broad band filters. It would visit selected sky areas at various time scales and at an unprecedented depth and angular resolution (0.3"), and generate alerts of transients and react quickly to alerts from other facilities (in space or ground based). The legacy would be ~1 Pbyte of archives consisting of catalogues, maps and alert records accessible through a Virtual Observatory model. At the present time, an effort is made to constitute an international consortium including Australian, Chinese, European and US scientists to support a project for a 2-4 m class telescope to be installed on the best site of the Antarctic Plateau (e.g., Dome C or Dome A) and that could be fully or partly dedicated to such surveys.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Aurorae and airglow at Dome A, Antarctica

Forename: Geoff Surname: Sims

Authors: Sims, Geoff; Ashley, Michael; Cui, Xiangqun; Everett, Jon; Feng, Longlong; Gong, Xuefei; Hengst, Shane; Hu, Zhongwen; Lawrence, Jon; Luong-Van, Daniel; Shang, Zhaohui; Wang, Lifan; Yang, Huigen; Yang, Ji; Xu, Zhou; Zhu, Zhenxi; Moore, Anna; Travouillon, T

Presentation Allocated: Oral

abstract: At Dome A on the Antarctic plateau, despite the absence of artificial light pollution, other factors such as airglow, aurorae and extended periods of twilight have the potential to adversely affect optical observations to some extent. We present spectroscopic data from Nigel, an optical/near-IR spectrometer operating in the 300-850 nm range. These data complement photometric images from Gattini, a wide field (90 degree) CCD camera using B, V and R filters, allowing the background sky brightness to be disentangled from the various airglow and auroral emission lines. Additionally, we are able to quantify the amount of annual dark time available as a function of wavelength, as well as in the standard BVR photometric bands.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Automatic Sky Survey with Antarctic Survey Telescope

Forename: Zhaohui Surname: Shang

Authors: Shang, Zhaohui; Hu, Keliang; Liu, Qiang; Hu, Yi; Ma, Bin; Ashley, Michael; Gong, Xuefei; Storey, John; Wang, Lifan; Yu, Ce; Yuan, Xiangyan;

Presentation Allocated: Oral

abstract: The first of the three Antarctic Survey Telescopes (AST3) has been deployed to Dome A, Antarctica in early 2012. This, the largest optical survey telescope in Antarctica, is equipped with a 10Kx10K CCD. The huge amount of data, limited satellite communication band, low temperature, low pressure and limited energy supply all place challenges to the control and operation of the telescope. We have developed both the hardware and software systems to operate the unattended telescope and carry out the survey automatically. AST3 will be obtaining data for both astrophysics research and site testing. We discuss the system and operations, and present the data from AST3.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: CMB observations from the polar stratosphere

Forename: Silvia Surname: Masi

Authors: Masi, Silvia;

Presentation Allocated: Poster

abstract: The Polar stratosphere offers unique opportunities for astronomical research carried out with stratospheric balloons. Our group is developing payloads and flight opportunities in the polar regions, focusing on Cosmic Microwave Background experiments. The OLIMPO experiment is a balloon-borne telescope devoted to spectral observations of the Sunyaev-Zeldovich effect in clusters of galaxies. Taking advantage of the wide spectral range available observable from the stratosphere, the instrument complements at high frequencies and with similar angular resolution the measurements carried out at 140 GHz by 10-m class telescopes like ACT and SPT.

☐

It is flown during the polar summer for a long-duration (2 weeks) flight, which will allow the spectral mapping of more than 50 clusters. The Large-Scale Polarization Explorer is spinning payload to be flown in the polar night to carry out precision measurements of CMB polarization at large angular scales, not accessible from the ground. Two instruments (SWIPE and STRIP) cover the range 40-220 GHz in 5 frequency bands, with angular resolution of 1-2 deg FWHM and with combined sensitivity around 10 μ K arcmin in a single long duration flight covering 25% of the sky. High sensitivity is obtained in the bolometric instrument (SWIPE) by means of large-throughput photon-noise limited bolometer arrays. We will also describe the testing program we have carried out to characterize the Arctic stratosphere in view of long duration flight carried out from Svalbard islands. These will complement efficiently the flights already carried out in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Deployment of Astronomical Instruments at Dome Fuji

Forename: Naruhisa Surname: Takato

Authors: Takato, Naruhisa; Okita, Hirofumi; Ichikawa, Takashi; Koyama, Takuya; Storey, John; Ashley, Michael C. B.; Bonner, Colin; 52-51st JARE, Dome Fuji team;

Presentation Allocated: Oral

abstract: About 1000 km inland from the coastline, Dome Fuji, with an altitude of 3810 m, is located on one of the highest peaks in the Antarctic plateau. We made an expedition to Dome Fuji in the Antarctic summer of 2010-2011 and deployed instruments for site evaluation including Snodar, an all-sky camera, a weather tower and cameras on an equatorial mount for transit observations of exo-planets. These instruments were designed to be operated over two years by automated power modules called PLATO-F developed by UNSW. We also deployed a 40 cm infrared telescope for sky brightness and DIMM measurements. This telescope will be installed on an 8-m tall platform during the 2012-2013 expedition. While traveling between the Antarctic coastline and Dome Fuji, we measured precipitable water vapor and obtained data showing its relationship to altitude. We present the overview of our 2010-2011 Antarctic expedition and future plans for astronomy at Dome Fuji.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Development of the High Elevation Antarctic Terahertz (HEAT) Telescopes for Ridge A

Forename: C.A. Surname: Kulesa

Authors: Kulesa, C.A.; Hesler, J.; Hnat, K.; Lesser, D.H.; Swift, B.J.; Walker, C.K.; Young, A.G.;

Presentation Allocated: Poster

abstract: Terahertz (THz) frequencies represent the last portion of the electromagnetic spectrum that has the potential of being explored from the ground, and in which the pivotal astrophysical spectral diagnostics of the formation of galaxies, stars, planets, and life are found. However, it is only with recent measurements of exceptional far-infrared atmospheric transparency from the high Antarctic plateau, combined with the increasing maturity of terahertz heterodyne instrumentation, that makes the construction of dedicated terahertz survey telescopes practical and timely. Here, we describe the development of 0.6-meter THz telescopes for remote field operation at an exceptional site, Ridge A, near the summit of the Antarctic plateau. These High Elevation Antarctic Terahertz (HEAT) telescopes provide sensitive heterodyne spectroscopy at frequencies between 0.8 and 2.0 THz, the first cryocooled detectors (50K) in remote operation on the Plateau, on-board data processing, and single-axis motion control in an extreme environment – all at a total power consumption of under 200 watts. The first HEAT telescope prototype, coupled with a specially-designed PLATeau Observatory (PLATO-R), was successfully deployed via Twin Otter aircraft to Ridge A in January 2012 in a joint US-Australian venture supported logistically by the US Antarctic Program. We provide an overview of the design strategies, development challenges, and lessons learned. Both HEAT and PLATO-R represent a new generation of polar instrumentation that exploit the excellent conditions available at remote sites without the costs and hazards associated with manned operations, and will pioneer the way for future astronomical investigations from the high plateau.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: DM-Ice: a Search for Dark Matter at the South Pole

Forename: Reina Surname: Maruyama

Authors: Maruyama, Reina;

Presentation Allocated: Oral

abstract: I will describe DM-Ice, a direct detection dark matter experiment at the South Pole. The aim of the experiment is look for dark matter and to test the claim for its observation by the DAMA collaboration by carrying out an experiment with the same detector technology, but in the southern hemisphere. By going to the opposite hemisphere, many of the suspected backgrounds would produce annual modulation with the opposite phase whereas the dark matter signature should stay the same. DM-Ice17, a 17-kg detector co-located with IceCube Neutrino Observatory, was installed in the Antarctic ice at the South Pole in December 2010 at the depth of 2500 m and is currently taking data. A larger scale experiment that has the sensitivity to DAMA's claim is currently being designed. I will report on the status of DM-Ice17 and the plans for the full-scale experiment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: ESCAPE: First Solar Coronagraphic Observations from Antarctica

Forename: Luc Surname: Dame

Authors: Abe, Lyu; Faurobert, Marianne; Fineschi, Silvano; Kuzin, Sergey; Lamy, Philippe; Meftah, Mustapha; Vivès, Sébastien; Damé, Luc;

Presentation Allocated: Oral

abstract: Antarctica high plateaus (Dome C, Dome A) are unique for high resolution coronagraphic observations: sky brightness is reduced, water vapour is low, seeing is excellent and continuity of observations on several weeks is possible. These combined advantages make Antarctica a remarkable place to install a large solar Observatory. To definitively validate the high resolution and coronagraphic advantages, a small coronagraph experiment, ESCAPE (the Extreme Solar Coronagraphy Antarctic Program Experiment) will first perform 2-dimensional spectroscopy of the forbidden line of Fe XIV at 530.285 nm: precise line profile analysis will allow the diagnostic of the nature of waves by simultaneous measurements of velocities and intensities in the corona. ESCAPE was proposed and accepted for a campaign in 2012-2013 at Dome C/Concordia since all subsystems are available in particular thanks to an ESA STARTIGER 2010 R&D "Toward a New Generation of Formation Flying Coronagraph". Using state-of-the-art technologies developed for Space missions (a Three Mirrors Anastigmat telescope, a 4 stages Liquid Crystal Tunable-filter Polarimeter) allows us to propose an automated Coronal Green Line full-field Polarimeter for unique observations (waves nature and intensity to address coronal heating) with the best possible performances on Earth and for preparing and testing the technologies for the next steps in on ground and in Space. No other site would allow such coronagraphic performances (the sky brightness is a factor 2 to 4 better than in Hawaii) and with high spatial resolution (better than an arcsec is possible). A future advanced facility, AFSIIC (Antarctica Facility for Solar Interferometric Imaging and Coronagraphy) with three off-axis 50 cm telescopes capable of coronagraphy and very high resolution will also be described for major and unique solar observations. Studies are pursued in SCAR/AAA (Scientific Committee on Antarctic Research / Astronomy and Astrophysics from Antarctica) Scientific Research Program.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Final Results from Three Years of Observations with the BICEP Telescope

Forename: Colin Surname: Bischoff

Authors: Bischoff, Colin;

Presentation Allocated: Keynote 20 mins

abstract: The theory of inflation proposes that the universe experienced a sudden period of superluminal expansion just a fraction of a second after the Big Bang, establishing the initial conditions for the everything that has come since. This extraordinary process, unconfirmed by particle physics, plays an important role in the very successful Standard Model of Cosmology. The most promising technique to detect the signature of inflation is to search for the faint impression that it makes in the polarization of the Cosmic Microwave Background (CMB), light that last scattered 300,000 years after the Big Bang. The South Pole has been leading the field of CMB polarization measurements, dating back to DASI, which produced the first detection of CMB polarization in 2002. A new generation of polarization-sensitive microwave telescopes at South Pole will have the sensitivity necessary to detect the signal of inflation occurring at the Grand Unified Theory (GUT) energy scale. BICEP, which operated from 2006 through 2008, is the first microwave polarimeter specifically designed to search for inflation, using small aperture refracting optics, sensitive bolometric detectors, and careful attention to systematic errors. This talk will cover the upper limits placed on inflation from three years of BICEP data -- the best limits to date from CMB polarization -- as well as the lessons learned from that experiment which have been applied to its successors, BICEP2 and the Keck Array.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: First AST3: A remote roboticized astronomical telescope at Dome A

Forename: Xuefei Surname: Gong

Authors: Gong, Xuefei; Yuan, Xiangyan; Du, Fujia; Shang, Zhaohui; Cui, Xiangqun; Wang, Lifan; Zhu, Yongtian; Feng, Longlong;

Presentation Allocated: Oral

abstract: According to site testing efforts of recent years, Dome A of the Antarctic plateau is regarded as an extremely good astronomical site on the earth. CSTAR (Chinese Small Telescope ARray), which is composed of four small telescopes with diameter 145 mm, has been installed at 2008 and run for four years, in this year the First AST3 (Three Antarctic Survey Telescope) also been mounted at Dome A by the 28th Chinese National Antarctic expedition team. First Antarctic Survey Telescope is a 500/680mm modified Schmidt telescope with auto-focusing, pointing and tracking function, mainly aimed observation of supernovae and searching of extra solar planets. This talk presents special design consideration for extreme environment, difficult transportation and mounting at Dome A and current status of this telescope.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: First look at HRCAM images from Dome A, Antarctica

Forename: Geoff Surname: Sims

Authors: Sims, Geoff; Ashley, Michael; Cui, Xiangqun; Feng, Longlong; Gong, Xuefei; Hu, Zhongwen; Lawrence, Jon; Luong-Van, Daniel; Shang, Zhaohui; Wang, Lifan; Yang, Huigen; Yang, Ji; Xu, Zhou; Zhu, Zhenxi; Tothill, Nick; Storey, John;

Presentation Allocated: Poster

abstract: HRCAM (High Resolution CAMera) is a Canon 50D 15-megapixel digital SLR camera equipped with a Sigma 4.5 mm f/2.8 fish-eye lens. It was installed at Dome A on the Antarctic plateau in January 2010 and photographs the sky every few minutes. Primarily functioning as a site-testing instrument, data obtained from HRCAM provide valuable statistics on cloud cover, sky transparency and the distribution and frequency of auroral activity. We present a first look at data from HRCAM during 2010, including a 5 minute time lapse movie spanning the entire winter. We also demonstrate the potential of stellar photometry by using linear combinations of the in-built Canon RGB filters to accurately transfer instrumental magnitudes into the photometric BVR bands.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: First Scientific Results from the High Elevation Antarctic Terahertz (HEAT) Telescope on Ridge A, Antarctica

Forename: C.A. Surname: Kulesa

Authors: Kulesa, C.A.; Ashley, M.C.B.; Augarten, Y.; McLaren, C.; Bonner, C.S.; Burton, M.G.; Bycroft, L.; Lawrence, J.; Lesser, D.H.; Luong-Van, D.M.; Martin, C.L.; Storey, J.W.V.; Swift, B.J.; Walker, C.K.; Young, A.G.;

Presentation Allocated: Oral

abstract: The ecology of our Galaxy, revealed through the evolution of interstellar gas, is best expressed through the terahertz spectral lines of carbon, nitrogen, oxygen, and their ions – which have historically been inaccessible to observation from the ground. Only recently, with measurements of exceptional far-infrared atmospheric transparency and stability from the high Antarctic plateau, combined with increasing technical maturity of terahertz heterodyne instrumentation and autonomous field platforms, has the realization of dedicated ground-based terahertz survey telescopes become both practical and timely. To this end, the 0.6-meter aperture High Elevation Antarctic Terahertz (HEAT) telescopes operate at frequencies between 0.8 and 2.0 THz to explore the Galaxy-wide evolution of gas and stars, the formation and destruction of interstellar clouds, and the dynamics of star-forming regions. In a joint venture between the US and Australia, with logistical support from the US Antarctic Program, a specially-designed PLATeau Observatory (PLATO-R) and a prototype HEAT telescope were deployed by Twin Otter aircraft in January 2012 to an exceptional site near the summit of the Plateau: Ridge A (elevation 4041 m). Here, we present the first scientific results at 0.8 THz from the HEAT telescope currently at Ridge A, discuss the advances expected from the second-generation HEAT telescope to be deployed in January 2013, and highlight exciting prospects for far-infrared/terahertz astronomical investigations from the high Antarctic plateau.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: IceCube, DeepCore and beyond: towards precision particle physics in Antarctica

Forename: Darren Surname: Grant

Authors: Grant, Darren;

Presentation Allocated: Poster

abstract: The IceCube Neutrino Observatory is the world's largest high-energy neutrino telescope, utilizing the deep Antarctic ice as the Cherenkov detector medium. In December 2010 the last of the observatory's 86 strings of optical detectors was deployed, completing the approximate cubic-kilometer array. With the addition of a low-energy extension, called DeepCore, the observatory has very high neutrino detection efficiency for energies ranging from ~ 10 GeV to 10 EeV. The low-energy threshold establishes the first steps towards precision neutrino measurements and low-mass dark matter searches in the Antarctic. Discussed will be early results from this emerging particle physics program as well as initial expectations from studies of potential future detector upgrades towards creating a multi-megaton neutrino detector with $O(10$ MeV) energy threshold.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: IceCube: high energy neutrino and cosmic ray astrophysics

Forename: Katherine Surname: Rawlins

Authors: Rawlins, Katherine;

Presentation Allocated: Keynote 20 mins

abstract: Construction of the IceCube Observatory, a cubic kilometer of Antarctic ice instrumented with 86 strings and over 5000 optical sensors, is now complete. IceCube is a versatile detector, whose primary mission is to search for TeV and PeV neutrinos of astrophysical origin. High-energy neutrino searches target diffuse sources, point sources, and transient sources. All three flavors of neutrino are detectable with IceCube. The detector can also be used for studying atmospheric neutrinos, and the energy, composition, and anisotropy of cosmic rays. An overview of recent results from these searches and studies will be presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Initial report from Keck Array

Forename: James Surname: Tolan

Authors: Tolan, James;

Presentation Allocated: Oral

abstract: The Keck Array is a 2,560 element microwave polarimeter which is currently deployed at the South Pole. It is the latest telescope in the lineage of BICEP and BICEP2, from which it inherits its small aperture refractive optical design, transition-edge sensor (TES) bolometers, SQUID readout, and operational knowledge. The Keck Array also shares the focused science goal of the previous experiments: we search for B-mode signal in the polarization of the Cosmic Microwave Background (CMB) in order to set constraints on models of inflation. Inflation is a process believed to have caused a rapid expansion of the Universe a fraction of a second after the Big Bang. Physically, the Keck Array consists of five co-pointed 512 detector telescopes, each differing from BICEP2 mainly in regards to cryogenic techniques. The increased number of detectors employed with the five telescopes improves our sensitivity and will allow us to improve our ability to constrain models of inflation by a factor of 5 over BICEP2. I will discuss the upgrades made to the BICEP2 design, current status of the experiment and projected results.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Integral field spectroscopy on small aperture telescopes

Forename: Samuel Surname: Richards

Authors: Richards, Samuel; Martin, William; Jones, Hugh; Gallaway, Mark; Campbell, David; Bland-Hawthorn, Joss; Lawrence, Jon; Brinks, Elias; Sarzi, Marc; Smith, Dan; Leon-Saval, Sergio; Bryant, Julia; Fogarty, Lisa; Goodwin, Michael;

Presentation Allocated: Poster

abstract: The art of integral field spectroscopy is one that has come on in leaps and bounds over the last decade, and is really pushing our understanding of galaxy formation and evolution. Of the 30 such instruments around the world, all but one are on 2+metre class telescopes. It is now possible to exploit recent advancements in small aperture telescopes (<0.5m) to enable an integral field spectrograph with a performance that allows taxonomy via optical emission line analysis ($H\beta$ to SII). An integral field spectrograph on this class of telescope warrants its use in Antarctica, and its ability to obtain data on 10^2 – 10^3 nearby galaxies in 500 hours of observing enables it to probe a new parameter space to aid our understanding of galaxies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Measurement of acoustic properties of the glacial ice at the South Pole

Forename: Rolf Surname: Nahnhauer

Authors: Nahnhauer, Rolf;

Presentation Allocated: Oral

abstract: The detection and study of ultra-high energy neutrinos produced by cosmic sources would answer fundamental questions of particle physics, astrophysics and cosmology. The expected tiny flux of these neutrinos requires detection targets of several hundred cubic kilometers, two to three orders of magnitude larger than presently existing devices. The Antarctic ice cap could be an ideal medium for that purpose allowing in principle the simultaneous measurement of optical, acoustic and radio signals from ultra high energetic neutrino interactions in the ice. Before such a hybrid detector concept can be realized, a careful investigation of specific ice properties has to be made. The South Pole Acoustic Test Setup - SPATS - has been built to evaluate the acoustic ice properties at the South Pole in the 10-100 kHz range. Four strings have been deployed in the upper part of bore holes drilled for optical sensors of the IceCube experiment. There are seven acoustic stations per string, with receivers and transmitters frozen in down to a maximum depth of 500 m. The SPATS data allowed us to do detailed in-situ studies of ice acoustic properties and their dependence on ice depth, direction, and frequency. The sound speed for pressure waves and partly for the first time for shear waves has been profiled. The sound attenuation has been measured and found in disagreement with expectations. An upper limit could be derived for the absolute acoustic noise level in the ice and transient noise sources have been mapped. To build 100 km³ size detectors in the ice needs new and at least partly robotic drilling technologies. A novel concept in this direction will be presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Millimetre astrophysical observations and site testing from Mario Zucchelli and Concordia Stations

Forename: Lucia Surname: Sabbatini

Authors: Sabbatini, Lucia; Dall'Oglio, Giorgio; Pizzo, Licia;

Presentation Allocated: Oral

abstract: Over the last few years, many astrophysical observations have been conducted using the OASI telescope (Infrared and Submillimetric Antarctic Observatory) located at the Italian Mario Zucchelli Station. The main scientific results concern the cold dust contained in HII regions and its physical parameters (dust temperature and spectral index), that have been estimated by modelling the free-free and modified black body emission. Other interesting results concern for example the millimetre brightness temperature of planets (Saturn and Mars). COCHISE (Cosmological Observations at Concordia with High-sensitivity Instrument for Source Extraction) is a telescope similar to OASI located at Concordia Station. During December 2010, the first light of COCHISE has been achieved. After all the tests and preliminary procedures, COCHISE is now fully working; the first observations are extremely promising. This result encourage the Group to start the cosmological observations, main goal of the project. Site characterization has been performed at MZS and Concordia by monitoring the columnar water vapour content. Our measurements, performed with a spectral hygrometer, have been compared to radiosounding data and to skydip observations in order to provide millimetric transparency. We report on the main results of the activity at both telescopes and on the status of the project, in the perspective of future observations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Numerical Models for Site Testing at Astronomical Observatories in Antarctica

Forename: Philip Surname: Anderson

Authors: Anderson, Philip;

Presentation Allocated: Poster

abstract: The planning of an optical astronomical observatory involves site testing to categorise the atmospheric climate, and hence the suitability, of the site for the telescopes. Traditionally, optical seeing, cloudiness, sky brightness and so forth, are monitored for months or years by dedicated instruments to build the necessary data base. These requirements are similar for future polar observatories but a different approach to site testing is possible. A combination of modern numerical atmospheric models, remote sensing and the relative simplicity of the topography means that much more emphasis can be placed on modeling the site rather than measuring. Some in situ instruments are still needed, in order to assess the validity of these models, but once validated, decades of existing numerical data from the climate community are then available to assess the site, and give accurate predictive probabilities of such aspects as cloud, air glow, aurora, seeing and winds. This scheme is not without problems, however: aside from a harsh working environment, the chosen sites for Antarctic polar astronomy are extreme in terms of fluid dynamics; indeed, it is the very nature of near laminar flow in the atmosphere that draws the Astronomy community to these places. Laminar or "stable" boundary layers are still not well understood and the subject is active in the meteorological community to better encapsulate energy transfer and other land-air processes that are key to climate models. AAA should be aware of these programmes for two reasons. 1. The AAA could offer superb facilities to assist in gather validation data for these state of the art models. 2. The groups developing stable boundary layer models will be able to offer unprecedented forecasting of seeing conditions. Collaboration between the AAA and this climate community could begin to develop "adaptive observing", i.e. forecasting exceptional seeing (or poor seeing) some days or weeks ahead, and thence modifying the telescope's instrument set. The key group working on Stable Boundary Layers (SBLs) are GEWEX GASS, who are about to embark on their 4th major inter-comparison of SBL models. For the first time, the validation data for these comparisons will be polar (Dome C and Halley). These will offer similar fluid dynamic conditions as expected at other Antarctic domes, allowing better modeling possibilities and guiding future AAA site testing.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: PLATO-R: a new concept for Antarctic science

Forename: Michael Surname: Ashley

Authors: Ashley, Michael; Augarten, Yael; Bonner, Colin; Bycroft, Luke; Lawrence, Jon; Luong-Van, Daniel; McDaid, Scott; McLaren, Campbell; Sims, Geoff; Storey, John;

Presentation Allocated: Oral

abstract: PLATO-R is an autonomous, robotic observatory that can be deployed anywhere on the Antarctic Plateau by Twin Otter aircraft. It provides heat, data acquisition, communications and up to 1kW of electric power to support astronomical and other experiments throughout the year. PLATO-R was successfully deployed in January 2012 to Ridge A, believed to be the site with the lowest precipitable water vapour (and hence best THz transmission) on earth. PLATO-R improves upon previous PLATO designs that were built into ten-foot shipping containers by being much smaller and lighter, allowing it to be field deployable within 48 hours by a crew of four.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: POLAR-1 and the future of CMB lensing surveys with POLAR Array

Forename: Zeeshan Surname: Ahmed

Authors: Ahmed, Zeeshan;

Presentation Allocated: Oral

abstract: POLAR-1 is a next-generation polarimeter to study the cosmic microwave background (CMB), building upon the technological success of BICEP, BICEP2 and the Keck Array. It will be a 1.6-m aperture telescope with 5-arcminute resolution at 150 GHz, coupled to a focal plane of 2000 dual-polarization pixels. This will provide a factor of six improvement in angular resolution over BICEP2 and Keck Array, and nearly a doubling of pixels over Keck Array. POLAR-1 will thus enable sensitivity to B-mode polarization of CMB photons from degree to arcminute angular scales. Consequently, a three-year observation program will set constraints on inflation models in terms of tensor-to-scalar ratio of <0.01 . Additionally, POLAR-1 will detect B-modes from lensing of the CMB by large-scale structure, providing insight into the dark matter distribution at high redshift, and offering a tool for precision cosmology in the post-Planck era. POLAR-1 is currently under construction and is slated for deployment to the South Pole in late 2013. POLAR-1 will also potentially serve as a pathfinder for an array of similar instruments with the ambitious goal of producing polarizations maps sufficiently deep for lensing reconstruction of a significant fraction of the sky. The POLAR Array will consist of $\sim 15,000$ pixels in ~ 10 POLAR-1-like polarimeters. It will set constraints on tensor-to-scalar ratio well below 0.01 with the aid of delensing, and will also probe the sum of neutrino masses to an unprecedented $<0.05\text{eV}$. In this talk, I will discuss the technological advances that make possible sensitivity increases beyond BICEP-2 and the Keck Array, the current status of POLAR-1 construction and the future of CMB lensing surveys with the POLAR array.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Probing Inflation with the BICEP2 Telescope at the South Pole

Forename: Randol Surname: Aikin

Authors: Aikin, Randol;

Presentation Allocated: Poster

abstract: For over two decades, the South Pole has been the premier observing site for experimental cosmology. Like its predecessor BICEP, BICEP2 targets the degree-scale polarization of the Cosmic Microwave Background (CMB). Our goal is to measure the curl component (or B-mode polarization) of the CMB which would provide strong evidence for the epoch of Inflation; the radical proposition that the Universe underwent a period of exponential expansion in just a tiny fraction of a second after the Big Bang. BICEP2 builds upon the success of previous generations of telescopes by employing cutting-edge detector technology and a proven observational strategy. Transition-edge sensor based detectors together with Superconducting Quantum Interference Devices are used to form closely packed arrays, making possible our order-of-magnitude increase in mapping speed over BICEP. Deployed to the field in 2009, BICEP2 is now in its third and final year of operation. The observing target is the Southern Hole, a region of the night sky accessible from the South Pole and exceptionally free from galactic foregrounds. Excellent observing efficiency is made possible by the extreme latitude as the observing target never sets below the horizon. With over 10,000 hours of data already acquired on this 800 square-degree field, it is currently the deepest CMB polarization data set of its kind. We will provide a brief and general overview of the instrument and observing strategy, a description of our summer and winter operations, and finally present the latest results from our ongoing analysis effort.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Science Goals for Antarctic Observatories

Forename: Michael Surname: Burton

Authors: Burton, Michael;

Presentation Allocated: Poster

abstract: The remarkable environment of Antarctica provides new opportunities for a wide range of investigations in observational astronomy, across both the photon and the particle spectrums. As part of the SCAR Astronomy and Astrophysics from Antarctica Scientific Research Program we (Working Group C: Science Goals) have considered what kinds of astrophysical research programs can best be conducted in Antarctica. This presentation summarises the conclusions of this Working Group. A range of frontier investigations, covering the domains of optical & infrared astronomy, terahertz and sub-millimetre astronomy, the cosmic microwave background radiation, neutrinos & cosmic rays and solar astronomy, are proposed as providing foci for developing future Antarctic astrophysical endeavours.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Site testing at Concordia Base (Dome C) for future cosmological observations.

Forename: Alessandro Surname: Schillaci

Authors: Schillaci, Alessandro; Masi, Silvia; de Bernardis, Paolo;

Presentation Allocated: Oral

abstract: The current challenge in cosmology is the detection of B-Mode polarization of the cosmic microwave background, predicted by the inflationary model. The QUBIC (Q and U Bolometric Interferometer for Cosmology) experiment uses the new technique of the bolometric interferometry in order to more precisely control instrumental systematics. This, combined with the high sensitivity of cryogenic bolometer arrays, will allow to further improve our knowledge of the CMB polarization. The installation of the experiment is scheduled for the 2014 antarctic summer at the Concordia Base in Dome-C. During the last years we have performed extensive site and logistic test campaigns. In this contribution we will introduce the QUBIC experiment and present the results of the measurements of emission and polarization degree of the atmosphere at 150 GHz, performed in 2009-2010 summer with the BRAIN-Pathfinder, as well as the infrared measurements of the precipitable Water Vapour (PWV) with a spectral hygrometer during the 2011-2012.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Snodar - The Dome F story

Forename: Colin Surname: Bonner

Authors: Bonner, Colin; Ashley, Michael; Storey, John; Ichikawa, Takashi; Takato, Naruhisa; Okita, Hirofumi; JARE Dome Fuji team, 51st and 52 nd;

Presentation Allocated: Poster

abstract: Snodar is a high frequency, high resolution acoustic radar designed specifically to profile atmospheric turbulence within the atmospheric boundary layer on the high Antarctic plateau. Snow and ice accumulation on instrumentation in Antarctica is a common problem. The original Snodar design, operating at Dome A since 2009, utilises 200W of heaters attached to the back of its parabolic dish to reduce frost formation and sublime small portions of snow. This system was found to provide satisfactory performance until large amounts of snow accumulation in around August each year proves too difficult to sublime. A new Snodar was installed at Dome F in the beginning of 2011. As this instrument will only be serviced every two years, a mechanical snow removal device is fixed to the parabolic reflector and the heater power reduced to 50W. We present here the design of the mechanical snow removal device, and some initial data from Dome F.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: The ARIANNA High Energy Neutrino Detector

Forename: Corey Surname: Reed

Authors: Reed, Corey;

Presentation Allocated: Poster

abstract: The ARIANNA experiment is designed to exploit the unique geophysical properties of the Ross Ice Shelf on Antarctica in order to observe very high energy neutrinos. Cosmogenic neutrinos produced by collisions of cosmic rays with CMB photons are expected to be a guaranteed source of such high energy neutrinos, although their flux has so far remained immeasurably small. ARIANNA will use the coherent Cherenkov radio emission of neutrinos with energies above 100 PeV to achieve a sensitivity to the neutrino flux that is an order of magnitude better than current limits. Several prototype stations have been deployed and have taken data during the Antarctic summers of 2011 and 2012. The motivation and design of these stations will be presented, and recent results from the deployment will be discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: The Askaryan Radio Array

Forename: Kara Surname: Hoffman

Authors: Hoffman, Kara;

Presentation Allocated: Oral

abstract: Building on the expertise gained by RICE, ANITA and IceCube's radio extension in the detection of neutrinos via the Askaryan effect in cold Antarctic ice, we are currently developing an antenna array known as ARA (The Askaryan Radio Array) to be installed in boreholes extending 200 m below the surface of the ice near the geographic South Pole. The unprecedented scale of ARA, which will cover a fiducial area of 150 square kilometers, was chosen to ensure the detection of the flux of ultra high energy cosmogenic neutrinos. A cluster of test antennas installed near the South Pole Station in 2010/11 has confirmed assumptions on ice quality and the radio quietness of the location. In the 2011/12 austral season, a first full prototype cluster of 16 antennas was successfully installed in the ice. Within 3 years of commencing operation, the full ARA would exceed the sensitivity of any other instrument for the detection of cosmogenic neutrinos in the 0.1-10 EeV energy range by an order of magnitude.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: The progress of CSTAR data reduction

Forename: Songhu Surname: WANG

Authors: WANG, Songhu; ZHOU, Xu; ZHNAG, Hui; ZHOU, Jilin;

Presentation Allocated: Poster

abstract: In 2008 January the 24th Chinese expedition team successfully deployed the Chinese Small Telescope ARray (CSTAR) to DomeA, the highest point on the Antarctic plateau. CSTAR consists of four 14.5cm optical telescopes, each with a different filter (g, r, i and open) and has a 4.5degree x 4.5degree field of view (FOV). Based on the CSTAR data the initial statistic of astronomical observational site quality and the light curvers of variable objects were obtained. For reach a higher photometric quality, we are continue working for overcome the affectin of uneven cloud cirrus, optical "ghost" disturb and intra pixel sensitivity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: The Stratospheric Terahertz Observatory (STO)

Forename: Christian Surname: Glueck

Authors: Glueck, Christian;

Presentation Allocated: Oral

abstract: Understanding the structure of the interstellar medium, the life cycle of interstellar clouds, and their relationship with star formation is crucial to deciphering the internal evolution of galaxies. Rapid, high resolution spectral line imaging of key gas tracers not accessible from the ground are needed to fill in major missing pieces of Galactic structure, such as the barometric distribution, and to witness the formation and dissipation of interstellar clouds. The Stratospheric Terahertz Observatory (STO), a balloon-borne 0.8-meter telescope, helps us to fill in these missing pieces. STO I launched successfully on 1/14/12 at the Columbia Scientific Balloon Facility (McMurdo) and landed on 1/27/12 on the Ross Ice Shelf. With STO I, we successfully observed [CII] 158 μm and CO J=12-11 emission in bright star forming regions, e.g. NGC 3576, eta Carina and the giant molecular cloud G328. We also obtained 15'x15' maps of CI toward these regions as well as a b-strip from -1Deg to +1Deg at 357.46Deg (gal. coord.). We proposed for STO II, a reflight of STO with improved hardware and better mapping capabilities, to be launched in late 2014. During its 10 to 14 day flight, STO II will map [CII] 158 μm and [N II] 122 μm emission in a 35 square degree area ($-20\text{Deg} < l < -55\text{Deg}$; $-0.5\text{Deg} < b < +0.5\text{Deg}$), as well as 5 deeper strips in Galactic arm and inter-arm regions ($|b| < 1\text{Deg}$), with an angular resolution of 1'. STO II will detect and resolve (spectrally and spatially) all Giant Molecular Clouds (GMCs), all significant H II regions, and all cold neutral medium (CNM) atomic clouds with $A_V > 0.4$ mag (potential building blocks of GMCs) in the surveyed region. STO data will be combined with other observations and surveys of tracers of interstellar gas to arrive at comprehensive picture of the life cycle of interstellar clouds in our galaxy.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Where is Ridge A?

Forename: Geoff Surname: Sims

Authors: Sims, Geoff; Saunders, Will; Kulesa, Craig; Ashley, Michael; Lawrence, Jon; Storey, John;

Presentation Allocated: Poster

abstract: First identified in 2009 as the site with the lowest precipitable water and best terahertz transmission on earth, Ridge A is located approximately 150 km south of Dome A, Antarctica. To further refine this optimum location prior to deployment in 2012 of a robotic THz observatory, we have modelled the atmospheric transmission as a function of location over a 1000 km square grid using three years of data from the Microwave Humidity Sounder on the NOAA satellite. The modelling identifies a broad area of exceptionally low water vapour close to the 4,000 metre elevation contour, reaching below 25 microns for extended periods of time.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 25

Title: Winter Sky Brightness and Cloud Cover at Dome A, Antarctica

Forename: Anna Surname: Moore

Authors: Moore, Anna; Yang, Yi; Fu, Jianning; Ashley, Michael; Cui, Xiangqun; Feng, LongLong; Gong, Xuefei; Hu, Zhongwen; Lawrence, Jon; Luong-Van, Daniel; Riddle, Reed; Shang, Zhaohui; Tohill, Nick; Travouillon, Tony; Wang, Lifan; Yang, Huigen; Yang, Ji; Zhou, X

Presentation Allocated: Oral

abstract: At the summit of the Antarctic plateau, Dome A offers an intriguing location for future large scale optical astronomical Observatories. The Gattini-DomeA project was created to measure the optical sky brightness and large area cloud cover of the winter-time sky above this high altitude Antarctic site. The Gattini- DomeA camera was installed on the PLATO instrument module as part of the Chinese-led traverse to Dome A in January 2008. This automated wide field camera consists of an Apogee U4000 interline CCD coupled to a Nikon fisheye lens enclosed in a heated container with glass window. The system contains a filter mechanism providing a suite of standard astronomical photometric filters (Bessell B, V, R) and a long-pass red filter for the detection and monitoring of airglow emission. The system operated continuously throughout the 2009, and 2011 winter seasons and part-way through the 2010 season, recording long exposure images sequentially for each filter. We have in hand one complete winter-time dataset (2009) returned via a manned traverse. We present here the first measurements of sky brightness in all three photometric bands and corresponding cloud cover measurements recorded during the winter season.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Amino acids in polar aerosols

Forename: Elisa Surname: Scalabrin

Authors: Scalabrin, Elisa; Zangrando, Roberta; Barbaro, Elena; Gambaro, Andrea; Barbante, Carlo; Capodaglio, Gabriele; Cescon, Paulo;

Presentation Allocated: Poster

abstract: Amino acids are recognized as significant components of atmospheric particles and they could be involved in cloud formation [1], act as ice-forming nuclei and affect pollutants scavenging and secondary aerosol formation[2,3]. As amino acids have a wide range of reactivities, they can help determine the atmospheric transport of particles and drops [2]. Several sources affect atmospheric amino acids, complicating the possibility of identifying their origin. Polar regions offer an unique opportunity to investigate the global atmospheric characteristics and to conduct source apportionment studies of such compounds. In this study we report the results from the determination of 20 free amino acids (FAAs) in 30 aerosol samples collected in polar sites at the Gruvenbadet Station, Ny-Ålesund, from April, 19 to September 14, 2010 and at the Campo Faraglione station, in the Terra Nova Bay, from November, 3, 2004 to January, 10, 2005. Samples were processed and analyzed using a previously developed method [4]. Total FAA concentrations resulted generally higher in the Arctic than in the Antarctic samples, that showed different FAA content and patterns. The dominant compounds were glycine and serine, which accounted together for at least the 30% of the total FAAs concentration, in both Arctic and Antarctic samples. Size segregation of Arctic aerosol in 6 dimensional classes allowed to study the amino acids size distribution, evidencing higher concentrations in the finest fraction (<0.49 µm) in almost all samples. Some samples showed a more complex distribution, suggesting the presence of local derived aerosol. Local aerosol sources, as volcanic activity and human induced fires, affected FAA concentrations and distribution in the samples collected during these events. Based on the different FAAs reactivity and the back trajectory analysis, we determine marine derived aerosol as the major amino acid source for both Arctic and Antarctica, demonstrating the contribution of long range transport. [1] Chan, M.N.; Choi, M.Y.; Ng, N.L.; Chan, K.C. Environ. Sci. Technol. 2005, 39, 1555-1562 [2] McGregor, K.G.; Anastasio, C. Atmos. Environ. 2001, 35, 1091-1104. [3] De Haan, D.O.; Corrigan, A.L.; Smith, K.W.; Stroik, D.R.; Turley, J.J.; Lee, F.E.; Tolbert, M.A.; Jimenez, J.J.; Cordova, K.E.; Ferrell, G.R. Environ. Sci. Technol. 2009, 43, 2818-2824. [4] Zangrando, R.; Piazza, R.; Cairns, W.R.L.; Izzo, F.C.; Vianello, A.; Zendri, E.; Gambaro, A. Anal. Chim. Acta. 2010, 675, 1-7

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Antarctic analogues: Microbial ecosystems and comparative biodiversity in the Canadian High Arctic

Forename: Warwick Surname: Vincent

Authors: Vincent, Warwick; Lovejoy, Connie;

Presentation Allocated: Oral

abstract: Permafrost landscapes with diverse types of deep lakes and seasonally frozen shallow waters are well known features of coastal Antarctica, and a similar diversity of aquatic ecosystems also occurs at high latitudes in the north polar region. Comparisons of these waters in High Arctic Canada versus Antarctica reveal that there are many commonalities, but also fundamental differences. Many of the freshwater habitats in both polar regions contain cyanobacterial mats that can dominate total ecosystem biomass and productivity, and initial genomic comparisons suggest some phylogenetic similarities between the microbial consortia that constitute Arctic and Antarctic mats. The meromictic lakes of northern Ellesmere Island have salinity-stratified, solar heated water columns similar to those observed in parts of Antarctica, and analyses by flow cytometry, HPLC pigments and DNA tag-pyrosequencing indicate a similar degree of biological stratification in both polar regions, with a large presence of picocyanobacteria in the Arctic and in some Antarctic lakes. Little is known about the microbiology of epishelf lakes (freshwaters dammed by ice shelves and overlying the sea) in either polar region, but our ongoing studies on the Arctic epishelf lake in Milne Fiord show diverse, stratified populations down through the water column. HPLC pigment analysis showed pronounced differences in phytoplankton composition through the highly stratified water column of the fiord. Chlorophytes dominated in the epishelf lake, prasinophytes prevailed in the halocline, while the bottom layer harboured mainly fucoxanthin groups. Clone libraries of a dark-incubated, concentrated sample from below the halocline (30 m) yielded marine Archaea (mainly Crenarchaeota), and known bacterial taxa from the Pacific and Arctic oceans (e.g., *Marimonas*, *Colwellia*). An equivalent sample from the epishelf lake (5 m) yielded many bacterial taxa that are characteristic of cold, freshwater habitats (e.g., *Polynucleobacter*, *Variovorax*), the euryhaline genus *Polaromonas*, and freshwater eukaryotes, notably ciliates. All of these Arctic ecosystems are undergoing major perturbations caused by rapid climate warming, and documenting these changes may yield additional insights into the controls on microbial ecosystem structure and function in both polar regions. Pole-to-pole genomic comparisons will also further our understanding of microbial dispersal and evolution throughout the cold biosphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Asymmetries in the gene pool of marine bipolar species of the protozoan ciliate, *Euplotes*

Forename: Graziano Surname: Di Giuseppe

Authors: Di Giuseppe, Graziano; Dini, Fernando; Vallesi, Adriana; Luporini, Pierangelo;

Presentation Allocated: Oral

abstract: Asymmetries in the gene pool of marine bipolar species of the protozoan ciliate, *Euplotes*. Di Giuseppe¹, F. Dini¹, A. Vallesi², C. Alimenti² and P. Luporini^{2*}¹Dipartimento di Biologia, University of Pisa; ²Dipartimento di Scienze Ambientali e Naturali, University of Camerino. Among a vast array of strains of the most ubiquitous ciliate, *Euplotes*, isolated from different sites of the Antarctic, Fuegian and Arctic coasts, we initially used morphological, genetic and breeding analyses to identify strains representative of three distinct species, i.e., *E. nobilii*, *E. polaris* and *E. euryhalinus*, characterized by a bipolar distribution. Of these strains we then determined the nuclear 18S rRNA gene sequences. The comparison of these sequences revealed that the Antarctic and Fuegian strains of each species were genetically homogeneous. Instead, with the exception of *E. polaris*, the Arctic strains differed from one another for up to five single nucleotide polymorphisms, and this extent of sequence divergence was found to be equivalent with the divergence shown by each species between the Antarctic and Fuegian strains on one side and the Arctic strains on the other side. By further analyzing these polymorphisms, we obtained evidence that the Arctic populations of *E. nobilii* and *E. euryhalinus* contain members that are hybrids with members of their Antarctic and Fuegian counterparts. It was therefore concluded that in these species there is a gene flow which is largely unidirectional from the Southern to the Northern pole. *Corresponding author <piro.luporini@unicam.it>

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Biogeochemical Partitioning Between the Liquid Water and Ice Phases during Freeze-Down in Antarctic and Arctic Lakes

Forename: Pamela Surname: Santibáñez

Authors: Santibáñez, Pamela; Michaud, Alex; Vick, Trista; Adams, Heather; Dore, John; D'Andrilli, Juliana; Priscu, John;

Presentation Allocated: Poster

abstract: The thick ice covers on polar lakes play a major role in the physical, chemical and biological properties of these lakes. Of particular importance is the partitioning of chemical and biological constituents between the water and ice, which can produce highly concentrated brines beneath the overlying ice and influence the biogeophysical properties of the ice itself. As water molecules freeze they create a crystalline lattice that repels most of the solutes and particulate matter that was in the water. The materials that are trapped in the ice typically concentrate in localized inclusions or concentrate between the ice grains. Despite much contemporary interest in the habitability of icy systems at Earth's poles, little is known about how constituents partition between the liquid and solid phase. We conducted a series of controlled freezing experiments using water from selected Arctic and Antarctic lakes to investigate chemical and biological fractionation between ice and water as the lake water freezes. The experiments were conducted in an insulated 50 liter mesocosm held at -100 C for 5 days in an environmental chamber designed to represent a "cold sky". Liquid samples were collected through a conduit in the ice at time points coinciding with each 5 cm of new ice formation. Once the ice had frozen almost completely to the bottom, the ice was cut into 5 cm sections to coincide with the time of liquid water collection. Conductivity, total ions, dissolved organic carbon and bacterial density were then measured in all samples. The experimental freezing generated the ice at different freezing rates of 0.5, 1.3 and 1.2 mm/h. The partitioning coefficient for Cl⁻ was estimated as 0.0087 and for NO₃⁻ as 0.0064; both of them are typically incorporated into the ice-lattice and showed a positive linear relationship with the ice formation. The ice-water partitioning of DOC, TOC, SO₄²⁻ and Br⁻ is a complex process because of the varied sites of incorporation of elements within ice, the effects of one ion on the incorporation of another, and the chemical species solubility. The partitioning into the ice phase increased as the conductivity in the lake water increased during the freezing process. The bacteria and microalgae trapped within the ice matrix formed distinct aggregates which appear to be related to the cryoconcentration of dissolved organic carbon within the lake water.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Bipolar Atlantic Thermohaline Circulation

Forename: Svein Surname: Osterhus

Authors: Osterhus, Svein;

Presentation Allocated: Poster

abstract: In the BIAC project we have studied the Arctic and Southern Ocean shelf ventilation processes and discussed their impacts on the bipolar Atlantic thermohaline circulation. Measurements in the Weddell Sea indicate a slower uptake of CO₂ in the ocean than predicted. Analysis shows that the ice formation in Storfjorden, Svalbard is effective because favourable winds keep polynyas open. Water samples analysis showed that the increased salinity due to brine release was associated with higher carbon concentration. This indicates, in contrast to earlier understanding, that ice formation is enhancing the ocean CO₂ uptake. Measurements and models indicate that the Atlantic Water is effectively cooled in the shallow Barents Sea, such that when it enters the Arctic Ocean the heat flux is small and may even be negative. Measurements in the Arctic indicate that the heat transport from deeper layers towards the surface has minor contribution to ice melting. Direct measurements of mixing and turbulence in the dense overflows have shown that for instance the turbulence in the Faroe Bank Channel overflow is 1000 times more vigorous than typical for ocean currents. In the Weddell Sea the cascading of dense waters towards greater depths are dominated by oscillation with 1.5, 3 and 6 days periods. The dynamics of these waves are not understood. New advanced instrumented platforms for long term observations and remote data upload has been developed and deployed. Five PhD and several MSc students have been assigned to the BIAC project. Her we will elaborate further results from the BIAC project.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Comparative Biodiversity of Bryozoans in the Polar Regions

Forename: Jennifer Surname: Loxton

Authors: Loxton, Jennifer; Spencer Jones, Mary; Porter, Joanne; Kuklinski, Piotr;

Presentation Allocated: Poster

abstract: Polar environments are unique habitats which feature year round low temperatures and extreme seasonality. The Arctic and Southern Oceans both feature a high level of isolation and combined with the challenging environment this has given rise to frequent specialisation and endemism in benthic fauna. This study reviews the comparative diversity of bryozoans in the Polar Regions and assesses patterns of endemism and distribution. With the ongoing effects of climate change our Polar environments face an uncertain future. In reviewing patterns of biodiversity we increase our understanding of the relationship between the unique environmental conditions in Polar regions and the diverse marine animals which live there.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Comparisons between bacterioplankton from the Southern Ocean and Arctic Ocean provide perspective on distinctiveness of polar marine systems.

Forename: Alison Surname: Murray

Authors: Murray, Alison; Ghiglione, Jean-Francois; Galand, Pierre; Pommier, Thomas; Maas, Els; Kirchman, David; Lovejoy, Connie; Pedrós-Alió, Carlos;

Presentation Allocated: Oral

abstract: High latitude polar oceans experience strong seasonal gradients driven by light availability, depth of the mixed layer and extent of sea-ice, but the degree to which these similarities in physical forcing also drive similarities in the diversity and structure of pelagic bacterioplankton communities between the poles and between the poles and lower latitudes is unknown. Next generation DNA sequencing technologies have enabled bipolar microbiological comparisons to be performed with standardized approaches using a deep ribosomal RNA gene sequencing effort. For the first time Southern ocean regions (Ross Sea, Weddell Sea, Antarctic Peninsula and Kerguelen Islands) can be readily compared with similar work conducted in the Arctic Ocean. The results showed that bacterioplankton assemblages in polar ocean systems were more similar to each other than they were to mid-latitude assemblages, though closer inspection of the Southern Ocean and Arctic Ocean data sets suggested that the differences in these polar ocean systems were significant. Within the Southern Ocean stations, regional comparisons showed that coastal stations were distinct from open ocean stations. Likewise, when surface assemblages from different seasons in the coastal and open ocean zones were compared, Antarctic and Arctic bacterioplankton assemblages always clustered separately such that significant differences were found between summer coastal (39% similar), winter coastal (46 % similar), and open ocean assemblages (56% similar). There are several polar surface ocean V6 tags (e.g. affiliated with uncultivated gammaproteobacteria and *Polaribacter* spp.) that are dominant in and common to both poles in comparison to lower latitude oceans. Similar findings were also found in deep ocean assemblages which appear to be less different between the poles but are distinct from to lower latitude deep ocean waters. The implications from these findings point to the polar regions harboring a distinctive bacterioplankton assemblage influenced by high latitude ecological drives (temperature, ice cover etc.) in which the coastal zones are responsive to differences between the terrestrially-dominated system of the Arctic and the glacially-influenced system of the Antarctic. How polar marine bacterioplankton will adapt and respond to influences of changing climate remains to be seen, but from these results we can predict that the influences in the coastal zone will be important to monitor.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Contrasting climate change in the two polar regions

Forename: John Surname: Turner

Authors: Turner, John;

Presentation Allocated: Oral

abstract: The two polar regions have experienced remarkably different climatic changes over recent decades. Sea ice extent has decreased throughout the year over the Arctic Ocean, but increased around the Antarctic as a whole. However, this masks a dipole of change with ice loss (increase) in the Bellingshausen (Ross) Sea. Much of the Arctic has experienced an increase in surface temperature, while changes over the Antarctic show a marked warming of the Antarctic Peninsula with a slight cooling across East Antarctica. The two polar regions receive almost exactly the same amount of solar radiation so the different climatic trends are largely a result of the differences in topography. The ice-albedo feedback mechanism, whereby a slight increase in air temperature can be amplified by the removal of highly reflective sea ice, is particularly effective in the Arctic, where much of the ice is at high latitudes. In the Antarctic the sea ice is generally at a lower latitude so the mechanism is less effective. The dominant factor in recent Antarctic climate change has been the loss of stratospheric ozone. This has increased the strength of the westerly winds over the Southern Ocean and been largely responsible for the summer/autumn warming on the Antarctic Peninsula and played a part in the collapse of a number of the ice shelves. However, the ozone hole only developed around 1980 so its impact is superimposed on longer term change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: DIVERSITY, THERMAL CHARACTERISTICS AND HYDROLASE ENZYME OF SOIL MICROFUNGI IN THE HORNSUND, SPITSBERGEN AND KING GEORGE ISLAND, MARITIME ANTARCTICA

Forename: Siti Hafizah Surname: Ali

Authors: Ali, Siti Hafizah; Alias, Siti Aisyah; Hii, Yii Siang; Smykla, Jerzy; Guo, Sheng Yu; Pang, Ka-Lai; Convey, Peter;

Presentation Allocated: Poster

abstract: Diversity of Arctic and Antarctic soil microfungi, their thermal classification and enzyme activity are presented in this study. Soil samples were collected from two geographically contrasting habitat: (1) Hornsund, Spitsbergen in the High Arctic, and (2) Maritime Antarctica, King George Island. Fieldwork and soil sampling at King George Island were conducted during the austral summer seasons of 2006/07 (February 2007) while at Hornsund in August 2010. We assessed culturable soil microfungi diversity in various habitats using potato dextrose agar (PDA) medium. Identification was based on morphological characteristics and sequencing intergenic spacer regions of morphotypes. Thermal growth classification of the fungi obtained was determined by incubation at 4°C and 25°C, permitting separation of those with psychrophilic, psychrotolerant and mesophilic characteristics. Psychrophilic and psychrotolerant isolates from Hornsund and King George Island were screened for activity of extracellular hydrolase enzymes (Hornsund – keratinase; King George Island – amylase, cellulase, protease) using screening plate method. Those enzyme activities were measured based on relative activity (RA) value. A total of sixty-four fungal taxa were obtained from both study sites consisting of twenty-nine genera, three yeasts, a sterile mycelium and two unidentified species. Thirty-three morphotypes were classified as psychrophilic, seven psychrotolerant and twenty-four mesophilic. Of these, twenty-five fungal taxa were isolated from Hornsund while forty-one taxa from King George Island. Four genera were observed to occur on both polar regions – *Geomyces pannorum*, *Mortierella* spp., *Phialophora* spp. and *Penicillium* spp. The most frequent isolated taxa at Hornsund was *Phialophora lagerbergii* while *Geomyces pannorum* was frequently isolated from Maritime Antarctica; King George. Five Hornsund isolates namely *Geomyces pannorum*, *Neonectria ramulariae*, *Varicosporum elodeae*, *Mortierella* sp. and *Phialocephala lagerbergii* showed keratinase activity by producing clear zone around the colony on the keratin media. Only one isolate from King George Island, which was *Geomyces pannorum* showed significant activity across all three enzyme types and isolate from Hornsund also showed keratinase activity. A further ten isolates from King George Island showed activity for at least two of the enzymes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Energetic adaptations to an extreme environment: The role of lipids in Antarctic and Arctic zooplankton

Forename: Wilhelm Surname: Hagen

Authors: Hagen, Wilhelm; Kattner, Gerhard;

Presentation Allocated: Poster

abstract: Antarctic and Arctic zooplankton species have developed very similar life strategies and energetic adaptations to the harsh environment via sophisticated modes of lipid accumulation. A very efficient biosynthesis, storage and utilization of lipids enable especially herbivorous species to buffer the pronounced seasonality of food supply in the polar oceans. Lipid levels usually peak at the end of the productive season in autumn and reach minimum levels in spring. In many species lipid deposits are not primarily used for maintenance during winter but are conserved to fuel reproductive processes at the end of the dark season. The dependence on seasonal primary production is also reflected by the respective lipid compositions. Detailed lipid analyses of dominant Antarctic and Arctic copepods revealed that the herbivorous *Calanus* and *Calanoides* species have developed the most complex lipid biochemical pathways. They biosynthesise large amounts of wax esters with long-chain monounsaturated fatty acids and alcohols (20:1, 22:1) as major components. In contrast, the Antarctic *Calanus propinquus* and *C. simillimus* synthesise primarily triacylglycerols consisting mainly of long-chain monounsaturated fatty acids with 22 and even 24 carbon atoms (2 major isomers), which is very unusual among plankton species. In contrast, the lipids of omnivorous and carnivorous taxa such as *Metridia* or *Euchaeta* are deficient in such long-chain fatty acids and alcohols, although their lipid reserves mainly consist of wax esters. Our investigations underscore that lipids are a key factor in high latitude ecosystems, especially for the lower trophic levels. The extremely lipid-rich herbivorous species ensure an efficient lipid-based energy transfer and represent high-calory food for fish and warm-blooded animals like birds and mammals.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Greenland Ice Sheet Monitoring Network (GLISN)

Forename: Masaki Surname: Kanao

Authors: Kanao, Masaki; Tsuboi, Seiji; Butler, Rhett; Anderson, Kent; Dahl-Jensen, Trine; Larsen, Tine; Nettles, Meredith; Voss, Peter; Childs, Dean; Clinton, John; Stutzmann, Eleonore; Himeno, Tetsuto; Toyokuni, Genti; Tanaka, Satoru; Tono, Yoko;

Presentation Allocated: Poster

abstract: Monitoring a dynamic response of the Greenland ice sheet to climate change is a fundamental component of long-term observations in global science. "Glacial earthquakes" have been observed along the edges of Greenland with seasonality and increasing frequency in 21st century by the Global Seismographic Network (GSN). During the period of 1993-2006, over 200 glacial earthquakes were detected, but most of them occurred on Greenland, with the others in Antarctica. Greenland glacial earthquakes are considered to be closely associated with major outlet glaciers at the margins of continental ice sheet. Temporal patterns of these earthquakes indicate a clear seasonal change and a significant increase in frequency. These patterns are positively correlated with seasonal hydrologic variations, significantly increased flow speeds, calving-front retreat, thinning at outlet glaciers. Seismicity of Greenland including tectonic events was investigated by applying a statistical model to globally accumulated data. Calculated b values, Magnitude-frequency-dependence parameter, indicated a slight increase from 0.7 to 0.8 in 1968-2007, implying the seismicity including glacial events become higher during the four decades. The detection, enumeration, and characterization of smaller glacial earthquakes were limited by the propagation distance to globally distributed GSN. Glacial earthquakes have been observed within Greenland, but the coverage has been sparse. To define a fine structure and detailed mechanisms of the earthquakes, a broadband, real-time network needs to be established throughout the ice sheet and perimeter. The IPY 2007-2008 was a good opportunity to initiate the program with international collaboration. The "Greenland Ice Sheet Monitoring Network (GLISN)" initiated for the purpose of identifying the dynamic response of the Greenland ice sheet to climate change. The GLISN significantly increases coverage of the surrounding Arctic region, with a significant role in the Sustaining Arctic Observing Network (SAON) of IASC. Additionally, the GLISN follows the IPY program named 'Polar Earth Observing Network' (POLENET), which establish a network to cover the whole Antarctica as well as Greenland, Lapland in the Arctic. The POLENET data are being used to clarify the heterogeneous structure of the Earth, and the newly established bi-polar stations is used to help monitor geographical variations in climate indicators, over the longer using a legacy.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: HYDROLASE ENZYMES FROM ANTARCTIC AND ARCTIC SOIL FUNGI

Forename: Abiramy Surname: Krishnan

Authors: Krishnan, Abiramy; Alias, Siti Aisyah; Clemente Vui Ling, Michael Wong; Convey, Peter; Ka-Lai, Pang; Ali, Siti Hafizah;

Presentation Allocated: Poster

abstract: We compared hydrolase enzyme activity in soil fungi isolated from locations in the Antarctic (Fildes Peninsula, King George Island) in February 2007 and Arctic (Hornsund, Svalbard) in 2010. A total of 38 psychrophilic and psychrotolerant fungal taxa were screened for production of the extracellular hydrolase enzymes, amylase and cellulase. For each fungal isolate, three replicates were prepared for each enzyme using R2A agar plates, and incubated at 4°C for 10 days. Cellulase activity was then screened using carboxymethyl cellulose and trypan blue and amylase using starch with lugol solution. In each case, activity was indicated by the formation of a clear zone around the fungal culture, allowing calculation of relative activity (RA). Fungal isolates showing an RA > 1.0 were categorized as good enzyme producers. Six of 28 Antarctic taxa were classified as having good amylase activity and two of 10 from the Arctic region. However, while four Antarctic strains possessed good cellulase activity, no Arctic strains showed this. The best amylase producer was *Geomyces pannorum*, isolated from King George Island, and the best cellulose producer was *Mrakia frigida* obtained from King George Island too. Considerable investment in the production of extracellular hydrolase enzymes appears to be an important element of the survival strategy of soil fungi in the cold soil habitats particularly in the Antarctic.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: KOPRI Culture Collection for Polar Microorganisms (KCCPM)

Forename: Soo Young Surname: Lee

Authors: Lee, Soo Young; Baek, Ye-Suel; Kang, Sung-Ho; Choi, Han-Gu;

Presentation Allocated: Poster

abstract: Korea Polar Research Institute (KOPRI) Culture Collection for Polar Microorganisms (KCCPM) is the culture collection for polar algae. Since 1989, we have collected various psychrophilic polar organisms including microalgae and macroalgae near King Sejong Station, Maxwell Bay, King George Island in the Antarctic, and more recently near Dasan Station, Ny-Ålesund, Svalbard in the Arctic. We maintains about 220 strains from the Antarctic and the Arctic, the preponderance marine diatoms, and we also keep up some green algae, blue green algae, and other freshwater organisms as well. From these collections, we have cultivated in the 2 culture room with LED lights consisting of three single wavelength red (660 nm), green (530 nm) and blue (460 nm). We have assessed the diversity of psychrophilic polar diatoms cultivated in the KCCPM and attempted to establish phylogenetic relationships among the diverse micro-algae based on light microscopic and electron microscopic observations as well as molecular investigations. An important consequence of our results is the establishment of a database for psychrophilic polar micro-algae based on morphological observations and molecular investigations in the KCCPM. The arctic cruises using the Korea Ice breaker, ARAON was conducted from 14th July to 13th August 2010 and from 26th July to 24th August 2011 at Canada Basin, Northwind Ridge and Chukchi Sea. During the cruises, we collected various plankton samples using plankton net (20 µm) for biodiversity and community studies. We will continuously expand our culture collections through the oncoming expeditions using ARAON and the collecting trips from various polar regions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Mixotrophic protists in the Ross Sea, Antarctica and the Arctic Ocean

Forename: Rebecca Surname: Gast

Authors: Gast, Rebecca; McKie-Krisberg, Zaid; Sanders, Robert;

Presentation Allocated: Poster

abstract: Protists are traditionally described as either phototrophic or heterotrophic to define their contribution to nutrient and carbon flow in the microbial food web. In recent years, increasing evidence indicated that many phototrophic protists also ingest particulate food and could have major impacts on their prey populations. During an austral spring cruise in the Ross Sea, Antarctica, we found that mixotrophic nanoflagellates comprised 4-34% of the chloroplastidic flagellates. We have since found similar proportions of these organisms during summer in the Ross Sea (4-33% of chloroplastidic flagellates) and in late summer/early autumn in the Arctic Ocean (4-32%). In both polar environments, mixotrophs often were more abundant than heterotrophic nanoflagellates, nominally considered the major bacterivores in marine waters. In the Arctic, mixotrophic activity in picoeukaryotes was an important component of total community bacterivory that was not detected in the Antarctic. Estimates of environmental abundances of mixotrophs are determined microscopically and are based upon the ingestion of fluorescent particles. In addition to being labor intensive, this method does not allow for the identification of individual species. We recently identified several mixotrophic algae in our Antarctic protist culture collection. To determine the abundances of these species in environmental samples, we developed SYBR-based qPCR amplification strategies based upon their 18S ribosomal gene sequences. We tested environmental DNA recovered from water samples collected in the Ross Sea, Antarctica in 2003, 2004, 2005 and 2011, and the Arctic Ocean in 2008, for their presence and abundance. Abundances varied between samples and organisms, and were usually less than 10% of the mixotrophic population predicted by microscopy, but the three species were reliably detected at both poles.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: New Korean bi-polar ocean program (K-PORT, Korea-Polar Ocean in Rapid Transition) using RV Araon

Forename: Sung-Ho Surname: Kang

Authors: Kang, Sung-Ho; Chung, Kyung-Ho; Hong, Jong-Kuk; Jin, Young-Keun; Lee, Sang H.;

Presentation Allocated: Poster

abstract: The bi-polar oceans (the Arctic and the Antarctic) are globally linked, not only through exchange of water and atmosphere but also by the fluxes and dispersal of flora and fauna between the two polar regions. Both regions are experiencing profound changes under the present warming and are predicted to be even more highly impacted under future global change. To understand how climate variability and change will affect these bi-polar ocean systems, it is essential to understand the role of biogeochemical, geological, and physical structure and transport processes between the Arctic and the Antarctic as well as the mechanisms that link the physical characteristics and biogeochemical systems of these ocean areas. The new Korean bi-polar ocean program using RV Araon (K-PORT, Korea-Polar Ocean in Rapid Transition) has now been developed to detect the changes of structure and processes in the water column and subsurface in the Arctic (Chukchi and Beaufort Seas) and the Antarctic (Ross Sea) regions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Satellite/ground-based total column ozone comparisons in Polar Regions

Forename: Claudio Surname: Rafanelli

Authors: Rafanelli, Claudio; Damiani, Alessandro; De Simone, Sara; Cordero, Raul; Laurenza, Monica;

Presentation Allocated: Poster

abstract: In the frame of Italian polar research activities, total ozone observations by Brewer spectrophotometers have been carried out since 90's at high latitudes of both hemispheres, e.g., Ny-Ålesund (78° 55' N, 11° 56' E), Ushuaia (-54° 47' S, -68° 20' W), Belgrano (-71°51' S, -34°33' W), according to international agreements. They provide an invaluable instrument to study stratospheric ozone changes in Polar Regions. Comparing satellite readings to ground-based observations is vital to check the quality of remotely sensed measurements. However the scarcity of high quality ground-based measurements at polar latitudes often prevent accurate analyses. The present paper focuses on the comparisons between ground-based Brewer total ozone measurements, carried out at Ny-Ålesund for almost three years (2007-2009), and satellite ozone readings, as a case study. Satellite ozone data have been retrieved from EOS Aura Ozone Measurement Instrument (OMI) (by using OMI-TOMS and OMI-DOAS algorithms) and from ERS-2 Global Ozone Monitoring Experiment (GOME) (by using TOGOMI algorithm). A good agreement between ground- and satellite-based measurements was found ($r = 0.99$ for OMI-TOMS and $r = 0.97$ for both OMI-DOAS and GOME datasets) but satellite ozone readings underestimate ground-based data, in agreement with prior results. OMI-TOMS data showed the highest negative mean bias (MB = - 1.94 %) whereas both DOAS based datasets showed a better agreement (MB = - 0.47 % and - 0.69 % for OMI-DOAS and GOME, respectively). On the other hand, both DOAS datasets present an important seasonal dependence whereas differences between OMI-TOMS and Brewer total ozone do not present significant dependence on season or on geometrical parameters. Differences in total ozone values between ground-based and satellite measurements are further discussed attending to the algorithm differences in dealing with cloud cover under high surface albedo conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Snow accumulation in West Antarctic and Russian Subarctic: climatic and glaciological aspects

Forename: Maria Surname: Ananicheva

Authors: Ananicheva, Maria; Krenke, Alexander; Semenov, Alexander;

Presentation Allocated: Poster

abstract: Until recently, in West Antarctica the spatial coverage and number of ice cores points was insufficient to characterize the variability of snow accumulation in this region. This paper presents data from 13 core sites, which allow assessing the variability of snow accumulation by rather high resolution in the continental sector of Ross Sea, and the Amundsen Sea sector.

□

Average snow accumulation is largely a function of elevation and location of the site (distance from the water bodies, altitude). Periods when deep layers of the ice cores show location in depressions may cause long-term trends (decadal-century) in snow accumulation, and thus, the results should be corrected. Temporal variability of snow accumulation is mainly due to climatic variability, which in turn may strengthen or weaken moisture transport to continental areas of Antarctica. In those regions where cyclonic formations may enter into the continent (such as the Amundsen Sea sector, as shown in this study), alternation in cyclone intensity, frequency, seasonality, and the trajectories of movement can change the annual variability of snow accumulation. In the area of the ice divide and the Ross Sea sector, snow accumulation is partly related to processes in the mid-latitudes. This is evidenced by the values of the correlation of pressure at sea level and snow accumulation, as well as the correlation values obtained from the EOF analysis. The results for West Antarctica for the recent several dozen years are compared to the situation with glacier systems in the NE Eurasia (Russian Subarctic) where we have obtained new assessments of glaciers reduction under climate warming taking place here from mid of 20th century. The controlling factor for the glacier state in here is snow accumulation lack.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: The adaptive evolution of hemoglobin in polar fish

Forename: Cinzia Surname: Verde

Authors: di Prisco, Guido; Verde, Cinzia;

Presentation Allocated: Oral

abstract: This presentation will summarise the current knowledge on the structure, function and phylogeny of hemoglobins of fish living in polar habitats. In fish, as in all vertebrates, hemoglobin adaptations may govern survival and biodiversity under specific environmental conditions and physiological requirements. Fish may experience variations in oxygen availability, salinity, ionic composition, pH and temperature. The study of their hemoglobins is aimed at identifying key links between molecular and eco-physiological adaptations. Notothenioidei, the dominant suborder in the Antarctic Ocean, have evolved decreased hemoglobin concentration and multiplicity, perhaps as a consequence of temperature stability and other environmental parameters. In the icefish family, the blood pigment is absent. In contrast, Arctic fish possess multiple hemoglobins with different functional properties, which may be selectively and differentially expressed, suggesting a mechanism of labour sharing in vivo in response to environmental variability and/or variations in metabolic demands. Hemoglobins of some Arctic fish display a polymerisation phenomenon, supporting the hypothesis that this feature may be a response to stressful environmental conditions. The success of many Arctic species appears to be shaped by plasticity to environmental variability.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: The comparison of the complete mitochondrial genomes of two polar calanoid copepod species, Antarctic *Boeckella poppei* and Arctic *Calanus hyperboreus*.

Forename: Sanghee Surname: Kim

Authors: Kim, Sanghee; Min, Gi-Sik; Choi, Han-Gu;

Presentation Allocated: Poster

abstract: Copepods are the most diverse and abundant groups in aquatic ecosystems and also dominate in polar ecosystem. Despite of their abundance and vast diversity, few complete mitochondrial genome data have been reported so far. Mitochondrial genomes contain the most informative sequences and gene arrangement for deeper phylogenetic analyses and they reflect evolutionary relationships and biogeography in the metazoonas. In an attempt to get more mt genome data of polar organisms, we selected two calanoid copepod species; *Boeckella poppei* and *Calanus hyperboreus*. *Boeckella poppei* and *Calanus hyperboreus* are considered being endemic species in Antarctic and Arctic, respectively. Firstly, we obtained the sequences of CO1, 12S, 16S, CO3 and Cytb in each copepod using universal primers published or newly designed by our group. The long-PCR fragments in various combinations were amplified and sequences were analyzed. In our result, the gene arrangement of *C. hyperboreus* is very distinctive compared to the pan-crustacean ground pattern. The interaction between adaptation in the harsh environment and mt genome rearrangement has been postulated in several studies. Therefore, we attempted to compare mt genome of Arctic *C. hyperboreus* with non-polar habiting *Calanus sinicus* previously published. Also, we compared mt genomes between Arctic *C. hyperboreus* and Antarctic *B. poppei* to investigate the possible correlation between environment and mitogenomic features. In addition, we attempted to solve the ordinal relationships of copepods in Subphylum Crustacea by phylogenetic analyses using sequence data from mitochondrial protein-coding genes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Third Pole Environment (TPE) program: a new base for the Arctic, Antarctica, and Third Pole contrastive study

Forename: Tandong Surname: YAO

Authors: YAO, Tandong; Thompson, Lonnie G.; Mosbrugger, Volker; LIU, Xiaohan; MA, Yaoming; ZHANG, Fan; YANG, Xiaoxin; Joswiak, Daniel; WANG, Weicai; Joswiak, Meri;

Presentation Allocated: Poster

abstract: Third Pole Environment (TPE) program: a new base for the Arctic, Antarctica, and Third Pole contrastive study Tandong Yao¹, Lonnie G. Thompson², Volker Mosbrugger³, Xiaohan Liu^{1,*}, Yaoming Ma¹, Fan Zhang¹, Xiaoxin Yang¹, Daniel Joswiak¹, Weicai Wang¹, and Meri Joswiak¹
¹Institute of Tibetan Plateau Research, Chinese Academy of Sciences² Byrd Polar Research Center, the Ohio State University³ Senckenberg Research Center for Nature Study
Abstract : Centered on the Tibetan Plateau, the Third Pole region stretches from the Pamir and Hindu Kush in the west to the Hengduan Mountain in the east, from the Kunlun and Qilian mountain in the north to the Himalayas in the south, covering an area over 5000km² with an elevation higher than 4000m. Like the Arctic and Antarctica, the Third Pole is one of the most sensitive areas responding to global climate change due to its high altitude and the presence of permafrost and glaciers, which are most sensitive to global warming. UNESCO, SCOPE, UNEP and the Chinese Academy of Sciences are launching an international scientific program, the Third Pole Environment (TPE) Program, to attract international research institutions and academic talents to focus on a theme of “water–ice–air–ecosystem -human” interactions in the Third Pole region and the Arctic, Antarctica, and Third Pole contrastive study, to reveal environmental change processes and mechanisms on the Third Pole and their influences on and regional responses to global changes, and thus to serve for enhancement of human adaptation to the changing environment and realization of human-nature harmony (www.tpe.ac.cn/en/)

SCAR OSC 2012 - Portland July 16th-19th

Session number: 26

Title: Western Arctic Vulnerability to Climate Variability over the past 3.6 Myr: A New View from sediments drilled at Lake El'gygytgyn, Western Beringia

Forename: Julie Surname: Brigham-Grette

Authors: Brigham-Grette, Julie; Melles, Martin; Minyuk, Pavel;

Presentation Allocated: Oral

abstract: International Continental Deep drilling (ICDP) at Lake El'gygytgyn (67°30' N, 172°05' E; or "Lake E"), recovered lacustrine sediments dating back to 3.58 Ma that now provides the first time-continuous Pliocene-Pleistocene paleoclimate record of different interglacials from the terrestrial Arctic. The Pliocene portion of the lake record (~3.58-3.0 Ma; a time when atmospheric CO₂ levels may have been in the range of 400 ppm) has nearly twice the sedimentation rate as later Quaternary intervals. The sediments are highly laminated in part and might be varved in sections. Studies of spores and pollen from this portion of the core show that the area was once dominated by trees, providing us with the pace of variability in Pliocene Arctic forests, which included species of pine, larch, spruce, fir, alder, and hemlock. Hemlock and tree pine pollen is exceptional for this latitude but the assemblage implies July temperatures nearly 8 degrees warmer than today with ~3 times the annual precipitation. Modeling suggests sustained forests at Lake E in both cold and warm orbits during this interval and restricted ice over Greenland. Extreme warmth in the Mid Pliocene Arctic occurs at the same time ANDRILL results suggest the WAIS was non-existent. The record includes a strong M2 cooling event at ~3.3 Ma to conditions like today, not glacial climates. This has major implications for reinterpreting isotopic shifts during this event in the North Atlantic. Warm interglacial portions of the core investigated so far are those correlative with MIS 5e, 9, 11 and 31 that differ in character, due to orbital forcing and feedbacks. The lithofacies can be linked directly to other proxies of climate change and allow us to interpret climatic influences on the watershed as well as changing conditions related to lake productivity, lake ice cover persistence, runoff and clastic input and vegetation in the basin. Multi-proxy evidence shows that interglacials MIS 9, 11 and 31 were remarkably warmer than MIS 5e. A warm MIS 31 at Lake E occurred half a precession cycle after the last time ANDRILL shows direct evidence of the collapse of WAIS. MIS 11, in particular shows surprising similarities to Lake Baikal records and Dome C ice core paleorecords but is remarkably warm. The climate record from Lake E, especially the history of past interglacials, provides a fresh means of testing what controls polar amplification over time.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Adaptation disturbances of human in Antarctic

Forename: Yevgen Surname: Moiseyenko

Authors: Moiseyenko, Yevgen;

Presentation Allocated: Poster

abstract: Work was based on the results of medical-biological studies, which were conducted with participation of the crew members of the Antarctic station (Vernadsky - 65 14'43"S; 64 15'24"W). The average age of examinees was $39,8 \pm 2,4$ years (130 men). The medical-biological studies included the modern clinic-laboratory, functional, instrumental, biochemical, immunologic, genetic, statistical methods. In Antarctic the unique complex of physical, chemical, biological, of social, nature (the meteo-heliogeophysical, biorhythmological, deprivation) factors, exceeding by power and duration, affect a human. It is shown that the mechanisms of adaptation disturbances of oxygen-transport systems of the human organism developed on the background of the chain neurohumoral, neuroimmune, metabolic, cellular dysfunctions. Such changes specify on the presence of signs of long stressful condition (the stress-syndrome) that brings to adaptative mechanisms exhaustion of compensation and requires using the methods of correction. It was shown the pathogenic mechanisms of development of dysadaptative disorders of integrative systems (change in cerebral electrogenesis, the activation of sympathoadrenal system, immune malresistance), respiratory, circulatory and hemic mechanisms of regulation of organism oxygen modes. By the characteristic feature of changes biorhythm activity of cerebrum of human after annual sensory deprivation in the extreme terms of Antarctic there is that emotional stimulation of different modality demonstrates depressed of answer of cerebral biorhythm with strengthening of its low frequency spectrum on a background universal desynchronization of rhythms of EEG with predominating of dysregulation displays in the projections of areas of bark of brain, relating to adjusting psychoemotional status of human. Before an expedition, training was executed magnetic stimulation. In the period of expedition registered EEG and indexes of self-appraisal. It is shown that the preliminary training magnetic stimulation positively influences on the processes of adaptation of the human to the extreme factors of Antarctic. The features of adaptations and dysadaptations alterations of the functional systems of organism of human at the protracted stay in Antarctic depend on the presence of polymorphism of HIF-1 α , which opens the prospects of study of genetic mechanisms of individual firmness and adaptation of organism to the extreme conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: An hour of bright white light in the early morning improves performance and advances sleep and circadian phase during the Antarctic winter

Forename: Richard Surname: Corbett

Authors: Corbett, Richard; Middleton, Benita; Arendt, Jo;

Presentation Allocated: Poster

abstract: Individuals over-wintering in the Antarctic, where there is minimal natural sun-light, are subject to delayed circadian phase with associated disrupted sleep patterns and possibly impaired alertness and cognitive performance. Previous work has demonstrated that exposure to an hour of bright light in the morning and the evening has beneficial effects on circadian phase. This study was designed to address the effect of a single hour in the morning of bright white light on circadian phase, sleep patterns, alertness and cognitive performance. The study comprised nine individuals (eight male, one female, median age 30 years), wintering at Halley Research Station, Antarctica from 7th May until 6th August 2007. Participants were exposed to bright light delivered by high intensity light boxes for a fortnight from 0830 - 0930, with two fortnight control periods on either side. This six-week schedule was performed twice, prior to and following Midwinter. Light exposure, sleep and alertness were assessed daily by actigraphy, sleep diaries and subjective visual analogue scales. Circadian phase (urinary 6-sulphatoxymelatonin acrophase) and cognitive performance were evaluated at the end of each fortnight. Circadian phase was advanced during periods of light exposure by around 53 minutes from 4.97 ± 0.96 decimal hours (dh) (mean \pm SD) to 4.08 ± 0.68 dh ($p = 0.003$). Wake-up time was shifted by a similar margin from 8.45 ± 1.83 dh to 7.59 ± 0.78 dh ($p < 0.001$). Sleep start time was also advanced but by a lesser amount, consequently, actual sleep time was also slightly reduced. There was no improvement in objective or subjective measures of sleep quality or subjective measures of alertness. Periods of light exposure were associated with an improvement in cognitive performance with both the Single Letter Cancellation Test ($p < 0.001$) and the Digit Symbol Substitution Test ($p = 0.026$) with preserved circadian variation. While the precise duration and spectral composition of light required for circadian entrainment remains unclear, this study would suggest that one hour of white light of around 4500 lux is effective in advancing circadian phase and sleep timing as well as improving objective measures of cognitive performance. This may have implications for not only the Antarctic but other remote environments where access to natural light and delayed circadian phase, is problematic. These results require validation in larger studies at varying locations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Antarctica to Mars, and Back: A Medical and Psychological Perspective on Analogue Environments

Forename: Marc Surname: Shepanek

Authors: Shepanek, Marc; Steel, Gary;

Presentation Allocated: Keynote 20 mins

abstract: Conditions encountered in Antarctica can be analogous to many experienced and expected in space. The reverse is also true; astronauts have much to teach Antarctic expeditioners. Nowhere is this more apparent than from the medical and psychological perspectives. Throughout all stages of an expedition –the elements of isolation, remoteness, the dependence on technology and fellow researchers for survival, combine to create challenges in both everyday operations and clinical care. There is a strong isomorphism between the two environments. Because of this, there is a well-recognized and strong potential for positive collaboration between Antarctic and space programs; a potential that can be realized on a range of levels depending on common goals, resources, time and commitment. For psychology and medicine, there are subtle but important features that distinguish these two extreme environments, which are rarely discussed when addressing the Antarctic/space correspondence. Both similarities and differences need to be taken into account when assessing the findings from both fields of study. This presentation will address some of these similarities and differences, including at least one example of a hypothetical Antarctic analogue study, showing how these environmental hallmarks can inform the practice of medicine and psychology in extreme and unusual environments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Expeditioner and Partner responses to critical incidents in Antarctica

Forename: Kimberley Surname: Norris

Authors: Norris, Kimberley; Paton, Douglas; Ayton, Jeff;

Presentation Allocated: Poster

abstract: Antarctica is one of the most extreme, unusual, and isolated environments on Earth. The inherent challenges posed to humans working in this environment means that critical incidents can, and do, occur. In this context, critical incidents are defined as those involving serious injury, illness, or death to an expeditioner member or members. Access to outside help or resources in such events is extremely limited, particularly during the Austral Winter, and therefore management of such incidents is primarily executed by those "on the ice". For this reason it is important to understand factors that facilitate positive coping and growth following exposure to such incidents, and incorporate this knowledge into proactive prevention and intervention strategies. Employing a mixed-methods design, the current research investigated expeditioner and partner functioning prior to, during, and following both fatal and non-fatal critical incidents in Antarctica. It was identified that those individuals (both expeditioners and partners alike) who had developed trust in the host organisation, informative communication channels, and positive pre-existing social support networks reported lower levels of distress before, during, and after the event compared to those who did not demonstrate these patterns. Furthermore, such individuals were more likely to report positive personal and professional gains as a result of their experience. Recommendations for enhancing these capacities are provided.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Human experience and culture in scientific winterovers

Forename: Claude Surname: Bachelard

Authors: SOLIGNAC, Amaury; BACHELARD, Claude;

Presentation Allocated: Oral

abstract: During a retrospective survey of 150 winterers from 60 years of French polar missions (1949-2008), their perceptions regarding their winterover experience were explored through a quantitative and qualitative questionnaire. Data from this research have been mainly used to study the homecoming period, after the mission has ended. The qualitative content of this dataset -along with an additional set of 150 debriefing interviews performed in the field by French psychologists between 1994 and 2006- was also analyzed to extract common aspects of the human experience of a winterover mission in an isolated scientific station. Five aspects were prominently reported by participants: the EXTERIORITY of the winterover as a daily life situation, the relative INCAPACITY to deal with home matters while being away, the TYPIFICATION of representations between winterers and their relatives, the experience of a small autonomous COMMUNITY, and what Romain Rolland described in another context as an OCEANIC FEELING, which describes a deeper connection with the surrounding natural environment. Parallel to these five aspects, cultural aspects that could be considered specific to the scientific polar environment were also identified: the importance of professional ROLES, the valorization of PAST EXPERIENCE, the valorization of the natural ENVIRONMENT, the valorization of the GROUP as a functional unit, and finally the valorization of international and scientific COOPERATION.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: In Vitro Analysis of the Photoprotective Effect of the Aqueous Extract of *Deschampsia antarctica*.

Forename: Hernán Surname: García

Authors: García, Hernán; Bizama, Carolina; Osorio, Jennifer; Gidekel, Manuel;

Presentation Allocated: Poster

abstract: Antarctic hair grass (*Deschampsia antarctica* Desv; Poaceae) is the only Gramineae that tolerates harsh stress conditions generated by UV irradiation that is present in the Antarctic territory. This particular trait makes of Antarctic hair grass an ideal candidate for extracting new natural active compounds with beneficial biological properties associated to skin protection. On this study we identified the action mechanisms by which the aqueous extract of *D. antarctica* (AEDA) exerts its photoprotective effect in Vitro. These assays were carried out on human keratinocyte cell lines (HaCaT). The first step was to identify an adequate AEDA concentration to perform the assays, which was not cytotoxic to the cells. Then we performed an in Vitro study of the photoprotective effect of the AEDA on cells that were irradiated with UV light. Finally, by conducting a microarray analysis we were able to identify the genetic expression profiles of cells treated and exposed to a high UV irradiation, and non-treated control. Results showed that at concentrations lower than 5 mg/ml, the extract is not cytotoxic to HaCaT cells. Furthermore, the extract presented a dose-dependant photoprotective effect. By using microarray technology we were able to identify differential expressed genes on HaCaT cells previously treated with AEDA and exposed to UV irradiation. These genes are related to biological properties of interest such as regulation of apoptosis, DNA repair, extracellular matrix, cell cycle, and cellular stress response. This study helps to elucidate the molecular mechanisms by which the photoprotective effect of AEDA is produced on human keratinocyte cell lines. We propose that the aqueous extract of *D. antarctica* can be of interest in the dermocosmetic area, in the production of skin products that prevent the damage caused by high UV irradiation. García, H1,2. Bizama, C1. Osorio, J1. and Gidekel, M1*. ¹ VentureLab. Business School, Universidad Adolfo Ibañez, Santiago, Chile. ² Facultad de Ciencias, Universidad de Chile, Santiago, Chile. ³manuel.gidekel@uai.cl

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Japanese Workshop on Antarctic Medical Research and Medicine 2011 -- Create collaborations, Extend Asian local network on Antarctic medicine --

Forename: Giichiro Surname: Ohno

Authors: Ohno, Giichiro; Watanabe, Kentaro;

Presentation Allocated: Poster

abstract: Japanese Workshop on Antarctic Medical Research and Medicine 2011 was held on 30 July, 2011 in Tokyo. The workshop has been held every year since 2004 to organize medical research and operational medicine in Japanese Antarctic activities and to discuss about medical research of next expeditionary team. The number of participant increases every year and in 2011 became about 60 personnel from many institutes including medical doctors with Antarctic experience, human biologists, research scientists from other fields and logistic staff members of the expedition. The resident doctors at Syowa Station joined the discussion through a real-time telecommunication system. Since 2006 we invited Asian nations' members to this workshop. This year, there were participants from China, Korea and India. Each country has only small group of Antarctic medical research and it is necessary to join other countries to make progressive discussion. This workshop performs a function of Asian local network on Antarctic medical research. Eighteen presentations were reported about many interesting issues on Antarctic medical research and practical medical problems. Each nation introduced Antarctic station, medical research program and medical issues during winter-over. There were presentations on psychological change in winter over and after Antarctica, the metabolism of amino acid under stress, severe medical cases during winter over. the telemedicine and so on. There was a specific session that reported about result of collaboration between Japan Aerospace Exploration Agency (JAXA) and Japanese Antarctic Research Expedition (JARE) in 2009-2010. One of the issues is the biorhythm change under abnormal day-night cycle studied by actinometer, sleep analysis with electroencephalograph and heart rate analysis with Holter electro cardiograph. Another is the change of skin Microbiota under unhygienic situation. These data are compared between ISS and Antarctic station.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: One Case of Acute Mountain Sickness (AMS) Occurred among the 27th Chinese Antarctic Expedition at Kunlun Station in Dome-A

Forename: Xiangmei Surname: Chen

Authors: Chen, Xiangmei; Wu, Quan; Xu, Chengli;

Presentation Allocated: Poster

abstract: Case: Chinese Kunlun Station (80° 22' 02" S, 77° 22' 23" E) at Antarctic Dome-A was established in Jan. 2009. With the altitude 4087m, the oxygen concentration is only 57% compared with plain areas, the annual average temperature is -54 . On Dec.17, 2010, 16 members of the 27th Chinese Antarctic Expedition left Zhongshan Station for Kunlun Station by taking snowtractors, they arrived at Kunlun Station after 12 days on Dec. 29, 2010. On the 1st of Jan. 2011, a 45-year-old Tibetan member suffered high altitude reaction, headache, dizziness, dyspnea, shortness of breath and fatigue. The Lake Louise score was tested as 7 points. His symptoms were getting worse on the 3rd of Jan., the oxygen saturation (sO2%) decreased to 45%. His sO2% increased to 65% after breathing high concentration oxygen and taking furosemide and dexamethasone, but the dyspnea persisted. On Jan.5, 2011, the patient was transferred from Kunlun Station by Australian plane to Daivs Station Hospital (altitude 0m) for cure. Arriving at Daivs Station Hospital, dyspnea of the patient improved, he had no disorder of consciousness and orientation, and his sO2% was at 85%. Breath sounds were coarse at both lung bases, his chest radiograph showed a little pleural effusion in the right costophrenic angle. An electrocardiogram revealed ST-T segment elevation, but his myocardium zymogram was normal. The patient had received oxygen therapy. On the next day, the patient recovered, and his sO2% was 99%. Discussion: Most people migrating from low altitude areas to the plateau above 2500m are prone to suffer from AMS. The etiology and mechanism is unclear, however, it is reported that it closely related to the rise rate and individual susceptibility of climbers. The Chinese expedition spent the last 3 days to reach Kunlun Station (altitude 4087m) with daily rising heights of 430m, 465m and 121m. The rising height of the first 2 days is higher than the literature recommended level of 150m/day after the climbers reached altitude 3000m, which may be one of pathogenic factors of AMS. According to reports, Tibetans living at 2000m altitude areas are more susceptible to AMS when they arrive at the higher altitude. The patient is a Tibetan living and working in Xining city located in more than 2000m plateau in west China, and no previous lung disease. It might be that the anxiety and tension of the patient at Dome-A induced AMS. Support: The fund of Chinese IPY plan

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Parasomnias During a Short-term Antarctic Field Activity

Forename: Gary Surname: Steel

Authors: Weymouth, Wells; Steel, Gary;

Presentation Allocated: Oral

abstract: Extreme conditions in Antarctica pose a significant challenge to researchers in field parties. One of the key issues noted in anecdotal evidence during expeditions is the presence of sleep disturbances. It is likely these disturbances are a result of the extreme photoperiod Antarctic personnel face, both in summer and winter. In an effort to examine the validity of these claims and define the variables associated with poor sleep during trips to Antarctica, 14 volunteers traveled to Antarctica and spent several days both in base and field camps. Participants self-reported sleep onset latency, sleep/wake times, number of awakenings, sleep quality, and mood rating during daytime. There is no indication that subjective sleep disturbance measures are significantly affected by travel to Antarctica on a group level, although individual differences varied markedly. STROOP and digit recall tests, given four times at approximately 3-day intervals show significant, $t(13)=2.16$ $p<.001$, increases only on digit recall . Future analyses will employ objective data to further explore the possible effects of the environment on sleep disturbance.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: PEPTIDE HORMONE CHANGES AT DOME FUJI STATION

Forename: MASA HARU Surname: OCHI

Authors: OCHI, MASA HARU;

Presentation Allocated: Oral

abstract: Background: Dome Fuji Station (DF) is located to approximately 1000km inland from the Antarctic coast, altitude is 3810m and mean air temperature is -55 C. From mid of November 2005 to end of January 2006,14 male members stayed there. Many members who are not specially trained for activities at high altitude are at risk of physical problems, including cardiovascular disorders. In order to investigate the cardiovascular function under high altitude and cold environment, Two Peptide hormone changes were analyzed. Those are Atrial natriuretic peptide (ANP) and Brain natriuretic peptide (BNP). ANP and BNP are Peptide hormone, secreted by heart muscle cells. ANP is secreted by the atria of the heart, BNP is secreted by the ventricles of the heart. Those are increased in response to excessive stretching of heart muscle cells. Methods: Checked 3 times both ANP and BNP for all members. Point A: Before departure to DF (mid of September 2005) Point B: On arrival at DF (mid of November 2005) Point C: 50 days past at DF (mid of January 2006) Results: Point A and B: Both ANP and BNP were within normal range at all members. Point C: Both ANP and BNP were increased at some members; other members were within normal range. Point C: 54 years old member showed an abnormal ANP, that was 53.2 pg/ml (normal range is 0-43.0 pg/ml). 55 years old member showed an abnormal BNP, that was 20.1 pg/ml (normal range is 0-18.4 pg/ml). First member showed insomnia and night cough, second member showed mild bradycardia. 29 years old member showed increased both ANP and BNP, but that level were within normal range. That member showed a bradyarrhythmia, so-called type 2 second-degree atrioventricular blocks under HOLTER(24hour)-electrocardiogram recording. Considerations: Increased ANP and BNP at Point C were a reflection of adaptation at high altitude. Elder member might have some latent problems on adaptation at high altitude. Mental and physical stress might affect ANP and BNP. ANP and BNP changes might express some subclinical cardio-pulmonary stress. Conclusions: ANP and BNP changes will be a predictor to detect a degree of adaptation at high altitude. Elder member had better to be reduced physical stress than younger member, and all member must take a proper rest to prevent high altitude illness. Further analysis about Peptide hormone changes and some other parameters may contribute to safer research

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Personality and the Positive Psychological Impact of Polar Sojourns

Forename: Peter Surname: Suedfeld

Authors: Suedfeld, Peter; Steel, Gary D.; Brcic, Jelena;

Presentation Allocated: Keynote 20 mins

abstract: Traditionally, the anecdotal and research literatures on the polar regions have emphasized the negative psychological aspects of working, living, and traveling in such extreme and unusual environments. More recent studies, however, have paid increasing attention to positive effects, including salutogenesis, the enhancement of psychological and/or physical health that occurs as a result of the experience. This paper describes the statistically significant relationships between the widely used "Big Five" personality measure and salutogenesis in 28 polar crewmembers who participated in the multinational Polar Psychology Project. Salutogenesis, as measured by the Sense of Coherence scale (SOC), was positively correlated with Conscientiousness and negatively with Neuroticism and depressive symptoms. The Big Five measure of Conscientiousness was positively related to the SOC factor Manageability (the belief that the individual has sufficient resources to cope with stressors), as was Extraversion to the factor Meaningfulness (the perception that life demands are worthy of pursuit and engagement). Neuroticism was negatively related to the third SOC factor, Comprehensibility (confidence that the environment is predictable). More detailed analyses will be presented concerning the relationship of SOC to gender, occupation, and nationality.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Psychological support for the medical service of the Russian Antarctic Expedition

Forename: Konstantin Surname: Levando

Authors: Gorbunov, Gennady; Levando, Konstantin; Kozak, Valery; Frolov, Boris; Ushakov, Vyacheslav;

Presentation Allocated: Oral

abstract: G. Gorbunov, K. Levando, V. Kozak, V. Ushakov, B. Frolov .Psychological support for the medical service of the Russian Antarctic ExpeditionThe Section of psychological support was founded at 2008. The purpose of the Section is to increase the effectiveness of medical care of Antarctic expeditions. It concludes the following directions of activities:1. Examination and testing of polar explorers before the expedition.2. Monitoring of psychophysiological state of polar explorers during the expedition.3. Testing of polar explorers after the expedition.2

Using methods and techniques:Psychological tests: B5, projective color Max Luscher`s test, psycholinguistic technique. Sociometric research: modified methodology of J. Moreno. Psychophysiological research: B. Frolov`s methodology for cardiorythmes examination.2

This research allows us to develop:1. Proposals for selection of the expedition members. 2. Reports of recurrent psychophysiological state of polar explorers and proposals to Antarctic station doctors for preventive events.3. Sociometric reports and suggestions to Antarctic station heads and doctors to prevent home and professional conflicts at stations. At the present time, psychological support is carried out partly at: Bellingshausen, Novolazarevskaya, Progress and Mirny stations. And wholly at Vostok station.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Subjective health complaints as a possible surrogate marker for overall well being in second over winterers in Antarctica

Forename: Anne Surname: Hicks

Authors: Hicks, Anne; Marquis, Peter;

Presentation Allocated: Oral

abstract: Subjectively as a remote healthcare provider to several Antarctic bases, we believed employees during their second consecutive winter had increased consultations when compared with their first. This appeared to be for minor illnesses/complaints. Historically BAS had many people being employed for double over wintering contracts, however latterly, it has moved away from this; the well being of employees being at the centre of this decision. Subjective health complaint (SHC) presentations are an accepted indicator for overall well being. This is interesting, not only for considering employment strategy for Antarctic research bases, but also relevant for all arenas where protracted postings to remote environments are to be considered. We interrogated a 6 year data set of 2177 medical consultations from 235 wintering staff of whom 90 undertook deployments of about 33 months. Significant and major Trauma and Medical events were excluded from analysis in order to consider those with SHCs'. With a deployed population breakdown of 20 % female to 80% male being served by a wintering Doctor cohort of whom 66% are female, a skew in reported consultations was assessed. Average number of SHC consultations increased by 72% in second consecutive winter deployments. There is an impact of over wintering for a second time on the well being of the individuals. The sex of the doctor became an apparent confounder, due to the significant difference in total number of attendances. There are clearly some obvious conclusions to draw from this, on bases where the male to female ratio is 80:20. However, it should be noted that the female doctor may also adopt more of a maternal position within the wintering cohort. Personnel on the base have ample opportunity for ad hoc access to unofficial doctor consultation, and as such, where the individual actually seeks an opinion in the surgery, then the data base in this regard should be considered the tip of the iceberg. Sub group analysis, also demonstrates that there is a large variety in number of consultations amongst the doctors, and so the individual doctor has an impact on pattern of presentation. Using subjective health complaints as a marker implies that over wintering for consecutive winters is associated with a significant decrease in overall well being. The caveat to this view, is that data collection can be influenced by the perception of the deployed crew towards the Doctor on site through factors such as gender

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: The Changes of the Cardiovascular Function and its Hormones Regulation of the 25th Chinese Expeditioners at Dome-A environment of Hypoxia and Extreme Cold

Forename: Chengli Surname: Xu

Authors: Xu, Chengli; Xiong, Yanlei; Mao, Yilei; Cidan, Luobu; Chen, Xiangmei; Guo, Zhengmin; Huang, Fumin;

Presentation Allocated: Poster

abstract: Objective: Antarctic Dome-A is a place of extreme cold and hypoxia, with average altitude of 4000m, average air pressure 560~590Pa (Jan.– April), average temperature -58.4°C . To prevent mountain sick at Dome-A, we investigated the effect of Dome-A hypoxia and cold environment on the cardiovascular function and its hormones regulation of the 25th Chinese expeditioners. Methods: Using monitor to detect cardiovascular function of the 22 members (average age $33.9\pm 8.6\text{y}$) of the 25th Chinese expedition at departure from Shanghai (Nov.2008), stayed 3 weeks at Dome-A (Jan.2009), returned to Shanghai (Apr.2009), synchronously collecting venous blood for testing cardiovascular-regulating hormone erythropoietin (EPO), angiotensin II (ANG II), brain natriuretic peptide (BNP), atrial natriuretic peptide (ANP) and endothelin (ET-1) levels by ELISA. Results: Compared with departure from Shanghai, the heart rate, systolic pressure, diastolic pressure, mean arterial pressure, peripheral vascular resistance and resistance index ($p<0.01$) increased, the stroke volume, stroke index, cardiac output, cardiac index ($p<0.01$), velocity index, acceleration index, left ventricular ejection time ($p<0.05$) decreased, the systolic time ratio ($p<0.05$) increased at Dome-A. The level of EPO significantly decreased ($p<0.001$), ET-1 ($p<0.01$) significantly increased, while the levels of ANP, BNP and ANG II had no significant changes. At their return to Shanghai, most of parameters of cardiovascular function recovered, but the level of ET-1 was high ($p<0.01$), the level of EPO significantly increased ($p<0.05$). Discussions: Three weeks exposure to the hypoxia and extreme cold environment at Dome-A made blood pressure and heart rate increasing, left ventricular blood pumping and systolic function decreasing. Elevated ET-1 level led to the vasoconstriction, vascular resistance and cardiac load increase, hence to cause the blood pressure elevating, stroke volume and cardiac output decreasing. Cardiovascular-regulating hormones (ANP, BNP, ANG II) did not change significantly. Hypoxia usually induce EPO level elevating, however, the EPO level of expeditioners decreased after 3 weeks stay at Dome-A, it might be that the expeditioners' sensitivity decreased under the low oxygen pressure after long term residence in hypoxia environment, hence to cause EPO secretion decreased. The extreme cold effect on EPO is not clear yet. Support: The fund of Chinese IPY plan and Institute of Basic Medical Sciences.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: The Hormone Changes of Hypothalamic-Pituitary-Thyroid Axis (HPA) of the 25th Chinese Expeditioners at Dome-A Environment of Hypoxia and Extreme Cold

Forename: Chengli Surname: Xu

Authors: Xu, Chengli; Chen, Xiangmei; Cidan, Luobu; Mao, Yanlei; Guo, Zhengmin; Huang, Fumin; Zu, Shuyu;

Presentation Allocated: Poster

abstract: Objective: Antarctic Dome-A is a place of extreme cold and hypoxia, with average altitude of 4000m, average air pressure 560~590Pa (Jan.– April), average temperature -58.4°C . To provide preventive measures with Chinese expeditioners in Dome-A, we investigated the effect of Dome-A hypoxia and cold environment on the hormones of HPA of the 25th Chinese expeditioners. Methods: Collected venous blood of the 15 members (average age $32.7\pm 7.7\text{y}$) of the 25th Chinese expedition at the time of departure from Shanghai (Nov.2008), stayed 3 weeks at Dome-A (Jan.2009), returned to Shanghai (Apr.2009). The serum hormones of HPA containing 3,5,3'-triiodothyronine (TT3), free T3 (FT3), 3,5,3',5'-tetraiodothyronine (TT4), free T4 (FT4), thyroid-stimulating hormone (TSH) and thyroglobulin (TG) were measured by chemiluminescence using an automated Advia Centaur XP kit (Siemens Diagnostics). Results: Compared with departure, the serum level of TT4, TSH ($p<0.01$) and FT4 ($p<0.001$) increased, TG decreased ($p<0.01$) at Dome-A; the level of FT4 increased ($p<0.05$) when they returned to Shanghai after 5 months. TT3 and FT3 levels had no changes significantly. When returned to Shanghai, among the 15 expeditioners, 1 member's TT3, TT4, FT3 and FT4 levels were found higher than clinic normal value while his TSH level was found lower than clinic normal value. During Dome-A stay, 4 members' FT4 levels were found higher than clinic normal value, 3 members' TSH levels were found higher than clinic normal value, 1 member's FT4 and TSH levels were found higher than clinic normal value. Discussions: Three weeks exposure to the hypoxia and extreme cold environment at Dome-A made serum TT4, FT4 and TSH increasing. That may be due to the hypoxia and low ambient temperature. The synthesis and release of thyroid hormone will increase with body at low temperature environment, and thyroid hormone will increase heat production so that the body is at the compensatory stage of hypoxia and cold environment. In order to adapt the hypoxia and cold environment, the body can show the increase of TT4, FT4 and TSH. Return to Shanghai, 1 member showed TT3, TT4, FT3, FT4 increase and TSH decrease with the clinical diagnosis of hyperthyreosis. It might be inferred that the extreme cold and hypoxia environment and individual susceptibility can induce hyperthyreosis. Support : Chinese National nature Science fund (30670783) and Chinese IPY plan fund (1511012602)

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: To screen hypoxia-susceptible Chinese Antarctic expeditioners in Tibet by applying cardiopulmonary function parameter

Forename: Chengli Surname: Xu

Authors: Xu, Chengli; Gong, Hui; Guo, Zhengmin; Chen, Xiangmei; Huang, Fumin;

Presentation Allocated: Poster

abstract: Objective: To detect the changes of cardiopulmonary function parameters of the Chinese expeditioners at different altitudes in Tibet, so as to explore the correlation among acute mountain sickness (AMS), cardiopulmonary function and mood. This data may help predict hypoxia susceptibility to select qualified Chinese expeditioners of Antarctic Dome-A. Methods: The work was performed with instruments including noninvasive cardiovascular monitor, electrocardiogram (ECG) machine, portable spirometers and questionnaire of the Lake Louise Score and mood in pre-selected healthy male members of the 25th and 26th Chinese expeditions who were screened at different altitudes for hypoxia susceptibility in Beijing (40m), Lhasa (3650m) and Yangbajing (4300m). Results: Compared with Beijing, from Lhasa to Yangbajing 1. Changes of cardiovascular system: heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), systemic vascular resistance (SVR) and SVR index (SVRI) increased significantly ($p < 0.05$); cardiac output (CO), cardiac index (CI), stroke volume (SV), stroke index (SI), velocity index (VI), acceleration index (ACI) and left ventricular ejection time (LVET) decreased significantly ($p < 0.05$). P axis and Q-TC increased significantly ($p < 0.05$); QRS complex increased in Lhasa but decreased in Yangbajing ($p < 0.01$); RV5 and RV5+SV1 decreased significantly ($p < 0.01$). 2. Changes of pulmonary function: tidal volume (VT), breathing frequency (BF), minute ventilation (MV), maximum voluntary ventilation (MVV), forced expiratory volume in one second per forced vital capacity (FEV1/FVC), peak expiratory flow (PEF), 25% expiratory flow (FEF25%), FEF50% and mid-expiratory flow (MMEF75/25%) increased significantly ($p < 0.05$); vital capacity (VC), FVC and FEV1 decreased significantly ($p < 0.05$). According to Lake Louise Score, the members were divided into the AMS group and non-AMS group, non-AMS group members showed better baseline lung function than AMS group members. Summary: 1. Along with altitude increasing, SVR increased significantly but contractile and blood-pumping function of left ventricular decreased inversely and it was negative correlated with the Q-TC interval. 2. The expeditioners with better pulmonary function and psychological stability suffered a milder degree of AMS which was negatively correlated with VC, FVC, FEV1, FEF25%, FEF50%, FEF75% and MMEF75/25%. Support: The fund of Chinese IPY plan (1511012602)

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: VITAMIN D HOMEOSTASIS AND ITS EFFECT ON BONE MINERAL METABOLISM AND SEASONAL AFFECTIVE DISORDER OVER ONE YEAR OF ANTARCTIC RESIDENCE.

Forename: Madhumita Surname: Premkumar

Authors: Premkumar, Madhumita; Sable, Tarulata; Dhanwal, Dinesh;

Presentation Allocated: Poster

abstract: Background: Vitamin D has long been known to play a significant role in calcium and bone mineral metabolism and has recently been shown to have pleiotropic actions on cardiovascular, cancer, neuroendocrine, psychological and cognitive function. The ultraviolet B (UVB) radiation component of sunlight influences the synthesis of vitamin D which shows marked seasonal variation due to the variant photoperiod of the polar summer and winter in Antarctica. In this study, an attempt was made to gauge the alteration of vitamin D homeostasis in Antarctica and its effect on bone mineral metabolism and mood in twenty healthy Indian Antarctic expedition members over a period of one year. Materials and Methods: This prospective cohort study involved twenty Indian Antarctic team members who wintered over at Maitri, the Indian permanent research station in Antarctica from November 2010 to December 2011. Fasting serum samples were assessed at baseline, 6 and 12 months for serum 25-hydroxyvitamin D, intact parathyroid hormone (PTH), total alkaline phosphatase (ALP), calcium and phosphate. Becks Depression Inventory (BDI), Positive and Negative Affect Scale (PANAS X) and Perceived Stress Scale (PSS) were used to measure depression, affect and stress at baseline, midsummer (light photoperiod) and midwinter (dark photoperiod). Results and Conclusion: Low vitamin D and increased intact PTH levels were found to be associated with depression during one year of Antarctic residence. The low dietary intake and decreased solar radiation exposure during the polar winter worsens an already precarious level of vitamin D in otherwise healthy individuals.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 27

Title: Vitamin D requirements during prolonged Antarctic expeditions

Forename: Sandra Surname: Iuliano

Authors: Iuliano, Sandra; Ayton, Jeff; Hillam, Sue; Denyer, Graham;

Presentation Allocated: Oral

abstract: During an Antarctic expedition, prolonged sunlight deprivation will result in vitamin D deficiency and may lead to bone loss unless exogenous sources of vitamin D such as supplementation are provided (1). We previously observed that vitamin D deficiency (serum 25(OH)D < 50 nmol/L) was prevented when expeditioners were provided with 50,000 IU vitamin D3 every alternate month. Current recommendations have suggested that serum 25(OH)D levels > 75 nmol/L denote adequate levels (2). We conducted a double blind randomised trial and based on the observed changes to serum 25(OH)D levels in 110 expeditioners assigned to either a monthly, bi-monthly or a single dose of 50,000 IU vitamin D3 prior to departure, the following recommendations are proposed to ensure vitamin D adequacy is maintained in expeditioners, using serum 25(OH)D levels prior to departure as a benchmark for supplementation (3). For those with serum 25(OH)D levels > 100 nmol/L at baseline, a single 50,000 IU dose prior to departure will likely maintain sufficiency. For those with baseline levels of between 75-100 nmol/L, then a bi-monthly dose would be recommended, and for those with baseline serum 25(OH)D levels < 50 nmol/L, then a monthly dose would be necessary. It is recommended that serum 25(OH)D levels are measured prior to departure, the appropriate supplementation dose administered, and levels remeasured on return from Antarctica to ensure adequacy was maintained. The monthly supplements can be easily administered during routine monthly medical examinations, and will help ensure good compliance, which may be compromised with daily therapies. No adverse events were reported. To help ensure vitamin D sufficiency is maintained during expeditions to this challenging environment, we propose that the above protocol be adopted as routine practice for those undertaking winter expeditions to Antarctica. (1) Iuliano-Burns et al. Osteoporosis Int. 2009 (2) Bischoff-Ferrari. Best Practic Res Clin Rheumatol, 2009 (3) Iuliano-Burns et al. Osteoporosis Int. 2012

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: Characterization of GPS-TEC measurements done in Antarctica from 2004 to 2011

Forename: Emilia Surname: Correia

Authors: Correia, Emilia; Paz, Amanda Junqueira; Gende, Mauricio Alfredo; Fagundes, Paulo;

Presentation Allocated: Poster

abstract: Here we present the GPS-TEC variations measured at Comandante Ferraz Brazilian Antarctic Station (62.1oS, 58.4oW) from 2004 to middle 2011, discarding the geomagnetic disturbed days. The daytime VTEC was analyzed considering the monthly median for January-February, April-May, July-August and October-November to represent summer, autumn, winter and spring seasons respectively. The analysis shows mean diurnal, seasonal and annual variations of VTEC. The seasonal variation shows a semiannual periodicity, with a minimum in winter and maximum during the equinoxes. The daily maximum VTEC shows clearly the effect of the solar activity, decaying from 2004 to 2008 during the decay phase of 23rd solar cycle and starting to increase on 2009 when the 24th comes up.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: GPS scintillations and TEC climatology in the southern middle and high latitudes regions

Forename: Luca Surname: Spogli

Authors: Spogli, Luca; Alfonsi, Lucilla; Cilliers, pierre; Correia, Emilia; De Franceschi, Giorgiana; Kinrade, joe; Mitchell, Cathryn; Romano, Vincenzo;

Presentation Allocated: Oral

abstract: In the recent years several groups have installed high-frequency sampling receivers in the southern middle and high latitudes regions to monitor the ionospheric scintillations and total electron content (TEC) changes above regions unevenly observed. Thanks to the synergy within the GRAPE Expert group, funded by SCAR, a fruitful and close collaboration was born among different groups operating scintillations monitors. Taking advantage of the archive of continuous and systematic observations of the ionosphere on L-band by the GPS constellation, we present the first attempt at ionospheric scintillation and TEC mapping covering Latin America, South Africa and Antarctica. The climatology of the considered area is derived through the GBSC (Ground Based Scintillation Climatology): a method able to identify the ionospheric sectors in which the scintillations are more likely to occur. The results produced by this sophisticated technique give significant indications on the spatial/temporal recurrences of the plasma irregularities, useful to extend the current knowledge of the mechanisms causing scintillations and, consequently, to develop efficient tools to forecast space weather events.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: Measuring ionospheric TEC at Concordia and application to L-Band radiometer

Forename: Vincenzo Surname: Romano

Authors: Romano, Vincenzo; Macelloni, Giovanni; Mitchell, Cathryn; Marinaro, Giuditta; Spogli, Luca;

Presentation Allocated: Oral

abstract: In the frame of the project "BIS - BIPOLAR IONOSPHERIC SCINTILLATION AND TEC MONITORING", ISACCO-DMC0 and ISACCO-DMC1 monitoring permanent stations have been installed since 2008. The principal scope of the stations is to measure the ionospheric Total Electron Content (TEC) and to monitor the ionospheric scintillations by high sampling frequency GPS receivers GISTM (GPS Ionospheric Scintillation and TEC Monitor). The disturbances that the ionosphere can induce on the electromagnetic signals emitted by the GNSS (Global Navigation Satellite System) constellations are due to the presence of electron density anomalies in the ionosphere, which occur with particular frequency at high latitudes where the upper atmosphere is highly sensitive to perturbations coming from the outer space. With the development of present and future low-frequency microwave missions (SMOS, Aquarius and SMAP), there is an increasing need to estimate the effects of the ionosphere on the propagation of electromagnetic waves which affects satellite measurements. As an example it is discussed how TEC data, collected at Concordia station, are useful for the calibration of the ESA's SMOS data within the framework of an experiment (called DOMEX) promoted by ESA. The presentation shows the capability of the GISTM station to monitor ionospheric scintillation and TEC, pointing out that only the use of continuous GPS measurements can provide accurate information on TEC variability, necessary for a continuous calibration of satellite data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: Probabilistic Forecasting of High-Latitude GPS Phase Scintillation

Forename: Paul Surname: Prikryl

Authors: Prikryl, Paul; Jayachandran, Periyadan T.; Mushini, Sajan C.; Richardson, Ian G.;

Presentation Allocated: Oral

abstract: Ionospheric scintillation can degrade GPS positional accuracy and performance of radio communication and navigation systems. The phase scintillation index has been obtained from L1 GPS data collected with the Canadian High Arctic Ionospheric Network (CHAIN) since 2008. Phase scintillation occurs predominantly on the dayside in the cusp and in the nightside auroral oval. Deterministic prediction of scintillation occurrence at high latitudes is a challenging problem because of the complexity of the coupling of the solar wind magnetic and electric fields to the ionosphere, variable convection of ionospheric plasma and of ionospheric irregularity generation. Instead, we investigate the feasibility of a probabilistic forecast of phase scintillation in the cusp keyed to the arrival time of solar wind corotating interaction regions (CIRs) or interplanetary coronal mass ejections (ICMEs). CIRs on the leading edge of high-speed streams (HSS) from coronal holes are known to cause recurrent geomagnetic and ionospheric disturbances that can be forecast one or several solar rotations into the future. Modeling of ICME evolution and propagation in interplanetary space is required for a successful forecast of ICME arrival. Cumulative probability distribution functions for the phase scintillation occurrence in the cusp are obtained from statistical data for days before and after CIR and ICME arrivals. The probability curves can also be specified for low and high (below- and above-median) values of various solar wind plasma parameters. Recent advances in solar wind modeling of CIRs and ICMEs combined with the proposed probabilistic forecasting of scintillation will lead to improved operational space weather applications.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 28

Title: Space Weather impact on the Upper Atmosphere over the South Atlantic Magnetic Anomaly.

Forename: Pierre Surname: Cilliers

Authors: Cilliers, Pierre; Opperman, Ben; Collier, Andrew; Feun, Anton; De Franceschi, Giorgiana; Spogli, Luca; Mitchell, Cathryn; Prikryl, Paul;

Presentation Allocated: Keynote 20 mins

abstract: The South Atlantic Magnetic Anomaly (SAMA) is the region of the Earth where the shielding from Space Weather impacts is compromised because of the reduced strength of the geomagnetic field. Due to the paucity of data from this region, the link between the SAMA and the impact of Space Weather on the Antarctic Upper Atmosphere is not well understood.

☐

During IPY 2007-2009 several new instruments were deployed for geomagnetic and ionospheric observations at the southern high latitudes including the Antarctic region just south of the SAMA. These included GPS scintillation and total electron content (TEC) monitors installed by the South African National Space Agency (SANSA, previously Hermanus Magnetic Observatory) at the South African polar research base SANAE-IV in Antarctica, on Gough Island near the centre of the SAMA and on Marion Island, near the edge of the SAMA, as well as on the South African Polar research ship, the SA Agulhas, which passed through the SAMA during its recent expedition to Antarctica. This paper presents a comparison of geomagnetic variations recorded at SANAE-IV and on Tristan da Cunha (400 km from Gough Island) with TEC and ionospheric scintillation observations at SANAE-IV, Gough Island and Marion Island with energetic particle precipitation data from the DMSP satellites. These data will be compared with narrowband VLF recordings on multiple paths from North America to Marion Island and SANAE, passing through the SAMA. The TEC will be reconstructed from GPS observations using the MIDAS (Multi-Instrument Data Analysis System) algorithm. An attempt will be made to extract the main scintillation features over the region of interest by using the GBSC (Ground Based Scintillation Climatology) tool. This multi-instrument approach for monitoring and investigation of ionospheric perturbations over the SAMA will contribute to better understanding of the extent and probability distribution of the ionospheric irregularities and scintillation associated with the SAMA and hence facilitate improvements of models to forecast the impact of solar disturbances on the upper atmosphere in this region during the upcoming solar maximum. SANSA is a member of the SCAR Expert Group "GNSS Research and Application for Polar Environment" (GRAPE), which is focused on utilizing the increased coverage in the Arctic and Antarctic regions provided by instruments deployed during IPY, to enhance remote sensing of the ionospheric TEC and scintillation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Developing a Hot-water Drill for the WISSARD Project.

Forename: Frank Surname: Rack

Authors: Rack, Frank; Duling, Dennis; Kippenhan, Matthew; Edwards, Robert; Blythe, Daren; Gibson, Dar; Fischbein, Steve;

Presentation Allocated: Poster

abstract: The Science Management Office at the University of Nebraska-Lincoln became involved in the WISSARD (Whillans Ice Stream Subglacial Access Research Drilling) Project in March 2011, and came up to speed quickly with the tasks required to design, build, test and deploy a hot water drill system that could be used for clean drilling into sub-glacial environments in the austral spring of 2012. The system is designed to provide up to 70 gallons per minute of hot water at up to 2500 pounds per square inch (psi) pressure at a temperature of 95 degrees C, using a 1000 meter-long, 1-1/4" internal diameter continuous length of thermoplastic hose. The main heating and pumping capacity is provided by six Alkota Model 12257K pressure washer, heater-pump units (HPU), each providing 12.5 gallons per minute of hot water, which are installed in two 40'-long ISO containers (4 units in one ISO container and 2 units in the other). The system has been designed to accommodate two additional Alkota units, if required, and the hose reel has been designed to accept up to a 1-1/2" internal diameter hose, to provide additional capacity for making larger diameter holes through 800+ meters of ice sheet/ice shelf to meet the requirements of future planned and proposed projects at the grounding line of the Ross Ice Shelf. A decontamination and filtration unit (DFU), containing 2 micron and 0.2 micron filters and UV filters at 185 nm and 254 nm, is located between the main 3700 gallon water supply tank (WST) and the two HPU containers. A melt 500 gallon melt tank (MT) will provide start-up water for the system. The main hose reel will incorporate a main hose winch and traction device that will guide the hose over a crescent (obtained from the ICECUBE Project, along with other equipment, through discussions with NSF) which is equipped with a reel encoder and load cell. About 50% of the system was delivered to Port Hueneme, CA in December 2011 and shipped to Antarctica on the cargo vessel. The remaining 50% of the system is currently being developed and fabricated, including the reel container and the command and control system for the hot water drill. Testing of the system at a location in Windless Bight and deployment of the system to the grounding line and Lake Whillans in support of the WISSARD Project will take place in 2012-2013, with a potential follow-on season planned in 2013-2014, depending on the availability of ARRA funding from NSF and other factors.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Development of Autonomous Underwater Vehicles for exploration of Antarctic Marine and Aquatic Ecosystems

Forename: Arturo E Surname: Cadena Jr.

Authors: Cadena Jr., Arturo E;

Presentation Allocated: Poster

abstract: The present work describes the ongoing development of unmanned platforms to explore the Antarctica by the Ecuadorian Antarctic Institute - ESPOL and exposes the results from sea trials in Ecuadorian waters and Antarctica. Since 2010 at the Ecuadorian Scientific Station Pedro Vicente Maldonado was carried out test of unmanned platforms in order to develop clean technology to explore extreme environments. One platform is an Autonomous Underwater Vehicle (AUV), called HIPOPOTAMO, with hybrid architecture that combines the best characteristics from the AUV and ROV (Remotely Operated Vehicles), high stability in the water column, high maneuverability at low speed without control surfaces and efficient hydrodynamics. The HIPOPOTAMO length is less than 1.50 m. The propulsion module is formed by four thrusters, three axial and one oriented vertically, this configuration gives to the HIPOPOTAMO three degrees of freedom: heave, surge, and yaw. This vehicle can work as a ROV or an AUV. The hybrid configuration features the vehicle to explore dangerous areas near to the glacier wall. This vehicle was tested in 2011, near to the Ecuadorian Scientific Station and got underwater imagery from the seafloor. The other platform is an AUV, called SKUA with the capacity to collect biological samples from the seafloor. The AUV SKUA uses a Laser Range Finder, infrared sensors and a camera to choose the best sector for the landing in order to minimize the impact to the seafloor and collects the sample. The SKUA length is less than 1.50 m. This AUV was tested on January 2012 at the Ecuadorian Scientific Station and collected a starfish and a sample of sediment from the seafloor. The main result of these vehicles is the underwater imagery from the seafloor (max depth 42 m) near to the Ecuadorian Scientific Station specifically the north of Greenwich Island, Dee Island and Barrientos Island; this data can be useful to make a Census of Antarctic Marine Life. The sea trials in Antarctic environment was a good opportunity to test the mechanical and electronics systems of the AUVs at a safe depth, these vehicles are designed to work at 200 m, in Antarctic environment for security reasons the max depth was 42 m. The ongoing development includes a hybrid AUV equipped with a Robotic Arm. This AUV is designing to explore the aquatic systems of Dee Island, South Shetland Islands, Antarctica. Before to the trials in Antarctica, this vehicle will test in Ecuadorian lakes located over 3200 m

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Drilling into subglacial Lake Vostok

Forename: Valery Surname: Lukin

Authors: Lukin, Valery; Lipenkov, Vladimir; Vasiliev, Nickolay;

Presentation Allocated: Keynote 20 mins

abstract: Lake Vostok is an essential element of the Antarctic subglacial hydrologic system and the largest subglacial lake on Earth with a surface area of about 16,000 km² and water volume exceeding 6,000 km³. The Russian Vostok Station sits at the southern end of the lake where the sub-ice water freezes onto the base of the Antarctic ice sheet. In 1998, deep hole 5G-1 drilled at Vostok by the Russian Antarctic Expedition (RAE) penetrated into accreted ice at 3,539 mbs. Study of the ice samples extracted as a core from the deeper depths provided first information on the geochemical conditions and potential biological residents of the lake. In January 2009, the drilling of hole 5G-1 was abandoned at a depth of 3,667 m due to a drill accident. The new branch-hole 5G-2 was started by deviation from 5G-1 at 3,585 m depth so that to allow replicate coring of the ice layer comprising large mineral inclusions bedded between 3,606 and 3,607 m. In the austral seasons of 2009-2010 and 2010-2011, RAE resumed drilling of the 5G-2 hole and with an electromechanical drill adapted for "warm ice" reached a depth of 3,720 m. Finally, the remaining 50 meters of accreted ice separating the hole from the lake were penetrated during the last austral season. On February 5, 2012 the drill bit reached the surface of Lake Vostok and allowed sub-ice water to flood into the hole. The pressure deficit in the hole at the moment when it punctured the ice ceiling of Lake Vostok exceeded 4 bars. The influx of lake water continued during 4 minutes until the pressure at the open bottom of the hole equalized. The drill was rescued from rapidly rising lake water, but upon reaching the surface the whole drill was filled and coated with refrozen water ice. The technological and environmental aspects of the first unsealing of Lake Vostok are discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Exploration of Subglacial Lake Ellsworth

Forename: Martin Surname: Siegert

Authors: Siegert, Martin;

Presentation Allocated: Oral

abstract: Antarctic subglacial lakes are thought to be extreme habitats for microbial life and may contain important records of ice sheet history and climate change within their lake-floor sediments. To find if this is true, and to answer the science questions that would follow, direct measurement and sampling of these environments is required. Ever since the water depth of Vostok Subglacial Lake was shown to be >500 m, attention has been given to how these unique, ancient and pristine environments may be entered without contamination and adverse disturbance. Several organizations have offered guidelines on the desirable cleanliness and sterility requirements for direct sampling experiments, including the US National Academy of Sciences and the Scientific Committee on Antarctic Research. In this presentation I summarize the scientific protocols and methods being developed for the exploration of Ellsworth Subglacial Lake in West Antarctica, planned for 2012/13, which is offered as a guide to future subglacial environment research missions. The proposed exploration involves accessing the lake using a hot-water drill and deploying a sampling probe and sediment corer to allow sample collection. Details are presented on how this can be undertaken with minimal environmental impact that maximizes scientific return without compromising the environment for future experiments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: IceMole - A Maneuverable Probe for Clean In-Situ Analysis and Sampling of Subsurface Ice and Subglacial Aquatic Ecosystems

Forename: Bernd Surname: Dachwald

Authors: Dachwald, Bernd; Mikucki, Jill A.; Tulaczyk, Slawek; Digel, Ilya; Feldmann, Marco; Espe, Clemens; Plescher, Engelbert; Xu, Changsheng;

Presentation Allocated: Oral

abstract: Subglacial environments are difficult to access given the tens to hundreds of meters of ice that must be penetrated. "IceMole" is a novel maneuverable subsurface ice probe for clean in-situ analysis and sampling of subsurface ice and subglacial materials. Conventional melting probes have distinct drawbacks for deep ice research in that they only penetrate downward and cannot change direction, are inhibited by dust/dirt layers, and cannot be recovered from greater depths. The IceMole design is based on the novel concept of combined melting and drilling with a hollow ice screw. The probe has the shape of a rectangular tube (15cm×15cm cross section) with a ~3-kW melting head at the tip. The required electric power is generated by a surface aggregate and transmitted via a cable that can be uncoiled from the probe. Communications and data transfer to the surface is also via this cable. The driving force of the ice screw presses the melting head firmly against the ice, thus leading to good conductive heat transfer. The IceMole can change direction by differential heating of the melting head, which generates a torque that forces IceMole into a curve. In Sep 2010, the first IceMole prototype was successfully tested on the Swiss Morteratsch glacier and demonstrated successful horizontal, upward and downward melting capabilities for distances up to 5m. A driving curve with a radius of ~10m and a penetration velocity of ~0.3m/hr was achieved. IceMole2 will have enhanced maneuverability, less weight, and increased melting velocity (~1m/hr). Our goal is also to adapt the concept to extraterrestrial targets. Thus, the third-generation probe has been named "Enceladus Explorer" (EnEx) and offers a sophisticated system for obstacle avoidance, target detection, and navigation in deep ice. The EnEx probe will pay particular attention to clean protocols for sampling subglacial materials for biogeochemical analyses. Contrary to conventional ice-core drilling methods, IceMole does not utilize drilling fluids and can be sterilized according to planetary protection standards prior to deployment. We intend to use the EnEx probe for clean access into a unique subglacial aquatic environment and an extraterrestrial analog in the McMurdo Dry Valleys, known as Blood Falls; with subsequent sample return from this subglacial brine. Our test results indicate that the IceMole concept is a viable approach for the clean access and sampling of deep ice/liquids for life detection.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Miniaturised “lab-on-a-chip” nutrient analyser for the in situ analysis of meltwater in the cryosphere

Forename: Alexander Surname: Beaton

Authors: Beaton, Alexander; Mowlem, Matthew; Wadham, Jemma;

Presentation Allocated: Poster

abstract: In situ chemical measurements of meltwater in the cryosphere can provide high temporal and spatial resolution data that allow us to infer microbially mediated biogeochemical processes in glacial systems. Despite this, in situ measurements of single chemical parameters in the cryosphere have so far largely been restricted to pH and dissolved oxygen (accompanied by electrical conductivity as a measure of total dissolved solids). The lack of commercially available high performance ruggedized in situ sensors for other analytes means that the analysis of manually collected samples takes place via traditional laboratory-based methods.

□

Microfluidics (through lab-on-a-chip technology) permits the miniaturisation of established chemical analysis techniques so that they can be performed in situ. The advantages of decreased size and low power and reagent consumption make these systems suitable for deployment in extreme and inaccessible environments where regular manual sample collection is logistically difficult. We present a stand-alone microfluidic wet chemical nutrient analyser that has been ruggedized to survive the freeze-thaw conditions, hydrostatic pressures, dilute concentrations and high sediment loads that can be associated with cryospheric environments. The system is small, has low power consumption and detects nitrate and nitrite with a limit of detection (LOD) of 0.025 micromolar. Although initial work has focussed on nitrate, the system can be modified to perform other established colourimetric analyses (e.g. iron II, iron III, phosphate, and manganese). The small size and low power consumption of the system make it potentially suitable for future integration into in situ cryospheric sensing platforms and probes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Novel wireless sensing methods for sub-ice applications

Forename: Elizabeth Surname: Bagshaw

Authors: Bagshaw, Elizabeth; Wadham, Jemma; Burrow, Stephen; Lishman, Ben; Chandler, Dave;

Presentation Allocated: Oral

abstract: In situ monitoring of subglacial environments can elucidate information about ice flow, biogeochemical conditions and potential habitats for life. However, by their nature, subglacial environments are challenging to access. Traditional sampling and monitoring methods have involved the deployment of tethered sensors via a borehole, in order to acquire data from the subglacial drainage system. Data collected by such methods are at-a-point and require the use of cables, which may not be practical in ice masses with high strain rates. Subglacial water pressure measurements via this method may also not necessarily measure the true pressure within the subglacial drainage system, since boreholes also respond to surface melt inputs. We introduce a new method for collecting data at the bed of glaciers and ice sheets via new wireless sensors that are capable of entering the subglacial drainage system at moulin access points. The first, the ETracer (Electronic Tracer), is a small (golf-ball sized), low cost sensor platform which is capable of travelling through the subglacial drainage system, collecting data as it transits. The sensor emits a radio frequency (RF) locating chirp, which allows the sensor to be recorded by a monitoring station once it emerges from the subglacial portal. A limited quantity of data is also transmitted during the chirp, but the majority is stored on internal memory and can be downloaded when the sensor is collected from the proglacial floodplain. The second platform, the CryoEgg, is larger and designed to become lodged in the subglacial drainage system, from where it can communicate data to a receiving station via RF. The current sensor suite includes water pressure, electrical conductivity and temperature, but the platform is versatile. We report results from testing and initial deployments of these sensors beneath the Greenland Ice Sheet, and suggest potential applications for a more challenging sub-Antarctic deployment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Project VALKYRIE: A Novel Approach for Sub-Glacial Lake Access and Sample Return

Forename: William Surname: Stone

Authors: Stone, William;

Presentation Allocated: Oral

abstract: Current approaches for physical access to Antarctic sub-glacial lakes involves the use of either traditional cutting bit drilling with a non-freezing back-fill liquid or the use of hot water jet drills. Both approaches require massive infrastructure to support multi-kilometer penetrations. More importantly, drilling access involves meeting stringent international environmental regulations designed to prevent forward biological contamination of the environment that scientists wish to study. The problem of forward contamination with drilling is fundamental: the drilling fluids are cycled and carry microbes downward from the surface at the same time that front face material and liquids are brought up for analysis. We have developed a radically different approach to sub-glacial lake sample return that involves the use of an autonomous "cryobot" or ice-penetrating robot. The cryobot can be pre-sterilized in a laboratory environment and then shipped to the field site in a sterile carrier. The device is then inserted into the ice cap via a sterile injection mechanism. Once the device is activated it begins to melt a path downward through the ice, traveling in a small bubble of melt water. Behind the vehicle the melt hole refreezes, greatly reducing downward propagation of contaminants. The design of the current quarter-scale Phase 2 VALKYRIE prototype will be presented along with descriptions of the power mechanisms, forward obstacle avoidance system, and onboard science payloads. Results from laboratory investigations beginning in 2010 will also be discussed along with plans for 2012 field testing and the long range objectives of the project.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Semi-automatic sonde for clean accessing and sampling subglacial aquatic ecosystems

Forename: Pavel Surname: Talalay

Authors: Talalay, Pavel; Markov, Alexey;

Presentation Allocated: Poster

abstract: The proposed semi-automatic sonde is based on the design of Philberth thermal probe. It is equipped by two hot-points with paraboloid heating elements located on the bottom and top sides of the sonde. The bottom hot-point is powered on the way down to the ice sheet bed, and the top hot-point is put into action in order to recover sonde to the surface. The melted water do not recover from the hole, and the sonde do not produced core. The 4000-m length electric line for power supply and communication with down-hole sensors are twisted on the coil inside the sonde. The power of the each hot-point is approx. 4 kW, and the expected speed of penetration is 1.5-2 m/h in pure ice. In the middle part of the sonde the special instrument chamber is installed to measure pressure, temperature, pH, sound velocity, conductivity and other parameters. In this section video camera and water sampler are fixed as well. The power is supplied from the surface by solar cell panels and wind generator through electric accumulators.

☐

A procedure has been produced and will be adopted to ensure all of the components are cleaned before they are used at subglacial aquatic ecosystem. During austral summer season the sterile semi-automatic sonde is installed on the surface of the Antarctic ice sheet above being studied subglacial reservoir. All equipment is got into working trim, and the sonde starts to melt down to the ice sheet bed. The personnel leave the site, and all further operations are going in semi-automatic mode. The penetration down to subglacial reservoir up to the depth of 3000-3500 m should take no more than 3-4 months. After sampling the motor connected with coil is switched on, and the sonde begins to recover himself by spooling the cable and melting overlying ice with the help of the upper hot-point. The way to surface should take a bit longer time than the way down. Before the next austral summer season the sonde reaches the surface and waits the personnel for servicing and moving to the next site.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: Testing of an ROV and borehole instrumentation in Lake Tahoe for future deployment in Subglacial Lake Whillans and grounding lines of Siple Coast

Forename: Ross Surname: Powell

Authors: Powell, Ross; Scherer, Reed; Griffith, Ian; Taylor, Elisabeth; Winans, John; Mankoff, Ken;

Presentation Allocated: Poster

abstract: A remotely operated vehicle (ROV) has been custom-designed and built by DOER Marine to meet scientific requirements for exploring subglacial water cavities. The plan is to use the sub-ice ROVER (SIR) to explore and quantitatively document the grounding zone areas of the Ross Ice Shelf cavity using a 3km-long umbilical tether by deployment through an 800m-long ice borehole. Instrumentation includes 4 cameras (1 forward-looking HD), a vertical scanning sonar (long-range imaging of vertical faces, for spatial orientation and navigation), Doppler current meter (determine water current velocities), multi-beam sonar (image and swath map bottom topography), sub-bottom profiler (profile sub-sea-floor sediment for geological history), CTD (determine salinity, temperature and depth), DO meter (determine dissolved oxygen content in water), transmissometer (determine suspended particulate concentrations in water), laser particle-size analyzer (determine sizes of particles in water), triple laser-beams (determine size and volume of objects), thermistor probe (measure in situ temperatures of ice and sediment), shear vane probe (determine in situ strength of sediment), manipulator arm (deploy instrumentation packages, collect samples), shallow ice corer (collect ice samples and glacial debris), water sampler (determine sea water/freshwater composition, calibrate real-time sensors, sample microbes), shallow sediment corer (sample sea floor, in-ice and subglacial sediment for stratigraphy, facies, particle size, composition, structure, fabric, microbes). A sophisticated array of data handling, storing and displaying will allow real-time observations and environmental assessments to be made. Other instruments include a 5m-long percussion corer for sampling deeper sediments, an ice-tethered profiler with CTD and ACDP, and in situ oceanographic profiler designed to fit down a narrow (30cm-diameter) ice borehole that includes interchangeable packages of ACDPs, CTDs, transmissometers, laser particle-size analyzer, DO meter, automated multi-port water sampler, water column nutrient analyzer, sediment porewater chemistry analyzer, down-looking color camera (see figure), and altimeter. This robotic submarine and other instruments will be tested in Lake Tahoe in April 2012 and results will be presented on its trials and geological and biological findings down to the deepest depths of the lake.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 29

Title: The WISSARD Project Strategy for Microbiologically Clean Drilling and Subglacial Access

Forename: Brent Surname: Christner

Authors: Christner, Brent; Priscu, John; Skidmore, Mark; Tulaczyk, Slawek; Edwards, Rob; Bolsey, Robin;

Presentation Allocated: Oral

abstract: In this paper we present the WISSARD (Whillans Ice Stream Subglacial Access Research Drilling) project's approach for microbiologically clean entry and access of subglacial lake, stream, and water-saturated sediment environments beneath the Whillans Ice Stream. WISSARD has developed a clean access plan that implements 4 proven and complementary technologies [(i) filtration, (ii) ultraviolet (UV) irradiation, (iii) pasteurization, and (iv) chemical disinfection] to reduce microbial contamination and viability in the drilling fluid and on equipment deployed in the borehole. To penetrate the 700-800 m of overlying ice, a hot water drilling system has been constructed which has a 150 to 380 L/min flow capacity and is capable of drilling and maintaining holes of up to 30 cm in diameter for 8 days. The volume of liquid water generated when drilling each borehole will be $\sim 57 \text{ m}^3$, the residence time of water through the system will be approximately 6 hours, and after 8 days of borehole operations, the borehole fluid should be completely circulated through the system at least 30 times. Laboratory testing of the water cleaning system demonstrated that a single passage through the filtration module reduced the total number of microbial cells and particles by 4 orders of magnitude, and 99.99% of the cells remaining in the water were inactivated by the combined effect of UV irradiance and pasteurization. The drill hose and instrument cables will be subjected to a 2 stage cleaning process in which they are passed through (i) a collar type cable-cleaning system designed to remove particulates, cells, and salts using a 0.2 μm -filtered mixture of hot water and compressed air (ii) followed by high intensity UV irradiation to reduce the concentration of viable microorganisms on exposed surfaces. In addition to UV treatment at the borehole entry, downhole science instruments and equipment will be disinfected using a 3% solution of hydrogen peroxide, which demonstrated at least a 3 log reduction in viable bacteria that were applied to plastic and stainless steel substrates in laboratory experiments. This strategy will facilitate the collection of pristine samples of high scientific value, and concurrently, ensure environmental stewardship of the subglacial ecosystem.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 30

Title: Absolute Gravity Observations on Ross Island and in Terra Nova Bay in November-December 2011

Forename: Yves Surname: Rogister

Authors: Rogister, Yves; Hothem, Larry; Bernard, Jean-Daniel; Hinderer, Jacques; Wilson, Terry; Capra, Alessandro; Zanutta, Antonio; Winefield, Rachelle; Collett, Dave;

Presentation Allocated: Poster

abstract: A campaign of absolute gravity measurements was conducted with a FG5 meter on Ross Island and in Terra Nova Bay in November and December 2011. It resulted from a collaboration between French, Italian, New Zealand and US agencies and institutes, under the POLENET program. For the second time in 2 years, absolute gravity was measured at McMurdo Station and Scott Base. For the fifth time in 21 years, it was measured at Mario Zucchelli Station. We will report on the very last campaign, show the gravity trend at the three locations, describe how it compares to estimates of the gravity variation derived from space measurements by the GRACE twin satellites and present the next campaigns of absolute gravity measurements planned at the same locations in 2015 and over the Antarctic Peninsula in 2013.

SCAR OSC 2012 - Portland July 16th-19th


Session number: 30

Title: Absolute-gravity stations in Western Dronning Maud Land

Forename: Jaakko Surname: Mäkinen

Authors: Mäkinen, Jaakko; Ravindra, Rasik; Tiwari, Virendra; Melland, Gudmund; Melvaer, Yngve; Lukin, V.V.; Anisimov, M.; Näränen, Jyri; Poutanen, Markku;

Presentation Allocated: Poster

abstract: Absolute-gravity stations are an essential part of the geodetic infrastructure in the Antarctic. They provide accurate starting values for gravity surveys performed e.g. for the determination of the geoid, for geological studies and for geophysical investigations. The time variation in gravity determined from repeated absolute-gravity measurements provides insights into the Glacial Isostatic Adjustment (GIA) and into solid Earth deformation due to variation in contemporary ice load. Given sufficient joint coverage with International Terrestrial Reference Frame (ITRF) sites, gravity rates in high latitudes could in principle provide an independent check of the geocentricity of the \dot{z} (velocities in the direction of the rotation axis of the Earth) of the ITRF. 

We give an update of the absolute gravity stations in Western and Central Dronning Maud Land. The oldest station is at the Finnish base Aboa, with 5 measurements by the Finnish Geodetic Institute (FGI) starting with the FINNARP 1993 expedition. Measurements at Maitri (India) and Novolazarevskaya (Russia) were first performed in 2004 by the National Geophysical Research Institute (NGRI) of India, and by the FGI, respectively. Recently, a new station was constructed at Troll (Norway). By the deadline of the abstract submission, the first-mentioned three sites had been successfully occupied in the season 2011/12 by the FG5-221 absolute gravimeter of the FGI, and Troll was in the program for the late season. At Sanae IV (South Africa) there are previous occupations by the FG5-221 in 2003/4 and 2005/6. Numerous supporting measurements have been made at the sites: microgravity networks, leveling and GNSS ties to excenters etc., for controlling the stability of the stations. At some sites, nearby glacier elevations were surveyed to keep track of the attraction of the variable close-field masses. We give a description of the sites and the measurements performed at them.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 30

Title: Current status of geodesy programs at Syowa Station, Antarctica

Forename: Kazuo Surname: Shibuya

Authors: Shibuya, Kazuo; Doi, Koichiro; Aoyama, Yuichi; Nogi, Yoshifumi; Fukuda, Yoichi;

Presentation Allocated: Poster

abstract: All of the space and precise geodesy instruments, except satellite laser ranging, have been operated for 20 years as winter-over Japanese Antarctic Research Expedition programs at Syowa Station (69.0°S, 39.6°E). We summarize current status below. (1) VLBI: Syowa 11-m VLBI antenna participated in the SYW and OHIG sessions coordinated by the IVS Coordinating Center since its start of 1999. Three to six sessions have been made each year. Because the antenna life time will end soon, we are discussing its replacement, preferably to a VLBI2010 compatible antenna. (2) GPS: After SCAR93-95 GPS campaigns at SYOW, a new pillar SYOG was established in 1995. Change from Rubidium frequency standard to Cesium standard (in 1999) produced high-quality 30 s sampling raw data. Transfer via Intelsat (from 2004) through GSI, Japan to IGS Center provides users quasi-real-time RINEX data. A 1-Hz sampling data (possibly for GPS seismometer) has been archived in GSI. (3) DORIS: First generation DORIS beacon was installed on a pylon tower (SYOB) in 1994. After its fall-down by blizzards (in 1998), new beacon SYPB was installed in February 1999 on a concrete (very stable) pillar. This has been working well until now, and keeps contributing to 1-2 cm accuracy measurements by Topex/Poseidon and Jason altimeters. (4) AG: We have IAGBN(A)#0417 absolute gravity station. Repeated measurements (five times) by FG5 have been done between 1995 and 2012. An A-10 absolute gravimeter was tested in 2012 on outcropped areas near Syowa Station. (5) SG: SG observations with TT70#016 started from March 1993. It was succeeded by CT#043 from December 2003, and again replaced with OSG#058 in January 2010. The data are available through NAO Mizusawa (for TT70#016 data) and GFZ Potsdam (for CT#043 data), and NIPR (for OSG#058 data) as archived files. (6) SAR: By using the 11-m antenna, synthetic aperture radar scenes from JERS-1, ERS-1, and ERS-2 were received until 2005. As a legacy program (using small budgets), NIPR continued archiving of ALOS/PALSAR data from 2006 to 2011. (7) Tide: We have GLOSS#95 site in Syowa Station, and ocean tide observations have been continuing from 1975 at the Nishi-no-ura Cove by a strain-sensor type bottom pressure gauge. As sea ice conditions change year to year, we are testing GPS buoy which does not require cabling to land. Data accessibility to each item will be examined, and several research topics will be presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 30

Title: The ice surface velocity measurement using GPS technique in the Dome A region and along the Chinese ITASE traverse

Forename: Shengkai Surname: Zhang

Authors: Zhang, Shengkai; E, Dongchen; Li, Fei;

Presentation Allocated: Poster

abstract: Dome A is the highest ice feature in Antarctica. The first Chinese ITASE expedition was carried out from Zhongshan station to Dome A during the 1996/97 austral summer. During the 2004/05 austral summer, the traverse was extended to the summit of Dome A by 21st Chinese National Antarctic Research Expedition (CHINARE). The real-time kinematic (RTK) GPS survey was carried out in the summit of Dome A during 2004/05 and 2007/08 austral summers. The surface topography of Dome A was drawn up from the kinematic double-frequency GPS data. Along the traverse route, more than 20 GPS sites were established at approximately 50 km intervals. The GPS monitoring network was set up during 2007/08 summer in the Dome A region, and was revisited in the next Dome A expeditions. The GPS data were processed using GAMIT/GLOBK software. Repeat GPS measurements provided ice velocities along the transverse profile and in the Dome A region. The horizontal ice velocities increase from the summit of the ice sheet to the coast from a few cm a^{-1} to 100 m a^{-1} . The flow directions are consistent with downslope motion of the ice sheet.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 30

Title: The Italian geodetic infrastructure at Mario Zucchelli Station, Antarctica: integration of technology for local and global monitoring

Forename: Alessandro Surname: Capra

Authors: Capra, Alessandro; Negusini, Monia; Zanutta, Antonio; Dubbini, Marco; Gandolfi, Stefano; Sarti, Pierguido; Vittuari, Luca;

Presentation Allocated: Poster

abstract: The Italian geodetic infrastructure in Antarctica has constantly developed during the last two decades. The integration of geodetic instruments with other geophysical sensors has been driving the planning and design of the geodetic infrastructure at Mario Zucchelli Station (MZS) and in a wide area around the base. Our purpose is to maximize the interdisciplinary use of the geodetic observations and to widen the field of investigation. The first geodetic GPS network was established in the area of Mt. Melbourne in the late 80s to study the local movement and deformation of the volcanic cone. A wider geodetic network was materialized on rocky outcrops in 1999-2000 with the purpose to study crustal deformations in the Northern Victoria Land (NVL). The project, named VLNDEF (Victoria Land Network for DEformation Control), also aims at collecting measurements to constrain Glacial Isostatic Adjustment (GIA) models. VLNDEF is formed by 28 points that are accessible by means of helicopter, the maximum distance of points from the Italian base MZS being about 500 km. A permanent GPS station (TNB1) was installed in 1998 at MZS with DOMES N. 66036M001. In addition, to increase redundancy in the long term observations at MZS, an additional permanent GPS station TNB2 was installed in 2008 on a marker materialized a couple of years earlier and a few meters apart from TNB1. In addition, during 2008 three semi permanent remote stations (VL01 Cape Hallett, VL05 Cape Philips, VL18 Starr Nunatak), powered by a set of batteries and solar panels, provide a few months of data acquisition every year. Since its establishment, VLNDEF has been surveyed nine times, of which three are surveys of the whole network. GPS measurements are the core of the Italian geodetic infrastructure and are acquired along with tide gauge measurements (since 2006), radiosoundings (during the Austral summer), on-ground meteorological parameters, episodic absolute and relative gravity measurements and geomagnetic field measurements. We present the most recent results derived from the VLNDEF GPS data set and the permanent GPS stations at MZS. We process the data with three different software (Bernese V5.0, Gamit-Globk, Gipsy-Oasis) adopting a consistent analysis approach and the most up to date models. Our results are valuable to assess the local and regional 3-D movements in the Northern Victoria Land.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 30

Title: UNAVCO Polar Group and the Polar cGPS Networks: 2012 State of Health, Technology Updates, and a Platform for Polar Scientific Research.

Forename: Jeremy Surname: Miner

Authors: Miner, Jeremy; White, Seth; Pettit, Joe;

Presentation Allocated: Poster

abstract: UNAVCO's Polar Engineering group currently maintains 132 continuous Global Positioning System stations in the heart of, and surrounding the two great ice caps of Greenland and Antarctica. With input and support from project PI's and the broader community, our advances in remote power systems, coupled with more consistent communications now enable us to transmit year round geodetic data in near real time for over 90% of these networks. Structural improvements to power supply systems, including the use of dual-bearing, vertical axis wind turbines have improved overall power reliability, while the integration of smaller, more compact frames is reducing the incidence of mechanical failure. Redundant anti-static measures have lowered electrical failures resulting from static electric discharge to geophysical instruments and communications systems. The hardening of cables and enclosure bulkheads are showing a reduction in wildlife damage related failures as well. Dual Iridium communications systems are demonstrating greater survivability of the data flow throughout the polar winters. In addition, Xeos modems are increasingly being deployed with the advantage of utilizing both Iridium SBD and RUDICS communications to maximize throughput and minimize power consumption. These polar systems are readily adaptable to suit instrumentation beyond GPS and already include meteorological stations, remote cameras, and other geophysical instrumentation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: A new GPS derived data set of uplift rates in the Antarctic Peninsula

Forename: Matt Surname: King

Authors: King, Matt; Thomas, Ian; Domack, Eugene; Riva, Riccardo; Whitehouse, Pippa;

Presentation Allocated: Oral

abstract: Models of glacial isostatic adjustment in the Antarctic Peninsula (AP) remain relatively poorly constrained, with the spatial pattern of predicted uplift rates differing between major models. The post-LGM configuration of the ice sheet around the Larsen B embayment is of particular interest, and is a focus of the LARSEN Ice Shelf System (LARISSA) project. Uncertainty also remains over the scale of contemporary ice mass loss from the fast warming Antarctic Peninsula over the last decade. It is now known that disintegration of buffering ice shelves, including the Larsen B Ice Shelf, is causing glaciers to speed up, resulting in an increase in the rate of continental ice loss, and a consequential elastic rebound of the Earth's surface. Recent acceleration in crustal uplift rates, from a surprisingly low base rate, has already been observed in GPS station coordinate time series for this region. Additionally, it has recently been suggested that there was also a loss of ice following the Little Ice Age (LIA). Here, we focus on an observed GPS dataset of uplift rates for the AP, and the challenge of separating out the elastic signal from the ongoing GIA correction. We present the results from an up to date analysis of continuous and campaign GPS data from the Antarctic Peninsula and West Antarctica, including the new LARISSA network of 6 GPS stations. We consider in particular the elastic component of the uplift. The LARISSA network is unique in its spatial organisation and ability to triangulate the location of recent ice mass loss. It is arranged in two triangular patterns with two coastal sites and one far field site on the west (Vernadsky, Duthier's Point and Hugo Island respectively) and one coastal and two far field sites on the east (Foynt Point and Robertson Island, Cape Framnes respectively). Finally, we compare our observed GIA rates with those predicted by several recent models of GIA uplift.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Characteristic Seismic Waves Associated with Cryosphere Dynamics Detected by Temporary Seismic Exploration in Eastern Dronning Maud Land, East Antarctica

Forename: Masaki Surname: Kanao

Authors: Kanao, Masaki; Yamada, Akira; Yamashita, Mikiya; Nettles, Meredith;

Presentation Allocated: Oral

abstract: Several kinds of natural source signals are recorded by seismic exploration stations on the continental ice-sheet in Eastern Dronning Maud Land, East Antarctica, during 2002 austral summer. They include not only tectonic earthquakes, but also ice related phenomena possibly involving recent global climate change. The recorded signals are classified into (1) teleseismic events, (2) local ice-quakes and (3) unidentified events (X-phases). The teleseismic waves show the high signal-to-noise ratio in spite of the small magnitude of the event: this indicates that it is highly feasible to study not only the local shallow structure but also the deep structure of the earth by using teleseismic events. Frequency spectra of the all waveforms represent discordances along the observation seismic profile. The abrupt change of topography in the valley along the seismic profile might cause both the anomalous frequency content and travel-times. Anomalous behavior of the waves characterized by the focusing/defocusing effects is possibly caused by a valley structure beneath the stations located at the middle of the seismic profile. Several characteristics were identified by detailed spectra analyses. A difference of the response generated from the valley structure might exist for different kinds of incident waves: i.e. P-wave incidence on the valley results in a 'frequency gap' while on the other hand, S-wave incidence produces both the 'gap' and the 'peak' with a sufficient delay of the arrival-time. Although the origin of X-phases is not accurately identified, the most plausible candidates are an intra-plate earthquake or a large ice-quake (glacial earthquake) in the Antarctic. Maybe the precursor vibration of the break-off process at the Larsen B Ice Shelf could be the most plausible candidate to cause the X-phases.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Detection of Tectonic, Volcanic, and Cryospheric Seismic Sources in Antarctica using POLENET Seismic Array and GSN Seismic Stations

Forename: Amanda Surname: Lough

Authors: Lough, Amanda; Barcheck, Catherine; Wiens, Doug; Barklage, Mitchell; Nyblade, Andrew; Aster, Richard; Anandakrishnan, Sridhar; Huerta, Audrey; Wilson, Terry;

Presentation Allocated: Poster

abstract: Antarctica has few reported seismic events (only 4 in the 2009-2010 ISC bulletin) partly due to poor station coverage with only 9 permanent stations. Over 40 temporary stations have been installed beginning in 2007 as part of the IPY POLENET project. These stations allow us to locate events too small to be recorded at coastal stations. This study analyzes seismic data from 2009-2011 filtered in both long period (33-75s) and short period (0.1-2s) bands from over 50 stations. We detect, associate, and locate events in short period bands by identifying first arriving P and S phases using both automated STA/LTA detection and visual inspection. We also use a modified time reversal to identify 'slow' events (sources associated with ice movement). Long period envelopes are shifted by Rayleigh wave propagation times and stacked at equidistant source locations. We find several glaciers including Vanderford (also seen in long period), David, and Mullock produce magnitude 3-4 sized events in the short period band associated with ice movements. The frequency of long period events at calving fronts is significantly lower than in Greenland. We detect fewer events over our entire study period than are detected in Greenland within a single year. Even Vanderford Glacier (the most active calving front) has only 10 detections which is less than the 5-30 events detected per year on Greenland calving fronts. Several tectonic earthquakes have been detected near the center of East Antarctica (20-40km deep) indicating at least some tectonic deformation is occurring in the craton. Tidally modulated Whillans Ice Stream slip events are common on the long period band. We detect a new type of cryospheric source (located in the upper ice sheet, possibly corresponding to crevassing or snow collapse events) characterized by ~ 1 s Rayleigh waves traveling in the ice layer (1.5-1.7km/s propagation velocity) over distances of up to 1000km. With the 2010 station configuration we detect events (located on subglacial promontories) most likely associated with Executive Committee Range volcanic activity. Clusters of deep LP volcanic events occur in two distinct locations (~ 25 km and 15-20km deep) and large numbers of extremely local events with a S-P time of ~ 1 s are observed only at Mt. Sidley. When completed the catalog will give insight into tectonic, volcanic, and glacial processes capable of producing seismic waves in unobserved regions of the the Antarctic continent.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Evidence of regularly-repeating glacially-generated seismicity in West Antarctica.

Forename: Lucas Surname: Zoet

Authors: Zoet, Lucas; Anandakrishnan, Sridhar; Nyblade, Andrew; Lloyd, Andrew; Wiens, Douglas; Aster, Richard; Huerta, Audrey; Wilson, Terry;

Presentation Allocated: Poster

abstract: Recent broadband seismic deployments have greatly increased seismic coverage in Antarctica and have detected events that are not visible to the global seismic network. The POLENET/ANET network consisted of as many as 33 seismographs deployed across much of West Antarctica during 2010-2012. The seismographs operate year-around even in the coldest parts of Antarctica, due to novel insulated boxes, power systems, and modified instrumentation developed in collaboration with the IRIS PASSCAL Instrument Center and the UNAVCO Geodetic Facility. Glacially generated seismicity has been observed in many regions of Antarctica, but generally with the fast-flowing ice streams or outlet glaciers. Here we present data that indicate the presence of glacial-flow related seismicity over large regions of West Antarctica, and is not limited to the Siple Coast ice streams or to the Transantarctic mountain outlet glaciers. A series of seismic events have been detected and located using the POLENET "transect" array that crossed much of West Antarctica from north to south. Some events are too small to be seen at more than one or two stations; nevertheless, we can infer some characteristics of seismic emission rates from those data. Some events were large enough to be located and may be either glacial or volcanic in origin. We present details on their timing and hypotheses on their generation by glacial sliding and water-pressure variations.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Flexural controls on late Neogene basin evolution in southern McMurdo Sound, Antarctica.

Forename: Gary Surname: Wilson

Authors: Wilson, Gary; Aitken, Alan; Tinto, Kirsty; Jordan, Tom;

Presentation Allocated: Oral

abstract: The basins beneath southern McMurdo Sound have evolved from flexure related to the progressive loading of the volcanoes of the Ross Archipelago. The loads of the nine discrete volcanic massifs of the Archipelago have the potential to provide a near continuous stratigraphic Late Neogene record of the ice sheet and climatic influence in sedimentary deposition in the SW Ross Sea. In order to characterize basin history, we have constructed a 3D model of the progressive development of accommodation space within the flexural basins. Elastic plate flexure was calculated for a range of effective elastic thicknesses (T_e) from 0.5 to 25 km using a spectral method and compared with seismic and gravity data. Models with elastic thickness between 2 km and 5 km, which is significantly less than the regional average ($T_e \sim 20$ km), produce the best fit to the gravity data, although there is some error in estimating load volume below sea level. Slope angles and direction in seismic reflection data are consistent with this estimate of T_e although variations in depth to surfaces imply a northward slope in the pre-flexed surface. This low strength may reflect the weakening effects of the Terror Rift, and perhaps also the Discovery Accommodation Zone, a region of major transverse faulting. Our low T_e model predicts the development of two discrete basins in southern McMurdo Sound: a northern basin associated with the younger loads of Ross Island and an older more southerly basin associated with the Loads of Mount Discovery and Mount Morning. Both basins are predicted to be 2-2.5 km at their deepest, with a < 2 Ma history recorded in the northern basin, now sampled by the ANDRILL AND-1B drill core, and a 10 Ma to 2 Ma history recorded in the southern basin and yet to be sampled by drilling. The AND-1B core also recovered an orbitally paced Pliocene glacial/interglacial alternations from beneath the Ross Island flexed surface and we expect that the more dispersed volcanoes of the Discovery subprovince will have provided intermittent accommodation space that should allow the glacial and climate history of the Ross Sea region to be extended back through the Late Miocene in the southern basin.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Geological boundary conditions for Institute and Möller Ice Streams, West Antarctica

Forename: Tom Surname: Jordan

Authors: Jordan, Tom; Ferraccioli, Fausto; Ross, Neil; Siegert, Martin; Corr, Hugh; Leat, Philip; Bingham, Rob; Rippin, David; le Brocq, Anne;

Presentation Allocated: Poster

abstract: The conditions at the base of an ice sheet influence its flow, and hence long term development and stability, and reflect the ongoing interaction between moving ice and the underlying geology. Critical influences on ice flow include subglacial topography, bed lithology, and geothermal heat flux. These factors are influenced either directly by the local geology, or by regional tectonic evolution. Geophysical methods have been used in many parts of Antarctica, such as the Siple Coast, to reveal the role subglacial geology plays in influencing ice flow. Until recently, however, the Institute and Möller Ice Streams, which drain ~20% of the West Antarctic Ice Sheet into the Weddell Sea, were only covered by sparse airborne radar (~50 km line spacing), and reconnaissance aeromagnetic data, limiting our understanding of the geological template for this sector of the West Antarctic Ice Sheet. Here we present our tectonic interpretation of the first integrated aerogeophysical survey over the catchments of the Institute and Möller Ice Streams, which collected ~25,000 km of new aerogeophysical data during the 2010/11 field season. This new data allows us to map both the subglacial topography with airborne radar, and the subglacial geology using the aeromagnetic and aerogravity data. Our maps show the fastest flowing part of the Institute Ice Stream is underlain by thinned continental crust and a broad sedimentary basin, interpreted as the margin of the Weddell Sea Rift, which formed ~180 Ma during the fragmentation of Gondwana. The newly identified, ~75 km wide, sinistral strike-slip Pagano Fault Zone forms the tectonic boundary between East and West Antarctica, and is the onset region for fast flowing ice feeding both the Institute and Möller Ice Streams. Digitally enhanced aeromagnetic data and gravity anomalies indicate that Middle Cambrian rift related volcanic rocks and Jurassic granites directly influence the pattern of subglacial topography, and hence ice flow.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: GPS and paleoshoreline record of solid earth deformation in Southern Victoria Land, Antarctica

Forename: Stephanie Surname: Konfal

Authors: Konfal, Stephanie; Wilson, Terry; Bevis, Michael; Kendrick, Eric; Hall, Brenda;

Presentation Allocated: Oral

abstract: Accurate estimates of Antarctic ice mass balance are essential for making predictions of global sea level change. Fundamental to this effort are models of glacial isostatic adjustment (GIA). These models require observational field data, such as measurements of crustal motion, to assess model accuracy, provide further constraints on model inputs, and ultimately allow for predictions of future behavior. We derive rates of crustal tilting from paleoshoreline records and GPS data in the Dry Valleys and surrounding region of Antarctica. The age range of tilted shorelines, dating between ~15,000 – 2,000 14C yr BP, provides a record of solid earth deformation coinciding with deglaciation of Antarctica since the Last Glacial Maximum (LGM), while GPS data record modern measurements of crustal motion. The combination of both long term and modern crustal motion data permits a unique observation of GIA. Shoreline tilts uniformly indicate tilting down to the southeast, away from East Antarctica, and increase exponentially in magnitude with age. A strong agreement between GPS horizontal velocities and derived shoreline tilt direction is observed, indicating modern horizontal movement in the same southeast direction as indicated by the shorelines. Vertical GPS velocities also indicate tilting to the east, although in a more northerly direction than that indicated by the shorelines and the horizontal crustal motion given by GPS vectors. The signature of tilting shown by both shoreline and GPS data is not explained by current models of GIA. If due to ice un-loading since the LGM, our results suggest models of GIA under predict rates of rebound for the Wilkes Subglacial Basin and Northern Victoria Land (WSB/NVL) region. Significantly, an under prediction of GIA rebound indicates that previous Gravity Recovery and Climate Experiment (GRACE) satellite-based studies of Antarctic ice mass balance, which are strongly dependent on GIA model corrections, have underestimated ice mass loss for the WSB/NVL region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Gravity change and vertical motion at the Finnish Antarctic Station Aboa, Dronning Maud Land – signatures of Glacial Isostatic Adjustment, contemporary ice load, and close-field snow attraction

Forename: Jaakko Surname: Mäkinen

Authors: Mäkinen, Jaakko; Näränen, Jyri; Koivula, Hannu; Ahola, Joel; Poutanen, Markku;

Presentation Allocated: Oral

abstract: The first absolute-gravity measurement at the Finnish Antarctic Research Station Aboa in Western Dronning Maud Land was performed by the Finnish Geodetic Institute (FGI) with the JILAg-5 gravimeter in the FINNARP 1993 expedition. The station has now one of the longest absolute-gravity time series in the Antarctic: repeat measurements were performed with the JILAg-5 in FINNARP 2000 and with the FG5-221 in FINNARP 2003, 2005, and 2011. The continuous GPS (CGPS) station at Aboa was established by the FGI in FINNARP 2002; it started operations in February 2003. Aboa is a summer station only and the receiver works unattended during the austral winter. The summer expeditions to Aboa recover the data stored in the memory card of the receiver. The CGPS station is part of the POLENET. The absolute-gravity laboratory also houses a broadband seismometer operated by the Institute of Seismology of the University of Helsinki. Its data is collected and recovered in the same way as that of the CGPS receiver. Both the gravity laboratory and the CGPS antenna close to it are on exposed bedrock on the nunatak Basen. However, it was soon recognized that the attraction of the snow on the slopes of Basen and of the near glacier Plogbreen below Basen can have a large influence on local gravity, and must be monitored. A snow stake line to a distance of 5 km has been operated as a joint effort by several institutes since FINNARP 1999. The CGPS functions as a RTK-GPS base station and whenever a summer expedition brings rover equipment to Aboa the glacier heights on the stake line are surveyed. In the intervening seasons accumulation is monitored by FINNARP logistic personnel. Detailed RTK-surveys to a distance of 2 km from the gravity laboratory are performed during every absolute-gravity occupation since FINNARP 2003. We report the results and discuss the contribution of GIA and contemporary ice mass load to the CGPS and absolute-gravity time series, and the contribution of the close-field attraction which is present in the absolute gravity only.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Influence of close-field snow and ice on gravity: Implications on interpretation of absolute gravity time series in Antarctica

Forename: Jyri Surname: Näränen

Authors: Näränen, Jyri; Mäkinen, Jaakko; Ahola, Joel; Koivula, Hannu; Poutanen, Markku;

Presentation Allocated: Poster

abstract: Finnish Geodetic Institute has conducted absolute gravity measurements in Dronning Maud Land, Antarctica, since 1993. The longest time series is located at the Finnish research station Aboa, where the fifth absolute gravity measurement was carried out during the Antarctic summer season 2011/2012. The Finnish Geodetic Institute has operated a permanent GPS station at Aboa since 2003. Joint interpretation of gravity change and crustal deformation allows the separation of the response of the solid Earth to contemporary variation in ice load and the GIA effects. A challenge in interpreting absolute gravity time series in Antarctica is that there are always snow and ice fields near the gravity measurement locations and the temporal change in the attraction by local ice and snow mass can cause gravity signals comparable to or even larger than the gravity signal due to the solid Earth responses. In order to assess and to correct for the local gravity change, we have measured the snow and ice field around the Aboa gravity observatory during several absolute gravity measurement campaigns. First measurements of the snow field surface elevations in the nearest vicinity of the gravity observatory were performed in 2001. In 2003-2004 the measurements were expanded by using RTK-GPS to measure a grid of height values in the nearest 0.2 X 0.1 km around the gravity observatory and by measuring height profiles down to the nearby glacier. These profiles were measured to approximately the distance of 2 km by RTK-GPS mounted on a sledge towed by a snowmobile. In total 21 profiles were measured resulting in ~35 km of height profiles. The RTK-GPS measurements were repeated in the seasons 2005/2006 and 2011/2012. In addition we have measured the density of the upper layers of snow at several locations on the study area. We report here our measurements of snow surface height variation during the absolute gravity observation campaigns at the Aboa station and we give a preliminary assessment of the effect these variations have on the absolute gravity time series.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Influence of Dynamic Topography on the Antarctic continent

Forename: Lester Surname: Anderson

Authors: Anderson, Lester; Ferraccioli, Fausto; Eagles, Graeme; Steinberger, Bernhard; Ritsema, Jeroen;

Presentation Allocated: Poster

abstract: Reconstructing Antarctic topography through time is a critical step to develop coupled models of cryosphere and climate evolution. Some of the tectonic, isostatic and erosional processes that shaped the Antarctic continent are increasingly well understood. However, our knowledge of the larger-scale consequences of dynamic topography in Antarctica remain in an infancy stage compared to other continents. Seismic tomographic models provide a tool to derive large-scale models of convection in the Earth's mantle, which can be used to reconstruct dynamic topography through time. By analyzing grids of global dynamic topography from present-day to 80 Ma based on the tomographic models S40RTS & S20RTS (Ritsema et al. 1999, 2011) we assess for the first time the potential space-time variability in dynamic topography in Antarctica. Our models reveal that the Gamburtsev Province and Dronning Maud Land, two of the major nucleation sites for the East Antarctic Ice Sheet (EAIS) were significantly elevated at ca 60 Ma. This was followed by ~500 m of subsidence throughout the Cenozoic. The increased elevation may have facilitated ephemeral ice cap development in the early Cenozoic prior to the formation of the EAIS at ca 34 Ma. We identify a highstand between ca 25 and 50 Ma over the northern Wilkes Subglacial Basin (ca 200 m) and a major increase in elevation (>600 m) over the last 20-15 Ma over the northern and southern Victoria Land segments of the Transantarctic Mountains (TAM). The most prominent signal is observed over the Ross Sea Rift (RSR) where predicted Neogene dynamic topography exceeds 1,000 m. It is tempting to associate these dynamic topography effects over the TAM and RSR to the flow of warm mantle from the West Antarctic Rift System (WARS). However, we found that these effects are comparatively less significant over the Marie Byrd Land Dome and the interior of the WARS. If these contrasting dynamic topography effects are included, then the predicted elevations of the Ross Sea Embayment are more similar to the interior of the WARS, with possible implications for the early development of the West Antarctic Ice Sheet.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Inland thinning of West Antarctic Ice Sheet steered along subglacial rifts

Forename: Robert Surname: Bingham

Authors: Bingham, Robert; Ferraccioli, Fausto; King, Edward; Larter, Robert; Pritchard, Hamish; Smith, Andrew; Vaughan, David;

Presentation Allocated: Poster

abstract: Ice currently being lost from the West Antarctic Ice Sheet (WAIS) accounts for ~10% of observed global sea-level rise. Losses are dominated by the accelerated draw-down and resultant “dynamic thinning” of ice along the coastline, forced by oceanic or atmospheric perturbations to the ice margin. Though key to improving projections of future ice-sheet contributions to global sea-level rise, the incorporation of dynamic thinning into models has been restricted by lack of knowledge of basal topography and subglacial geology so that, for much of WAIS, the rate and ultimate extent of its potential retreat inland remain difficult to quantify. Here we report the discovery of a subglacial basin up to 1.5 km deep and 20 km wide, that connects the ice-sheet interior to the Bellingshausen Sea margin, whose existence impacts profoundly on current ice-dynamic losses. We use a suite of ice-penetrating radar, magnetic and gravity measurements to propose a rift origin for the basin in association with the wider development of the West Antarctic Rift System. Now likely inactive, but overdeepened by glacial erosion, the Ferrigno Rift represents a conduit which fed a major palaeo-ice stream on the adjacent continental shelf during glacial maxima. The palaeo-ice stream eroded the “Belgica” trough which today routes warm open-ocean water back to the ice front to reinforce dynamic thinning. We show that dynamic thinning from both the Bellingshausen and Amundsen Sea region is being steered back to the ice-sheet interior along rift basins. We conclude that rift basins that cut across the WAIS margin can rapidly transmit coastally-perturbed change inland, thereby promoting ice-sheet instability.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Low temperature thermochronology in Prydz tectonic belt in eastern Antarctica

Forename: hong Surname: chen

Authors: chen, hong; hu, jianmin; P. Kohn, Barry;

Presentation Allocated: Poster

abstract: The Pan-African Prydz tectonic belt in East Antarctica, extends from the Prydz Bay- Eastern Amery Ice Shelf area to the Grove Mountains. In this belt, all the bedrock is formed at Precambrian. For this reason, the researches for Eastern Antarctica are mainly focusing on the Rodinia and Gondwana super-continent's evolution at present, and the study for the geological evolutions that before 1 Ga and after 0.5 Ga is limited greatly by comparison. For the evolution before Rodinia continent, we need more samples remained the geological information before 1 Ga. Maybe, the sub-glacial geological research will obtain more valuable information. For the Mesozoic and Cenozoic evolutionary history, we can use the low temperature thermochronology, such as AFT and apatite and zircon (U-Th)/He analyses, because the closure temperatures for these methods are below 200°C, whereas apatite (U-Th)/He analysis would typically have a closure temperature of ~70°C. We have chosen 9 samples for the AFT and (U-Th)/He analyses from Zhongshan station and Grove Mountains. The Zhongshan station locates at the east edge of the Amery Ice Shelf, and the Grove Mountains locates at the interior Antarctic continent. At present, we only finished the apatite (U-Th)/He analysis, and the results are rather mixed. Those samples from Zhongshan Station in particular don't reproduce that well. The most reproducible analyses (taking into account 2 sigma errors) are from the Mt. Harding samples, although each of these has one analysis that seems to be older. One from Zakharoff Ridge reproduces well but another one does not. Based on the limited data, we could preliminary indicate that the uplifting at Zhongshan Station maybe began at Triassic(210-243Ma) and the Grove Mountains was from Permian(300 Ma) and Continue to Triassic(230Ma). It just like that the Zhongshan Station uplifted later than the Grove Mountains. The results of the low temperature thermochronology may indicate the Prydz structural belt uplifting related to later reactivation of the Lambert Graben rift area formed during initial Permo-Triassic separation between the Indian and Antarctic areas of Gondwana. Of course, we need the AFT and Zr-He date to get a more evidential cognition and general framework for the eastern Antarctic evolution.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Mantle xenoliths from Santa Marta Cove, James Ross Island, Antarctic Peninsula

Forename: Joaquín Surname: Bastías

Authors: Bastías, Joaquín; Ramírez, Cristian; Hervé, Francisco; Fuentes, Francisco;

Presentation Allocated: Oral

abstract: In the recent 2012, the XLVIII Chilean Antarctic Expedition (ECA XLVIII, in spanish), the project ACT-105 visited the Santa Marta Cove, in the south-east coast of James Ross Island (JRI), north-east of Antarctic Peninsula. The area located in the north slope of the Smellie Peak, the expedition found a 200 meter wide and, at least 600 long area with north-west trending comprising hyaloclastites and basaltic lavas of the James Ross Island Volcanic Group (JRIVG), rich in mantle xenoliths, up to 2 cm in diameter. The presence of regolith is intense and the widespread outcrops display typical columnar igneous structures. The volcanic rocks of the JRIVG dominate the outcrops of the Santa Marta Cove. They unconformably overlie relatively unconsolidated Cretaceous marine sediments from the Snow Hill Island Formation. The JRIVG basalts present alkaline affinity, and are interpreted as erupted in a back-arc extensional setting during the slowing stages of subduction of Drake Passage oceanic crust at the South Shetland trench, whose peak activity was between late Miocene and middle Pleistocene. The area is close to Mount Haddington, the island's largest volcano and likely source of the most voluminous basaltic eruptions. Previous studies have examined mantle xenoliths at JRI's Ekelöf Point, however no recent report have been done regarding this subject in Santa Marta Cove. Analyses of Re/Os isotopes, major-elements and EPMA are currently being prepared by the authors and the collaborating institution, and are expected to be presented at the XXXII SCAR. These results will further our understanding of the condition of the lithosphere beneath the north Antarctic Peninsula at the time of emplacement of the JRIVG. The authors want to thank the Chilean Antarctic Institute, CONICYT and N161 UNAB project for their logistical and financial support.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: New Seismic Structure Models of Antarctica and Implications for Lateral Changes in Lithospheric Thickness, Mantle Viscosity and Heat Flow

Forename: Douglas Surname: Wiens

Authors: Wiens, Douglas; Heeszel, David; Sun, Xinlei; Lloyd, Andrew; Nyblade, Andrew; Anandakrishnan, Sridhar; Aster, Richard; Chaput, Julien; Huerta, Audrey; Wilson, Terry;

Presentation Allocated: Keynote 40 mins

abstract: Recent broadband seismic deployments have greatly increased seismic coverage in Antarctica and have enabled the generation of new higher resolution seismic models of the continent. The AGAP/GAMSEIS deployment consisted of 24 broadband seismographs deployed across the Gamburtsev Subglacial Mountains (GSM) and surrounding regions in East Antarctica during 2007-2009. The POLENET/ANET consisted of as many as 33 seismographs deployed across much of West Antarctica during 2010-2012. The seismographs operate year-around even in the coldest parts of Antarctica, due to novel insulated boxes, power systems, and modified instrumentation developed in collaboration with the IRIS PASSCAL Instrument Center. We analyse the data using several different techniques to develop a high resolution model of Antarctic seismic structure. We use Rayleigh wave phase velocities at periods of 20-180 s determined using a modified two-plane wave decomposition of teleseismic Rayleigh waves to invert for the three dimensional shear velocity structure [Heeszel et al., 2011]. In addition, Rayleigh wave group and phase velocities obtained by ambient seismic noise correlation methods provide constraints at shorter periods and shallower depths [Sun et al., 2011]. Crustal thickness is jointly constrained with surface waves and receiver functions [Sun et al., 2011; Chaput et al, 2011].

□

The new seismic velocity models provide constraints on parameters needed for glaciological modeling, including elastic lithosphere thickness, mantle viscosity variations, and heat flow. We explore several different methods for estimating these parameters from the seismic models. Despite uncertainties in the parameterization, several trends become clear. Lithospheric thickness is much greater in East Antarctica than in West Antarctica. Within West Antarctica, the lithosphere is extremely thin and heat flow is high beneath the Ross Sea and Central West Antarctica, particularly near the Transantarctic Mountain Front, with thicker lithosphere and lower heat flow beneath the Whitmore Mountains and Marie Byrd Land. Asthenospheric viscosities are lowest beneath Marie Byrd Land and highest beneath East Antarctica. Realistic glacial isostatic adjustment models must take these large lateral variations into account.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Quaternary volcanism in Deception Island (Antarctica): subduction-related signature in the Bransfield Strait backarc domain

Forename: Lago Surname: Marceliano

Authors: Marceliano, Lago; Andrés, Gil-Imaz; Carlos, Galé; Belén, Oliva-Urcia; Teresa, Ubide; Inmaculada, Gil-Peña; Ruth, Soto; Jesús, Galindo-Zaldívar; Jorge, Rey; Adolfo, Maestro; Jerónimo, López-Martínez;

Presentation Allocated: Poster

abstract: Deception Island shows a volcanism related to passive subduction of the Phoenix Plate and roll-back at the South Shetlands Trench in the present. The rocks of Deception Island can be subdivided into two main groups: the pre- (and syn-) caldera unit and the post-caldera unit. The pre-caldera unit includes the oldest rocks exposed on the island and is mainly composed of hydrovolcanic tephra deposits and basaltic lava flows of strombolian origin. The post-caldera unit includes hydrovolcanic tephra deposits and dacite lavas at the base and tuff cones and maar deposits to the top. We have studied the petrology and geochemistry of the Deception Island rocks. Massive hyaloclastites, surge-like deposits and basaltic flows were sampled from the pre-caldera unit. Regarding the post-caldera unit, we sampled the oldest cones, a dike cutting the oldest cones, the late 18th century volcanism and the youngest cones. The studied pre-caldera rocks are basaltic andesites to dacites and range from microlitic to microporphyritic with minor microphenocrysts of clinopyroxene and plagioclase in a fine-grained, plagioclase-rich groundmass; vacuoles are common. Their mineral assemblage is: Al-rich augite (Fs: 10-20), plagioclase (An: 74-24) and opaque minerals (ilmenite and Ti-bearing magnetite); exsolution lamellae of orthopyroxene (En: 73-65) have been observed in isolated augite microphenocrysts in the dacites. The oldest sample shows evidence of palagonitization. On the other hand, the post-caldera rocks are intermediate to acid and range from dacites to rhyolites. They are microlitic to microporphyritic with microphenocrysts of olivine and plagioclase. Their mineral assemblage is mainly composed of olivine (Fo: 86-31), plagioclase (An: 79-21), opaque minerals (ilmenite and Ti-bearing magnetite) and apatite. The youngest sample also contains Al-rich augite (Fs: 14-16). All the studied rocks display a subalkaline affinity (Nb/Y: 0.07 – 0.2), closer to the tholeiitic series according to the AFM diagram. They are enriched in incompatible elements ca. x10 to x100 times over the primitive mantle. Their normalised patterns are characterised by Nb-Ta negative anomalies and strong La-Ce, Zr and Y positive anomalies. These features could indicate the involvement of subducted sediments in the source, greater for the evolved rocks (higher (La/Sm)_N ratios), being this signature related to the subduction context of the South Shetland Islands.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Relative sea-level history of Marguerite Bay derived from optically stimulated luminescence-dated beach cobbles

Forename: Lauren Surname: Simkins

Authors: Simkins, Lauren; Simms, Alexander; DeWitt, Regina;

Presentation Allocated: Poster

abstract: Calmette Bay located within Marguerite Bay along the western side of the Antarctic Peninsula contains one of the most continuous flights of raised beaches anywhere in Antarctica. The series of raised beaches extends to 40.8 meters above sea level (masl) and is thought to reflect isostatic rebound due to the retreat of the Antarctic Peninsula Ice Sheet since the Last Glacial Maximum. Prior work in Marguerite Bay places the Holocene marine limit at 41 masl - the elevation of the highest beach ridge in Calmette Bay. Although the age component of the sea-level reconstruction is reasonably well-constrained below 20 masl, no age constraints exist for sea-level indices above 20 masl. Using optically stimulated luminescence, we dated quartz extracts from cobbles within the raised beaches at Calmette Bay. Initial age results from two samples suggest that the upper beach at 40.8 masl formed as a result of pre-Last Glacial Maximum uplift around 38 ka; therefore, the Holocene marine limit in Calmette Bay needs to be redefined. Dated cobbles from beaches at 33.8 masl and 21.7 masl suggest the beaches formed at 8.7 ka and 7.4 ka, respectively. Further optically stimulated luminescence dating is underway to obtain a higher resolution record of beach ages at Calmette Bay between modern sea level and the highest beach at 40.8 masl; however, our initial results suggest that the Holocene marine limit lies between 33.8 masl and 40.8 masl. Improvements made for dating Antarctic geomorphic features using optically stimulated luminescence are important for determining a robust relative sea-level history of Marguerite Bay. In addition, the application of optically stimulated luminescence dating for cobble-sized sediment is a potentially useful tool for coarse-grained beaches around Antarctica as well as in the northern hemisphere high latitudes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Rupture characteristics of slip events from the Whillans Ice Stream, West Antarctica: analysis from near-field and far-field seismic signals

Forename: Martin Surname: Pratt

Authors: Pratt, Martin; Winberry, J. Paul; Wiens, Douglas; Anandakrishnan, Sridhar;

Presentation Allocated: Poster

abstract: The lower reaches of the Whillans Ice Stream, referred to as the Whillans Ice Plane (WIP), exhibits tidally modulated stick-slip motion that releases seismic signals detectable at distances in excess of 1000 km. Each slip event is characterized by three distinct signals attributed to asperities or 'sticky-spots' at the ice-bedrock interface. The location of the asperities has been the main objective of recent field work using in situ GPS and broadband seismic instruments. A dense array of instruments pinpointed that the initial rupture impulse, resulting in the first of the three far-field signals, occurred after two sticky-spots were broken towards the southern grounding line of the WIP. Rupture propagates over the upstream portion of the WIP at ~ 1 s/km. Approximately 8–10 mins after initiation a second signal is observed to pass southwards from the northern shear margin at ~ 90 s/km and is consistent with the second far-field signal. Both these rupture slownesses are dependent on the recurrence interval. The third far-field signal is correlated to a near-field response originating from the downstream grounding line region. Frequency-wavenumber analysis of seismic data has yielded azimuthal directions of source origins. Recent fieldwork using a wider array of instruments across the entire ice plane has enabled a better constraint on the source location of the second rupture to the vicinity of Subglacial Lake Engelhardt. These findings have been correlated with locations using far-field travel times collected by the POLENET A-NET array throughout West Antarctica. The effect of the subglacial lake on the seismic characteristics is not clear, however analysis of second-phase amplitudes from GSN station VNDA correlate with satellite data showing the subglacial lake emptying and gradually refilling over the last decade.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Solid Earth Response and influence on Cryosphere Evolution: A Developing SCAR Research Focus

Forename: Terry Surname: Wilson

Authors: Wilson, Terry;

Presentation Allocated: Keynote 40 mins

abstract: The overarching objective of the SERCE scientific research programme is to 'Advance understanding of the interactions between the solid earth and the cryosphere to better constrain ice mass balance, ice dynamics and sea level change in a warming world.' This broad objective will be accomplished through integrated analysis and incorporation of geological, geophysical and geodetic observations constraining properties of the solid earth and crustal motions. Observational data will be incorporated into models of glacial isostatic adjustment (GIA) and ice sheet dynamics. Close collaboration with the glacial geology and glaciological communities investigating ice sheet dynamics and history is integral to the programme. By combining GPS vertical velocity fields with information on ice sheet histories from geological and glaciological information it will be possible to improve understanding of Antarctic ice sheet evolution from the Last Glacial Maximum (LGM) to the present. Integration and synthesis of seismological data, together with other airborne and in situ geological and geophysical data will allow improved mapping of the Antarctic lithospheric and upper mantle structure and rheological properties. Combining these results will allow development of improved models of glacial isostatic adjustment (GIA). Better-constrained GIA models will, in turn, improve estimates of present-day ice mass balance obtained by satellite measurements by removing one of the largest uncertainties in analysis of satellite data for present-day change. The SERCE program also aims to contribute to documentation and evaluation of ice sheet boundary conditions and subglacial processes, neotectonic deformation of the solid earth, and interdisciplinary efforts to understand the troposphere, climate change and space weather. A SCAR-based programme will provide an international forum for initiating collaborative, focused working groups, for exchange of data and metadata, and for sharing of technical information and improvements essential to building the capacity to establish and maintain an augmented network of autonomous remote geophysical observatories. Workshops and training schools on advanced solid earth-ice sheet topics are planned, to advance programme science objectives and to provide opportunities to engage students and early career scientists in polar earth science research.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: The ANET (Antarctic-POLENET) GPS Array in West Antarctica

Forename: Terry Surname: Wilson

Authors: Wilson, Terry; Bevis, Michael; Dalziel, Ian; Hothem, Larry; Kendrick, Eric; Konfal, Stephanie; Raymond, Carol; Smalley, Robert; Science Team, ANET;

Presentation Allocated: Poster

abstract: A new array of continuously-recording GPS stations has been deployed in West Antarctica, the ANET component of the Arctic-Antarctic POLENET geophysical observatory network. Since 2007, 20 CGPS co-located with seismic sensors have been installed, 17 on bedrock and 3 on ice. An additional 14 CGPS sites have been installed on bedrock. Thirty GPS sites also have Vaisala meteorological stations installed. GPS and met data are telemetered daily by Iridium modem to UNAVCO data archives in the USA. Due to the challenges of station deployment, only a subset of the CGPS stations have >3 years of continuous data as of end-2011. However, some additional sites have legacy campaign data from the prior JPL, WAGN and TAMDEF projects, providing longer time series. Overall, measured vertical crustal velocities are lower than rates predicted by current GIA models. Continuous time series of vertical bedrock motions from ANET stations show prominent seasonal displacement cycles, due to a combination of seasonal atmospheric pressure and seasonal ice mass changes. Data from met stations are helping to model the pressure signal. We are examining the longer time series for accelerations in vertical motion, indicative of the earth's elastic response to recent changes in ice mass. Shorter time series yield steady secular vertical motions, although an elastic component may be embedded in these as well. Companion ANET seismic studies, yielding improved elastic and viscous earth structure for West Antarctica, will help to model the elastic and viscoelastic glacial isostatic adjustment to ice mass change. The accumulating synoptic measurements acquired by the ANET GPS/seismic network will provide a test for satellite measurements indicating that West Antarctica is losing ice mass, and that this trend is accelerating.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: The provenance analysis of morainal detritus belt in Grove Mountains : an evidence from the subglacial geology for the Pan-African Prydz belt of eastern Antarctica

Forename: Jianmin Surname: Hu

Authors: Hu, Jianmin; Ren, Minghua; Zhao, Yue; Liu, Xiaochun; Chen, Hong;

Presentation Allocated: Poster

abstract: The Grove Mountains, located at ~400 km from the edge of eastern Antarctica continent, is part of the Pan-African Prydz structural belt. In recent years, the tectonic feature of the Prydz structural belt has been one of the focuses for the eastern Antarctica geological research. But, there are only 2 % rock exposures which mainly distributed on the edge of this continent, and about 98 % area was covered by ice sheet. So, it is very difficult for geologists to study whether the Prydz belt is a collisional belt or a deformational belt in eastern Antarctica. At the most bedrock exposed at central Grove Mountain area, several irregular morainal breccias belts distributed on top of the blue ice sheets. The morainal deposits mainly have two major sources, the rocks packages collapsed from the nearby weathered hill cliffs and the transported materials scraped from the underlying bedrock during the glacier movement. Recently, the authors found some mafic high-pressure granulite gravels in a morainal detritus belt at the west of Gale Escarpment in Grove Mountains. This study reported the latest LA-ICPMS U-Pb ages from detrital zircon of medium gravel and sand gravel of the morainal deposits and one soil sample. The distribution of LA-ICPMS Pb-Pb isotopic ages of the detrital zircons in the fine gravel-sand grain gravel indicates that, the characters of the age distribution for this two samples are consistent, which are composed of two peaks of 500-550 Ma and 900-1000 Ma. These distributions suggest that the provenance of the samples are similar. Moreover, the distribution form is similar with the bedrock in Grove Mountains, which suggests that the provenance of the gravel belt nearby comes from the bedrock of Grove Mountains. Therefore, mafic high pressure granulite discovered in gravel belt on the west of Gale Escarpment maybe also comes from Grove Mountains bedrock wreathing. The results are supporting the previous bedrock studies at Grove Mountains and will indicate the the Prydz structural belt origins from the orogenic collision. This has great significance on the reconstruction of Gondwana. Keywords: Eastern Antarctica; Grove Mountains; Morainal detritus belt; High pressure granulite; Detrital zircon; U-Pb dating; Sub-glacial geology

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: The role of deep layers in the move of the Antarctic Peninsula from The Andes to the Eastern Antarctica

Forename: Rudolf Surname: Greku

Authors: Greku, Rudolf; Greku, Tatiana;

Presentation Allocated: Oral

abstract: The role of deep layers of the Earth in the evolution of the Antarctic Peninsula (AP), in the discovery of the Drake Passage and the influence of the shelf glaciers to the width of the western and eastern shelves is shown in our report. Most of works on the evolution of AP are based on studies of the spreading processes, subduction, volcanic activity, mechanics of shifting and strike-slip. Geological analysis in those cases describes only the construction of some first tens of kilometres. We used the method of the gravitational tomography for modeling of the whole AP's body up to the depth of asthenosphere and deeper. Maps and cross-sections of density anomalies distribution were built, along particular lines across AP. The results show that the lower border of the AP's block including the lithosphere can be seen to the depth of 75-150 km. The more congeneric horizontal asthenosphere layer is located along the whole length of the cross sections at the depth of 165-250 km. Its spatial configuration is shown on lateral maps. The area of low density of the asthenosphere has a wedge-shape contour and it is located at the depth of 270 km right below the southern end of the South America. The base of the wedge is positioned at the south-east from the current AP's location. The EGM2008 geoid model was used for computing. We took an assumption that the spatial position of the asthenosphere and the mantle structures has not changed appreciably from the moment of disintegration of the Gondwana continent. Back then, that moment triggered the slip of the AP's block on the plastic-like matter of the asthenosphere directed along the maximum gradient to the minimal values of density in the base of the wedge. Here at the depth of 219 km, AP was located in the ellipse of the minimum values and its shifting was stopped. Lateral maps also demonstrate continuous dynamics of layers related to the formation of the Drake Passage and opening of the South Atlantic. These events can be referred to the authentic dates by the geophysical, biophysics and other data. We can see that loading of the ice shelf causes a geostatic stress or pressure and corresponding deviatoric stress as a horizontal stretch on the cross-sections. The result is a widening of the shelf, which increases to the south with an increasing of the ice mass.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: The South Australian Heat Flow Anomaly in east Antarctica: hot rocks in a cool place.

Forename: Chris Surname: Carson

Authors: Carson, Chris; McLaren, Sandra; Boger, Steven; Roberts, Jason; Blankenship, Don;

Presentation Allocated: Oral

abstract: Sub-glacial geothermal heat flow is acknowledged to be a critical and poorly constrained boundary parameter influencing ice sheet behaviour. Geothermal heat flow is the sum of residual heat from the formation of the Earth and the natural heat generated within the Earth from the radiogenic decay of the major heat producing elements (HPEs), U, Th and K. Estimates of the sub-glacial geothermal heat flow in Antarctica are largely deduced from remotely-sensed low-resolution datasets such as seismic tomography or satellite-based geomagnetics. These methods provide broad regional estimates of geothermal heat flow reflecting variations in the mantle contribution as a function of thickness of a thermally homogeneous crust. These estimates of sub-glacial geothermal heat flow, although widely utilised in ice sheet modelling studies, fail to account for lateral and vertical heterogeneity of heat production within the crust where HPEs are concentrated and can impact regional geothermal heat flow values. Significant variations in regional geothermal heat flow due to heterogeneous crustal distribution of HPEs have been recognised within southern Australia, a region that was connected to east Antarctica along the George V, Adélie and Wilkes Lands coastline prior to breakup of Gondwana. The South Australian Heat Flow Anomaly (SAHFA) is characterized by surface heat flows as high as 126 mWm⁻², some 2-3 times that of typical continental values, due to local enrichment of HPEs. The SAHFA forms part of a continental block called the Mawson Continent, a now dismembered crustal block that is known, from geological and geophysical evidence, to extend deep into the sub-glacial interior of the Antarctic. It is highly probable that the high geothermal heat flow characteristics of the SAHFA also extend into the sub-glacial hinterland of Terra Adélie and George V lands, a possibility that has not been previously considered in ice sheet studies. In order to account for the occurrence of several sub-glacial lakes in Adélie Land, Siegert & Dowdeswell (1996) concluded that 'a further 25-50 mWm⁻² of equivalent geothermal heat' was required over the assumed local geothermal heat flow of ca. 54 mWm⁻². Although that study concluded that the additional heat required for basal melting was derived from internal ice deformation, they acknowledged the possible role of variations in geothermal heat flow. Now that the SAHFA is well-characterised, this possibility appears very likely.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Tracking the Effect of Sea Ice Cover on Microseismic Noise Using Two Seismic Arrays in Antarctica

Forename: Franklin Surname: Koch

Authors: Koch, Franklin; Wiens, Douglas; Euler, Garrett; Wilson, Terry; Nyblade, Andrew; Aster, Richard; Huerta, Audrey; Anandakrishnan, Sridhar;

Presentation Allocated: Poster

abstract: The annual growth and retreat of ice sheets around Antarctica provides a dynamic environment for studying the effect of ice on microseismic noise. We cross correlated noise from the AGAP seismic array in East Antarctica and the Polenet seismic array in West Antarctica. This process allows us to observe azimuthal noise variation at periods ranging from about 12.5 s to 100 s. The magnitude of the noise is directly affected by the ice. In August and September, when the Antarctic ice extent is greatest, the magnitude of the noise is lowest and there are no distinct noise sources. For the rest of the year various noise sources show up at different periods. The most consistent microseismic noise source is the Antarctic peninsula. This area is directly exposed to the ocean for most of the year. Also, it is surrounded by relatively shallow ocean floor, allowing for coupling between ocean waves and the sea floor. Other areas of Antarctic coastline also act as microseismic sources, especially small East Antarctic bays. Microseismic noise is also affected by storms. Although the noise is at a maximum in January and February, there is another minor temporary maximum around June and July when southern hemisphere storms are the strongest.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 31

Title: Upper Mantle Structure Beneath the Whitmore Mountains, Byrd Basin, and Marie Byrd Land from Body-Wave Tomography

Forename: Andrew Surname: Lloyd

Authors: Lloyd, Andrew; Wiens, Douglas; Anandakrishnan, Sridhar; Nyblade, Andrew; Aster, Richard; Huerta, Audrey; Wilson, Terry; Zhao, Dapeng;

Presentation Allocated: Poster

abstract: As part of the International Polar Year in Antarctica, 37 seismic stations have been installed across West Antarctica as part of the Polar Earth Observing Network (POLENET). 23 stations form a sparse backbone network of which 21 are co-located on rock sites with a network of continuously recording GPS stations. The remaining 14 temporary stations, in conjunction with 5 backbone stations, formed a seismic transect extending from the Whitmore Mountains across the Byrd Basin and through Marie Byrd Land. With the successful conclusion of the 2011-2012 Antarctic field season a complete two-year data set from the seismic transect is now available and is used to invert for regional P and S wave velocity models of the upper mantle using travel times from teleseismic events. P and S wave velocity models reveal 3 distinct regions corresponding to the physiographic provinces of Marie Byrd Land, Byrd Basin, and the Whitmore Mountains. Fast velocities (relative to the mean of the model) and thick lithosphere are seen beneath the Whitmore Mountains, while slower velocities are observed beneath Marie Byrd Land. In particular a significantly slower velocity anomaly ($\delta V_p \geq -1.5\%$ and $\delta V_s \geq -3.0\%$) is observed beneath the Executive Committee Range. Finally, upper mantle velocities beneath Byrd Basin are near the mean of the model ($\delta V_p \sim 0.0\%$ and $\delta V_s \sim 0.0\%$).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: A 40-year accumulation dataset for Adelie Land, Antarctica and its application for model validation

Forename: Cécile Surname: Agosta

Authors: Agosta, Cécile; Favier, Vincent; Genthon, Christophe; Gallée, Hubert; Krinner, Gerhard; Lenaerts, Jan T.M.; van den Broeke, Michiel R.;

Presentation Allocated: Poster

abstract: The GLACIOCLIM-SAMBA (GS) Antarctic accumulation monitoring network, which extends from the coast of Adelie Land to the Antarctic plateau, has been surveyed annually since 2004. The network includes a 156-km stake-line from the coast inland, along which accumulation shows high spatial and interannual variability with a mean value of 362 mm water equivalent a-1. In this paper, this accumulation is compared with older accumulation reports from between 1971 and 1991. The mean and annual standard deviation and the km-scale spatial pattern of accumulation were seen to be very similar in the older and more recent data. The data did not reveal any significant accumulation trend over the last 40 years. The ECMWF analysis-based forecasts (ERA-40 and ERA-Interim), a stretched-grid global general circulation model (LMDZ4) and three regional circulation models (PMM5, MAR and RACMO2), all with high resolution over Antarctica (27-125 km), were tested against the GS reports. They qualitatively reproduced the meso-scale spatial pattern of the annual-mean accumulation except MAR. MAR significantly underestimated mean accumulation, while LMDZ4 and RACMO2 overestimated it. ERA-40 and the regional models that use ERA-40 as lateral boundary condition qualitatively reproduced the chronology of interannual variability but underestimated the magnitude of interannual variations. Two widely used climatologies for Antarctic accumulation agreed well with the mean GS data. The model-based climatology was also able to reproduce the observed spatial pattern. These data thus provide new stringent constraints on models and other large-scale evaluations of the Antarctic accumulation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: A blowing snow observing system in Adélie Land, Antarctica: Instruments, methods, deployment and results

Forename: Alexandre Surname: TROUVILLIEZ

Authors: TROUVILLIEZ, Alexandre; Genthon, Christophe; Naaim-Bouvet, Florence; Gallée, Hubert;

Presentation Allocated: Poster

abstract: There are very few field observations of blowing snow available especially for a numerical model validation. With logistical support by the French polar institute (IPEV) and instrumental funding by ICE2SEA, a blowing snow observing system was launched in 2009 to acquire new, more model-validation-oriented observations. In order to verify and calibrate the blowing snow package included in the Modèle Atmosphérique Régional, different types of instruments capable of measuring the blowing snow flux were deployed in the coastal area of Adélie Land. Instruments were chosen to stand the harsh polar environment with a few power requirements so they can be installed on an Automatic Weather Station. Instruments are compared with other sensors or butterfly net measurements. Each of them is evaluated in terms of blowing snow events – is there a blowing snow event or no- and quantitative flux. The first instrument deployed on the field is the first version of the snow gauge called “FlowCapt” in January 2009. The flux profile was increasing with the height every time a blowing snow event occurs. Those sensors were inadapted for a quantitative flux as shown by butterfly net measurements. However they detect every blowing snow event. As they can be half buried, they can detect the velocity threshold value in the saltation layer. A snow gauge second version has been developed and it seems that the blowing snow event detection is as accurate as the first version with a better estimation of the flux. This version is installed 10 kilometers from the coast and 100km from the coast. A disdrometer VPF-730 were set right at the coast. A comparison in the French Alps with a Snow Particles Counter show that, with a new calibration made from the matrix raw data, the flux can be calculated. A version working on 24V is installed in blue ice area in Antarctica and fluxes are calculated for 2011. The disdrometer PWS100 is also compared with butterfly net measurements in Antarctica. It can't be reliable neither in terms of blowing snow events nor for flux quantification. The

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Air-Sea Fluxes in Terra Nova Bay, Antarctica from In Situ Aircraft Measurements

Forename: Shelley Surname: Knuth

Authors: Knuth, Shelley; Cassano, John; Maslanik, James; Zappa, Christopher; Cullather, Richard;

Presentation Allocated: Poster

abstract: In September 2009, the first unmanned aerial vehicles (UAVs) were flown over Terra Nova Bay, Antarctica to collect information regarding air-sea interactions over a wintertime coastal polynya. The UAVs measured wind, temperature, pressure, and relative humidity in flights parallel to the downslope wind flow over the polynya, and in a series of vertical profiles at varying distances from the coast. During three flights on three different days, sufficient measurements were collected to calculate sensible heat, latent heat, and momentum fluxes over varying oceanic surface states, including frazil, pancake, and rafted ice, with background winds greater than 15 ms⁻¹. During the three flights, sensible heat fluxes upwards of 600 Wm⁻² were estimated near the coast, with maximum latent heat fluxes near 150 Wm⁻² just downwind of the coast. This presentation will summarize the methodology for calculating the fluxes from the UAV data, present the first ever in situ estimates of sensible heat, latent heat, and momentum fluxes over Terra Nova Bay, and compare the UAV flux calculations to flux measurements taken during other field campaigns in other regions of the Antarctic, as well as to model estimates over Terra Nova Bay.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Amundsen Sea bio-optical properties in Antarctic

Forename: Hyun-cheol Surname: Kim

Authors: Kim, Hyun-cheol; Lee, Seung-kyeom; Han, Jeong-min;

Presentation Allocated: Poster

abstract: Sea-ice in Amundsen Sea of Southern Ocean is melting rapidly. This melting seems to influence on marine ecosystem. Ocean color data have showed high chlorophyll-a concentration in polynya, Amundsen Sea. However, accuracy of ocean color should be studied to understand of the variation because the ocean color algorithms are not much CAL/VAL in high latitude due to the inaccessibility. We tried to get bio-optical data by using Korean icebreaker, ARAON to improve ocean color satellite data accuracy. During the Amundsen Sea expedition from Dec. 2010 through Jan. 2011, we observed inherent optical properties (IOPs) and apparent optical properties (AOPs). To measure the IOPs, we sampled 3 depths water at each station. In addition to, we deployed free-fall typed hyper-spectroradiometer (HPRO II/Satlantic inc.) until euphotic depth having 1% light intensity from sea surface for AOPs. And also we observed above water reflectance by using the above water spectroradiometer (HSAS/Satlantic inc.) every 15 minutes over the expedition. Mostly, satellite retrieved chlorophyll-a data is higher than in-situ chlorophyll-a data. But spatial distribution of chlorophyll-a data has relatively similar between the both data. Absorption by phytoplankton (aph) in polynya is higher than in open sea especially around 600nm. Water leaving radiances retrieved from MODIS/AQUA data underestimated comparing with field-measured data. Sampled data can be used to develop current ocean color data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: AN EXTENDED STUDY OF MICROWAVE REMOTE SENSING ON SEA ICE AND INVERSION OF SEA ICE THICKNESS IN ROSS ISLAND ANTARCTICA

Forename: Yu Jen Surname: Lee

Authors: Lee, Yu Jen; Lim, Wee Keong; Ewe, Hong Tat;

Presentation Allocated: Poster

abstract: The use of microwave remote sensing as a means of data retrieval in the Antarctic requires the accurate analyzing and interpretation of data from the radar backscatter data. Previously, a forward model based on the Radiative Transfer Theory with Dense Medium Phase and Amplitude Correction Theory (RT-DMPACT) was developed for the purpose of predicting the backscattering coefficient. For this model, sea ice is considered as an electrically dense medium as the average distance between the scatterers (air bubbles, brine inclusions) is smaller than the wavelength penetrating into the sea ice medium. In view of that, the model considers the close spacing effect of these scatterers by introducing both amplitude and phase corrections to the phase matrices of the scatterers. This incorporation produces better prediction of the radar backscattering returns from sea ice medium with good validation with ground measurement data in Ross Island, Antarctica and satellite data. With this validation of model, an inverse microwave scattering model for sea ice thickness retrieval based on the above forward model was developed with the incorporation of the Levenberg-Marquardt Optimization algorithm. From theoretical analysis of the inversion model, it has shown promising capability in predicting sea ice thickness. In addition, ground truth measurements were carried out by the research group under the Malaysian Antarctica Research Programme since 2001 up until 2009. The multiyear measurements were crucial towards the understanding of the variations in the various parameters important for radar backscatter prediction. The results have shown that the inversion model provides good prediction of sea ice thickness based on these multiyear measurements. In this paper, a discussion of the improved forward model will be presented with the consideration of the inversion requirement. Overview of theoretical analysis and validation of the forward model will also be provided with sensitivity analysis. With that understanding, the development of the inversion model will be discussed with theoretical results. Good inversion results using single polarization Radarsat data by validating with ground data will be presented with the analysis of validity range of inversion. In addition, further works with additional measurement data from the years 2008 and 2009 as well as inclusion of multipolarization data for sea ice thickness prediction are also presented.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: An Improved Satellite Chlorophyll Algorithm for the Southern Ocean.

Forename: Robert Surname: Johnson

Authors: Johnson, Robert; Strutton, Peter; Wright, Simon; McMinn, Andrew; Meiners, Klaus;

Presentation Allocated: Poster

abstract: Remote sensing of Southern Ocean chlorophyll concentration is the most effective way to detect changes in phytoplankton populations driven by seasonality and climate change. However the current Sea-viewing Wide Field-of-view Sensor (SeaWiFS) algorithm, OC4v4, significantly underestimates chlorophyll concentrations in the region. Here we use a long-term dataset from the eastern Southern Ocean (20 – 160°E) to develop a more accurate algorithm to replace OC4v4 in southern high latitude regions. This new algorithm improves in-situ vs. satellite chlorophyll retrieval coefficients of determination from 0.39 to 0.65. This significantly improved algorithm will permit more accurate estimates of standing stocks and more sensitive detection of regional and temporal changes in those stocks, with flow on effects to derived products such as primary production and carbon drawdown.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Assessing the suitability of seaglider for monitoring krill distribution

Forename: Damien Surname: Guihen

Authors: Guihen, Damien; Fielding, Sophie; Creed, Elizabeth; Heywood, Karen;

Presentation Allocated: Oral

abstract: The distribution of Antarctic krill (*Euphausia superba*) in the Weddell Sea is poorly understood, in large part due to the difficulty and expense of accessing this remote and often ice-covered region. The Weddell Sea is believed to be an important spawning site for Antarctic krill, seeding, among others, the population of the important fishing grounds of South Georgia. In an effort to gain further insight into the distribution and transport of krill out of the Weddell Sea and north into the Scotia Sea, a sea glider with an integrated echo sounder was deployed on the continental shelf, east of the Antarctic Peninsula. The glider sampled continuously for a period of almost two months, undertaking several dives a day to depths of up to 1000 m before being collected later in the season. The echo sounder glider deployment is one aspect of the GENTOO project (Gliders: Excellent New Tool for Observing the Ocean), which saw three gliders in total deployed in the north-western Weddell Sea in late January and early February, 2012. The two other gliders housed conductivity and temperature cells as well as fluorimeters and oxygen optodes. In addition to the gliders, forty drifters were deployed and CTD, net and acoustic transects were undertaken. Here we discuss the early results of the echo sounder deployment, including the success of the platform in detecting and measuring krill biomass. The advantages and disadvantages of using glider-based sensing platforms for krill detection, versus more traditional ship-based systems will be examined. The potential for accessing remote regions or gaining season-long data sets using sea gliders will also be considered, along with the cost effectiveness and coverage of glider fleets versus ship-based surveys.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Characterization of temporal and spatial variability in hydrographic conditions in the Ross Sea from instrumented seals

Forename: Andrea Surname: Piñones

Authors: Piñones, Andrea; Hofmann, Eileen; Costa, Daniel; Goetz, Kimberly; Burns, Jennifer; Dinniman, Michael; Klinck, John;

Presentation Allocated: Poster

abstract: Vertical profiles of temperature and salinity on the continental shelf of the Ross Sea were collected from sensors deployed on Weddell seals (*Leptonychotes weddellii*) between February and November 2010 and January to May 2011. The observations covered much of the western continental shelf of the Ross Sea, in particular the inner shelf off Victoria Land and the region north and west of Ross Island. These data were used to describe the temporal and spatial variability of the hydrographic conditions of the Ross Sea. Depth-averaged time series of temperature and salinity were constructed for regions where seals remained for extended periods of time. The seal-derived data showed three dominant water masses on the shelf, Modified Circumpolar Deep Water, Antarctic Surface Water and Modified Shelf Water. Depth-time distributions of temperature constructed for both years showed the summer to fall/winter transition of the upper water column. These time series showed that the upper 200 m of the water column was warmer in 2010 relative to 2011. Calculation of the total heat content of the upper 200 m gave a value for 2010 that was 8% higher than that obtained for 2011. Interannual differences were also observed in the rate of erosion of the summer stratification, with a faster rate for 2011 (0.8°C month⁻¹) than in 2010 (0.5°C month⁻¹).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: CIRCULATION OF CIRCUMPOLAR DEEP WATER ON THE WESTERN AMUNDSEN SHELF

Forename: Anna Surname: Wahlin

Authors: Wahlin, Anna;

Presentation Allocated: Oral

abstract: Recent hydrographic measurements are used to analyze the circulation and subsurface modification of Circumpolar Deep Water (CDW) on the Western Amundsen Shelf. Southward flows of warm deep water are observed in the main deep channel crossing the shelf, and also present as a thick layer in the inner deep basin. Historical observations are combined with CTD- and LADCP transects across and along the channel and one year of mooring data to trace the inflowing CDW and its modification as it flows along the channel and recirculates in the deep basin close to the ice shelves. The inflow is highly variable, but most of this variability is in the barotropic mode. Tidally induced mixing is discussed as well as the effects of remote and local wind field, barotropic currents along the shelf break and buoyancy driven flows at the ice shelves and/or icebergs. A number of cross-shelf break transects are used to identify the origin depth of the inflowing CDW.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: CODE-AFA: How Antarctic Bottom Water regional varieties are spreading into the global ocean?

Forename: Rodrigo Surname: Kerr

Authors: Kerr, Rodrigo; Mata, Mauricio; Azevedo, José Luiz; Wainer, Ilana; Azaneu, Marina; Dotto, Tiago; Pozzolini, Hugo; Garcia, Carlos Alberto;

Presentation Allocated: Poster

abstract: The project "Oceanographic characterization and spatial distribution of Antarctic Bottom Water regional varieties (CODE-AFA - Portuguese acronym)" is part of the activities executed by both the Brazilian High Latitudes Oceanographic Group (GOAL) and the National Institute of Cryosphere (INCT-CRIOSFERA). This work aims to improve the amount of information and understanding of the Antarctic Bottom Water (AABW) regional varieties distribution and contribution to the global ocean. Recently, several works point to the fact that AABW is getting warmer and fresher through the decades, which represents the deepest branch of the meridional overturning circulation (MOC). Thus, quantifying AABW varieties that spread from distinct sources to the global oceans is essential to understand the water mass evolution process and the contribution of each AABW varieties after spreading from their sources. In this context, we analyze historical and recent observational hydrographic dataset from the NODC/NOAA and GOAL teams, respectively. Also, ocean reanalysis and output from ocean global circulation model are investigated (SODA and the ocean component of the NCAR-CCSM4 model). The three main global AABW source areas (i.e. Weddell Sea, Ross Sea and Australian-Antarctic basin) were chosen to define the water type of each AABW regional varieties. The water type datasets used to run the water mass inverse model were determined in each source area based on two distinct approaches, i.e. z-level and neutral density criteria. As expected, considering the historical literature, the Weddell Sea varieties present the highest contribution and govern the bottom water distribution in the Atlantic Ocean basin. The contribution of the AABW varieties originated in the other areas around the Antarctic continent (normally less dense than the Weddell Sea variety) dominate the distribution of the Indian and Pacific Oceans basins. The preliminary results show that the large AABW contribution (higher than 70%) to the global oceans comes from the Weddell Sea. However, AABW varieties formed in Ross Sea and in the Australian-Antarctic basin also play a significant role in the MOC, occupying the deeper layers in the Indian and Pacific Oceans basins.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Combining airborne hyperspectral data and satellite imagery for monitoring of the Antarctic Peninsula

Forename: Andrew Surname: Fleming

Authors: Fleming, Andrew; Corr, Hugh; Achal, Stephen; McFee, John; Hughes, Kevin;

Presentation Allocated: Oral

abstract: In February 2011, the British Antarctic Survey (www.antarctica.ac.uk) acquired an extensive airborne hyperspectral dataset in collaboration with ITRES (www.itres.com) and Defence Research & Development Canada (www.drdc-rddc.gc.ca). The primary goal is investigation of new techniques to monitor changes in the extent and health of vegetation occurring on the Antarctic Peninsula. These techniques are especially focused on Antarctic Specially Protected Areas (ASPAs) and other sensitive areas which are likely to be affected by changing temperatures, increasing visitor numbers and national operator pressures. Vegetation changes (distribution, type) are amongst the most widely predicted consequences of future regional climate change. However baseline vegetation survey data for the Antarctic Peninsula do not exist and traditional ground based methods are not a practical or cost effective way of monitoring. Together with Canadian collaborators (DRDC and ITRES) this airborne hyperspectral data (using CASI, SASI and TASI instruments to cover the visible and near, short-wave & thermal infrared parts of the spectrum) has been acquired over eight sites on the Antarctic Peninsula. We use these airborne and coincident ground spectral data to characterise and classify vegetation and the underlying rock. This data then allows better understanding of the patterns seen in the lower spectral resolution (sub-metre resolution) satellite imagery and derivation of more accurate vegetation information over larger and remote areas. This unique dataset, combining coincident airborne, satellite and ground observations, provides an excellent opportunity for development of new ecosystem observation methods. We will present results from this investigation, including spectral unmixing and classification methods to process the hyperspectral data and details of vegetation type and extent identified in the airborne and satellite imagery. Looking forward we will also comment on the application of forthcoming hyperspectral satellite sensors to Antarctic environmental monitoring.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Controls on rupture speed of the stick-slip events on the Whillans Ice Plain, West Antarctica

Forename: Jacob Surname: Walter

Authors: Walter, Jacob; Tulaczyk, Slawek; Brodsky, Emily; Schwartz, Susan;

Presentation Allocated: Poster

abstract: The bi-daily speed-up events of the Whillans Ice Plain, West Antarctica, provide a unique glimpse into glacier basal mechanics. Our results indicate that the events initiate consistently in a region south of Ice Raft A, closer to the grounding line and the southernmost extent of the Ross Ice Shelf. The initiation may be controlled by a discontinuity in basal boundary conditions at the suture between two ice streams, as well as being an area where GPS measurements indicate greater frictional coupling at the ice-till interface. Successive slip events propagate with different rupture speeds (100-300 m/s) that strongly correlate with the inter-event duration, suggestive of a healing mechanism. The basal stress conditions currently promote freezing during inter-event periods and melting during the speed-up events. One enigma of these events is that the rupture speed is an order of magnitude less than the shear wave speed of ice. Earthquakes often rupture at rates approaching the value of the shear wave speed (~ 0.9 times). We analyze whether the magnitude of rupture speed may be explained by the unique loading conditions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Differences on the thermohaline structure and water masses in the Bransfield Strait between the austral summer and winter of 2008

Forename: Marcelo Surname: Santini

Authors: Santini, Marcelo; Souza, Ronald; Muelbert, Mônica; Wainer, Ilana; Hindell, Mark;

Presentation Allocated: Poster

abstract: Were observed near the Antarctic Peninsula the largest increases in air temperature and greater reductions in sea ice than at any other place in this continent. It is necessary a continuous monitoring of ocean conditions in this region, even in times of high concentration of sea ice. As an alternative to traditional ways of obtaining of oceanographic data and behavioral monitoring of top predators in the Southern Ocean, were fixed data collection platforms in the southern elephant seals (*Mirounga leonina*). These marine mammals perform deep dives during the entire year, even in conditions of high sea ice concentration. Using a data set consisting of 74 profiles collected during the summer and 43 profiles collected during the winter, we present transects and thermodynamics state diagrams and the changes of the thermohaline structure and water masses present in the Bransfield Strait in these two seasons. During the summer the values of potential temperature, salinity and potential density is in the range between -1.68° to 2.08° C, 33.91 to 34.87 psu and 27.13 to 27.83 respectively. In winter, the magnitudes of the differences in observed variables are smaller when compared with summer, and these bands between -1.84° to 0.82° C for potential temperature and between 34.14 to 34.68 psu and 27.43 to 27.89 for salinity and potential density. The thermohaline structure shows the major differences in the surface, where the seasonal heating and mechanical forcing cause a thin layer, relatively warmer and less saline overlap the Bransfield cooler waters. During the winter the water column becomes thermally uniform and salinities are increased mainly due to haline release held during formation of sea ice. Among the changes in the water bodies, observe the Antarctic Surface Water (AASW) only in the summer and the Winter Water (WW) and Ice Shelf Water (ISW) only in winter. The Warm Deep Water (WDW) and Bransfield Water (BW) are present in the two times analyzed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: ESF-IMCOAST: an integrated multi-disciplinary study of coastal climate change effects in Western Antarctica

Forename: Liliana Surname: Quartino

Authors: Quartino, Liliana; Abele, Doris; Falk, Ulrike; Schloss, Irene; Monien, Donata; Bers, Valeria; Piquet, Anouk; Sahade, Ricardo; Dominguez, Carmen; Wasilowska, Agnieszka; Braun, Matthias; Hass, Christian; Torre, Luciana; Monien, Patrick; Hernando, Marcelo;

Presentation Allocated: Poster

abstract: IMCOAST is an interdisciplinary ESF program, observing environmental and biotic changes in Antarctic coastal systems on King-George Island (KGI), Western Antarctica in response to the ongoing rapid climate change. IMCOAST research (www.imcoast.org) includes European core projects (glaciology, sedimentology, biogeochemistry, oceanography and biology) and associated South American partner projects. Both coastal systems, Potter Cove near the Argentinean Jubany Station and Admiralty Bay fronting the Polish Arctowski Station are under continued investigation since the past 15-20 years, and historical and present data sets are archived. IMCOAST aims at developing multi-level spatial (GIS based) models of climate change effects for the KGI coastal area. A weather and climate driven glacial melt model is linked to the changes in oceanographic parameters and sedimentation in a spatial context. Glacier mass loss at KGI is most pronounced in the lower part of the glaciers < 270m above ellipsoid and amounts to 14 m of ice thickness in 11y. Sediment accumulation rates in coastal KGI have tripled since the 1940ies and were 0.66g cm⁻² y⁻¹ in 2006. Melt water and sediment discharge are highly variable in time. Warm days with high air temperatures and precipitation lead to immediate discharge waves. A 19y time series analysis revealed sediment run-off maxima in La Niña and SAM+ years. Erosive particle transport is low in glacial effluents and high in melt water streams on thawing permafrost. Eroded particles are Cu, K, Zn enriched, but not in Fe or Mn. Contrary, increased Fe and Mn concentrations are observed in hypoxic sediment porewaters. The bivalve *Laternula elliptica*, an Antarctic benthic key species, is tested as a “live archive” (tissues and shells rings) for sedimentary and porewater elementary concentrations. Sedimentary run-off limits water column productivity close to the island during periods of melting so that micronutrients mobilized at KGI may fertilize regional blooms. Stress sensitivity of diatoms to reduced salinity favored growth of phytoflagellates over larger diatoms in mesocosm experiments simulating melting events. Salps dominated zooplankton in recent summers. Benthic population shifts are observed with an increase in abundance of sediment tolerating bivalves and sea pens. Sediment-sensitive species such as stalked ascidians are declining in numbers. Data are collected to build a food web model for the area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Exposing Expendable Bathythermograph bias from data collected in the Atlantic sector of the Southern Ocean

Forename: Katherine Surname: Hutchinson

Authors: Hutchinson, Katherine;

Presentation Allocated: Poster

abstract: Data from three research cruises occupying the GoodHope line in the Atlantic sector of the Southern Ocean is used to identify and quantify Expandable Bathythermograph (XBT) bias in this region. XBT measurements are compared with CTD data to determine the magnitude of the errors associated with XBT temperature readings. The variation in net temperature bias with depth and latitude is examined, and the influence of distance between XBT-CTD inter-comparison stations is explored. XBT data is found to be on average warmer than CTD measurements, and the depths of isotherms are overestimated. This study further supports the hypothesis of the dependence of the XBT fall rate on viscosity and thus water temperature, which has been reported in previous literature. The results from this study expose the necessity to develop an XBT correction scheme specifically appropriate to the Southern Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Future Opportunities in Antarctica and the Southern Ocean

Forename: David Surname: Bromwich

Authors: Bromwich, David; Dunlea, Edward;

Presentation Allocated: Oral 20 mins

abstract: Antarctica—the continent, the surrounding ocean, and the unencumbered views it offers into space—makes a spectacular laboratory for a wide range of scientific endeavors. A 2011 National Research Council (NRC) report, *Future Science Opportunities in Antarctica and the Southern Ocean*, identifies important research questions that will drive science in the region over the next few decades. Specifically, the report assesses the anticipated types and scope of future U.S. scientific endeavors and international scientific collaborations over a ~20-year period in this region. Options to enhance research are also considered, including any new and emerging technologies or logistical capabilities that enable the collection of scientific data in more effective or efficient ways. Drawing upon the report’s recommendations, this presentation examines opportunities to advance Antarctic science well into the future by identifying several frontier research questions presented in the context of two themes: environmental change and scientific discovery. The report builds upon the work of other organizations (e.g., ICSU, SCAR, etc.) and scientific achievements in Antarctica and the Southern Ocean, including those reported during the 2007-2008 IPY.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: High resolution hydrographic observations of Weddell Sea shelf-offshelf interaction during GENTOO

Forename: Sunke Surname: Schmidtko

Authors: Schmidtko, Sunke; Heywood, Karen; Thompson, Andrew; Peloquin, Jill; Smith, Walker;

Presentation Allocated: Poster

abstract: We present preliminary results from our hydrographic – glider – drifter – satellite campaign during the austral summer 2012. All fieldwork was performed within the GENTOO project. The surveyed area was partly covered by seaice, which extended unusual far north in February 2012, well into the Powell basin, the northwestern part of the Weddell Sea. Data include two hydrographic CTD sections and multiple cross shelf glider sections, occupied simultaneously by 3 different gliders. We present the observations of the 2012 summer variability of water mass properties, geostrophic currents and intrusions along the continental shelf break in the Powell basin. Multiple, simultaneous crossings of the Antarctic Slope Front (ASF) along its pathway revealing its characteristic V-shape give insight into its spatial and temporal evolution. The ASF separates the high biomass on the shelf with a deep (>100 m) chlorophyll signal from the uniformly low biomass in the deeper water. Despite a shallow (1000dbar) maximum dive depth, Antarctic Bottom Water is observed in the glider sections cross the ASF. The impact of the northern seaice edge in comparison to other years on our results is discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Hydrographic characteristics of the Bransfield Strait (Antarctic) collected by a southern elephant seal between February and August 2008.

Forename: Marcelo Surname: Santini

Authors: Santini, Marcelo; Souza, Ronald; Muelbert, Mônica; Wainer, Ilana; Hindell, Mark;

Presentation Allocated: Poster

abstract: In this paper we present variations of the thermohaline structure across the Bransfield (BS). We used a data set obtained by CTD-SRDLs fixed in southern elephant seal (SES, *Mirounga leonina*) between 07 February and 17 August 2008, consists of 538 profiles with an average depth of 566.9 +/- 239.3 m and transmitted at a rate of 2.78 times a day. Although BS is one of Southern Ocean regions most historically sampled, here we have the opportunity to show seasonal changes of the oceanic vertical structure that is driven mainly by mechanical forcing and sea and land ice cover. This fact is extremely important especially in a climate change scenario, where the polar regions, due to its sensitivity, require continuous monitoring. The ranges of potential temperature (Θ), salinity (S) and potential density ($\sigma\Theta$) are observed between -1.88 and 1.86°C , $34.00 - 34.79$ psu and $27.26 - 27.99$, respectively. As observed in previous studies the Bransfield Strait Water ($0 > \Theta$ and $34.45 < S < 34.6$) is dominant at depths greater than 100 m, the Circumpolar Deep Water is observed only for a short period at the end of July, probably due to an intrusion between Livingston and Greenwich Islands where the SES remained on this occasion. Surface waters ($\sim 0 - 150$ m) there is a reduction of potential temperatures of about 3°C between the beginning and end of the sampling period, this is mainly due to seasonal changes of air temperature. The opposite occurs with the salinity and potential density, which due to the release of salt for the formation of sea ice causes an increase in these values.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: ICEBERGS PROFILING BY COMBINATION OF SATELLITE AND ADCP DATA

Forename: SULTAN Surname: Emmanuelle

Authors: Emmanuelle, SULTAN; Marie-Noëlle, Houssais; Benoit, Legresy; Lydie, Lescaumontier; Mickaël, Beauverger; Hervé, Legoff;

Presentation Allocated: Oral

abstract: In February 2010 the Mertz glacier ice tongue calved, releasing an 80x30 km iceberg (C28) and open a path for the B9B (95x20 km). The CRACICE program studies and monitors the effect of the calving on the dynamics of the glacier upstream using teledetection and GPS. In the mean time, from 2008 to 2012, in the framework of the ALBION project, 2 moorings equipped with uplooking 75 kHz ADCPs have been deployed in the Adelie Depression to monitor the currents of the Mertz glacier Polynya. Underneath this huge coastal Antarctic polynya, a large amount of dense water precursor of the Adelie Land Bottom Water is formed and exported. The first ADCP is located offshore the Buchanan Bay and has been recovered in January 2012, the second one is located at the sill and has been recovered in 2011. After the release of the Mertz Glacier Tongue, icebergs C28 and B9B, drifted in the Adelie Depression. The C28 iceberg went through the main polynya in the Adelie depression, and then across the Adelie depression sill in April 2010. The B9B stopped its drifting offshore the MGT close to the Buchanan Bay probably anchored along the western flank of the Adelie Depression. It remains there till march 2011. On their way, the icebergs drifted above the 2 ADCPs. Extensive satellite imagery coverage gives the position of the icebergs. By correlating those data with the mooring records the iceberg draft can be profiled. Using SPOT satellite stereo imagery, satellite altimetry and radio echo sounds profiles, the surface topography of the iceberg can be estimated. With this large amount of information, we determined the composition of the iceberg through an averaged column density and furthermore learned more about the behavior of the water under the iceberg while passing the sill. Finally, we emphasize on the current change associated to the iceberg transit and the coupling between the iceberg/bathymetry/currents that could influence giant iceberg drift. The region of the Mertz glacier is a good example to investigate the drift and trajectories of large Antarctic icebergs. This experiment offers us a unique way to size large iceberg and know more about the water/ice interaction largely influenced by the actual climate context.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Infrasonic Waves in Antarctica: A New Proxy for Climate and Environmental Monitoring

Forename: Masaki Surname: Kanao

Authors: Kanao, Masaki; Ishihara, Yoshiaki; Yamamoto, Masa-yuki;

Presentation Allocated: Poster

abstract: Characteristic infrasound waves recorded at Antarctic stations cleared physical interaction involving environmental changes in Antarctic continent and surrounding oceans. A Chaparral type infrasound sensor was planted at Syowa Station (SYO; 39E, 69S), East Antarctica, as one of the projects of the International Polar Year (IPY2007-2008). Continuous recorded data during the last three seasons in 2008-2010 indicate the contamination of background oceanic signals (microbaroms) with peak with few seconds or more of its intrinsic period. The characteristic signals are identified as the Double-Frequency Microbaroms (DFM) with peaks between 4 and 10 s observed during a whole season. The peak amplitudes of DFM may reflect the large influence of winter extratropical cyclonic storms in Southern Ocean. The DFM has relatively lower amplitudes during austral winters, caused by the larger amount of the sea-ice extent around the Lützow-Holm Bay near the SYO, with decreasing the ocean wave loading effects. On the contrary, the Single-Frequency Microbaroms (SFM) with intrinsic periods between 12 and 30 s are observable under excellent storm conditions, particularly in local winter. The oceanic effects appeared on infrasound data are modulated by the presence of sea-ice and are explained by the relationship between the atmosphere-ocean-cryosphere systems in polar environment. Microbaroms measurements are a useful tool for characterizing ocean wave climate, complementing other oceanographic and geophysical data. On the infrasound data, in addition, stationary continuous signals are identified with harmonic over tones at a few Hz to lower the most human audible band, which might probably be related to local effects near the surface, such as the sea-ice cracking vibration close to the Station. A continuous monitoring by infrasound sensors in the Antarctic firmly contributes to the Comprehensive Nuclear-Test-Ban Treaty (CTBT) in southern high latitude, together with the Pan-Antarctic Observations System (PAntOS) under the Scientific Committee on Antarctic Research (SCAR). Detail measurements for infrasound waves in Antarctica, consequently, could be a new proxy for monitoring a regional environmental change as well as the temporal climate variations in the polar region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: LARISSA: LARsen Ice Shelf System, Antarctica; an Interdisciplinary/International Observing and Monitoring Study of a Critical Antarctic Region

Forename: Eugene Surname: Domack

Authors: Domack, Eugene; Vernet, Maria; Scambos, Ted; Huber, Bruce; Mosley-Thompson, Ellen; Leventer, Amy; Yoo, Kyu-Cheul; King, Matt; Ishman, Scott; Smith, Craig; Truffer, Martin; Petit, Erin; McCormick, Mike; Brachfeld, Stefanie; Yoon, Ho Il; Wellner, Julia; van

Presentation Allocated: Oral

abstract: We report here on the initiation and progress of the LARISSA program which is an international and interdisciplinary study of the region surrounding the Larsen Ice Shelf and northern Antarctic Peninsula. A set of six new cGPS stations are and have been monitoring crustal motion since early 2009 and two more are planned for installation in the near future. Crustal rebound rates record some of the highest vertical velocities of any Antarctic (POLENET) sites and help to constrain post glacial isostatic as well as immediate elastic response to post ice shelf acceleration of glacial flow. AWS stations on these sites provide unprecedented spatial and temporal perspectives on winter advection of warm air masses into the Larsen embayment region and help place constraints upon the meteorological climate forcing of past (and future) warming events that led (lead) to ice shelf disintegration. Paleoenvironmental records from both marine sediment cores and ice cores (Bruce Plateau is 460 m depth to bedrock) are providing seasonal to multi-decadal records which expand our historical perspective on climate change back at least several thousand years to the last glacial maximum, respectively. The records are proving useful in deciphering key proxies for both ocean productivity and sea ice cover as determined from organic geochemistry, micropaleontology (diatoms and foraminifera), physical properties, and stable isotope geochemistry. Cosmogenic exposure age dating of glacial erratics is also helping to constrain estimates of ice surface lowering and deglaciation based upon marine sediment archives and new cores. Physical oceanographic and water column studies are elucidating the role of glacial melt water influx into coastal fjords and embayments and the response of phytoplankton communities to new configurations of water column structure, salinity and temperature. Benthic ecosystem studies have helped relate changing water temperatures and sediment flux to dynamic adjustment of long established community structure. These results include likely disruption of chemotrophic ecosystem functioning and well documented and devastating impacts by invasive species. All these results will be discussed and data management plans will be presented in order that the wider Antarctic community can benefit from our observations and planning.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Long term teleseismic detectability of the FDSN stations in East Antarctica

Forename: Masaki Surname: Kanao

Authors: Kanao, Masaki; Storchak, Dmitry;

Presentation Allocated: Poster

abstract: Phase identifying procedure for teleseismic events at Syowa Station (69.0°S, 39.6°E), East Antarctica have been carried out since 1967 after the IGY period. From the development of INTELSAT telecommunication link, digital waveform data have been transmitted to NIPR for utilization of phase identification. Arrival times of teleseismic phases, P, PKP, PP, S, SKS have been reported to USGS, ISC, and published as "JARE Data Reports". In this presentation, hypocentral distribution and time variations for detected earthquakes was studied in 21 year period from 1987 to 2007. Characteristics of detected events, magnitude dependency, spatial distributions, seasonal variations, together with classification by focal depth are demonstrated. Obtained b values (Magnitude-number relation factor) for various focal depth groups took in 0.89-1.03 which was comparable with those by regional arrays and ISC data. Variations in teleseismic detectability in longer terms have possibly associated with meteorological environment and sea-ice spreading area in terms of global warming. Moreover, several kind of ice signals (sea-ice movement, tide-crack shocks, ice-berg tremor, basal sliding of ice-sheet) are demonstrating in the vicinity of the Station. Broadband array deployments, moreover, were carried out on the outcrops around the Lützow-Holm Bay (LHB). Recorded teleseismic and local signals have sufficient quality for various analyses of dynamics and structure of the crust and mantle. Teleseismic passive seismic studies such as receiver functions and shear wave splitting were carried out; indicating heterogeneous structure along the coast in LHB. The obtained data can be applied not only to lithospheric studies but also to Earths deep interiors, as one of the major contribution to 'POLENET' during the IPY 2007-2008.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Long-term Japanese observations of oceanic physical parameters in the Indian sector of the Southern Ocean

Forename: Shigeru Surname: Aoki

Authors: Aoki, Shigeru;

Presentation Allocated: Poster

abstract: The whole Southern Ocean is experiencing rapid changes in the recent decades. Subsurface temperature in the Antarctic Circumpolar Current (ACC) region increases and properties of bottom waters are changing, possibly in accordance with the watermass changes on the continental shelf region and changes in air-sea heat and freshwater fluxes. To clarify their mechanism and monitor these changes, sustained long-term observations are indispensable. Along the 110E line in the Indian Ocean sector, physical properties of the upper ocean surface have been monitored by supply vessels since 1960s under the framework of the Japanese Antarctic Research Expedition (JARE) and its outcome has significantly contributed to the understanding the subsurface warming of the ACC region. However, restructuring and optimization of the marine observation is needed due to the change in ship operation. From 2000s, Umitaka-Maru of Tokyo University of Marine Science and Technology have been actively involved in the observations in the same area, partly in association with JARE. Umitaka-Maru is capable of the oceanographic measurements including top-to-bottom water samplings of various parameters such as oxygen isotope ratio and is ideal platform for the deep-ocean observations. The role of Umitaka-Maru will continue to increase in monitoring the Southern Ocean. Observations of the air-sea fluxes are extremely sparse in the high-latitude Southern Ocean. In January 2012, deployment of Top-to-bottom buoy has successfully conducted by the Japan Agency for Marine-Earth Science and Technology. The buoy was originally designed for air-sea interaction studies in the equatorial region and has been refined for the cold and harsh environments. Successful operation of this platform and its possible sustained observations will enhance the ability of prediction of atmospheric conditions and understanding of climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Meridional extent of subtropical and polar water masses in the Indian sector of Southern Ocean

Forename: Anilkumar Surname: N

Authors: N, Anilkumar; Pednekar, Shailesh. M; Chacko, Racheal; Ravindra, Rasik;

Presentation Allocated: Oral

abstract: To understand the intrusion of water masses and meridional overturning circulation in the Indian sector of Southern Ocean two major expeditions were carried out. From Subtropics to Polar Regions rapid changes in thermohaline structure and upper ocean heat content were observed during austral summer in 2004 and 2006. Two north-south transects between the subtropics and polar region were selected for this study. The western transect was selected between Peter Edwards Island and Crozet island and the eastern transect was chosen east of Crozet island. Features of water masses from south such as Subantarctic Surface Water, Antarctic Surface Water, Antarctic Intermediate Water and Circumpolar Deep Water were observed upto 42°S in the west. However Subtropical Surface Water and Mode water were identified more southward upto 44°S in the eastern transect (57°30'E). Results from in-situ CTD data were compatible with the findings from satellite and ARGO observations. A drastic change in heat content towards south was observed in the subtropical region. At 61°S, temperature inversion ($\sim -1.62^{\circ}\text{C}$) was observed at 78m depth. This subsurface minimum layer can be attributed to the Winter Water. Along 48°E geostrophic current velocity reversed between 39°S and 41°S at the northern boundary of the merged frontal regime of Agulhas Return Front +Subtropical Front + Subantarctic Front. It increased and became stronger (0.43 m/s) at the centre of the merged frontal system and depicted a large volume transport (43.37 Sv) between 40°15'S to 42°S. These results are new findings considering the water mass characteristics, overturning circulation and upper ocean heat content in the study region. However there is a scarcity of data during winter for a comprehensive understanding of mass and heat transport from subtropics to polar region which plays a major role in regional climatic variabilities. It is suggested that in future deployment of mooring instruments shall be useful for understanding seasonal variations of dynamical process between subtropical and polar regimes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Meteorological measurement biases on the Antarctic plateau

Forename: Christophe Surname: Genthon

Authors: Genthon, Christophe; Six, Delphine; Gallée, Hubert; Favier, Vincent; Lazzara, Matthew; Keller, Linda; Pellegrini, Andrea; Grigioni, Paolo;

Presentation Allocated: Poster

abstract: Meteorological measurement biases on the Antarctic plateau. Genthon, D. Six, H. Gallée, V. Favier, Laboratoire de Glaciologie et Géophysique de l'Environnement, CNRS / Grenoble University, Saint Martin d'Hères, France. Lazzara, L. Keller, Antarctic Meteorological Research Center, University of Wisconsin-Madison, Madison, USA. Pellegrini, P. Grigioni, ENEA, s.c.r.l Via Anguillarese, 301 00123 Rome, Italy. The atmospheric environment of the Antarctic plateau is characterized by extreme cold temperatures, low aerosol levels, significant frost deposition, and permanently covered high-albedo snow surface. This quite differs from other places on Earth, and few meteorological measurement systems available on the market are fully validated to work in such conditions. As a consequence, one may wonder if all meteorological report from the Antarctic plateau is equally valid. Cold and frost directly affect all mechanical devices including and in particular propeller or cup anemometers. Because of a very high surface albedo, the passive shields that are mostly used to shade thermometers from solar radiation are inefficient. Winds are insufficient on the plateau to ensure adequate ventilation and errors of more than 10°C in summer occur even on cloudy days (Genthon, C., 2011, J. Atm. Oceanic Technol., DOI 10.1175/JTECH-D-11-00095.1). The frost deposition that affects anemometers suggests that the atmosphere is frequently over-saturated with moisture. This is possible because of very low levels of impurities and condensation nuclei in the air. Meteorological models that use advanced microphysics parametrizations do simulate over saturation, yet solid-state instruments ("Humicap") do not report value significantly above 100%. It is suggested that this is a measurement artifact rather than an error in the models. Being unaware of possible systematic measurement biases may result in inadequate evaluations of meteorological and climate models.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Multi-criteria evaluation of Dry and Wet Snow Zones on the Antarctic Peninsula in ENVISAT ASAR imagery

Forename: Cláudio Wilson Surname: Mendes Jr.

Authors: Mendes Jr., Cláudio Wilson; Arigony Neto, Jorge; Cardia Simões, Jefferson; Costi, Juliana;

Presentation Allocated: Poster

abstract: The analysis of spatiotemporal variations of glacier facies, like the Wet Snow Zone (WSZ), can provide evidences of climatic and glaciological changes observed in the Antarctic Peninsula in the last decades. To quantify more accurately the WSZ extension in imagery acquired by ENVISAT ASAR sensor, we developed a knowledge-based algorithm with a backscattering threshold (for images in dB scale) and a threshold in synthetic images (created by rationing summer and winter sigma linear images). We also used altimetric thresholds to discriminate the WSZ from the Dry Snow Zone (DSZ) and the RAMP Digital Elevation Model (DEM) as ancillary data. We classified ASAR wide-swath imagery (150 m spatial resolution) acquired in winter 2006 and summer 2007. The ASAR images and the RAMP DEM were used to classify the WSZ based on the following thresholds: i) $-25 \text{ dB} < \sigma_{\text{linear}} < -14 \text{ dB}$ (Rau et al., 2001); ii) altitude $H < 1200 \text{ m}$ for the Antarctic Peninsula setentrional region and $H < 800 \text{ m}$ for meridional region (Rau and Braun, 2002); iii) $\sigma_{\text{linear summer}} / \sigma_{\text{linear winter}} < 0.4$ (Arigony-Neto, 2009). The continental data of ASAR images were extracted using the coastline mask from the Antarctic Digital Database - ADD (SCAR, 2000), updated according to the new frontal position of ice shelves in these images. In the classification rule iii, the sigma linear summer was the ASAR image in sigma linear scale to be classified, while the sigma linear winter was the ASAR image in sigma linear scale used as reference data. The ratio image threshold 0.4 allowed to discriminate the WSZ from the DSZ (because the WSZ has ratio values less than 0.4 and the DSZ has values near to 1), from RADAR shadows (which has ratio values near to 1) and from transitional areas between this glacier zone and the Frozen Percolation Zone (i.e., in these transitional areas the ratio values are greater than 0.4). In the last two targets, some continental areas would be classified incorrectly as WSZ if we used only thresholds in altimetry and backscattering. The classified data were post-processed by a focal majority 5 x 5 filter, which was used to generate more contiguous and coherent WSZ areas. After that, these were superimposed by an image of rock outcrops derived from the ADD, and the unclassified continental area of the Antarctic Peninsula was assigned to be a DSZ (i.e., it covers the radar glacier facies DSZ, Frozen Percolation Zone and Bare Ice Zone, as described by Rau et al., 2001).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Next generation sustainable long term observatories

Forename: Svein Surname: Osterhus

Authors: Osterhus, Svein;

Presentation Allocated: Oral

abstract: Long term observations of the flow of the dense water from its formation areas toward the abyss of the world oceans are a key issue for the climate research. For the Weddell Sea this means to monitor the formation of HSSW on the Ronne shelf, the transformation to Ice Shelf Water (ISW) underneath the floating Filchner-Ronne ice shelf, the flux of ISW overflowing to the deep Weddell Sea, and its path and dynamics. In cooperation with British Antarctic Survey (BAS) we operate a number of monitoring stations in the southern Weddell Sea. The monitoring systems build upon techniques and methods developed during several decades of NARE projects and have a proven record of high data return [Foldvik et al., 2004; Nicholls et al., 2004; Nicholls and Østerhus, 2004]. During the last decade, substantial progress has been made in both technology and refined and focussed observations in key locations. In our IPY project BIAC we have developed new sustainable ocean observing systems for long term observation in Polar Regions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Ocean-Ice observations from the Princess Ragnhild Coast of East Antarctica

Forename: Katherine Surname: Leonard

Authors: Leonard, Katherine; Pattyn, Frank; Tison, Jean-Louis;

Presentation Allocated: Poster

abstract: We present the first comprehensive survey of ocean properties at the calving front of the Roi Baudoin Ice Shelf on the Princess Ragnhild Coast of East Antarctica. These new bathymetric and hydrographic results were collected by lowering acoustic depth sounding and conductivity-temperature-depth (ctd) instruments through leads and holes drilled through fast ice along the ice shelf front and ice mélange in rifts within the ice shelf. This work forms a component of the “BELgian Ice Sheet – Shelf Ice Measurements in Antarctica” (BELISSIMA) project, a field and modeling study of East Antarctic ice shelves and ice streams in this region. Our new findings show important contrasts with International Geophysical Year – era bathymetry and with oceanographic measurements collected in the region during JARE expeditions during the 1980s. Useful context is provided by these earlier studies, as they demonstrate that the continental shelf is unusually narrow in this region, and that the Antarctic Circumpolar Current is in close proximity to this region’s ice shelves.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Overview of the Antarctic Automatic Weather Station Network

Forename: Lee Surname: Welhouse

Authors: Lazzara, Matthew; Welhouse, Lee; Keller, Linda; Thom, Jonathan; Weidner, George; Cassano, John;

Presentation Allocated: Oral

abstract: The modern day United States Antarctic Program (USAP) Automatic Weather Station (AWS) project has origins in multiple attempts since the International Geophysical Year in 1957. Groundbreaking work done by Professor Alan Peterson at the Radio Science Laboratory, Stanford University in 1979 led to the development of the forerunner of the current Antarctic AWS systems. Since 1980, the University of Wisconsin-Madison has been the steward of the USAP AWS program, with support from the Office of Polar Programs at the National Science Foundation. This presentation will provide a brief review of the quest for an AWS for Antarctica as well as the 32 year history of the AWS project from the development of the crucial low power computer components and key satellite communications systems that has made AWS systems possible in the extreme conditions of the Antarctic. Multiple versions of the weather stations have been built and installed over the years. Commercial- data logging cores will also be briefly discussed. Sensor selections and observing strategies will be reviewed and contrasted over the lifetime of the project. Applications that the AWS network has been and continues to be utilized for will be summarized. The quality control system and review of AWS data flow will be presented. Real-time and archival quality products will be outlined including a reintroduction of new quality controlled datasets available from a limited set of AWS sites. Associated with this effort is a CLIMAT message project important for some climatological applications. This presentation provides an outline of the basic operations, highlights the objectives of the project, and lists methods of obtaining the data from the network.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Passive acoustic monitoring of baleen whales in the Southern Ocean

Forename: Ana Surname: Širović

Authors: Širović, Ana;

Presentation Allocated: Poster

abstract: Baleen whales were the primary targets of the whaling industry during the 20th century. As a result, most species stocks in the Southern Ocean were severely depleted. Resulting low population numbers combined with the large area make it hard to obtain reliable abundances estimates from traditional visual surveys. In addition, it is difficult to visually observe cetaceans in the harsh climate conditions of the Southern Ocean, which often include high sea state, ice cover, and long periods of darkness. Baleen whales produce a variety of loud, low-frequency, species-specific calls. Presence of animals in an area can thus be determined from long-term passive acoustic recordings even during times when visual observations are not feasible, including winter months. Since the recordings may detect whales over a large area, there is an increased likelihood of an individual detection. Additionally, variation in species calls may provide information on stock structure. Passive acoustic recorders were deployed at a variety of locations around the Southern Ocean, from the Ross Sea to the Antarctic Peninsula, between 2001 and 2005. Presence of blue (*Balaenoptera musculus*) and fin whale (*B. physalus*) calls was detected at these sites for periods from multiple months to up to three years. Fin whale presence in the Southern Ocean was seasonal, with peak calling during the austral fall and early winter. Generally, fin whales were no longer detected acoustically after the onset of the seasonal sea ice advance. Based on the circumpolar variation in their call characteristics, there may be at least two distinct stocks of fin whales present in the Southern Ocean. Blue whales, on the other hand, produce the same call circumpolarly. They were detected in the Southern Ocean during most months of the year, although during the austral winter they were commonly detected at more northerly recorders, close to the ice edge. Due to the apparent link between the presence of calling whales and the sea ice cover, the total presence of these species in the Southern Ocean will likely be affected by climate change. A potential increase in their presence would have an impact on krill, their primary prey source. Continuing to collect passive acoustic data as a part of long-term monitoring efforts such as ocean observatories would be an efficient way to increase our understanding of these important predators in the Southern Ocean and assess their response to the changing environment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Towards an Antarctic-wide and multinational system of monitoring penguin colonies by using satellite based remote sensing

Forename: Osama Surname: Mustafa

Authors: Mustafa, Osama; Body, Artur; Fraser, William; Hertel, Fritz; Kopp, Matthias; Lyver, Philip; Metzig, Robert; Peter, Hans-Ulrich; Pfeifer, Christian; Weimerskirch, Henri;

Presentation Allocated: Oral

abstract: Changes in individual number, spatial distribution and species composition of penguin colonies are noticed all over the Antarctic. The reasons are assumed to be in a chain from climate change over shifting ice regimes to modified distribution of food resources and accessibility of breeding sites. In the logic of these processes an Antarctic-wide monitoring program could be an effective tool to provide important information on alterations of penguin populations. Its results could serve as indicators for changes in ecosystems and geomorphodynamic processes as well as regional climatic conditions. Because of the infeasibility of an Antarctic-wide ground-based census and mapping of all penguin colonies the project aims to detect penguin colonies by using remote sensing techniques. As a first step the scientific Antarctic community has been invited for cooperation in this project including provision of data/information, exchange of experiences concerning methodologies and techniques, e.g. interpretation of satellite imagery etc. If the here tested methods turn out to be feasible, the second step could be a joint development of a possible concept for an Antarctic-wide multinational penguin monitoring program, ideally used and supported by many Antarctic Treaty Parties. For this reason a feasibility study examines the chance of detecting alterations in penguin colonies by using different optical systems and a radar system as well. Test sites with different climatic and surface conditions and also with different species composition were chosen to obtain the groundtruthing census data, including most recent (season 2011/12) and historic data, kindly provided by several national monitoring initiatives. The colonies extend is derived by classification of spectral and radiometric signatures of guano and penguin individuals. A relation to the number of penguins is made by using the census data of the respective test sites. The presentation outlines the prospects and limitations of the different imaging systems, regarding spatial and time resolution, data availability, technical as well as financial efforts and the chances to automate the processing operation. First results indicate that despite some limitations there is a principal ability for tested satellite imagery to be a suitable method for a large-scale monitoring of penguins.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Using Autonomous Observations and Numerical Models to Understand the Antarctic Atmosphere

Forename: John Surname: Cassano

Authors: Cassano, John; Knuth, Shelley; Nigro, Melissa;

Presentation Allocated: Oral

abstract: Compared to the mid-latitudes, atmospheric observations in the Antarctic are quite limited. This lack of observations hinders our ability to understand the Antarctic atmosphere. Autonomous observing systems are one way to help fill this data void and provide essential information on the state of the Antarctic atmosphere. Gaps in both space and time in the observing network will never be completely filled and as such other data sources, such as numerical models, can help fill this gap. In this presentation we will discuss how a combination of automatic weather station (AWS) and unmanned aerial vehicle (UAV) observations when combined with output from an operational numerical weather prediction model, the Antarctic Mesoscale Prediction System (AMPS), can be used to understand the dynamics of high wind events over the Ross Ice Shelf and the coupling of atmosphere, ocean, and sea ice processes in the Terra Nova Bay polynya.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 32

Title: Wet snow zone monitoring on the Antarctic Peninsula by subpixel analysis of SMMR and SSM/I EASE-Grid data (1978-2008)

Forename: Cláudio Wilson Surname: Mendes Jr.

Authors: Mendes Jr., Cláudio Wilson; Costi, Juliana; Arigony Neto, Jorge; Cardia Simões, Jefferson;

Presentation Allocated: Poster

abstract: The objective of this work is the subpixel analysis in Scanning Multichannel Microwave Radiometer (SMMR) and Special Sensor Microwave Radiometer (SSM/I) images for monitoring Wet snow zone (WSZ) on the Antarctic Peninsula during the period 1978-2008. For WSZ subpixel analysis, we used calibrated Equal Area Scalable Earth (EASE)-Grid data (25 km spatial resolution) and estimated spectral signatures of WSZ, Dry snow zone and rock outcrops (Costi et al., 2010) in a Spectral Linear Mixing Model (SLMM). Based on the spatial analysis of the WSZ fraction images estimated by SLMM, it was observed that superficial melt primarily takes place in late October and ends in late March, peaking on January 7th (about 172,237 km² or 31,6% of the Antarctic Peninsula area). The WSZ median total area in summer was about 89,690 km². Regression analysis over the 1978–1979 to 2007–2008 austral summers, revealed a negative interannual trend in surface melt of 330.854 km². Nevertheless, this trend inference is not statistically significant, due to the high WSZ interannual variability. Exceptionally strong melting occurred in summers 1984–1985 (176,507.3 km²), 1989–1990 (172,681.8 km²) and 1982-1983 (154,418.1 km²), while weak melting was observed in summers 1993–1994 (26,392.2 km²), 2003–2004 (23,410.7 km²) and 1981–1982 (23,244.3 km²). The most persistent and intensive melt occurred on Larsen, Wilkins, George VI and Wordie ice shelves and was related to the break-up and disintegration events that occurred on these ice shelves during the last two decades. The most persistent and intensive melt was observed on Larsen, Wilkins, George VI and Wordie ice shelves and it was related to the break-up and disintegration events that occurred on these glaciers in the last two decades. Surface melting is closely related to the stability of the Antarctic glacial system and global sea level changes. It could be monitored for the whole Antarctica, by using the WSZ subpixel analysis in SMMR and SSM/I imageries proposed by this study.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: A high resolution modeling of the Antarctic crustal magnetic anomaly field

Forename: Hyung Rae Surname: Kim

Authors: Kim, Hyung Rae; Hong, Jongkuk; von Frese, Ralph R.B.; Golynsky, Alexander V.;

Presentation Allocated: Poster

abstract: A localized analysis technique for the geomagnetic modeling is studied over the Antarctic to model near-surface and satellite magnetic anomaly data. As one of the regional modeling of the geomagnetic field, a spherical cap analysis has been widely used and recently this technique was well updated by Thebault et al. (2006) and Thebault (2008). In this study, we introduce a more straightforward regional analysis technique that has been effectively implemented to model satellite gravity data for small cap regions of the Earth and Moon (Han et al., 2008; Han, 2009). Newly compiled ADMAP data grids are incorporated to model a set of so-called Slepian coefficients for high-frequency spherical harmonic components. These Slepian functions are basically a linear combination of spherical harmonic functions concentrated on the area of interest. Therefore, a considerably fewer number of these coefficients are necessary to represent magnetic data over a limited area with orthogonal basis functions that effectively preserve the spectral properties. In this study, a high-resolution crustal magnetic anomaly field is modeled with Slepian coefficients that can be transformed to a full set of the spherical harmonic coefficients. This approach offers the promise of converting the ADMAP database into a set of coefficients that can be evaluated for the integral and differential properties of the anomalies anywhere at the Earth's surface up to satellite altitudes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: A primary 3D model based on multi-sensor fusion for environmental studies

Forename: Guido Surname: Staub

Authors: Staub, Guido;

Presentation Allocated: Poster

abstract: Antarctic ice shelves are of great importance for a variety of climate change studies due to the fact that they can be considered as a significant indicator for almost any kind of environmental alterations. As a showcase, the northern front of George VI ice shelf, embedded in George VI Sound, and limited by Marguerite Bay is chosen as primary study object because it is situated almost on the same geographic latitude as the Wilkins ice shelf, that disintegrated partially in 2008/2009. Data obtained from spaceborne Long Wavelength Infrared (Aqua MODIS) and Synthetic Aperture Radar (ASAR WSM) are combined in one single and comprehensive 3D representation in order to provide information that allows study of sea ice and ice shelves. The Digital Terrain Model used to generate such a three dimensional model of the study area comes from corresponding tiles of the ASTER GDEM V2. In order to complement the representation, sub-surface and –ocean data from geophysical surveys (Bedmap project) are incorporated. All these height information and data derived from the raw spaceborne observations are combined and assigned to the z-axis accordingly. In consequence, this representation can be considered as the basic (sub-) surface representation that incorporates environmental information. By such a 3D, multi-sensor model it is possible to make a statement about the actual situation within the study area (e.g. about a possible ice shelf retreat) and the nearby environmental conditions (e.g. about the Sea Surface Temperature). And what is even more important, it can be enhanced by any kind of georeferenced data that might be considered of importance for scientific climate change studies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: A Sled-Mounted Vibroseis Seismic Source for Climate, Glacier and Tectonic Studies in Antarctica

Forename: Marvin Surname: Speece

Authors: Speece, Marvin; Harwood, David; Rack, Frank; Luyendyk, Bruce; Wilson, Doug; Powell, Ross; Tulaczyk, Slawek; Pekar, Stephen; Temple, Doug; Blenkner, Rick;

Presentation Allocated: Poster

abstract: Seismology's role in Antarctica is to help determine the geology of the subsurface of this still largely unexplored continent. Seismic reflection surveys in Antarctica have traditionally been collected as marine multichannel and single channel data. However, controlled or active source seismic experiments have played an integral, albeit limited, part in geophysical surveys of the Antarctic ice sheet. In more recent years, sea-ice and ice-shelf seismic reflection surveys have shown promise for producing useful data for regions not accessible by ship. However, a thick firn layer that covers much of the Antarctica ice sheet has limited the use of surface-based active seismic sources. To overcome attenuation caused by the firn layer, explosives are typically placed in 10 to 30 m-deep boreholes. These shot holes can be drilled by a variety of techniques but all require significant time and energy. In contrast to an impulsive seismic source that releases energy over about a millisecond duration, a seismic vibrator (vibroseis) emits energy as a controlled sweep of frequencies over several seconds. As a consequence, energy losses due to inelastic processes are less because of reduced ground pressure and the total energy produced is integrated over the length of the sweep. Long seismic reflection profiles across Antarctica can be accomplished efficiently by pulling a sled-mounted vibrator that in turn pulls a snow streamer. We propose the acquisition of a vibroseis for Antarctic research by scientists within the U.S. Antarctic Program (USAP). Antarctic research objectives that could be impacted by the use of a vibrator include (1) mapping of sub-ice stratigraphic sequences suitable for sampling by scientific drilling, (2) correlating offshore and onshore seismic data and complementing airborne geophysical surveys to help determine Antarctica's geologic history, (3) identifying ice-bedrock interface properties and exploring grounding-line processes, (4) exploring sub-glacial lakes and water-routing systems, and (5) investigating the seismic properties of ice sheets. Suggested seismic profiles include the South Pole traverse route across the Ross Ice Shelf with diversion routes to Coulman High and the Siple Coast. Additional profiles are planned for Byrd Station to West Antarctic Ice Sheet (WAIS) Divide camp and continuing to Pine Island Glacier, and over the 'Discovery Deep' trough, seaward of Byrd Glacier in the eastern Ross Embayment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Aerogeophysical investigations off Dronning Maud Land: Status and Outlook

Forename: Wilfried Surname: Jokat

Authors: Jokat, Wilfried;

Presentation Allocated: Oral

abstract: The breakup of Gondwana was the last major tectonic event, which had a profound long term impact on the continent configuration and environment of the southern hemisphere. Numerous experiments and studies exist to constrain the movements of the different plate since Jurassic times. Early models based on sparsely distributed marine magnetic profiles provided the first general models for the dispersal of Gondwana into the southern hemisphere continents, namely South America, Africa, Madagascar, India, Australia and NewZealand. In this contribution we focus on areas off Dronning Maud Land, Antarctica, which once were conjugate to Africa and India. Systematic aeromagnetic surveys along East Antarctica and its conjugate margins off East Africa provided new details on the kinematic evolution of this sector, and forced to refine the interpretation of geological structures along the conjugate margins. Here, we like to introduce new magnetic data sets off SE Africa and East Antarctica (0° - 40°E), and their consequences for the geological interpretation. The latest interpretations of structures off south and central Mozambique as well as in the Lazarev and Riiser Larsen seas will be discussed in relation to its kinematic history and their underlying processes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Age-depth relationship and lithosphere behaviour in the western and central Scotia Sea (Antarctica)

Forename: Yasmina M. Surname: Martos

Authors: Martos, Yasmina M.; Bohoyo, Fernando; Galindo-Zaldivar, Jesus; Maldonado, Andres;

Presentation Allocated: Poster

abstract: The age-depth relationship representing standard seafloor subsidence is well established. The depth and age are related by the square of the age for oceanic crusts younger than 70 Ma and by the exponential decay of the age for the oceanic crusts older than 70 Ma. Although time dependence of the oceanic crust depth has been studied globally, the southern oceans are still a gap of this information. In this research we help to fill this gap in the Scotia Sea area. The Scotia Sea is an oceanic basin located between South America and Antarctic plates and it contains the Scotia and the Sandwich plates, which are bounded by the SFZ to the west and by the Scotia Arc on the three remaining sides. The Scotia Sea shows several spreading ridges that were active simultaneously since the Oligocene resulting in the opening of the Drake Passage. We used geophysical data, including multichannel seismic (MCS) and magnetic data, acquired on board BIO Hespérides, in the austral summer of 2004 and in January/February of 2008 along four long profiles located in the western and central Scotia Sea. The chosen profiles, with NW-SE orientation, are perpendicular to the spreading axis and are located to the southern part of the plate, crossing the spreading axis in two cases. MCS reflection profiles were used to determine the depths of the seafloor and the oceanic basement along the profiles. On the other hand, taking into account the magnetic anomaly models that have been published in the area by several authors and the preliminary results obtained from our data, it was possible to associate an age to oceanic floor along the studied profiles. Then, we determine an age-depth relationship in this area. The studied oceanic crust satisfies, in general, an equation that resembles the standard one for seafloor subsidence. However, we found an important region, limited by two transform faults, where the sea floor did not follow the general law for the area and where even the depth of the basement decreased towards the oldest oceanic crust near the continental Terror Rise. The presence of a large high of basement makes that the crust behaviour were different in this region. This fact may be related with the characteristics of the lithosphere in the anomalous region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Antarctic Ice Velocity Mapped from Space: An IPY Success Story and the Way Forward

Forename: Bernd Surname: Scheuchl

Authors: Scheuchl, Bernd; Mouginot, Jeremie; Rignot, Eric;

Presentation Allocated: Oral

abstract: Ice velocity is a fundamental characteristic of the dynamics of ice sheets and is essential to know for measuring the mass budget of ice sheet as well as for controlling ice sheet numerical models with realistic boundary conditions. Our reference digital mosaic of ice motion covering all of Antarctica establishes a long-term legacy for quantitative measurements of the dynamics of the Antarctic ice sheet. The data product (ice velocity, in meters per year, measured on a regular earth fixed grid, at 900 m resolution) is available for download at NSIDC. In addition to ice velocity we generated InSAR based grounding line of the entire continent, this product is also available via NSIDC. Data from a suite of spaceborne Synthetic Aperture Radar (SAR) sensors acquired during the International Polar Year 2007-2009 were available for the project (Japanese Space Exploration Agency: ALOS PALSAR (2006 to 2010), European Space Agency: ENVISAT ASAR (2007 to 2009) and Canadian Space Agency: RADARSAT-2 (2009 and 2011)). Data acquisitions were coordinated through the IPY Space Task Group (STG), leading to the first-ever complete coverage of Antarctica with interferometric SAR (InSAR) data. More recently we started to include historic data sets from RADARSAT-1 and ERS-1/2 in our research. The challenges of this project include the coordination of the data acquisitions (managed by STG), data processing on a continental scale, and combining data from different SAR sensors to a seamless product. The data products benefit glaciologists and ice sheet modelers, but also climate modelers interested in how ice sheets are evolving, physical oceanographers studying sea level change and changes in oceanic circulation, solid earth scientists interested in post-glacial rebound, and atmospheric scientists interested in surface mass balance in Antarctica. We present our products, provide a status update of the ongoing project, highlight our most recent results, and lay out a road map for the way forward. This work was conducted at the Department of Earth System Science, University of California Irvine under a contract with the National Aeronautics and Space Administration's MEaSUREs program. Spaceborne SAR data were made available for this project courtesy of the IPY Space Task Group.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: BEDMAP2 – a benchmark new dataset for Antarctic Earth science

Forename: Hamish Surname: Pritchard

Authors: Pritchard, Hamish; Fretwell, Peter; Vaughan, David; Jordan, Thomas;

Presentation Allocated: Oral

abstract: We present BEDMAP2, a new, updated and continuous map of bed elevation and ice thickness for Antarctica and the southern ocean from a large international consortium of Antarctic field programs. We have incorporated all of the ice thickness data from the original BEDMAP with approximately 265 000 km of newly acquired airborne radio-echo-sounding lines over the ice, plus recent, improved compilations of surface elevation, ice shelf thickness and bathymetry. There are significant improvements to the mapping of key areas of rapid change in West Antarctica and recently discovered mountain ranges under the East Antarctic ice sheet. BEDMAP products have for the last decade been key components of ice sheet models, geological models, tectonics and crustal seismics analyses, gravity and magnetic analyses and ice core interpretation. Freely-available BEDMAP2 will continue and enhance this tradition.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Compositional Remote Sensing of the McMurdo Dry Valleys: Integrated Analyses of Primary and Secondary Processes within the Ferrar Dolerite

Forename: Mark Surname: Salvatore

Authors: Salvatore, Mark; Mustard, John; Head, James; Marchant, David; Wyatt, Michael;

Presentation Allocated: Poster

abstract: Reflectance and emission spectroscopy are utilized to discriminate the high silica (e.g. Beacon Supergroup) and mafic silicate mineralogy (e.g. Ferrar Dolerite) of the diverse lithologies in the McMurdo Dry Valleys (MDV), an ideal location for orbital spectral studies due to the lack of vegetation. In particular, the Ferrar magmatic complex exhibits a range of spectral signatures due to primary and secondary processes that are identifiable from orbit. In this study, we assess the spatial distribution of these spectral signatures and their relationship to local environmental variables. Spectral mapping of the MDV was performed using multispectral visible/near-infrared (VNIR) reflectance and mid-infrared (MIR) emission data. These datasets were radiometrically and atmospherically corrected and mosaicked to cover the majority of ice-free terrain throughout the MDV. The completed map has fourteen bands ranging from 0.4 to 12 microns with a spatial resolution of 30 m/pix. Primary compositional variability resulting from magmatic evolution during emplacement is the principal source of spectral heterogeneity observed throughout the Ferrar Dolerite. The lower Basement and Peneplain sills are enriched in Mg and orthopyroxene relative to the upper Asgard and Mt. Fleming sills, which is observed as a strengthening of the 1 and 2 micron pyroxene bands in VNIR data. These spectral signatures are validated by laboratory measurements that show similar variability in the strength of mafic absorptions in samples collected from different sills. Geographically isolated and stable doleritic plateaus within the Labyrinth of Upper Wright Valley exhibit subdued 1 and 2 micron absorption bands as compared to fresher scree slopes derived from the same sill. These subdued signatures are consistent with laboratory observations of weakly altered dolerites. Chemical alteration of dolerites in the hypo-thermal and hyper-arid environment results in the formation of thin oxidation rinds via cation migration in addition to a de-structuring of mineral grains, resulting in amorphous silica signatures in the MIR. Sediment sorting and physical mixing of aeolian detritus with the dolerites in Victoria Valley and Bull Pass also result in a weakening of mafic signatures as observed from orbit. These processes, their heterogeneous distribution throughout the MDV, and their relationship to local microclimates can help to explain the range of spectral signatures observed within the Ferrar Dolerite.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Crustal architecture and uplift mechanisms for the Gamburtsev Subglacial Mountains

Forename: Fausto Surname: Ferraccioli

Authors: Ferraccioli, Fausto; Finn, Carol; Bell, Robin; Jordan, Tom; Anderson, Lester;

Presentation Allocated: Poster

abstract: The Gamburtsev Subglacial Mountains are the least understood tectonic feature on Earth, as they are completely hidden beneath the East Antarctic Ice Sheet. The paradox of their high elevation and Alpine topography, but location in the interior of the Precambrian East Antarctic craton, has puzzled researchers since their first discovery in 1958. Recent studies suggest that the preservation of Alpine topography in the Gamburtsevs may reflect extremely low long-term erosion rates beneath the East Antarctic Ice Sheet. However, the origin of the Gamburtsevs has remained problematic. We analyse crustal architecture and uplift mechanisms for the Gamburtsevs using recent radar, gravity and magnetic datasets collected during the International Polar Year as part of AGAP. The aerogeophysical data help map a 2500 km-long rift system in East Antarctica surrounding the Gamburtsevs and image a thick crustal root beneath the range. In our interpretation the thick crustal root formed during the Meso and/or Paleoproterozoic assembly of a collage of East Antarctic basement provinces as opposed to reflecting more recent Pan-African (i.e. late Neoproterozoic-Cambrian age) collisional or intraplate events. Rather than being delaminated into the mantle the inferred Proterozoic root was preserved (as is the case in the Paleozoic Urals or the Paleoproterozoic TransHudson Orogen) and was likely rejuvenated during much later Permian (ca 280 Ma) and Cretaceous (ca 100 Ma) rifting. Our flexural models show that the combination of rift-flank uplift, latent root buoyancy, and the isostatic response to fluvial and glacial erosion can account for both the high-elevation and relief of the modern Gamburtsevs. The proposed evolution of the Gamburtsevs demonstrates that continental rifting processes, when coupled with preserved orogenic roots, can help produce broad regions of elevated topography within Precambrian continental interiors.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Design and Realization of Polar Information Map Symbol Database and Automated Mapping Model Based on ArcGIS10 System

Forename: Yanjie Surname: Zhang

Authors: Zhang, Yanjie;

Presentation Allocated: Poster

abstract: Design and Realization of Polar Information Map Symbol Database and Automated Mapping Model Based on ArcGIS10 System
ZHANG Yanjie (National Marine Data and Information Service, Tianjin, 300171) Abstract: ArcGIS10 system is a GIS software product for geographic information. It can provide users with a convenient and efficient system of mapping. Years of polar scientific investigations and studies accumulated a wealthy information and data of various types, such as those of polar glaciology, polar oceanography, polar geophysics, polar atmospheric science, polar biology, polar environmental science, polar geography, polar geology, polar engineering, Antarctica astronomy and so on. In order to fully demonstrate the results of polar scientific investigations, the paper, based on ArcGIS 10 system, presents a technical method of designing the database of map symbols and font symbols for polar Information. The characteristic elements of each theme in polar researches are analyzed, and then classified and graded. The shape, size, orientation, brightness, density and color of element symbols are designed and made following the map scale and the map unit. The size of symbol matches its actual distance or area. The intelligent, three-dimensional and outline symbol library system of all the thematic elements and the geographic names information system are established. And data-driven pages method is used for an easy and convenient way of mass production of thematic map. It provides a means to disseminate a majority of polar information, thereby providing an efficient service to polar scientific studies and thematic data sharing.
Key Words: polar thematic elements; ArcGIS10 system; map symbol database; font symbol database; data driven pages

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Environmental Domains Analysis for the Ross Sea Region

Forename: Fraser Surname: Morgan

Authors: Morgan, Fraser; Aislabie, Jacqueline; McLeod, Malcolm; Price, Robbie; Barker, Gary;

Presentation Allocated: Oral

abstract: In 2008 an objective, spatially explicit classification was produced that grouped the Antarctic continent into 21 distinct 'environments' titled Environmental Domains for Antarctica. The approach was the starting point in providing the fundamental scientific basis for the systematic environmental-geographic framework for protected areas as outlined in Article 3(2) of the Antarctic Treaty. The classification was recently evaluated by SCAR, which concluded that the classification was a "useful, important measure of environmental variation across Antarctica that, in terms of its ice-free domains, can be considered essential as a first order assessment of likely systematic variation in biodiversity" (SCAR Meeting XXXIII – WP3). Building on the success of the continental classification, a New Zealand research programme has been funded to incorporate new knowledge on soil, climate, and biological diversity and abundance into a new environmental domains analysis focusing on the Ross Sea Region. The multivariate two-stage process used in the original classification is being revised to enable new classification options and the ability to accommodate the unique challenges the region provides. Based on discussions held with the New Zealand Antarctic science community, the research team has begun to develop a range of geospatial data layers that will capture the biogeographic variation within the region. The proposed layers can be split into three main categories (Climate, Landform, and Geologic/Soil) and will be presented in this paper for wider discussion by the Antarctic science community. Using existing biodiversity information from the Evolution and Biodiversity in the Antarctic (EBA) database and individual researchers, the research team is exploring new approaches that will improve the level of biogeographic variation captured in the Ross Sea Region classification. This paper will introduce the Environmental Domains analysis used in the continental Antarctic classification while also explaining how the improvements being undertaken for the new Ross Sea Region classification will improve upon the original classification. The research team hopes to stimulate feedback on the approaches being undertaken and provide an opportunity to contribute to the development of the classification for the Ross Sea Region.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Google's Contribution to Antarctic Science and Outreach

Forename: David Surname: Cohn

Authors: Cohn, David; Herried, Brad; Morin, Paul; Starns, Alex; Manolides, Matt; Sholts, Crystal; Giencke, Pete; Niebuhr, Spencer; Kelleher, Cole;

Presentation Allocated: Poster

abstract: Antarctica's remoteness and inaccessibility has traditionally restricted its exploration to scientific expeditions. However, the recent availability of vast amounts of high-quality imagery and geospatial data has made new kinds of scientific exploration possible, not only for seasoned professionals, but for backyard scientists, teachers and students around the world. Much of this imagery and data has been made available through a public-private collaboration between the Google Earth and Maps team and the National Science Foundation-funded Polar Geospatial Center (PGC). So far, the collaboration has developed on two fronts: 1. Commercial satellite imagery of both poles has been made available through Google Maps and Google Earth. The selection of imagery is driven by the international science and logistics community. 2. In collaboration with the U.S. Geological Survey (USGS), the PGC has used high-resolution imagery to increase the accuracy of the locations of Antarctic place names. These names will be placed and searchable in Google Maps and Earth after being updated in the SCAR Composite Gazetteer. The goal of these efforts is to provide scientists and the public the most accurate, highest resolution geospatial data in freely available web tools and software. The imagery and data can be explored and navigated at no cost by anyone with a browser and an Internet connection. Schoolchildren in Bangalore can count penguin colonies on Snow Hill Island, and geologists in Georgia can trace sedimentary layers in the Dry Valleys from the comfort of their desks. The benefit for Antarctica goes far beyond science and traditional mapping - by providing an immersive "like you are there" experience for citizens of countries around the world, these images help raise awareness and create a "sense of place" and responsibility for the world's least understood continent.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: High-resolution aeromagnetic mapping of the Antarctic Peninsula: new snapshots of the magmatic arc from Adelaide Island

Forename: Tom Surname: Jordan

Authors: Jordan, Tom; Ferraccioli, Fausto; Neale, Fraser;

Presentation Allocated: Poster

abstract: The Antarctic Peninsula is a natural laboratory for studying the process of magmatic arc evolution and terrane accretion. Reconnaissance aeromagnetic mapping has played a key role in revealing Mesozoic and Cenozoic magmatic arc provinces and accreted terranes along the Antarctic Peninsula. However, the relatively coarse (~3 km) line spacing and 1-2 km elevation of these regional surveys limits their utility for mapping detailed structures, which are critical to understanding the processes of arc development. Here we present results from two new high-resolution aeromagnetic surveys flown during the 2010-11 field season over Adelaide Island, on the western edge of the Antarctic Peninsula. This area includes exposures of Cretaceous forearc basin sediments and Early Tertiary plutons, which may relate to westward migration of the arc towards the trench. The surveys cover the northwest and southeast parts of Adelaide Island, with a line spacing of 1 km and 500 m respectively, and a terrain clearance of ~250m. With the aid of a variety of digital enhancement techniques we map a series of 20-30 km-long linear magnetic anomalies with amplitudes of 200-600nT and wavelengths of ~5-10 km over the northwest of Adelaide Island. The NNE-SSW trends of these anomalies reveal previously unrecognised structural controls along the magmatic arc. However, similar trends are not observed to the southeast, over exposures of Eocene (44 – 58 Ma) mafic and intermediate arc plutons. We put forward two alternative interpretations to explain the contrasting magnetic signatures: i) The anomaly patterns reflect different degrees of structural control on Cenozoic magma emplacement, with the north-western intrusive bodies emplaced along a dextral strike-slip fault system; ii) Alternatively, the north-western anomalies reflect uplifted Cretaceous intrusions similar to those exposed in Palmer Land (e.g. over the Willey Complex east of George VI Sound).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Hyperspatial WorldView-2 Satellite Remote Sensing Data for Polar Geospatial Information Mining of Larsemann Hills, East Antarctica

Forename: Shridhar Surname: Jawak

Authors: Jawak, Shridhar; Luis, Alvarinho;

Presentation Allocated: Poster

abstract: An endeavor is made under DigitalGlobe's "8 Band Research challenge" to assess the prospective of very high spatial and spectral resolution Worldview-2(WV-2) data for mining of polar geospatial information and thematic elevation mapping of about 100 sqkm area nearby Larsemann Hills where the new Indian Antarctic station "Bharati" is being established. We present the research work carried out using 8-Band WV-2(PAN 0.5m + Multispectral 2m) satellite imagery for better understanding of the spatial changes in the surface topography, including land ice variation, and land cover dynamics which will help in logistic activities in the future Indian Antarctic expeditions. It is the first Indian attempt and one of the very few recent International polar research attempts of thematic land cover mapping of any part of Antarctica using very high resolution remote sensing data. A stereo pair of WV-2 data, acquired on 9th December 2009 and 10th September 2010 by DigitalGlobe, has been used for the analysis, and we are successful in mapping of the study area into 4 major thematic classes namely continental Ice (30.09 km²), landmass (12.9 km²), Sea-ice (56.65 km²) and lakes (0.36 km²) along with elevation mapping in the form of DEM with less than 1m vertical RMSE. The thematic classes are identified and extracted by the differences in spectral wavelength and visual interpretation using various well-known classification approaches. Overall, the research indicates that WV-2 can significantly improve the visual interpretation and the expert classification is a powerful tool in the production of a reliable thematic map of remotest Antarctic region, where aerial photography is difficult due to extreme harsh climatic conditions and high logistic costs. Thematic classification results showed that an overall accuracy of 95.52 % (kappa statistics value 0.9485) from 200 reference ground truth data collected during Indian Scientific expedition to Antarctic, which is considered acceptable or good for optical remote sensing data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: IBCSO v1 – A preview on Version 1 of the International Bathymetric Chart of the Southern Ocean

Forename: Jan Erik Surname: Arndt

Authors: Arndt, Jan Erik; Schenke, Hans Werner; Barrios, Felipe; Black, Jenny; Daniell, James; Jakobsson, Martin; Nitsche, Frank O.; Peralta, Walter Reynoso; Rebesco, Michele; Tate, Alexander J.; Wigley, Rochelle;

Presentation Allocated: Oral

abstract: The International Bathymetric Chart of the Southern Ocean (IBCSO) is an expert group of SCAR since the XXVIII SCAR Conference held on 30th July 2004 in Bremen Germany and a regional Mapping project of the General Bathymetric Chart of the Ocean (GEBCO) operated under the joint auspices of the Intergovernmental Oceanographic Commission (IOC) (of UNESCO) and the International Hydrographic Organization (IHO). The objective of IBCSO is to produce the first seamless bathymetric grid for the area south of latitude 60° S surrounding Antarctica. This will be a benefit for several scientific purposes including (a) interpretation of seabed geology, (b) the building of habitat models and maps, and (c) mapping and tracing of deep ocean current pathways. In addition the IBCSO will serve as an indispensable database for new nautical Charts in the Southern Ocean to improve the safety of navigation in Antarctic waters. After the inaugural meeting in 2004, the Editorial Board was then established at the 1st IBCSO Meeting at Santa Barbara in 2007 including ambassadors of several SCAR member countries. Since then plenty of institutions holding bathymetric data in the Southern Ocean have been asked for a contribution to the IBCSO dataset. Gathering, compilation and analyses of bathymetric data turned out to be larger and more time consuming tasks than first envisioned. For this reason, there has not yet been an IBCSO gridded digital bathymetric model released. However, a first version is now scheduled to be released during the fall of 2012. It is proposed to give an overview in what has been done in the IBCSO project in the last years for the creation of IBCSO v1. This will include acknowledgements to the data contributors and a short explanation of the working steps data acquisition, homogenization, cleaning and gridding. Furthermore information on the current status of the grid production and previews of preliminary sections of the new dataset will be given.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: ICECAP Airborne Gravimetry over East Antarctica, 2008 to 2012

Forename: Thomas Surname: Richter

Authors: Richter, Thomas; Young, Duncan; Kempf, Scott; Greenbaum, Jamin; van Ommen, Tas; Siegert, Martin; Blankenship, Donald;

Presentation Allocated: Poster

abstract: Starting with the 2008/09 Antarctic field season the international Project ICECAP (International Collaborative Exploration of the Cryosphere through Airborne Profiling) has executed annual expeditions collecting aerogeophysical data over East Antarctica. The collection platform has been an instrumented, long-range DC-3T operated from several bases on the continent. The goal of the survey was to better constrain the geology, glaciology and offshore bathymetry of eastern East Antarctica. Scalar gravity was a prime geophysical observable recorded. The gravimeter used was a Bell Aerospace BGM-3, provided on loan by the National Geospatial-Intelligence Agency. In addition, during the 2011/12 expedition a ZLS Dynamic Gravimeter provided by the British Antarctic Survey was operated in parallel with the BGM-3. Both meters are two-axis stabilized platform types. Due to extremely long baselines, we used Precise Point Positioning GPS solutions as the primary source of kinematic acceleration information. Flight profiles included drapes, step changes in altitude, and significant accelerations transverse to the direction of flight. The transverse accelerations induced by course corrections were more numerous and problematic than the longitudinal accelerations induced by the altitude changes. Correction algorithms allowed recovery of reasonable and useful gravity results from a majority of the line-kilometers recorded. Simultaneous observations of surface elevation, ice thickness, and geomagnetic field strength produced a context for the gravity observations and allowed calculation of Bouguer anomalies. To date, 285,000 line kilometers of data have been gathered over the interior (including a collaboration with the Danish-Argentinian-Norwegian ICEGRAV program). Funding was provided by the UK's NERC, the US NSF Office of Polar Programs, NASA Operation Ice Bridge, Australia's ACE-CRC, and the Jackson School of Geosciences at the University of Texas. Logistics and instrument support were provided by USAP, AAD, IPEV, PNRA, NGA, BAS and UNAVCO/EarthScope.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: ICECAP data over the periphery of East Antarctic: A new view of a crucial ice sheet

Forename: Duncan A. Surname: Young

Authors: Young, Duncan A.; Roberts, Jason L.; Wright, Andrew P.; Greenbaum, Jamin S.; Kempf, Scott D.; Ng, Gregory; Richter, Thomas G.; Holt, John W.; Le Meur, Emmanuel; Schroeder, Dustin M.; Warner, Roland C.; Young, Neal W.; Blankenship, Donald D.; van Ommen, Ta

Presentation Allocated: Poster

abstract: East Antarctica is the largest reservoir of ice in Cenozoic Earth, and has played a critical role in climate history. ICECAP (International Collaborative Exploration of the Cryosphere through Airborne Profiling) is a major international project targeting the margins of the massive ice sheet, addressing three major problems: what are the boundary conditions controlling the architecture of the East Antarctic Ice Sheet; what is climate record archived within the ice, and what is the sensitivity of the East Antarctic Ice Sheet to change. To these ends, a long range multi-instrumented aerogeophysical aircraft has been operated from US, Italian, French and Australian coastal stations, over the Wilkes and Aurora Subglacial Basins and their margins every season since 2008, as part of both the International Polar Year and Operation Ice Bridge. Funding was provided by the UK's NERC, the US's NSF Office of Polar Programs and NASA's Operation Ice Bridge, and Australia's ACE-CRC, and the Jackson School of Geosciences at the University of Texas. Logistics and instrument support was provided by USAP, AAD, IPEV, PNRA, NGA, BAS and UNAVCO/EarthScope. Primary science results include delineation of a former ice sheet margin in the interior of the Aurora Subglacial Basin, a better definition of the structure of the subglacial hydrology under East Antarctica, and greatly improved our understanding of the geometry many of East Antarctica's outlet glaciers. The data have also been used to validate new ice thickness interpolation methods, and provide a high resolution tie between the Vostok and EPICA ice core sites. To date, 285,000 line kilometers of data have been gathered over the interior (including a collaboration with the Danish-Argentinian-Norwegian ICEGRAV program), including ice penetrating radar, laser altimetry, gravity and magnetics. The primary data products include ice thickness, surface elevation (repeated in many locations), and potential fields data indicating geology and bathymetry. We review the new data over this important sector, and discuss plans for its release.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Long-range airborne geophysics in interior Dronning Maud Land and the Antarctic Peninsula

Forename: Rene Surname: Forsberg

Authors: Forsberg, Rene; Olesen, Arne; Nielsen, Emil; Kristensen, Steen; Dall, Jorgen; Ghidella, Marta; Zakrejsek, Andres; Greenbaum, Jamin; Blankenship, Don; Gidskehaug, Arne;

Presentation Allocated: Oral

abstract: Long-range airborne geophysics measurements were carried out in February 2011 in hitherto unexplored parts of Interior East Antarctica (Dronning Maud Land), as well as over parts of the Antarctic Peninsula. The 2011 measurement programme completed two earlier 2010 measurement campaigns in the IceGrav project, a Danish-led project with the primary goal to improve the gravity coverage over Antarctica, and carried out in scientific or logistical cooperation with IAA Argentina, Norwegian Polar Institute, BAS and the University of Texas, with funding support by NGA and ESA. The airborne surveys were carried out with a Basler DC3 aircraft, equipped with gravimeter, magnetometer and two ice penetrating radars: a novel 435 MHz P-band radar, and the 60 MHz UTIG/TUD radar. The fully polarimetric P-band radar, developed by DTU-Space for ESA, was tested for the first time in Antarctica, and provided unique high-resolution depth sounding data, and proved the ability to obtain ice thickness even at the very high P-band radar frequency. Gravity data, collected with a Lacoste and Romberg gravimeter, showed accuracy levels of 2-4 mGal r.m.s., in spite of very challenging flight conditions, especially on the Antarctic Peninsula. Comparisons between IceBridge and IceGrav data shows excellent bias-free agreement, highlighting the accuracy which can be obtained by airborne gravity, and the usefulness to supplement GOCE satellite measurements. The combined geophysical results in the inner part of Dronning Maud Land shows large anomalies associated with the major icestreams, indicating the presence of major sedimentary basins in the region, and highlights the potential of long-range aerogeophysics for sub-ice geology exploration, and for improving Antarctica-wide data compilations such as AntGP, ADMAP and BEDMAP.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Magnetic anomaly pattern in eastern and southern Dronning Maud Land

Forename: Matthias Surname: Mieth

Authors: Mieth, Matthias; Jokat, Wilfried;

Presentation Allocated: Oral

abstract: Systematic airborne surveys conducted by the Alfred Wegener Institute over the last decade have investigated a significant part of Dronning Maud Land (DML). In eastern DML aerogeophysical data were acquired during the 2004 VISA campaign at a line spacing of 20 km. The ongoing WEGAS campaigns improved the line spacing to 10 km and extend the survey area. Recent processing of the combined data sets revealed elongated magnetic anomalies with low amplitudes. These anomalies trend northwest – southeast and are confined in all directions, except towards the southeast, where they can be traced further into older Russian magnetic data sets. However, a sound structural interpretation of these anomalies in the Russian data is highly speculative due to sparser line spacing. Magnetic anomalies with almost similar orientation are found south of the Prince Charles Mountains (PCMEGA) and in the Gamburtsev Region (AGAP). Currently it is not clear, if these anomalies are connected or caused by the same geological process. Furthermore, a high amplitude anomaly with values above 300nT was discovered further to the west in southern DML. This arch-shaped north-south anomaly is over 300 km long and might continue towards the southeast. Though interpretation of its origin is speculative, it is worth to note that it separates the area of elongated low amplitude anomalies in the east from the magnetic patterns of the Coats Land Block and the Shackelton Range in the west. That means the magnetic data show no evidence of a structural link between Shackelton Range and Sør Rondane as proposed in several studies.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Magnetic surveys of the Antarctic into the 21st century

Forename: Alexander Surname: Golynsky

Authors: Golynsky, Alexander; Damaske, Detlef; Ferraccioli, Fausto; Ghidella, Marta; Ivanov, Sergey; Jokat, Wilfried; von Frese, Ralph;

Presentation Allocated: Poster

abstract: Since the production of the ADMAP-2001 map, more than 1.5 million line-km of new marine and airborne magnetic survey data, as well as much improved satellite magnetic observations from the Ørsted and CHAMP missions have become available. These new magnetic data together with survey data that were not previously in the public domain can significantly upgrade the ADMAP compilation for crustal studies of the Antarctic. The synthesis of these magnetic data into the next generation ADMAP compilation will enable a better understanding of the geological structure and tectonic history of the Antarctic region. In particular, improved modeling of geodynamic evolution of the Antarctic lithosphere that was a key component in the break up of Rodinia and Gondwana is possible. Improved perceptions of the nature of transition from the Antarctic continent to its modern oceanic surroundings also can result from the next generation ADMAP compilation for the Antarctic region south of 60oS. The new magnetic anomaly map of the East Antarctic continental margin compiled recently by Golynsky et al. (2012) incorporates all available data obtained by the international community since the IGY 1957-58 through 2009. This map provides the most complete magnetic anomaly data set compiled for the region to date and can be considered a key element of the new generation ADMAP. Golynsky, A.V., Ivanov, S.V., Kazankov, A.Ju., Jokat, W., Masolov, V.N., von Frese, R.R.B. and the ADMAP Working Group. 2012. NEW CONTINENTAL MARGIN MAGNETIC ANOMALIES OF EAST ANTARCTICA. Tectonophysics.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: MULTIBEAM BATHYMETRY MAPPING IN THE DRAKE PASSAGE (ANTARCTICA): BAT-DRAKE PROJECT

Forename: Fernando Surname: Bohoyo

Authors: Bohoyo, Fernando; Larter, Rob D.; Galindo-Zaldívar, Jesus; Leat, Phil T.; Maldonado, Andres; Maestro, Adolfo; Lopez-Martinez, Jeronimo; Barnolas, Antonio; Barragan, Antonio; Bermudez, Oscar; Gomis, Damia; Hernandez-Molina, F.Javier; Llave, Estefania; Lobo

Presentation Allocated: Poster

abstract: The opening of the southern gateways, mainly Drake Passage and the Tasman Strait, permitted the modern pattern of ocean circulation, involving extensive exchange of water between the main ocean basins, to be established. In particular, it led to the development of the Antarctic Circumpolar Current (ACC), which caused the thermal isolation of Antarctica, and was partially responsible for global cooling at the Eocene-Oligocene boundary. Therefore the gateway openings constitute first order tectonic events involving complex geological process such as continental fragmentation, the development of oceanic basins and the rifting of continental blocks. Detailed cartography of the sea floor in Drake Passage will identify the main physiographic features, which can be related to dynamic processes of deep oceanic currents. Sea-floor topography in the region is an important boundary condition for high-resolution ocean circulation models and also provides constraints on stress field models for the initiation of Drake Passage opening. Sea-floor digital elevation models are also very important to other sciences such as physical oceanography or marine biology. This project constitute an international cooperative effort between the Spanish Geological Survey (IGME), other Spanish research institutions and the British Antarctic Survey (BAS) for the compilation of precise bathymetric data obtained on previous and future cruises in the Drake Passage region (located between parallels 54°S and 62.5°S and meridians 70 °W and 52 °W) and the development of sea-floor cartography and digital elevation models. This initiative is part of IBCSO (International Bathymetric Chart of Southern Ocean), under the SCAR umbrella, which recognises the importance of regional data compilations in areas of particular scientific interest in the Antarctic, such as the Ross Sea, Drake Passage and the southern margin of Weddell Sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Near Real-time Imagery for Ice Monitoring

Forename: Paul Surname: Morin

Authors: Morin, Paul; Flemming, Andrew; Schmaltz, Jeff;

Presentation Allocated: Poster

abstract: We have entered a time of near-real-time data from a number of public and commercial sources that are enabling Antarctica to be monitored at a rate and resolution that was previously not possible. A number of important changes to data policy and advances in sharing of geospatial data mean an increasing volume of data is available to scientific researchers, national program operators and the public. Three important initiatives related to maritime science and operations in the Southern Ocean are highlighted here. The Polar View Antarctic initiative has continued to provide access to current sea ice information for the past 5 years. Using a combination of satellite image sources and derived information products such as sea ice charts, Polar View provides a complete picture of the Antarctic sea ice zone. The service has employed novel geospatial tools to ensure routine access to all users whether they are office based or restricted to poor bandwidth connections onboard ships. Access to such information clearly has benefits for safety and efficiency of sea ice based science and operations. The NASA Land Atmospheres Near-real time Capability for EOS (LANCE) provides a variety of data and imagery products from the Terra, Aqua, and Aura missions in near-real-time to assist in meeting the needs of a variety of application users. The Rapid Response component of LANCE delivers MODIS true and false color optical imagery at 250m resolution (2 overpasses per day) and thermal imagery at 1km resolution (4 overpasses per day) within approximately 2 hours of acquisition. The high-resolution optical satellite imagery companies Digital Globe, Inc and Geoeye, Inc have imaged, and continue to refresh, Antarctica at sub-meter resolution. These satellites have a very small field-of-view but high-resolution and frequent repeat. This poster we will show the how this international public-private sector team integrated these diverse set of resources to increase the safety and efficiency of marine operations as well as enabling better science.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: New Aerogeophysical Observations of the East Antarctic Coastline

Forename: Jamin Surname: Greenbaum

Authors: Greenbaum, Jamin; Roberts, Jason; Young, Duncan; Richter, Thomas; Le Meur, Emmanuel; Warner, Roland; Young, Neal; Durand, Gaël; van Ommen, Tas; Siegert, Martin; Blankenship, Donald;

Presentation Allocated: Oral

abstract: Over 5,200 line-km of aerogeophysical data were acquired over coastal targets in East Antarctica during the 2011/2012 season of the international collaborative ICECAP project, as part of NASA's Operation Ice Bridge. Data types include multi-frequency ice sounding radar, spot and scanning laser altimetry, dual-instrument airborne gravimetry, and magnetics. The Totten Glacier and nearby Moscow University Ice Shelf were prime targets, resulting in 5 km x 5 km and 10 km x 10 km coverage, respectively, when combined with data acquired during the 2010/2011 field season. These data enable three-dimensional structural inversions for seafloor bathymetry that will be used to guide planning activities for forthcoming shipborne surveys of the region. Recent studies using independent, space-based platforms indicate accelerating mass loss around Totten Glacier during the last decade so these new data provide the sub-glacial context for those estimates and extend the record of surface elevation change begun using satellite radar and laser altimetry. Other focus areas include 5 km x 5 km gridded coverage of the David Glacier grounding zone and seven profiles of the Drygalski ice tongue as well as exploratory profiles of the Mertz Ice Tongue, the Ninnis Glacier grounding line, and the Cook Ice Shelf. Gravity-derived, three-dimensional bathymetry and radar thickness and basal characteristics will be presented for the Totten Glacier and sample profiles of the remaining targets will be shown.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Origin of the Conrad Rise in the Southern Indian Ocean and breakup process of the Gondwana

Forename: Yoshifumi Surname: Nogi

Authors: Nogi, Yoshifumi; Sato, Hiroshi; Ishizuka, Hideo; Sato, Taichi;

Presentation Allocated: Poster

abstract: The Conrad Rise in the Southern Indian Ocean between Africa and Antarctic is regarded as one of the LIPs (large igneous provinces) related to upwelling plume activities. However, clear hot spot tracks associated with the Conrad Rise are not well demonstrated and the origin of the Conrad Rise are still unknown. Total intensity and vector geomagnetic field measurements as well as swath bathymetry mapping were carried out during the R/V Hakuho-maru cruise KH-10-7 to understand the tectonic history of the Conrad Rise related to the Gondwana breakup in the Southern Indian Ocean. The dredge rock sampling were also conducted at the Ob and Lena Seamounts in the Conrad Rise during the cruise. Magnetic anomaly signals, most likely indicating Mesozoic magnetic anomaly sequence, are obtained almost parallel to the west of WNW-ESE trending structures just to the south of Conrad Rise inferred from satellite gravity anomalies. Mesozoic sequence magnetic anomalies are also observed along the NNE-SSW trending lineaments between the south of the Conrad Rise and Gunnerus Ridge. Magnetic anomalies originated from Cretaceous normal polarity superchron are found in these profiles, although magnetic anomaly C34 has been identified just to the north of the Conrad Rise. However Mesozoic sequence magnetic anomalies are only observed in the west side of the WNW-ESE trending lineaments just to the south of Conrad Rise and not detected to the east of Cretaceous normal superchron signals. These suggest counter part of Mesozoic sequence magnetic anomalies in the south of Conrad Rise would be found in the East Enderby Basin, off East Antarctica. Moreover, approximately one-third of the dredged rock samples at the Ob Seamount are of metamorphic origin, whereas half of recovered samples are volcanic rocks. Gravity anomaly patters in vicinity of the Ob seamount show broad positive anomalies, and are different from that around the Lena Seamount which show negative gravity anomalies around the seamount. These imply that the Ob Seamount in the Conrad Rise are continental origin, affected by volcanic activities, in between India and Antarctica in the context of the Gondwana and have left behind in the middle of the Southern Indian Ocean by Gondwana breakup process. These results provide new constraints for the initial breakup process of the Gondwana in the Southern Indian Ocean.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Paleoproterozoic suturing and extent of Neoproterozoic rifting revealed in interior East Antarctica

Forename: Fausto Surname: Ferraccioli

Authors: Ferraccioli, Fausto; Armadillo, Egidio; Jordan, Tom; Young, Duncan; Anderson, Lester; Blankenship, Donald; Siegert, Martin;

Presentation Allocated: Poster

abstract: Although East Antarctica is often regarded as a keystone within the Rodinia supercontinent both its position within Rodinia and the extent of Neoproterozoic rifting related to its break-up remains uncertain. Here we present recent aeromagnetic and airborne gravity datasets combined with satellite magnetic and gravity data to unveil the crustal architecture of the Neoproterozoic rifted margin of the East Antarctic shield in the Wilkes Subglacial Basin and Transantarctic Mountains region. We interpret a 1,900 km-long linear magnetic low along the edge of the composite (Proterozoic-Archean) Mawson continent as delineating a major Neoproterozoic rift system, connected to the Adelaide Rift Complex and other broadly coeval rift zones in Australia. Our new magnetic anomaly compilation indicates that Neoproterozoic rocks exposed in the Central Transantarctic Mountains belong to the eastern branch of the rift system, which lies considerably further outboard compared to the western rifts. A residual Bouguer gravity high extends for over 1,000 km along the margin of the western rifts. By analogy with the edge of the Curnamona craton and Mt Isa province in Australia, we propose that the anomaly images an older Paleoproterozoic suture zone, which in turn helped control the extent and location of Neoproterozoic rifting. Neoproterozoic rifting in East Antarctica appears to have been largely amagmatic compared to Australia, Laurentia, or China, where mantle plume-related dyke swarms and large igneous provinces accompanied early extension within Rodinia.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Present stresses and deformations within the Scotia plate: intraplate fault reactivation?

Forename: Jesús Surname: Galindo-Zaldívar

Authors: Galindo-Zaldívar, Jesús; Bohoyo, Fernando; Ruano, Patricia; Lodolo, Emanuele; Maldonado, Andres; Martos, Yasmína M; Somoza, Luis; Suriñach, Emma; Schreider, Anatoly A.; Vazquez, Tomas;

Presentation Allocated: Poster

abstract: The Scotia Arc is the most active tectonic area in Antarctica and the southern oceans, which enclosed two plates: the Scotia plate to the west and the Sandwich plate to the east. They are located between the major South American and Antarctic plates. The Scotia plate is mainly formed by oceanic crust, including thinned continental fragments of the former connection between South America and the Antarctic Peninsula. These small blocks are now located along its northern and southern margins. Magnetic anomalies roughly support that oceanic crust in the western part formed between Late Oligocene and Latest Miocene. At present, the Scotia plate underwent a regional ENE-WSW compression (De Mets et al., 2010), that determines the sinistral motion along the major northern and western transpressional and southern transtensional boundaries. Although tectonic plates may be considered as rather stable blocks, the occurrence in the Scotia plate of moderate magnitude earthquakes, points to a present-day unstable behavior. Seismic profiles nearby the southern boundary of the Scotia Plate evidence oceanic crust intraplate deformations including recent reverse and normal faults. The most interesting feature pointing to Scotia plate instability is the location of the highest magnitude earthquake (1986/12/22, Mw= 6.4) located in the central part. While along the boundaries, the presence of active fault zones with associated seismicity release regional stresses, the central area may probably accumulate the highest stresses, as reveals this intraplate earthquake. Moreover, this epicenter is located nearby the intersection of the Endurance transform fault and an inactive spreading axis. Earthquake is crustal, at 15 km depth, although the far distance to seismic stations implies an uncertainty in the depth determination. Earthquake focal mechanism evidences that the nodal plane with sinistral motion corresponds to the former transform fault. The WNW-ESE orientation of the fault facilitates its present as sinistral reactivation, according to the regional stress field. The seismicity of the central and western Scotia plate evidences that the former crustal weakness structures, such as transform faults, may be reactivated and are suitable to develop active faults in this medium size, largely oceanic plate.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Progress in the Antarctic Seismic Data Library System Spanish branch

Forename: Oscar Surname: Bermúdez

Authors: Bermúdez, Oscar; Bohoyo, Fernando; Barragán, Antonio; Galindo-Zaldivar, Jesús; López-Martínez, Jerónimo; Maldonado, Andrés; Acosta, Juan; Canals, Miguel;

Presentation Allocated: Poster

abstract: In 2008 the National Polar Data Centre of Spain (NPDC) began actions to participate in the seismic data library of SCAR (SDLS), as a response to the needs of the Spanish scientific community and the advantage of international coordination in this field. Ever since the NPDC, in coordination with the Spanish National SCAR Committee (NC-SCAR), has frame the necessary mechanisms to compile and manage the multichannel seismic data acquired by different Spanish research institutions as Instituto Andaluz de Ciencias de la Tierra (IACT, belongs to Consejo Superior de Investigaciones Científicas), University of Granada, Instituto Geológico y Minero de España, Instituto Español de Oceanografía, University of Barcelona and University of Vigo in the last 20 years. The seismic information is stored within the NPDC facilities and currently you can access this information through a computer dedicated solely to the consultation. The scientific data responsibility, NPDC and NC-SCAR are working on drafting a manual of procedure for access to seismic library. Spanish seismic data comprises about 17,000 km of multichannel seismic lines acquired by BIO Hespérides cruises in Bransfield Strait, Pacific Margin of the Antarctic Peninsula and Scotia and Weddell seas. Data belongs to 8 oceanographic cruises; SCOTIA92 cruise developed by the Instituto Español de Oceanografía, COHIMAR(2001) cruise developed by Barcelona University, and 6 cruises developed by the SCAN Group (IACT), ANT92, HESANT9293, SCAN97, ANPAC9798, SCAN2001 and SCAN2004. Nowadays is processed 3056 km DRAKE-SCAN2008 cruise in collaboration with the SDLS and are available on the SDLS website.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Progress in the measurement and improvement of the gravity field in Antarctica

Forename: Mirko Surname: Scheinert

Authors: Scheinert, Mirko;

Presentation Allocated: Oral

abstract: Still large areas of Antarctica are unexplored with respect to gravity measurements. There already exist a lot of - mainly geophysically motivated - gravity measurements, which leave, however, large data gaps. In the view of geodesy there is also the problem of the polar data gap, which arises due to the deflection from a polar inclination of the respective gravity satellite missions, especially GOCE (polar data gap with a diameter of approx. 1,300 km). Also, satellite gravity field solutions are limited to a certain harmonic degree of resolution. For a complete, high-resolution gravity field determination we still need a much more better gravity data coverage in Antarctica. Within SCAR it is the program "Geodetic Infrastructure in Antarctica" (GIANT) of the SSG Geosciences, with its project "Physical Geodesy", which is dedicated to improve the gravity data coverage in Antarctica. Closely related there is an entity of the International Association of Geodesy (IAG), namely the IAG Subcommittee 2.4f "Gravity and Geoid in Antarctica". Thus, it is ensured that a truly international and interdisciplinary cooperation is maintained to work on this task. The presentation will review the present situation regarding the Antarctic gravity data coverage. In this context, airborne gravimetry provides the most powerful technique to carry out surveys in the vast and remote areas of Antarctica. New possibilities for airborne gravimetry in Antarctica shall be presented, like the new German research aircraft HALO. The feasibility of the regional geoid improvement in Antarctica will be investigated, utilizing heterogeneous gravity data available from different surveys and techniques. The linkage to up-to-date satellite-only gravity field models will be discussed. Eventually, an outlook shall be given to the release of a gridded Antarctic gravity dataset, which is foreseen to be realised this year.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Surface Clutter Suppression Experiment using P-band Multi-Channel SAR Ice Sounder Data over Jutulstraumen Glacier

Forename: Chung-Chi Surname: Lin

Authors: Lin, Chung-Chi; Bekaert, David; Gebert, Nicolas; Casal, Tania; Dall, Jorgen; Kusk, Anders; Savstrup Kristensen, Steen; Mosig, Juan R.; Zuercher, Jean-Francois; Forsberg, René;

Presentation Allocated: Poster

abstract: Radar ice sounding allows for the retrieval of ice depth and provides information on basal topography, basal conditions, flow, and layering. In the prospect of a possible future satellite ice sounding mission, surface clutters are expected to severely hamper measurement of weak radar echoes from the depth due to the unfavourable observation geometry. Synthetic aperture radar (SAR) processing enables to attenuate surface clutters in the forward and backward directions, but not in the across-track directions. Thus, additional across-track clutter cancellation is a necessary step for extracting subsurface radar echoes masked by strong surface clutters. ESA's P-band POLarimetric Airborne Radar Ice Sounder (POLARIS), recently upgraded with a larger antenna of 4 m length, enables simultaneous reception of up to 4 sub-aperture channels in across-track. Several datasets were acquired in the multi-channel configuration over East Antarctica during the Danish IceGrav campaign in Feb. 2011. The presentation will mainly concentrate on the description of the POLARIS system and of the different data processing approaches used for clutter suppression. Clutter rejection performance is quantified through comparison with original data. The set of processed sounding data from the complete IceGrav campaign is available on the ESA Earth Observation Campaigns Data site.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: Tectonic implications of the debris flow deposit in the Southern Scotia Sea (Antarctica)

Forename: Lara F. Surname: Pérez

Authors: Pérez, Lara F.; Hernández-Molina, F. Javier; Maldonado, Andrés; Bohoyo, Fernando; Galindo-Zaldivar, Jesus;

Presentation Allocated: Poster

abstract: The Scotia Sea, located eastwards of the Drake Passage, is an oceanic basin bounded by the tectonic elements of the Scotia Arc. East Scotia Ridge is an active spreading centre that separates the Scotia and the Sandwich plates. The North Scotia Ridge and South Scotia Ridge represent the northern and southern plate boundaries, whereas the Shackleton Fracture Zone located westward represents the Scotia-Antarctica plates boundary. An important set of small oceanic basins (Protector, Dove and Scan, from west to east) separated by submerged banks of continental nature, have been developed since the Miocene in the southern most sector of the Scotia Sea. An important geophysical dataset, including multichannel seismic profiles (MCS), has been acquired during the SCAN1997, SCAN2001 and SCAN2004 cruises on board of the BIO Hespérides vessel. The main objective of this study is to establish a stratigraphic correlation between debris flow deposits observed within the sedimentary record in each oceanic basin. The post-rift sedimentary record of the Southern Scotia Basins can be characterized by five main regional sedimentary units. According with previous works, these units can be grouped into two differentiated sets, separated by a regional stratigraphic discontinuity denominated Discontinuity-c. The two lower units depict different facies into each basin. Nevertheless, the three upper units can be correlated basin to basin. The seismic facies that characterize the debris flow deposits are usually identified in the MCS profiles. The debris flows deposits are usually located in the western flank of the basement highs. The deposit size and thickness increase eastwards; this is, the Scan Basin debris flow deposits are more abundant and greater than those of the Protector Basin. Into the stratigraphic record, most of the debris flows deposits are concentrated above the Discontinuity-c. However, in the Dove Basin and especially in the Scan Basin several debris flows are located in Unit IV. The preferential distribution of debris flows in the western margin of the basement highs and the eastwards increase in the abundance and size of debris flows may be related to the local deformation due to the influence of the Scotia-Antarctica plate boundary and the East Scotia Ridge. In addition the preferential debris flows position in the stratigraphic record above Discontinuity-c is indicative of the timing of the deformation and the evolution of the basins and the Scotia Arc.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: The aeromagnetic survey of Deception Island, South Shetland Island, by autonomous unmanned aerial vehicle, Ant-Plane 6-3

Forename: Minoru Surname: Funaki

Authors: Funaki, Minoru; Higashino, Shin-ichiro; Sakanaka, Shinya;

Presentation Allocated: Poster

abstract: It is expected that an autonomous unmanned aerial vehicle (UAV) contributes to a safe and economical airborne survey in the risky area, such as the polar region or active volcanos. We developed UAV, so called Ant-Plane, to be used at the coastal regions of Antarctica in the summer season. Ant-Plane 6-3 is a pusher type UAV having 2.89 m in span with 86 cc gasoline engine. The weight is 30 kg (20 kg for dry) including 10 liters of gasoline and 2 kg of payload. The plane flies along waypoints, consisting of latitude, longitude, altitude and speed, controlled by an onboard computer. An onboard magnetometer system (525g in weight, 0.5 W) consisting of 3-axes fluxgate magnetometer, data logger and GPS, and a digital video camera are stored in the nose of airframe. The sensor of magnetometer was attached at the tip of aluminum pipe of 1 m length that was extended forward from the nose to avoid the magnetic noise of airplane. Deception Island is located in Bransfield Strait between Antarctic Peninsula and South Shetland Island and was formed by volcanism resulting from opening structure of Bransfield Strait. The aeromagnetic survey in this study was carried out above Deception Island due to lack of the precise magnetic data in the island. December 18, 2011, Ant-Plane 6-3 took off from the glacier behind St. Kliment Ohridski (SKO) Base (Bulgarian Antarctic Station, Livingston Island, South Shetland Island) which is 35 km from Deception Island. The flight was 302 km in distance, 3 hours 38 minutes in time and 800 m in altitude. Twelve survey lines of 18 km in length of the parallel to latitude were set to the N-S direction within 10 km in distance, where the first 2 lines and the last 2 lines were same courses but they were anti parallel directions each other. Namely, the interval of survey lines was 11.1 km. As the heading of airplane was unknown, a total magnetic field was used for analyses of the magnetic anomaly. The variation of magnetic field was more than 2000 nT at 800 m in altitude. The positive anomaly appeared at the east side of island where is concordant to the highest topography. The negative one appeared at the ocean of the N-W area of the survey area. The aerial photographs revealed the volcanic and glacial topography of the northern half of Deception Island. However, the survey in the southern half of Deception Island was not conducted due to bad weather for UAV flight.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: The development of the Weddell Sea: the premature demise of a spreading center.

Forename: Lawrence Surname: Lawver

Authors: Lawver, Lawrence; Ghidella, Marta; Gahagan, Lisa; Lavier, Luc;

Presentation Allocated: Oral

abstract: Using the only unambiguously identified magnetic anomalies in the Weddell Sea, chrons C33n/C33r/C34 as markers, synthetic flowlines were calculated from major plate motions between South America (SAM) and Africa (AFR) and between AFR and East Antarctica (ANT). The flowlines produce a remarkable match with satellite-derived gravity "fracture zone" lineations (Sandwell and Smith, 2009) between C33r/C34n to near where the present day SAM - ANT spreading center should be. Our synthetic flowlines imply that a present day SAM - ANT spreading center should still exist south of the South Sandwich Fracture Zone in an area that has high heat flow, ~ 180 mW/m². The narrow strip of SAM plate was separated from the main SAM plate by the recent, rapid, eastward motion of the South Sandwich trench and plate. A still active spreading center should be apparent from seismic events but there are no epicenters along what should be the remnant, spreading center. While the lack of apparent teleseismic events and the lack of the tell-tale gravity low associated with many abandoned spreading centers argue against an abandoned spreading center, synthetic magnetic anomalies, generated using the major plate motions give an excellent match for anomalies younging from the C33r/C34n marker to magnetic anomalies as young as C5c (~ 16 Ma). The marine magnetic anomaly locations agree quite well with the flowline picks for anomalies ranging from C25 (~ 56 Ma) to C5c. In addition, there is one match between the synthetic and marine magnetic anomalies crossing the possible spreading center, with the presumptive match extending out to C4 (~ 7.5 Ma). All of the magnetic anomaly matches younger than C25 disagree with the previously published interpretations for anomalies in the northwest Weddell Sea. Those interpretations generally assumed that the ANT - SAM spreading center was subducted at Jane Bank by 20 Ma. The very rapid eastward motion of the South Sandwich Trench with respect to the major plates, isolated this fragment perhaps only within the last few million years, isolating the very long and narrow sliver of the SAM plate. This strip may have been too young and warm to continue as an independent small plate. Since the bathymetry changes character close to where the relict spreading center should be, this suggests that the former SAM plate fragment may have deformed as the SAM - ANT spreading slowed and then ceased. Any related subduction beneath Discovery Bank would have also ceased.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: The East African-Antarctic Orogen in central-eastern Dronning Maud Land: new geological and geophysical mapping of previously untouched areas between Sør Rondane and Wohlthat Massif

Forename: Joachim Surname: Jacobs

Authors: Jacobs, Joachim; Laeufer, Andreas; Damaske, Detlef; Jokat, Wilfried; Riedel, Sven; Mieth, Matthias; Elburg, Marlina; Estrada, Solveig;

Presentation Allocated: Oral

abstract: East Antarctica probably formed by amalgamation of a number of cratons along distinct Ediacaran mobile belts, including the ca. 600-500 Ma East African-Antarctic Orogen that dissects Dronning Maud Land. In East Antarctica, the spatial mapping of both cratons and mobile belts is challenging because of its vast ice cover; it requires combined geological-geophysical approaches. During the international expeditions Geodynamic Evolution of East Antarctica (GEA) I + II in the austral summers 2010/11 and 2011/12, the southeastern continuation of the East African-Antarctic Orogen through Dronning Maud Land was investigated. The work in the mountains included structural fieldwork, a geochronological-geochemical sampling program and a susceptibility survey of the main rock types. This work was accompanied by a major aero-geophysical program. The structural and geophysical work revealed the eastern margin of the orogen in southwestern Sør Rondane as a major dextral transpression zone. For the first time ever, a number of major nunataks between the Sør Rondane and the Wohlthat massif were studied. These include a number of major nunataks from Blåklettane and Bergekongen in the E to Urna and Sørsteinen in the W. This area might form a key in the understanding of the southern continuation of the East African-Antarctic Orogen into East Antarctica. This area is typified by a very distinct aeromagnetic signature, oriented oblique to the main trend of the orogen. The rock assemblage found include a medium- to high-grade supracrustal package, including significant occurrences of graphite bearing schists, metacarbonates and metavolcanic rocks. This package is intruded by various meta-igneous rocks of which a voluminous late-tectonic granitoid suite marks the final stage of the orogeny. The age of the metasupracrustal sequence is so far unknown but might correlate with similar rocks in western Sør Rondane that have Neoproterozoic ages and might represent relics of the Mozambique Ocean. In this presentation we summarize our field results, complemented by first geophysical interpretations and new geochronological findings.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: The Herdman Bank: a remote key piece of the Scotia Arc evolution

Forename: Fernando Surname: Bohoyo

Authors: Bohoyo, Fernando; Galindo-Zaldívar, Jesus; Larter, Rob D.; Larter, Phil T.; Maldonado, Andres; Suriñach, Emma; Schreider, Anatoly A.;

Presentation Allocated: Oral

abstract: The Herdman Bank is a complex tectonic structure located near a ridge-transform fault triple junction, formed by the southernmost East Scotia Ridge along which the Scotia and Sandwich plates are separating, and the eastern end of the transform Scotia-Antarctic plate boundary. This bank shows differences in nature and origin with respect to other banks in the Scotia Arc such as the South Orkney microcontinent, and Terror, Bruce, Pirie, and Discovery banks. The remote location of Herdman Bank and the scarce geophysical data has previously prevented discussion of its origin. The revision of previous geophysical data from the Spanish SCAN97 cruise (1997), the British Antarctic Survey BAS845 (1985) and global data sets allows to describe the structure in more detail and point out the additional data needed to fully constrain its nature and age. Multichannel seismic profiles SM17 (SCAN97 cruise) and BAS845-19 (BAS845) together with bathymetry data (swath bathymetry from SCAN97 and derived from satellite, Smith and Sandwell, 1997) shows a horst structure cut by stepped normal faults and bounded by main transform faults to the SW and to the NE. It is bounded to the east by a rifted margin facing the East Scotia Ridge. The Bank has high elevations of between 1500 and 2500 m over the surrounding seafloor and reaching less than 600 m below sea level. It does not have a thick sediment cover. Seismic data do not reveal internal reflectors, suggesting an igneous nature. Additional gravity and magnetic modeling, from SCAN97 and BAS845 data, will permit characterization of the bulk density and magnetic signature of the Bank. The seismicity information from NEIC (Engdahl et al., 1988) and CMT (Dzienwonski et al., 1981) global databases in the sector help to characterize the kinematics of the tectonic structures. The Herdman Bank appears to be bounded by two NW-SE trending transform faults. Between these transform faults, there are numerous earthquake epicenters which indicate deformation, possibly extensional, of the Bank. These data support an igneous origin for the Bank. We discuss possible origins of the Bank as an oceanic spreading centre or as part of a remnant early Sandwich volcanic arc and its relationships with the active East Scotia Ridge Spreading centre.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 33

Title: The Polar Geospatial Center's Management of Antarctic Spatial Data, Imagery, and Maps

Forename: Brad Surname: Herried

Authors: Herried, Brad; Juntunen, Thomas; Porter, Claire; Summers, Katherine; Sigler, Chad; Swanson, Matt; Morin, Paul;

Presentation Allocated: Poster

abstract: The Polar Geospatial Center (PGC), at the University of Minnesota, is funded by NSF to provide geospatial support to the United States research mission in polar regions. Support to researchers and logistics communities includes satellite imagery delivery, on-demand mapping, and spatial analysis. Our users require a wide range of spatial data types and products, making it vital that the data be effectively managed, documented, and accessible. For Antarctica, the PGC holds a repository of remote sensing data (e.g. 300,000+ historical trimetrogon aerial photographs, half-petabyte of DigitalGlobe and GeoEye commercial satellite imagery, etc.), historic and contemporary digital Antarctic maps (e.g. U.S. Geological Survey topographic maps, nautical charts, research planning and navigation maps, etc.), and coordinate datasets (e.g. United States' placenames, COMNAP facilities, survey control collection, etc.). The data are cataloged, maintained, and archived to ensure quick access, continued use, and longevity. Specifically, the data are hosted on a redundant spatial database infrastructure using open-source and commercial tools via map/imagery catalogs and relational database management systems (RDBMS). The database and server structure serve as a back-end for the archiving, metadata attribution, and organization of spatial data while front-end tools such as web applications and web-enabled database querying (e.g. map and imagery searches) allow access to the wealth of spatial data available to researchers and the general public. Furthermore, the management system allows for science and operations to be conducted with relevant spatial data centralized and maintained in one center. With a management system in place, the Antarctic community has quick access to organized and available spatial data products that monumentally assist in field planning, safety, site selection, and analysis from the Polar Geospatial Center.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Actions of the Spanish National Polar Data Centre (NPDC)

Forename: Oscar Surname: Bermúdez

Authors: Bermúdez, Oscar; Barragán, Antonio;

Presentation Allocated: Poster

abstract: The aim of this paper is to disseminate the proceedings of the National Polar Data Centre (NPDC). These projects are part into four areas: (i) disclosure of the activities of the NPDC within the scientific community. The NDPC has organized a round table of Antarctic data management at the VIII Symposium on Polar Research in September 2011, Palma de Mallorca (Balearic Islands) with the participation of members of the executive of SCAR Standing Committee on Antarctic Data Management(ii) collaboration on projects and initiatives supporting national and international technical their developments. The NDPC is actively involved in the project International bathymetric chart of the Southern Ocean (IBCSO) and BAT-DRAKE Spanish project, (iii) the generation of metadata records management and raw data by the Spanish Policy of Antarctic Data. The NDPC continues to identify and generating metadata to provide a support service for researchers, and (iv) implementation of new technologies and the development of systems for the maintenance of information held in the NPDC. During the year 2012 will implement a national digital repository as a focus of scientific and bibliometrics and scientometric studies, and evaluation of scientific activity.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: DEVELOPMENT OF UKRANIAN NATIONAL ANTARCTIC DATA CENTRE

Forename: Vladimir Surname: Litvinov

Authors: Litvinov, Vladimir; Moroz, Igor; Globa, Larysa; Novogrudskay, Rina;

Presentation Allocated: Poster

abstract: The paper reviews the main approaches to designing of the National Antarctic Data Centre - Internet knowledge-portal. Basic modern technical solutions, underlying software and hardware complex of the portal are discussed. In particular, emphasis is made that development of a united information environment of Antarctic research data will provide significant economic benefits because of their unique data. Functionally, the National Antarctic Data Centre will develop a unified information environment for presenting the results in fields of Antarctic research of Ukrainian scientists in the Internet environment; provide the single access point to all kinds of scientific resources; use of basic approaches such as: simultaneity of system development, implementation and use of data while providing simultaneous operation of all scientists; standardization of common components of information processes; integration as a method of interaction of individual components; intellectualization as a method of necessary analytical and statistical data computing. The process of the Antarctic research involved a large group of Ukrainian scientists and a number of prominent educational and research institutions. However, there is a problem of access to the results obtained and further processed. There is a process of knowledge concentration in certain fields of science, and they are available only to a narrow circle of scholars and specialists. It is very important negative factor in the process of access to knowledge such as poor and weak ordering and structuring of large amounts of information in the currently existing storage systems. In connection with all mentioned above the urgent task is to hold the generalization, classification, reduction to a single format of the data, and on this basis, enabling them to use a wide circle of knowledge for domestic and foreign scientific community, for whom they are intended. To solve these problems it is proposed to construct specialized knowledge Internet-portal for work with big amounts of various informational and computational resources in a definite technical sphere. Such kind of portal can not only give the possibility to search and systematize the information, but can also help to realize definite computational user's tasks. The aim of this research is to improve access to Antarctic scientific knowledge by means of designing specialized Internet portal of Antarctic research knowledge.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Digital tools to identify Antarctic marine life – Atlas of Antarctic Bryozoa
(www.antarcticbryozoa.net)

Forename: Piotr Surname: Kuklinski

Authors: Kuklinski, Piotr;

Presentation Allocated: Poster

abstract: Identification of many groups of Antarctic organisms are causing problems and are limited to specialist. Specialized literature was often published in the last century and usually contains information which are currently not relevant. Also taxonomical literature is often scattered in many sources which makes search time consuming. Web based taxonomy is offering easy access to various sources of data as well as a great platform for building tools which will enable fast identifications of organisms. Here I present web based Atlas of Antarctic Bryozoa - one of the most specious benthic Antarctic macrofaunal group. The Atlas gathers all the information scattered in numerous publication and institutions worldwide. It will act as specialized tool for identification of this aquatic organisms, for broad spectrum of end users including students, environmental managers, ecologist as well as professional taxonomists. It contains original descriptions of the species, numerous electron scanning microscopy images of both type and no type material, distributional maps link to SCARMarbin data base. Atlas also aims to be a source of all the existing literature for each Antarctic bryozoans species.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Freely available geographic information sources for Antarctica: Status and new developments in SCAR-SCAGI products.

Forename: Adrian Surname: Fox

Authors: Fox, Adrian; Pirlot, Jean-Yves;

Presentation Allocated: Oral

abstract: The Weddell Gyre is the main location of deep water formation and sequestration of carbon, nutrients and atmospheric gases in the Southern Ocean. Dense waters formed on the Antarctic continental shelf spill down the slopes entraining surrounding water masses as they descend. The waters travel northward along the western boundary before being exported to the mid-latitude Southern Ocean and spreading globally at depth. These processes are critically reliant on the regional freshwater balance, as at low temperatures density, and by extension stratification, circulation and deep water formation, depends largely upon salinity. We investigate the freshwater composition of water masses entering and exiting the Weddell Sea through comprehensive measurements of the stable isotopes of oxygen ($d18O$). At high latitudes, $d18O$ combined with salinity data enables the partitioning and quantification of freshwater from meteoric (glacial ice melt, precipitation) and sea-ice melt sources. In this region, the $d18O$ pure source glacial and non-glacial freshwater endmembers are sufficiently well-constrained to enable quantification of their exports to be carried out by this method. Two full-depth hydrographic cruises conducted as part of the UK ANDREX project combined with the US I6S cruise allowed the formation of a box around the Weddell Gyre. Individual box import and export of the different forms of freshwater and from the Gyre into the global oceanic thermohaline circulation were quantified by solving the component mass balance for each water sample and combining with calculated velocity fields. Meteoric water is found to be the dominant freshwater source near the surface, accompanied by a maximum in sea-ice melt. Distributions are observed to track the circulation of Antarctic Bottom Water; relative maxima for meteoric water at depth suggest the presence of sizable contributions of shelf waters during water mass formation, whilst negative sea-ice fractions suggest its formation as part of the same process. Large quantities of freshwater are observed to enter the Weddell Gyre from the east as part of the Antarctic Slope Front. Combined with transient tracer data, water mass ages and source location fractions are determined, enabling the assessment of freshwater fluxes within the Weddell Gyre. The context of these results with regard to implications for controls on ocean circulation and climate against a background of a changing hydrological cycle are discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: IDIPOS: a feasibility study for an Italian Database Infrastructure for Polar Observation Sciences

Forename: Vincenzo Surname: Romano

Authors: Romano, Vincenzo; Salvati, Alberto; Rafanelli, Claudio; Coco, Iginio;

Presentation Allocated: Oral

abstract: Since long time the Italian Antarctic Program (PNRA) supports and funds scientific and technological activities addressed to the realization, the upgrade and the maintenance of the infrastructure and instruments used to monitor the Sun-Earth system in the polar regions. This paper describes the first results of IDIPOS project, recently approved by PNRA, addressed to realise a feasibility study for an hardware and software infrastructure that would allow the creation of relational databases of digital acquisitions from past and current experimental measurements performed in polar areas. The feasibility study is based on some fundamental characteristics of the infrastructure: its implementation in Italy with locations across the country and its integration with the existing or future telematics infrastructures to be realized at the Italian polar bases. The project aim is to propose a modern and high-tech infrastructure dedicated to the data treatment, accessibility and archiving, accordingly to the international standards. Such infrastructure, allowing a modern, fast and reliable treatment of the acquired data, is crucial during the planning phase of the scientific and monitoring activities of the PNRA, mostly of them included in SCAR projects, IPY (International Polar Year) and in the frame of international cooperation. In the first phase of the project the observations involved are those related to research projects within the following PNRA sectors: "Geodesy and observatories", "Glaciology", "Atmosphere physics and chemistry", "Sun-Earth Relations and Astrophysics", "Technology". The infrastructure will be planned to be potentially extensible to other observational activities.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Improving Access and Discoverability and Use of Antarctic Geoscience data through GeoMapApp

Forename: Frank O. Surname: Nitsche

Authors: Nitsche, Frank O.; Carbotte, Suzanne; Ferrini, Vicki; Ryan, W.B.F.; Arko, Robert; Bonczkowski, Julie; Morton, John; O'Hara, Suzanne; Chan, Samantha; Goodwillie, Andrew; McLain, Kevin;

Presentation Allocated: Keynote 20 mins

abstract: It was an experience of a lifetime, truly to the end of earth, away from civilization. We were to be a big multinational family of Indians, Russians, Koreans, Norwegians & Germans. It seemed a never ending sojourn with incessant rolling/pitching/yawing crossing the roaring 40s/furious 50s/shrieking 60s, truly exhilarating/humbling. I drew great inspiration from the tiny birds which flew with no respite for 1000s of miles, undeterred by the perils of nature. The whales made way for penguins, blue warm oceans made way to frozen Southern Ocean, vast strength of fast ice dumbfounded us & numbed the engines of our expedition vessels. We finally reached our destination-Larsemann Hills, Antarctica & got busy with multifarious tasks. What seemed like 'eternal day' with no time/day night demarcation brought new excitement & challenges. As Medical Officer, it was not only my duty to look after the physical health, but holistic mental/emotional social/ spiritual health, with an added new portfolio "Cultural Secretary". It was no mean task to work in the isolated icy continent, day in/out, away from our families friends, in an entirely new multinational-multicultural society, which seemed to be the ultimate physical and mental endurance test. The monotony of long periods of strenuous tasks/interdependence between members drawn from different backgrounds of colour/creed/language/culture posed huge challenges. As the Cultural Secretary, it was my onus to cross all these boundaries & make this an enjoyable experience, come what may! Blizzards/gales/katabatics white outs came, so did birthdays/anniversaries, myriad of festivals-Diwali/Id Christmas New Year/Holi/National holidays. We not only strolled with penguins seals, but invited Chinese, Russians, Australians & organized multinational Cross Country/Tug of War! It was a great opportunity to interact/build lasting friendships & realize how inherently social/peace loving we are, despite color/creed/geographic boundaries! All these thoughtfully planned cultural and recreational activities besides yoga proved to be healthy stress busters. The untouched pristine beauty peace/raw rustic challenges of Antarctica touched each of our lives in its own special way. Nature is not only a source of great delight, but a powerful teacher too-penguins teach us the importance of caring/nurturing in the most hostile environs; necessity teaches interesting, innovative ways of finding joy and harmony, as we tread along our journey, no matter how treacherous the terrain!

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Italian Metadata Polar System

Forename: Simona Surname: Longo

Authors: Longo, Simona; Nativi, Stefano; Leone, Corrado; Migliorini, Sonia; Mazari Villanova, Luigi;

Presentation Allocated: Poster

abstract: The Italian Antarctic Research Programme (PNRA) is a government project funding and coordinating scientific research activities in polar regions. PNRA manages two scientific Stations in Antarctica - Concordia (Dome C), jointly operated with the French Polar Institute "Paul Emile Victor", and Mario Zucchelli (Terra Nova Bay, Southern Victoria Land). In addition National Research Council of Italy (CNR) manages one scientific Station in the Arctic Circle (Ny-Alesund-Svalbard Islands), named Dirigibile Italia. PNRA started in 1985 with the first Italian Expedition in Antarctica. Since then each research group has collected data for each kind of research, autonomously with different formats. In 2010 the Italian Ministry of Research assigned the scientific coordination of the Programme to CNR, which is in charge of the management and sharing of the scientific results carried out in the framework of the PNRA. With the acknowledgement of this directive, CNR has provided skilled personnel and facilities, in order to spread the importance of storing and publishing metadata in real time. Therefore, CNR is establishing a new distributed cyber(e)-infrastructure to collect, manage, publish and share polar research results. This is a service-based infrastructure built on Web technologies to implement resources (i.e. data, services and documents) discovery, access and visualization; semantic-enabled functionalities will be provided too. The new infrastructure is provided with SOS service which allows real time updates on data and metadata directly from remote sensors. Furthermore, CNR will offer a new historical catalog of polar metadata federated into the new digital infrastructure. The architecture applies the "System of Systems" principles to build incrementally on the existing systems by supplementing but not supplanting their mandates and governance arrangements. This allows to keep the existing capacities as autonomous as possible. This cyber(e)-infrastructure implements multi-disciplinary interoperability following a Brokering approach, supporting SCAR data policy and in accordance with European and international standards, including GEO/GEOSS, INSPIRE. The Brokering approach is empowered by a technology developed by CNR, advanced by the FP7 Euro GEOSS project, and recently adopted by the GEOSS Common Infrastructure (GCI).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Managing Marine Data – Latest Developments at the British Antarctic Survey

Forename: Gwen Surname: Buys

Authors: Buys, Gwen; Tate, Alexander;

Presentation Allocated: Oral

abstract: The British Antarctic Survey (BAS) collects a wide range of marine data each year with its dedicated research vessel the James Clark Ross (JCR). These data go on to be used by scientists both within and external to BAS. It is imperative that the data are sufficiently described and managed so that they can be easily discovered, accessed and interpreted by interested parties. In order to achieve this goal the BAS Polar Data Centre (PDC) is working on a range of systems to aid marine data management and dissemination. In conjunction with the British Oceanographic Data Centre (BODC) a system is being developed for the JCR to enable efficient recording and transfer of all deployments for each cruise. This will have the benefit of standardising records for all JCR cruises, streamlining the transfer of information to the BODC and enabling scientists to quickly assess whether a certain cruise may have data they are interested in. In the past data from the JCR originating from different scientific disciplines has been managed separately. As a first step to developing a more combined approach to marine data management the PDC intends to create a collection of cruise tracks for all JCR cruises. Collating this spatial information for historic cruises will form the foundation of a first stop reference system for BAS marine data. Marine geophysical data is collected on a large proportion of JCR cruises. The BAS Geophysics Data Portal was set up in 2008 to enable discovery and download of multibeam swath bathymetry, sub-bottom profiler and magnetic data from JCR cruises. In its current state the portal is not up to date and has limited functionality. The PDC aims to improve this by: adding all historic JCR cruises which collected geophysical data, improving the metadata available on the portal and adding links to additional metadata, adding track line interrogation functionality and increasing the number of available data download formats to suit different users. It is hoped that these systems when working in conjunction with each other will greatly improve the ease with which BAS marine data can be discovered by and disseminated to scientists worldwide.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: ONLINE FORECAST SYSTEM FOR INDIAN STATION OPERATIONS in ANTARCTICA

Forename: SAKTHIVEL Surname: SAMY

Authors: SAMY, SAKTHIVEL; K, Satheesan;

Presentation Allocated: Poster

abstract: ONLINE FORECAST SYSTEM FOR INDIAN STATION OPERATIONS in ANTARCTICA. Forecasts of the weather over the Antarctic have been made since the first expeditions to the continent. Dissemination of weather forecast in the early stages was using the conventional methods. Weather observations are usually condensed into coded figures, symbols and numerals and are transmitted via radiophone, teletype, facsimile machine or telephone. The forecasts are then aired in various radio stations by telephone or sent by telefax machines. They are also furnished to different media outlets. The development of instant communications, remote sensing, and computers brought a sea change in communicating weather forecast and its fast dissemination. The recent advances in Information and Communication Technology (ICT) and display of weather information will be fully utilized for our stations in Maitri and Larsemann Hills in Antarctica with help of Internet facilities are available. Works for real-time forecast of the weather in Antarctica to support the operations of the Indian Stations have been initiated. The output from the mesoscale model WRF generated by Scientists at NCAOR will be used for the above work and following software modules are proposed as:- 1. Model fields updated every 1-3 days forecast 2. In-situ Observation Data 3. Past model output for one week 4. Generation of Statistics 5. Comparison with Observations. This system will make use of the data collected by instruments installed at the station and mesoscale model WRF output generated by the Atmospheric Science Group and the expected results could be such as 24 hours live temp, current wind direction, wind distribution for past 24 hours, cloud height and etc.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Rewarding data publication: ipt.biodiversity.aq

Forename: Anton Surname: Van de Putte

Authors: Van de Putte, Anton; Danis, Bruno; Chavan, Vishwas;

Presentation Allocated: Keynote 20 mins

abstract: Easy access to expert information on Antarctic Biodiversity is a prerequisite for improving related science, conservation and management. This information is progressively made available through specialized web platforms, such as the Antarctic Biodiversity Information Facility (www.biodiversity.aq). Here, we present an element of ANTABIF, in the form of a novel tool designed to reward the publication of raw data by the community: the GBIF Integrated Publishing Toolkit (ipt.biodiversity.aq). The IPT is a new online interface, developed by the Global Biodiversity Facility (GBIF), that allows researchers to prepare and clean their dataset as well as publish metadata and primary biodiversity data (checklists, occurrence data) when they wish to. Rather than a centralized data portal, users are able to publish data residing in local databases, upload existing files in various formats, and access central services to make use of standardized controlled vocabularies and data quality reporting services. The IPT offers interfaces to transfer complete resource archives efficiently in order to reduce the latency between data publication and discoverability through the GBIF indexes. With an embedded database and web application, the IPT is an open platform to build upon, offering additional services and benefits both to the biodiversity data holders and users. The IPT also includes a web application to browse and search published data. An important feature of the IPT is the automatic generation of a manuscript describing the submitted dataset (a Data Paper). The aim is to give due recognition to efforts by scientists and institutions making data accessible to the wider scientific community. The manuscript can be submitted to a scientific journal (such as PhytoKeys, ZooKeys, BioRisk, Neobiota, Biodiversity Data Journal and Nature Conservation) for peer review and possible publication. As well as providing potential benefits to the metadata publisher through citations of the article, the system will alert scientists and other users about the availability and "fitness for use" of new biodiversity data resources. While the current scope is limited to biodiversity data, such an approach could extend towards other data types, allowing a better cross disciplinary discovery and exchange of data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Spain in international cooperation in Antarctic research through scientific publications (2008-2009)

Forename: Oscar Surname: Bermúdez

Authors: Bermúdez, Oscar; Alonso, Francisco;

Presentation Allocated: Poster

abstract: The objective of this work is to identify, quantify and representing collaboration among Spain and different countries by means of the scientific production result of their investigations. To achieve this objective authors have employed techniques of bibliometric and network analysis. Queries from Thomsom Scientific's Science Citation Index database have result into 3857 scientific articles. The social network of international collaboration in scientific output over Antarctica consists of 84 countries. These include representation from 28 countries signed the Antarctic Treaty. The position on the network structure is a result of the relationship of each node with the other. The positions are focused on the net positions of social power (eigenvector). Countries with lower levels found in peripheral positions. A total of 25 countries are the k-core(17), who have collaborated with at least 17 different countries. Ten of them are signatories to the Antarctic Treaty, among which is Spain, and the 7 countries which are not included the position of Canada and Switzerland. The country with the highest degree and a more central position is the U.S. with UK, Netherlands, New Zealand and Germany. In a medium level of grouping are four distinct aggregates. The largest is the 43% of the countries and among which 71% of the Antarctic Treaty consultative members. Note the presence in this cluster of institutions in countries such as Madagascar (Université d'Antananarivo) and Botswana (Centre for Governance of Knowledge and Development). Bradford's law applies to Antarctic scientific output 2008-2009 and that more than 33% (N = 3856) of the articles have been published in 3% of the magazines. In this core journal Polar Biology publication is the largest number of items. Exististen themed magazines Antarctic (Antarctic Polar Biology andScience) and not others, such as Nature with a 1.31% dedicated to this area, or Journal of Glaciology with 34.46% of its content dedicated to the Antarctic environment, or as Quaternary Science Reviews or Geophysical Journal of Research and Deep-Sea Research with percentages above 10% of its content dedicated to the Antarctic research.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: The Antarctic Biodiversity Information Facility: what can it do for you?

Forename: Bruno Surname: Danis

Authors: Danis, Bruno; Van de Putte, Anton;

Presentation Allocated: Poster

abstract: ANTABIF, the Antarctic Biodiversity Information Facility offers free and open access to Antarctic biodiversity data. It takes the form of an innovative set of web platforms giving access to a distributed network of contributing database, according to the principles of the Global Biodiversity Information Facility (GBIF). Building on the grounds of SCAR's Marine Biodiversity Information Network, ANTABIF is building a set of new data discovery tools using an advanced technical infrastructure, capable of linking with many potential data resources, and of presenting them in many different contexts. This presentation will focus on the ANTABIF features, and will showcase how its components can be used to access existing data, but also to publish and present information online in a coherent way. For example, the Data Paper concept will be introduced, as a feature of the Integrated Publishing Toolkit (IPT), which is a component of the infrastructure. Also, several community-driven products, such as the Antarctic Field Guides, the Biogeographic Atlas of the Southern Ocean will be presented, showing how the many contributions flowing into the information systems can take advantage of enhanced interoperability and openness. New perspectives will also be introduced, improving the fitness for use of the Facility for scientists, but also for the general public and policymakers.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: The Antarctic Master Directory (AMD): Discover, Access and Contribute Antarctic Data Sets, Related Services and Climate Diagnostics

Forename: Alicia Surname: Aleman

Authors: Aleman, Alicia; Ritz, Scott; Stevens, Tyler; Morahan, Michael; Cepero, Laurel; Olsen, Lola;

Presentation Allocated: Oral

abstract: The Antarctic Master Directory (AMD), hosted by NASA's Global Change Master Directory (GCMD), serves as the central repository for all Antarctic data set descriptions maintained by the National Antarctic Data Centers (NADCs). The AMD provides access to over 7500 Antarctic data set descriptions covering various science disciplines, including: Oceans, Paleoclimate, Cryosphere, Climate Indicators, Atmosphere and Solid Earth. Access to Antarctic and polar data related service descriptions and climate diagnostics are also available. Users can search for Antarctic data set descriptions by using controlled keywords and/or free-text and further refine the query by geospatial and temporal ranges. An online metadata authoring tool, docBUILDER, enables AMD users to create and maintain data set, service and climate diagnostic records within the website. Controlled keywords (which include science keywords, service keywords, data centers, projects, location, data resolution, instruments, platforms and visualization/analysis type) help users accurately characterize their data and also provide for a normalized search. An update to the GCMD's search functionality is planned to further capitalize on the controlled vocabularies while performing database queries. By implementing a dynamic keyword "tree", users may search by combining keywords in new ways - enabling more relevant and efficient database searches. The AMD will also be able to take advantage of this new functionality once beta testing on the main GCMD site is complete. <http://gcmd.nasa.gov/portals/amd/>

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: The Role of SCADM in Promoting and Curating the Vital Data Legacy of Antarctic Science

Forename: Taco Surname: De Bruin

Authors: De Bruin, Taco;

Presentation Allocated: Poster

abstract: Preservation of and free access to Antarctic data is key to the further development of Antarctic science. The SCAR Standing Committee on Antarctic Data Management (SCADM) coordinates the development of the Antarctic Data Management System (ADMS), which aims to provide centralized access to a repository system of distributed sources of Antarctic data. The focus of the work of SCADM is on the implementation of the SCAR Data and Information Strategy (DIMS) and further development of the ADMS as defined in the Strategy document. The presentation will give a short introduction of SCADM, comprising of representatives of the National Antarctic Data Centres or national points of contact, and of its main activities. It will then focus specifically on the DIMS Implementation Plan activities and on the outcomes of the recent SCADM meeting, such as the development of a best practices guidance document for the DIF metadata format, improvement of Antarctic data management communications, data management for the Southern Ocean Observing System (SOOS) and the links with the SCAR science community and the CODATA-initiated Polar Information Commons (PIC). Towards the end, the presentation will provide a vision of future sharing and preservation of Antarctic data.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 34

Title: Utilizing the Antarctic Master Directory to find orphan datasets

Forename: Juliet Surname: Bonczkowski

Authors: Bonczkowski, Juliet; Carbotte, Suzanne; Arko, Robert A; Nitsche, Frank O.; Grebas, Stephanie K;

Presentation Allocated: Poster

abstract: While most Antarctic data are housed at an established disciplinary-specific data repository, there are data without suitable repository. In some cases, these “orphan” data are served from local servers by the principal investigators. There are many pitfalls with data served privately, including lack of adequate documentation and the impermanence of personal web sites. To ensure continued availability of data, submission to long-term national data repositories is needed. The US National Science Foundation Office of Polar Programs (NSF/OPP) requires investigators to submit their data for curation and long-term preservation. This includes the registration of a dataset description into the Antarctic Master Directory (AMD), <http://gcmd.nasa.gov/Data/portals/amd/>. The AMD is a Web-based, searchable directory of thousands of dataset descriptions, known as DIF records, submitted by scientists from over 20 countries. The US Antarctic Program Data Coordination Center (USAP-DCC), funded through NSF/OPP, was established in 2007 to help streamline the process of data submission and DIF record creation. When data does not quite fit within any existing disciplinary repository, it can be registered within the USAP-DCC as the fallback data repository. Within the scope of the USAP-DCC we undertook the challenge of discovering and “rescuing” US orphan datasets currently registered within the AMD. In order to find DIF records of data served privately, all records relating to US data within the AMD were parsed. After identifying the records containing a URL leading to a national data center or other disciplinary data repository, the remaining records were individually inspected for data type, format, and quality of metadata and then assessed to determine how best to preserve. Of the records reviewed, those for which appropriate repositories could be identified were submitted. An additional 21 were deemed acceptable in quality of metadata to register in the USAP-DCC. The content of these datasets were varied in nature, ranging from magnetometer data to paleo-geologic maps to results of meteorological models all of which are discoverable through our search interface, <http://www.usap-data.org/search.php>. The remaining 19 records linked to either no data or had inadequate documentation for preservation highlighting the danger of serving datasets on local servers where minimal metadata standards can not be enforced and long-term access can not be ensured.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: 12,000 years of westerly wind and ecosystem changes on sub-Antarctic Macquarie Island

Forename: Krystyna Surname: Saunders

Authors: Saunders, Krystyna; Hodgson, Dominic; Grosjean, Martin;

Presentation Allocated: Poster

abstract: Sub-Antarctic islands are the only landmasses between Antarctica, South America, Africa & Australia where terrestrial climate and ecosystem records are available, making them crucial locations for linking southern mid/high latitude regions. However, there are few long-term climate & ecosystem datasets from the sub-Antarctic. The mid-high latitudes of the Southern Hemisphere are dominated by the westerly winds. These are important because changes in their strength determine precipitation & temperature regimes. They are also a key factor influencing global carbon dioxide flux because the winds control the upwelling of deep ocean water rich in dissolved inorganic carbon, which in turn is exchanged with the atmosphere. Despite their importance, little is known about how the westerly winds changed in the past. Several key questions remain: What is their past variability in the strength? How comparable is the pattern of change in the winds between different regions of the sub-Antarctic, Antarctica & mid-latitudes of the Southern Hemisphere? What are the ecological implications of these changes? This project aims to address these questions by utilising lake sediment cores from Campbell (52°32'S, 169°8'E) & Macquarie Islands (54°30'S, 159°57'E) to reconstruct changes in wind strength, precipitation & temperature, and identify ecosystem shifts over time. This presentation outlines preliminary results from Macquarie Island. A marked west-east gradient in salinity exists across Macquarie Island as saline ions are delivered by wind-derived sea spray. A diatom-salinity model was established and applied to a sediment core extracted from Emerald Lake (54°32'45"S, 158°52'53"E). This was dated using 210Pb & 14C. The diatom-salinity model was used to infer past lake water salinity and wind strength (i.e. higher salinity implies stronger winds). Windier conditions prevailed during the early-mid Holocene (7000-5500 yrs BP), followed by a period of reduced wind strength. After c. 4700 yrs BP conditions became windier. An abrupt change in sedimentation rate occurred c. 4000 yrs BP, following a peak in wind strength. A period of very slow sedimentation occurred from 4000 yrs BP, possibly due to drier conditions. Comparisons to other studies in the sub-Antarctic region & mid/high latitudes of the Southern Hemisphere are made to investigate broader-scale changes in westerly wind strength & ecological responses to changing climatic conditions over time

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Analysis of trends and sudden changes in environmental long-term data from King George Island (Antarctica): Relationships between global climatic oscillations and local system response

Forename: VALERIA Surname: Bers

Authors: Bers, Anna VALERIA; Momo, Fernando; Schloss, Irene; Abele, Doris;

Presentation Allocated: Oral

abstract: A long-term environmental data set from King George Island, Western Antarctic Peninsula, was analysed using statistical approaches that can deal with missing values. Since the WAP region belongs to the most rapidly warming regions on earth it is vital to find methods that take into account the incompleteness of Antarctic time series, but are still applicable to analyze general patterns in the series to arrive to conclusions on long term trends and inter-annual variability in the face of the rapidly changing climate in Western Antarctica. We applied U statistics after Pettit and Buishand to detect sudden changes over time, a dynamic factor analysis as well as additive modelling to detect common trends and patterns related to climatic cycles such as the Southern Annular Mode and El Niño Southern Oscillation. Our results not only reveal sudden changes for sea surface temperature and salinity, but also clear patterns in all investigated variables (sea surface temperature, salinity, suspended particulate matter and Chlorophyll a) that can be directly be assigned to climatic cycles. Hence, our statistical analyses may prove valuable for other polar environmental data sets and contribute to a better understanding of the regional variability of climate change and its impact on coastal systems.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Biological and physical parameters of the Maritime Antarctic intertidal zone - indicators of polar ecosystem changes

Forename: Piotr Surname: Kuklinski

Authors: Kuklinski, Piotr; Balazy, Piotr; Grzelak, Lukasz; Grzelak, Katarzyna; Kedra, Monika; Legezynska, Joanna;

Presentation Allocated: Oral

abstract: In the last decade we observe significant changes in the Antarctic ecosystem. Phenomena such as air temperature increase and ice reduction have a very dynamic character in the region of the Antarctic Peninsula. These changes have an influence also on living organisms, especially those living in coastal ecosystems, including tidal zone. In order to track and identify the environmental changes taking place in the ecosystem of Antarctica, we launched a long term monitoring project of tidal flat in the vicinity of Polish Polar Station on King George Island. Current priority is to collect the fullest possible knowledge of biodiversity and the physical parameters in order to build a solid base line which will enable detection of any changes. In 27 samples of macrofauna eight groups of organisms was recorded including Gastropoda, Bivalvia, Amphipoda, Isopoda, Bryozoa, Nemertini, Polychaeta and Pantopoda. The greatest species richness was observed within Amphipoda, while Pantopoda was represented by only one species. In terms of numerical abundance all stations were dominated by gastropods, which also had the largest biomass. Additionally 14 taxa of meiofauna was recorded. Dominant taxa were Nematoda, Harpacticoida and Turbellaria. With the height of the tide level a decrease in all parameters of meio- and macrofauna (eg. number of species, density and biomass) was very pronounced. The average temperature at tidal flat varied between 1.89 and 3.26°C. However much higher fluctuations in the temperature were recorded at higher tide location reaching in its amplitude up to 21°C. The study revealed a high biodiversity, abundance and biomass in an extremely dynamic environment which show great potential as a monitoring tool. Variability of parameters such as biodiversity, abundance and biomass was due to a clear gradient in physical conditions (tide and what is connected with this temperature). With the change of the physical dynamics of the environment including water temperature, wave intensity and the presence of ice will likely change the biological parameters. Therefore, systematic monitoring of the basic components of this biological ecosystem will enable us to track changes occurring in the rapidly changing polar environment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Boulder transport on perennially ice-covered lake: Lake Hoare, Antarctica

Forename: Maciej Surname: Obryk

Authors: Obryk, Maciej; Allen, Phillip; Hewitt, Richard; Doran, Peter;

Presentation Allocated: Poster

abstract: Large boulders are commonly found on the surface of perennially ice-covered lakes in Taylor Valley. The origin of the boulders is from some combination of rock falls and slides from local slopes, moraine deposition from glaciers damming the lakes and plucking of lake bottom boulders from shallow regions of the lake. A GPS survey campaign of 13 boulders on the perennial ice cover of Lake Hoare was performed between 1995 and 2011. The boulders exhibit two predominant modes of transportation: rolling and ice-rafting. Highly variable surface morphology of the ice cover and solar heating of the boulder surface is responsible for the rolling effect. Ice-rafting, on the other hand, occurs during the austral summers when a moat is present by the edge of the lake, allowing the ice cover to shift. The average direction of boulder movement during the entire survey campaign is NW, which is consistent with the average wind direction over the same time period, but also is the direction of predominant solar insolation. However, seasonal changes in a few boulders' position show a highly variable stochastic movement. The investigation provides information about the local-scale behavior of boulders on the ice-covered surface of Lake Hoare and also offers methodologies and interpretive frameworks for the study of sediment transportation dynamics on ice-covered lakes in glacial environments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Changes in moss bank spatial distribution in response to climate warming: a case study at Signy Island (South Orkney Islands, maritime Antarctica)

Forename: Michele Surname: Dalle Fratte

Authors: Dalle Fratte, Michele; Convey, Peter; Guglielmin, Mauro; Cannone, Nicoletta;

Presentation Allocated: Oral

abstract: Moss banks were surveyed at Signy Island in the 1960s. The survey also identified some sub-fossil banks recently exposed by retreating glaciers. In 2009 the moss banks of Signy Island were re-mapped in detail using GIS, and compared with the previous survey. We assessed whether changes observed were related to responses to climate and environmental change on the island, and which topographical (elevation, aspect, slope, location) and environmental (distance from the glaciers, fur seal disturbance) factors may influence distribution patterns. Over the 50 y period between surveys the areal extent of these features decreased by 15.6 ha (-28.1%). However, the total number of moss banks increased by 9.1%. Within this figure, continuous moss turfs and carpets decreased -by 34.7%, while discontinuous moss patches increased by 176.3%. We did not detect any significant change of total elevation range (10 – 203 m a.s.l.) occupied by mosses, although the distribution of mosses at different elevations changes over time. The distribution of moss cover in slope classes (0-10°; 11-20°; 21-30°; 31-40°; 41-50°) did not change in the fifty year period, with fewer mosses being found on steeper slopes. Changes were observed in relation to aspect, with the moss cover increasing SW, NW and NE aspects, slightly decreasing from NE to SE and strongly decreasing from SE to SW (-33.3%). Most moss patches are located more than 100 m from the nearest glaciers front (89.4% in the 1960s and 90% in 2009, respectively), although four moss patches recorded in 2009 were in areas covered by glaciers in 1960s. Of the areas of moss that had been lost between the two surveys, most were continuous and 97% were located at elevations below 50 m a.s.l. These observations are likely to be related to the massive impact of fur seals, whose abundance on the island showed a drastic increase in the period 1978-1994. Peat and moss samples were collected at the base of all moss banks mapped and recorded in 2009 for their radiocarbon datation in order to reconstruct with more precision vegetation and glacier dynamics at Signy Island during the Holocene. Moreover, moss banks spatial distribution was compared with the permafrost distribution and active layer thickness.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Decadal Heat Accumulation in Ice-Covered Lakes of the McMurdo Dry Valleys, Antarctica

Forename: Michael Surname: Gooseff

Authors: Gooseff, Michael; Priscu, John; Doran, Peter; Chiuchiolo, Amy; Obryk, Maciej;

Presentation Allocated: Oral

abstract: Lakes integrate landscape processes and climate conditions. Most of the permanently ice-covered lakes in the McMurdo Dry Valleys, Antarctica are closed basin, receiving glacial melt water from streams for 10-12 weeks per year and lacking advective outflow. We measured vertical profiles of water temperature three lakes in Taylor Valley since 1988. From these measurements, calculated heat contents indicate that these three lakes have been gaining heat since 2002. Analyses of lake ice thickness, meteorological conditions, and stream water heat loads indicate that the main source of heat to these lakes is from the glacially fed streams. These results indicate that McMurdo Dry Valley lakes are sensitive indicators of climate processes in this polar desert landscape and demonstrate the importance of long-term data sets when addressing the effects of climate on ecosystem processes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: DECADAL TRENDS IN ABUNDANCE, SIZE AND CONDITION OF ANTARCTIC TOOTHFISH IN MCMURDO SOUND, ANTARCTICA, 1972-2010

Forename: David Surname: Ainley

Authors: Ainley, David; Nur, Nadav; Eastman, Joseph; Ballard, Grant; Parkinson, Claire; Evans, Clive; DeVries, Arthur;

Presentation Allocated: Oral

abstract: We report analyses of a dataset spanning 38 years of near-annual fishing for Antarctic toothfish (*Dissostichus mawsoni*), using a vertical setline through the fast ice of McMurdo Sound, Antarctica, 1972-2010. This constitutes one of the longest biological time series in the Southern Ocean, and certainly the longest for any fish and the first to pre-date a major fishery. Fish total length, condition and catch per unit effort (CPUE) were derived from the >5500 fish caught. Contrary to expectation, length-frequency was dominated by fish in the upper half of the industrial catch. The discrepancy may be due to biases in the sampling capabilities of vertical (this study) versus benthic (horizontal) fishing gear (industry long lines), related to the fact that only large Antarctic toothfish (>100 cm TL) are neutrally buoyant and occur in the water column. Fish length and condition increased from the early 1970's to the early 1990s and then decreased, related to sea ice cover, and may ultimately be related to the fishery (which targets large fish) and changes in the Southern Annular Mode through effects on toothfish' main prey over the shelf, Antarctic silverfish (*Pleuragramma antarcticum*). CPUE was constant through 2001 and then decreased dramatically, likely related to the industrial fishery, which began in 1996 and which concentrates effort over the Ross Sea slope, where tagged McMurdo fish have been found. Due to limited prey choices and, therefore, close coupling among mesopredators of the Ross Sea, Antarctic toothfish included, the fishery may be altering the trophic structure of the Ross Sea.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: EFFECT OF EXPERIMENTAL WARMING ON SUGAR CONTENT IN DESCHAMPSIA ANTARCTICA PLANTS

Forename: Gustavo E Surname: Zuñiga

Authors: Zuñiga, Gustavo E; Pizarro, Marisol; Zuniga-Libano, Gustavo; Casanova-Katny, Angelica;

Presentation Allocated: Poster

abstract: The Antarctic Peninsula has experienced the highest temperature increase during the last 50 year. During this time, several changes have been documented in the terrestrial biota. The Antarctic tundra includes only two native vascular plants (the hairgrass *Deschampsia antarctica*, and the pearlwort *Colobanthus quitensis*), whose populations have been positively affected by the amelioration of cold temperatures. However, some experimental data, have suggested that *D. antarctica* do not increase its growth rate under increasing temperatures after even four years of experimental manipulations. To evaluate plant responses under microclimatic conditions of the South Shetland Islands, passive warming experiments were carried out in situ in Fildes Peninsula, King George Island during two seasons. We installed ten open top chambers (OTC) on a herb tundra community dominated by *Deschampsia antarctica* and evaluated growth and sugar profile by HPLC. During the first and second season significant growth rate were observed. The hairgrass produced significantly more spikes per plant, many of them in advanced state of anthesis, inside than outside OTCs. Sugar content was determined in roots, leaves, and spikes. Sucrose content was higher in leaves and spikes of plants growing inside than outside OTC. Besides, the content of kestose increased only in the roots of plants grown in the OTC. The results suggests that sugar allocation change under warming, increasing reproductive growth of *D. antarctica* plants, with more seeds as compared with control plants. These changes could explain the increasing size of natural populations observed in the west Coast of the Antarctic Peninsula. Clearly, responses to warming experiments carried out under natural conditions are variable according to microclimatic conditions and other environmental characteristics like soils nutrient and water content. Long term experiments are a realistic approach to understand how plants are responding to the changing environment.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Environmental change captured by repeat photography: using the South African Antarctic legacy

Forename: Aleks Surname: Terauds

Authors: Terauds, Aleks; Chown, Steven;

Presentation Allocated: Oral

abstract: There has been a long history of South African presence in the broader Antarctic region. Over this time, several generations of scientists and other expeditioners have photographed significant human and environmental features. Recent research into the human history of Marion Island has revealed the existence of a plethora of images. Long-term changes at a landscape scale can clearly be documented by comparison of old images (late 1960s and early 1970s) and repeat images taken at the same sites approximately 40 years later. The original images were some of the first colour representations taken of these landscapes, and even though the original intent may not have been for monitoring purposes, their use in these comparisons makes them a unique set of baseline data. Several, significant landscape scale changes are revealed by such comparisons. First, at higher elevations, mesic and xeric fellfield are being replaced by mire grassland vegetation. These changes are clearly related to long-term warming at the island, as demonstrated by repeat surveys of plant altitudinal limits. Second, many slope crest tussock grassland communities have been replaced by fernbrake, reflecting the extirpation of burrowing petrels by feral cats throughout the 1950s to 1990s. These slope crest communities are proving slow to recover. Third, riparian vegetation has typically been transformed from *Acaena magellanica*-dominated banks with no vegetation on stream boulders, to dense mats of the invasive alien *Sagina procumbens*, found both on banks and rocks. The latter has emphasized the extent of riparian invasions on the island, a factor previously not widely recognized, although riparian invasions are common in continental systems. Our work demonstrates the value of archiving historical pictures, not only for understanding the social dimensions of the human presence in Antarctica, but also for comprehending human impacts. Of particular interest are the changes in indigenous – invasive diversity relationships, and these photopoints, which have now been documented with appropriate metadata, will prove extremely useful in monitoring these changes at a landscape scale into the future.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Episodic Growth of Sponges on Artificial Structures in McMurdo Sound, Antarctica

Forename: Kathleen Surname: Conlan

Authors: Dayton, Paul; Kim, Stacy; Conlan, Kathy; Jarrell, Shannon;

Presentation Allocated: Poster

abstract: Episodic Growth of Sponges on Artificial Structures in McMurdo Sound, Antarctica Paul Dayton, Stacy Kim, Shannon Jarrell, Kathy Conlan Recruitment and growth of the sponge fauna in McMurdo Sound were investigated in 1967-68. Twenty species of sponges showed no measurable growth; two species showed remarkably fast growth. These sponges were revisited in 1974-77 and many species had measurable but very slow growth, suggesting that with the exceptions of a few species, the vast majority of sponges grew very slowly between 1967 and 1977. We observed a localized population explosion of *Homaxinella balfourensis* in the 1970s and measurable growth of *Rossella antarctica* in the late 1970s. Generally slow growth rates continued through 1989. These observations on natural surfaces contributed to the paradigm of slow settlement and growth of Antarctic sponges. Artificial structures placed between 1960 and 1974 also showed virtually no recruitment or growth of sponges through 1998. Repeat visits to each site were opportunistic and varied in frequency. With the exception of a few of the relatively fast growing *Mycale* and *Haliclona* spp., none of the sponge species tracked between 1967 and 1989 settled on the artificial structures. Many of the structures were photographed again in 1998 and there was virtually no sponge settlement at that time. In 2010 we revisited many of the initial sampling sites and underwater structures and found surprisingly high recruitment and growth of more than 30 species of sponges. The most dramatic change was an IGY era gangplank north of Hut Point. The gangplank had been observed to be clean through the 1960s, was covered by *H. balfourensis* through the 1970s, was cleared by anchor ice in the 1980s and remained clean through the 1990s, and in 2004 was photographed with a dense settlement of *Anoxycalyx joubini*. By 2010 nineteen individuals dominated most of the space and together were estimated to weigh over 360 kg. This long term data set shows the importance of decadal perspectives in Antarctic research, and provides strong support for maintaining baseline research. These sponge populations were followed for up to 40 years before a settlement event was recorded, and rapid growth was seen only in the last 10 years of a 50-year observational span. This emphasizes the importance of protecting these fragile ecosystems.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Geographic Information System applied to Stinker Point, Elephant Is: a means for spatial analysis

Forename: Tiago Surname: Borges Ribeiro Ga

Authors: Borges Ribeiro Gandra, Tiago; Muelbert, Monica;

Presentation Allocated: Poster

abstract: Geographic Information Technologies (GIT) is a set of specialized Information which helps to collect, manage, and analyze data about the resources, landscape and demographic characteristics of an area in both space and time. It constitutes an important means for knowledge sharing and conservation purposes. Geographic Information Systems (GIS) are an important tool that help to store, manage, create, visualize and analyze geographically geo-referenced integrated data. Elephant Island (EI) is located at the tip of the Western Antarctic Peninsula (WAP) in the South Shtelands Archipelago ($61^{\circ} 10'S 55^{\circ} 10'W$) with an area of approximately 49,114 hectares (about 46 km from E to W and 24 km from N to S). Our study area consists of the Praia Grande and Naufragos at Stinker Point, which are located near the Brazilian Refuge Emilio Goeldi ($61^{\circ} 13.3'S 55^{\circ} 21.5'W$), in the SW portion of the island. Several species of birds and pinnipeds breed and haul-out in the area which are subject of scientific studies under the sponsorship of the Brazilian Antarctic Programme (PROANTAR) in collaboration with a number of national and international institutions. The aim of this study is to create a GIS and provide a detailed map of our study area that will help understand demographics and spatial distribution of individuals. A digital elevation model (DEM) was produced by means of a navigation GPS, helping to associate the seals location to the topography. The resulting database consisted of 2279 records (lat-long) and elevation (x, y, z), divided into 27 sectors which included observations of each point to describe specific features such as lakes, rivers, rocks, moraines mapped in the field and demographics. The development of a Digital Terrain Model (DTM) tested various methods of spatial interpolation data and the best adapted to the spatial distribution of data was "Natural Neighbor", which produced smooth topographical curves and did not extrapolate the actual elevations registered on site. The elevation of points obtained ranged from 0 to 79 meters (average 15.5 m). Through the combination of census data and the spatial distribution of individuals we were able to assess preferred areas of occurrence, relate them to specific features such as substrate, topography and distance from water. This information integrated over the years will represent an important tool for conservation and management of marine birds and pinnipeds breeding in the area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Initiation of a Global Alliance of Continuous Plankton Recorder Surveys (GACS)

Forename: Graham Surname: Hosie

Authors: Hosie, Graham; Batten, Sonia; Edwards, Martin; Chiba, Sanae; Fukuchi, Mitsuo; Hall, Julie; Melrose, Chris; Muxagata, Erik; Richardson, Anthony; Verheye, Hans; Burkill, Peter;

Presentation Allocated: Poster

abstract: Continuous Plankton Recorders have been deployed as a lower trophic level sampling tool for many decades in the North Atlantic, and have provided a wealth of data used to describe plankton diversity, biogeography, response to climate forcing and influence on upper trophic levels. Other regions of the ocean have since been monitored with CPRs; the Southern Ocean for over 20 years, the north Pacific for over 10 and new surveys have recently been initiated around Australia, New Zealand, Brazil and in the Benguela Current. The CPR has remained the instrument of choice because it offers a cost effective way to routinely sample deep ocean basins and coastal ecosystems seamlessly, and is the only current instrument that does so while measuring biodiversity of both zooplankton and larger phytoplankton. Recognising the need to combine expertise and data to address global issues affecting lower trophic levels (ocean warming, acidification etc.) a Global Alliance of CPR Surveys (GACS) was formed in September 2011. GACS will provide that global perspective using CPR data. It will also allow us to assess changes and events at a local or regional level in a world-wide context. The group has a board of governance comprising members from 9 regional CPR surveys and active working groups to develop a joint database and maintain working standards and methodologies. Other specific aims are to produce a regular ecological status report for global plankton biodiversity, and to provide an interface for plankton biodiversity with other global ocean observation programmes.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Isotopic signature and foraging habitats of southern elephant seals, *Mirounga leonina*, from the Northern Antarctic Peninsula

Forename: Monica Surname: Muelbert

Authors: Muelbert, Monica; Gallon, Susan Louise; Lewis, Mirtha Noemi; Hindell, Mark Andrew;

Presentation Allocated: Poster

abstract: Elephant Island (EI) is uniquely placed to provide southern elephant seals (SES) breeding there with potential access to various foraging grounds such as the Weddell Sea, the frontal zones of the South Atlantic Ocean, the Patagonian Shelf (PS) and the Western Antarctic Peninsula (WAP). Twenty-nine SES (5 sub-adult males-SAM and 24 adult females-AF) were equipped with SMRU CTD-SLDRs during their post-breeding (PB 2008-09) and post-moulting (PM 2007-10) trips to sea. Whiskers were taken at the time of tag deployment and represented stable isotope (SI) signatures during the 3 to 4 months prior to the tracking period. Six females were re-sampled as they returned from their migration providing simultaneous SI signatures and tracking information. Striking intra-annual and inter-sex differences in foraging areas emerged, with most of the PB females remaining within 150 km of EI while 16 of the 20 PM females foraged near the winter ice-edge south of the WAP. Most SAM remained close to EI although one male spent the early part of the winter foraging on the PS exhibiting higher ^{15}N values (13.4 to 14.7‰) and ^{13}C values (-19.5 to -18.8 ‰) than other SAM (11.1 to 13.5‰ and -22.6 to -20.6‰ for ^{15}N and ^{13}C , respectively). SAM and PB females that foraged around EI had different ^{15}N values suggesting they were feeding at different trophic levels. PM females mainly fed on the shelf and their ^{15}N values were positively related to body weight and time spent on the shelf. Heavier animals had higher ^{15}N ratios independently of the sex of the animal. Our results suggest that sex and age differences are not the only forces driving the foraging strategies adopted by different seals: individuals of similar sex and age may forage in the same habitat but feed at different trophic levels influenced by body weight. Interestingly, AF from EI made more benthic dives than SAM in contrary to other sites where females are known to forage in open waters near frontal systems. While seals from EI had shorter migrations and were using shelf habitats more than other SES populations some individuals still employed open water foraging strategy. This study demonstrates the importance of shelf and slope habitats to SES and the influence of sea-ice, bathymetry and local ocean condition in the choice of foraging habitat. Quantifying where and at what trophic level seals from EI forage should provide new insights into the types of habitats available and which are of particular importance to SES

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Lake-ice ablation rates in Taylor Valley, Antarctica

Forename: Hilary Surname: Dugan

Authors: Dugan, Hilary; Obryk, Maciek; Doran, Peter;

Presentation Allocated: Poster

abstract: Three large closed-basin lakes exist along the valley floor of the Taylor Valley, one of the few areas in Antarctica that remain ice free due to a lack of precipitation. In this extreme desert ecosystem, the lake volumes are regulated by gain from glacially fed streams and direct glacial melt, and mass loss through ablation (the sum of melt evaporation and ice sublimation). Over the past decade, the lake levels of Lake Bonney (4.3 km²), Lake Hoare (1.8 km²), and Lake Fryxell (7.1 km²), have risen 2.6 m, 0.8 m and 1.0 m, respectively. Ablation is the foremost variable which moderates the rate of lake level rise, and is often poorly estimated in lacustrine settings. As part of the Long Term Ecological Research program operating in the Taylor Valley, both manual and automated lake-ice ablation rates have been recorded from 2000-2011. Results indicate relatively constant winter ablation rates of 10-20 cm (0.4 mm/day). Lake Bonney has the highest rates of winter ablation, which are associated with periods of sustained wind activity that warm air temperatures and lower relative humidity. Summer ablation rates in Taylor Valley are more variable and range from 20-160 cm (2-30 mm/day), over an average 56 day period. Lake Bonney has the lowest summer rates as a result of steep valley walls which depress summer insolation below that of Lake Fryxell and Lake Hoare. Until now, ablation rates have been typically cited as 35 cm/year in the Dry Valleys based on modeling from meteorological variables. We show that this value significantly underestimates average ablation and ice cover turnover in the Taylor Valley. Only during years of notably low summer ablation, do annual ablation rates approach this value. Accurate ablation data are essential to closing the hydrologic balance in the Taylor Valley, and should be used to corroborate theoretical values modeled in this and other glacial and lacustrine settings. This long term data set will advance regional climate modeling, sublimation models of nearby ground ice, and limnological studies which incorporate lake ice formation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Monitoring impacts of a changing climate on plant communities of Continental Antarctica

Forename: Diana Surname: King

Authors: King, Diana; Wasley, Jane; Turnbull, Johanna; Ryan-Colton, Ellen; Mullany, Kate; Lucieer, Arko; Robinson, Sharon;

Presentation Allocated: Oral

abstract: Antarctic terrestrial ecosystems are important models for studying community structure and dynamics, allowing understanding of ecological processes to be transferred to more complex ecosystems. Due to the simple vegetation community structure, the fact that Antarctic vegetation has been predominantly unaffected by direct human influences or invasive species, and the geographic isolation of the continent make Antarctica a particularly good baseline environment for climate change research. In addition, Antarctica is expected to be more sensitive to environmental changes than communities in less severe conditions. Long term vegetation studies are made more difficult in Antarctica, due to the climatic extremes, however, they are vital in establishing trends in plant growth, particularly due to the slow growth rates of Antarctic flora. A planned 25-year long term vegetation study has been established along a moisture gradient at two sites in the Windmill Islands, East Antarctica, and the first two sampling periods completed. These data inform the only Australian Antarctic State of the Environment Indicator for terrestrial vegetation (SOE 72: http://data.aad.gov.au/aadc/soe/display_indicator.cfm?soe_id=72). The sampling methods used for long-term monitoring of these communities were designed to comply with the Antarctic Treaty System principle of minimisation of destructive sampling, due to the slow growth and regeneration capacity of Antarctic vegetation. Minimal destructive sampling techniques are being utilised for fine-scale change analysis of relative abundance of bryophyte species and lichen taxa. Digital imaging and automated classification techniques are being utilised for broad-scale percent cover analysis of community change. UAV imaging and subsequent terrain and image analyses are being utilised for site-wide modelling of environmental factors affecting microclimate suitability affecting bryophyte turf distribution and growth. Our results indicate that this methodology is sensitive enough to detect climate-induced change in these slow growing communities.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Penguin Life Observatories as indicators of climate impacts on SubAntarctic and Antarctic ecosystems

Forename: Celine Surname: LE BOHEC

Authors: LE BOHEC, Celine; ALLEMAND, Denis; BABEL, David; CHATELAIN, Nicolas; CORNET, Cindy; COURTECUISE, Julien; CRENNER, Francis; WHITTINGTON, Jason D.; LE MAHO, Yvon;

Presentation Allocated: Oral

abstract: In the context of global warming, a key issue is to understand how organisms cope with changes in their environment. The Intergovernmental Panel on Climate Change (IPCC - 2007) has thus highlighted an urgent need to assess how marine ecosystems respond to climate change. As good bioindicators of the modifications affecting different levels of food chains, upper-level predators, such as seabirds, are perfect tools to monitor and predict impacts of global change on marine ecosystems. In that context, Life Observatories 'ANTAVIA' have been established to explore the effects of environmental modifications on population dynamics of these sentinels of Southern Ocean ecosystems: the King penguin *Aptenodytes patagonicus* (Crozet and Kerguelen Archipelagos), the Adélie penguin *Pygoscelis adeliae* and the Emperor penguin *Aptenodytes forsteri* (Adélie Land). Using innovative technologies, our team implements Automatic or Mobile Identification Systems (AIS/MIS) based on Radio Frequency Identification (RFID), allowing us to work on individuals of known life history and status (i.e., sex, age, and other phenotypic traits expressing the experience and quality of individuals) at a population scale. In addition to minimizing the animals' disturbance and avoiding biasing effects of flipper bands, our unique databases allow us to obtain the first reliable demographic parameters on these species and to evaluate the capacity of the populations to adapt to changes of their ecosystems. We first intend to emphasize both the importance of biological long-term monitoring, at the same level as physical Earth Observatories, and the crucial need of a standardization of Life Observatory procedures to assess the impact of climate on ecosystems. From this, we will present some life-history and phenotypic traits (such as age-specific survival rates, recruitment parameters and reproductive performances, behavioural traits, etc.) and the consequences of environmental changes. We will see how the response to climate depends on the biology of the species, but also on the life-history traits considered within a species (i.e., their relative importance to the variation of the population growth). Finally, using some of the above parameters in stochastic stage-structured models, we will present the first results on extinction risk of an unbanded king penguin population under projections of warming-climate scenarios forecast by the IPCC for the upcoming decades.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: PLANT COMMUNITIES FROM ANTARCTIC ICE FREE AREAS

Forename: Antonio Surname: Pereira

Authors: Pereira, Antonio; Albuquerque, Margéli; Schünemann, Adriano; Pereira, Clarissa; Francelino, Marcio; Roesch, Luiz; Putzke, Jair; Victoria, Filipe;

Presentation Allocated: Poster

abstract: PLANT COMMUNITIES FROM ANTARCTIC ICE FREE AREAS Antonio Batista Pereira, Margéli Pereira de Albuquerque, Adriano Luis Schünemann, Clarissa Kappel Pereira, Marcio Rocha Francelino, Luiz Fernando Wurdig Roesch, Jair Putzke & Filipe de Carvalho Victoria. **Keywords:** terrestrial ecosystems, vegetation, biodiversity. This work presents the description, mapping and evaluation of plant communities from Antarctic ice free areas. The data are being used to monitoring those ecosystems, to know the possible environmental impacts by human action or natural phenomena such as the global climate changes. The plant diversity and the plant coverage were used as bioindicators to reach the aims proposed. The research in each plant community were initiated by the species identification in order to provide conditions for the phytosociological studies. The quadrat method were used to study the frequency and coverage of plant species in the studied areas, using 20x20 squares as sample unity. The plant communities were described and grouped into two types: (1) Antarctic tundra communities, with seven formations: 1.1. Grass and cushion chamaephyte formation, 1.2. Fruticose lichen and moss turfs formation, 1.3. Crustose and foliose lichen formation, 1.4. Moss tufts formation, 1.5. Moss hummock formation, 1.6. Lichen – Moss cushions Formation, 1.7. Fruticose and crustose lichen Formation; and the (2) Antarctic Swamp communities, with three formations: 2.1. Moss cushion formation, 2.2. Moss carpet formation e 2.3. Fellfield communities. Based on those results we proposed maps of plant communities distribution of Stinker Point (Elephant Island) in the austral summer 1993/1994; Rip Point (Nelson Island) in 1994/1995; Keller Peninsula 2002/2003 and 2009/2010, Hennequin Point in 2004/2005 and 2010/2011, Arctowski regions 2003/2004, Copacabana and Demay Point in 2005/2006, located in the King George Island. This work was supported by the Brazilian Antarctic Program through CNPq (process no. 574018/2008, FAPERJ (process no. E-26/170.023/2008) Ministry of science and Technology – MCT, Ministry of Environment – MMA and CIRM.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: RESISTIVITY MAPPING IN THE MCMURDO DRY VALLEYS REVEALS SIGNIFICANT HYDROLOGICAL CONNECTIVITY IN THE SUBSURFACE ENVIRONMENT

Forename: Jill Surname: Mikucki

Authors: Mikucki, Jill; Auken, Esben; Sørensen, Kurt; Virginia, Ross; Kyle, Phil; Tulaczyk, Slawek;

Presentation Allocated: Oral

abstract: The MCM-SkyTEM project during the 2011-12 austral season mapped resistivity in the McMurdo Dry Valleys and at Cape Barne on the Ross Island using an airborne transient electromagnetic method. The SkyTEM system is mounted to a helicopter which enables a broad geophysical survey of subsurface resistivity structure over terrain that was previously considered inaccessible to traditional ground-based methods. The resistivity measurements obtained can distinguish between highly resistive geologic materials such as glacier ice, bedrock and permafrost, and conductive materials such as unfrozen sediments or brine pockets to depths of about 300 m. Although SkyTEM has been used extensively in mineral exploration and for hydrology mapping of groundwater and groundwater quality, this was the first deployment of such an instrumentation package in Antarctica. We covered approximately 1000 line kilometers of terrain and surveyed a range of systems including subglacial environments, ice covered lakes and permafrost regions in the dry valleys and coastal margins of Ross Island. Here we present preliminary results from our survey completed in December 2011. Our results suggest significant hydrological connectivity between New Harbor and Lake Fryxell as indicated by highly conductive material, which we interpret as unfrozen sediments below the surface and extending beyond the lake margin. These findings are consistent with borehole data from the Dry Valley Drilling Project (DVDP, 1972-74). SkyTEM also indentified the presence of a conductor below the Taylor Glacier, which could be the brine source to Blood Falls, a saline, subglacial outflow at the terminus of Taylor Glacier. Collectively, the MCM-SkyTEM dataset will allow us to integrate the subsurface environment into our understanding of the greater McMurdo ecosystem.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Resolving Spatial and Temporal Heterogeneity in Terrestrial Antarctic Microbial Communities: an emerging biosecurity dilemma

Forename: Craig Surname: Cary

Authors: Cary, Craig; Lee, Charles; McDonald, Ian; Tiao, Grace;

Presentation Allocated: Poster

abstract: Although recent reports on the microbial ecology of McMurdo Dry Valley soils have rejected the notion that Antarctic Dry Valley soils contain limited microbiota, little is known regarding how these microbial communities are influenced by the harsh environmental conditions that preclude the existence of vascular plants and macrofauna. The Dry Valley soil ecosystem is exceptionally simple and provides a highly manageable framework for elucidating interactions between abiotic factors and soil microbial communities. Reported dominance of aeolian transport in biota distribution and extremely low estimated turnover rates contribute to an assumption that, despite clear physicochemical heterogeneity within the region, Dry Valley soil microbial communities are homogeneous and respond to change very slowly. Our ongoing research challenges these beliefs by revealing incredibly localized phylogenetic diversity and rapid turnover rates in Dry Valley soil microbiota. The New Zealand Terrestrial Antarctic Biocomplexity Survey (nzTABS), is examining the effects of local physicochemical factors on Dry Valley biodiversity. Soil samples collected from 4 Dry Valleys were subjected to biogeochemical analyses and high throughput DNA sequencing to characterize the microbial communities. The results show that the communities are structurally and phylogenetically distinct, and possess vastly different levels of microbial diversity. Geochemical analyses reveal correlation between physicochemical parameters and compositions of bacterial and cyanobacterial communities. In a second experiment using similar methodologies, we monitored the effects on the microbial communities after placing a mummified seal on a patch of pristine Dry Valley soil. We found that Dry Valley soil microbiota respond quickly to changes in macroclimatic conditions with a dramatic change in community structure and significant loss of diversity. Our results indicate that physical and geochemistry play major roles in shaping and maintaining microbiology of ice-free areas of Antarctica, and the surprisingly localized diversities of Dry Valley soil microbial communities indicate extraordinary spatial heterogeneity. These observations underscore the need to re-evaluate current ideas of microbial biogeography, raises issues regarding microbial biosecurity within the Dry Valley system and signals the potential loss of biodiversity induced by changes in macroclimatic under current climate change predictions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Spatio-temporal patterns in the abundance of bacterioplankton from Antarctic and SW Atlantic waters

Forename: Viviana Andrea Surname: Alder

Authors: Alder, Viviana Andrea; Franzosi, Claudio Atilio;

Presentation Allocated: Oral

abstract: We present an overview of the quantitative distribution of subsurface bacterioplankton abundance and biomass from a data series obtained during summer and autumn of four consecutive years (2002-2005) by latitudinal transects covering Argentine shelf waters, the Drake Passage, the Bellingshausen Sea and the Weddell Sea. Samples collected at each of ca. 300 oceanographic stations were processed (DAPI staining) by duplicate on board. Concentrations of heterotrophic bacteria and other picoplanktonic autotrophic cells (cyanobacteria and picoeukaryotic algae) were estimated by fluorescence microscopy and further analyzed by digital imaging for biovolume-to-biomass conversions. The large spatial scale covered by this study allowed to: 1) examine the seasonal, interannual and spatial fluctuations of bacterioplankton biomass in relation with the main environmental variables (temperature, salinity, Chl-a, nutrients) of these contrasting systems; 2) describe the changes in the heterotrophic/autotrophic ratio from a mesotrophic shelf system to oligotrophic oceanic waters; 3) demonstrate how global temperature increments can affect the ecological trends of bacterioplankton; and 4) relate the different categories of El Niño events to bacterioplankton concentration at local and regional scales. Future plans related with long term data collection from microbial planktonic communities will be briefly discussed.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: The Geochemistry of the Taylor Valley Lakes, Antarctica

Forename: W. Berry Surname: Lyons

Authors: Lyons, W. Berry; Welch, Kathleen A.; Gardner, Christopher B; Leslie, Deborah L; Priscu, John C; Bagshaw, Elizabeth A;

Presentation Allocated: Keynote 40 mins

abstract: The McMurdo Dry Valleys (MDV) are the largest ice-free expanse in Antarctica. Even though the MDV are a polar desert with less than 10 cm of precipitation per year, they contain a number of perennially ice-covered lakes. Taylor Valley contains three large, closed-basin lakes that have been the primary focus of the McMurdo Dry Valleys Long-Term Ecological Research investigations for ~20 years. The salinity and major ion ratios of these three lakes are very different; the hypolimnia of Lake Bonney, Lake Fryxell and Lake Hoare are hypersaline, brackish and fresh, respectively. These differences reflect, in part, the evolutionary history and age of the lakes as well as their landscape position. The lakes respond rather rapidly to changes in austral summer temperature. Warmer summers produce more glacier melt (the primary source of water), which in turn impacts the surface water chemistry of the lakes. In this paper, we will review the differences in chemistry of these three lakes and the processes and reactions occurring in the lakes. Using the freshest water lake as the primary example, we will demonstrate how hydrological variations driven by summer temperature changes effect the chemistry changes in the lake. We will compare the geochemistry of Lakes Hoare and Fryxell and discuss the source of their differences. Our most recent work suggests that aeolian debris deposited on glacier surfaces may play a much more important role in lake geochemistry than previously thought. Finally, we will speculate on the future of these lakes in a warming climate.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: The SCAR Southern Ocean CPR Survey

Forename: Graham Surname: Hosie

Authors: Hosie, Graham; Fukuchi, Mitsuo; Kitchener, John; Takahashi, Kunio; McLeod, David; Robinson, Karen;

Presentation Allocated: Poster

abstract: Antarctic plankton are expected to be particularly sensitive and vulnerable to climate change. Global warming will not only cause increase in ocean temperature that could affect plankton but warming will affect sea ice patterns further affecting plankton distributions. Increased UV levels, ocean acidification, invasive plankton species, pollution and harvesting impacts are also potential major threats. The synergistic effect of any of these threats working in combination is currently not known. Any change in the plankton are expected to have flow on effects through the rest of the food chain, as well as altering the role of the plankton in the global climate system. The SCAR SO-CPR Survey was established in 1991 by the Australian Antarctic Division to map the spatial-temporal patterns of plankton biodiversity and then to use the sensitivity of plankton to environmental change as early warning indicators of the health of the Southern Ocean. It also contributes to or can serve as a reference for other observational programs such as SOOS, Southern Ocean Sentinel, CCAMLR's Ecosystem Monitoring Program, and ICED. SO-CPR is also a founding member of the Global Alliance of CPR Surveys which places the Antarctic observations in a global context. Several countries have joined the Survey. ~50 CPRs tows are conducted annually using vessels from Australia, Japan, Germany, New Zealand, USA, Russia, Brazil and Chile, with further support of personnel from South Africa and countries in the South American CAML consortium. This provides a near circum-Antarctic Survey. The principal product is a high quality dataset for the purposes of mapping plankton biodiversity, monitoring and development of models at seasonal, inter-annual, decadal, and spatially local and global scales, and providing core plankton data for ecosystem models. The dataset holds data for 20+ years from ~ 33,600 samples at 5 nautical mile resolution for ~230 zooplankton species and krill developmental stages. A new zooplankton atlas for the Southern Ocean has just been published using CPR data. New modelling methods are providing predictive temporal and geographic patterns of individual species or whole assemblages by modelling the relationship between plankton and remotely measured environmental variables. The analyses will assist in the study of environmental effects on plankton, predator-prey relationships, the identification of foraging zones, and assist fisheries and conservation management.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Using Antarctic mosses as proxies for water availability- can carbon isotopic fraction tell us how wet it was in the past?

Forename: Jessica Surname: Bramley-Alves

Authors: Bramley-Alves, Jessica; Robinson, Sharon; Wanek, Wolfgang;

Presentation Allocated: Poster

abstract: Recent climate change in polar regions, coupled with a large temporal and spatial deficits in long-term meteorological data, has called for innovative climate proxies to fill in observational gaps. This study explores the possibility of using stable carbon isotopes in slow growing Antarctic moss species as a fine scale proxy for water availability. Three moss species from the Windmill Island region, *Ceratodon purpureus*, *Schistidium antarctici* and *Bryum psuedotriquetrum*, were selected to test if $\delta^{13}\text{C}$ signatures of moss cellulose material accurately reflect water availability in the season of growth. Samples of each species were collected from three different sites within the Windmill Islands, East Antarctica from locations with different water availability, ranging from moss that remain submerged throughout the season, through partially submerged turf to ones which were free of standing water. Reciprocal transplant experiments across water gradients were also conducted on all three species to determine if short-term changes in water availability are reflected in the $\delta^{13}\text{C}$ signatures. Cellulose (bulk) $\delta^{13}\text{C}$ was analysed by an elemental analyser (EA) coupled to an isotope ratio mass spectrometer (IRMS). The hypothesis is that mosses growing in submerged areas will show a distinctly less negative $\delta^{13}\text{C}$ signal due to diffusional limitations reducing the potential for Rubisco to fractionate. If successful we can then explore $\delta^{13}\text{C}$ signatures down dated moss shoots to achieve a high resolution reconstruction of water availability in the Windmill Islands, and potentially other polar locations, over the past century.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 35

Title: Whisker isotopic signature depicts foraging strategies in southern elephant seals from a rapidly warming region

Forename: Susan Louise Surname: Gallon

Authors: Gallon, Susan Louise; Muelbert, Monica; Hindell, Mark Andrew;

Presentation Allocated: Poster

abstract: The Antarctic Peninsula is one of the most rapidly warming regions on earth and changes in its marine ecosystem are predicted. Studying the foraging behaviour of apex predators, such as southern elephant seals (SES), is thus critical at a time where pressure on their environment is increasing. We studied the dietary history of 119 individuals during their most recent trip to sea by analyzing stable isotope (SI) concentration on consecutive sections of whole whiskers. We then investigated differences in diet between sex and age classes in southern elephant seals from Elephant Island (61°13'5 55°23'W). Males were grouped in five age classes (pup, yearling, juvenile, sub-adult and adult) and females in three age classes (pup, yearling and adult). Finally, we compared SI values obtained in the present study with SI values obtained for different geographic populations of juveniles and yearling southern elephant seals. At the individual level, SI analyses depict a large diversity of foraging strategies. Whiskers' isotopic signatures suggest that prey items varied by a complete trophic level for some individuals with a range of ^{15}N values varying from 10.20 to 14.36 ‰ (a 4.2 ‰ difference), while it varied little for most animals. SI analyses also confirmed marked differences in foraging habitats, trophic levels and dietary habits of SES according to sex, age group and geographic location. Sub-adult and adult males showed higher and broader stable N isotope ratios (9.91 to 15.87 ‰) along the length of their vibrissae compared to adult females (9.30 to 13.34 ‰) indicating males were feeding on higher trophic level prey. Sub-adult males occasionally fed near the sub-tropical front (16 ‰) and yearling females had lower ^{13}C values compared to adult females suggesting they were feeding in different geographical areas of the Southern Ocean. Our analyses indicate the possibility of three geographic populations of yearling and juvenile seals according to different ^{13}C and ^{15}N values. We discuss how these differences are likely a result of a combination of intra-specific competition, ontogenetic factors and resource distribution

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: A white continent? The racialisation of Antarctica in South Africa (c. 1955 – 2005)

Forename: Lize-Marié Surname: van der Watt

Authors: van der Watt, Lize-Marié;

Presentation Allocated: 5 oral

abstract: Social history has repeatedly urged that history be studied 'from the bottom up.' This paper asks what such a history from the 'bottom of the world' looks like? Taking social history's call seriously requires dissecting the historically limited and stereotyped narrative of who went to Antarctica and why. Being in Antarctica requires capital and technological sophistication. If one examines Antarctica as though it is a state, it appears to be a model post-industrial one. In Antarctica there is no unemployment and the crime rate is negligible. The cost of living is possibly the highest in the world, but there is no indigence. Medical care and literacy are universal. Antarctica appears a wholly elite space – gazed upon only by a privileged few, a place whose history can be unashamedly about the ubiquitous 'dead white men.' Yet, South Africa's Antarctica was never really just white. In conversation with scholars like Kathryn Yussoff, Lisa Bloom and Klaus Dodds, this paper looks at how the Antarctic was not only gendered but, in the case of South Africa, also explicitly racialised. Using interviews and archival sources, it traces the experiences of some of the black South Africans who have been part of South African activities on the continent. But more than merely inserting token black actors into the narrative, the paper also asks how, in a country obsessed with race, the expression the 'white continent' referred to far more than the colour of snow.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Antarctic Voices: A New Resource for Unlocking the Past

Forename: Joanna Surname: Rae

Authors: Rae, Joanna; Bazeley-White, Ellen;

Presentation Allocated: 3 oral

abstract: The paper introduces the British Antarctic Oral History Project (BAOHP), initiated in 2009 to preserve the memories of those involved with British scientific endeavour in the Antarctic. The project has created a new and unique collection of over 200 audio and video recordings. The data provide opportunities to ask new, and different, questions about personal, social, scientific and political interactions. We illustrate some of the surprising and entertaining insights uncovered – from a near mutiny aboard a research vessel, through inter-institutional conflict to underlying organisational cultural norms. The BAOHP is a collaboration between British Antarctic Survey (BAS), UK Antarctic Heritage Trust (UKAHT), BAS Club, and Scott Polar Research Institute (SPRI). The project built on the work of a much smaller BAS oral history project, begun in 1985. Oral histories can offer a powerful alternative source to institutional or government archives. Official records can be infuriatingly silent about the detail of events and activities, or context of decisions and relationships of interest to the researcher. Oral accounts differ from personal diaries because time lends distance and an element of reflection. Many of the interviewees have long since left the organisation and so feel able to speak openly about their reactions and relationships with other individuals or with the organisation. The result is a different form of qualitative data that hints at the complexity of the human experience. We are privileged to hear the personal stories and interpretations of a wide variety of individuals that provide an unofficial history to compliment the organisation's account. Comparing the testimonies of colleagues provides an opportunity to explore the differences in what is remembered or admitted, and what that says of personal memory and motivation. Best of all, once there is a body of interviews you can also span time to understand how life, work and attitudes to Antarctic research have changed (or not) over the decades – and hear it in the words of those who experienced it.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Breaking Glass: An analysis of Tristan da Cunha as Robinsonade.

Forename: Thierry Jean-Mari Surname: Rousset

Authors: Rousset, Thierry Jean-Marie;

Presentation Allocated: 8 oral

abstract: Breaking Glass: An analysis of Tristan da Cunha as Robinsonade. By Rousset, J.M.T. *University of Cape Town – Republic of South Africa. thierry.rousset@gmail.com Keywords: Tristan da Cunha, Robinsonade. Although Tristan da Cunha is an island that may not often be considered as forming part of the Antarctic world, large amounts of research have been done on the island under the auspices of SCAR, particularly in the field of ornithology. However, Tristan da Cunha has successfully managed to elude the gaze of historians of the Southern Ocean. This is most likely because of its close associations with the Cape Colony (and later the Union of South Africa) as well as with Britain. This paper will briefly deal with representations of what it means to be a part of 'the Antarctic' and suggests that Tristan da Cunha forms an active part in the imagination of the Antarctic and as such is worthy of further historical research. Through the use of various sources, but paying particular attention to travel narratives by the likes of Augustus Earle and the works of various clerics who stayed on the island for long periods over the course of the last two centuries this paper will use techniques from the field of literary criticism in an attempt to unpack these narratives and show how they all fall under the same basic template of a Robinsonade. These popular travel narratives, such as that of Katherine Mary Barrow, drew a far wider readership than government reports on the island and by mapping the ideologies behind these narratives, it can be seen how the authors – and the Tristan da Cunha islanders themselves – were actively trying to shape how the island was 'read' by the outside world. These portrayals of Tristan da Cunha as Robinsonades were not accidental and fed into the wider field of adventure literature as agents of empire. These Robinsonades have often attracted widespread analysis from academics but those dealing with the Southern Ocean have been, for the most part, completely ignored by academics in general and historians in particular. For an example of this one need only look at the voluminous amounts of research done on Rider Haggard's 'King Solomon's Mines' and compare this to the scant attention paid to 'Mary of Marion Isle' by the same author. It is hoped that this paper will be a first step towards further research that will seek to deconstruct narratives of the Southern Ocean as Robinsonades.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Breaking out: On Building a Digital Platform for South African Antarctic History

Forename: Dora Surname: Scott

Authors: Scott, Dora; van der Watt, Lize-Marie; Cooper, John; Prozesky, Heidi; Swart, Sandra; Chown, Steven;

Presentation Allocated: poster

abstract: In 1959, South Africa sent the ship, the Polarbjorn, down to Antarctica to take over the Norwegian research station in Queen Maud Land. The men on board were the first South African team sent down and were to run the station. Although the event and other similar events were documented, and even publicised, many South Africans remain curiously unaware of and therefore unaffected by the country's Antarctic activities. In 2009 the Antarctic Legacy Project was launched. One of the aims of the project is to create a new archival platform for the forgotten South African Antarctic histories to be expressed and revived, to the benefit of researchers globally. This archive allows for the material culture relating to the personal Antarctic experiences, diaries, photographs and other items to be digitised, preserved, and made available to bona fide researchers. This paper introduces the work of the Antarctic Legacy Project and discusses how new technologies have been incorporated to allow for the creation of such a platform. It reflects upon methods of primary research and the interaction with subjects. Furthermore, it demonstrates how digital technologies can be utilised to review history and historical curation, and how that could be used to expand knowledge fields. The potential exists for the creation of a new South African identity that includes the Antarctic as a point of reference. This paper also evaluates how this new awareness of South Africa's Antarctic self may enable further understanding and interaction with national and international Antarctic activities.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Griffith Taylor's Missing Lake: An Example of How History Can Influence Science in
McMurdo Dry Valleys

Forename: W. Berry Surname: Lyons

Authors: Lyons, W. Berry; Howkins, Adrian; Tyler, Scott; Poreda, Robert; Fountain, Andrew;

Presentation Allocated: poster

abstract: In the first week of February, 1911, Griffith Taylor led the first scientific expedition into what would be later called Taylor Valley in the McMurdo Dry Valleys. In his exploration of the valley he noted what we now called Lakes Bonney, Chad, and Hoare. In his written account of his 05 February trek from Andrews Ridge to New Harbor, he only states that the Commonwealth Glacier "blocked the drainage and formed a small lake..." but he did not show this lake on his sketch of the valley floor or on a map he later published. Currently Lake Fryxell sits between the Canada and the Commonwealth Glaciers in Taylor Valley; as of ~2000 it had a volume of $\sim 4.3 \times 10^{10}$ liters and a surface area of $\sim 7 \times 10^6$ m². Lyons et al. (1998) using stable isotope and chloride profiles from the lake waters estimated that Fryxell had been very "small" lake but between 750-900 years ago not 100! So did Taylor miss the lake or did the Lyons et al. misinterpret their data? In this paper, we will revisit all of the geochemical and isotopic data collected by the McMurdo Dry Valleys Long-Term Ecological Research project on Lake Fryxell over the past 20 years and attempt to solve the problem of Taylor's missing lake.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Historical cartography and archaeology: voicing the sealers and whalers of 19th century Antarctica

Forename: Maria Ximena Surname: Senatore

Authors: Senatore, Maria Ximena; Zarankin, Andres;

Presentation Allocated: poster

abstract: The aim of this paper is to present the analyses of archaeological evidence and historical cartography linked to whaling and sealing activities in the South Shetland Islands during the 19th century. In order to contribute to the rethinking of the history told by the Master Narratives, the efforts were directed to studying the contribution of whalers and sealers to the knowledge and experience of Antarctica. Master Narratives about the Antarctic past seem to have been built over a dichotomist basis: on the one hand invigorating and praising all the stories related to exploration whereas on the other darkening or silencing the stories related to the exploitation of natural resources such as whaling and sealing. These Master Narratives of Antarctica highlight events, proper names and precise dates and tend to consider isolated facts, oblivious to the process in which these events were framed. The result is a fragmented history with lights and shades, shaped as a series of exceptional events unevenly emphasizing the "Heroic Era" of exploration. These well-known and widely spread versions of the history of Antarctica ignore other stories: those lived by anonymous sealers and whalers who, during the whole of the 19th century produced experiences and knowledge about Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Pliable Penguins: Changing Perceptions of Antarctic Wildlife

Forename: Brandon Surname: Luedtke

Authors: Luedtke, Brandon;

Presentation Allocated: 7 oral

abstract: This research explores the human history of Antarctica's most charismatic animal. Building on environmental history and the emerging history of animals, it studies representations and displays of penguins and how they illustrate wider social, political, and scientific priorities. During the Heroic Age of Antarctic Exploration, penguins captured the imagination of actual and arm-chair explorers. The explorers themselves used penguins as food, fuel, and friends, whilst penguins sent back home were placed in natural history museums and became one of the public's only tangible connections to a distant, exotic place. By the mid-1900s, penguins had become the quintessential symbols of a mythical Antarctic landscape. Stuffed penguins showed up in display cases in Wyoming and zoological parks in Wisconsin. More than emblematic of the Antarctic landscape, penguins have become, in the 21st century, emotive indicators of climate change at a global level. In this way, displays and representations of penguins have become useful for the dissemination of climate change science. This story offers a chance to study not only the global appropriation of nature and Antarctica's place in it, but also the various ways in which penguins have been incorporated into and used by human culture.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: THE "IN-CORPORATION" OF THE LANDSCAPE; A PHENOMENOLOGICAL APPROACH TO THE ARCHAEOLOGY OF THE SOUTH SHETLAND ISLANDS (ANTARCTICA)

Forename: Andrés Surname: Zarankin

Authors: Zarankin, Andrés; Salerno, Melisa;

Presentation Allocated: 2 keynote 20 mins

abstract: The aim of this work is to present the results of an experimental study that we are conducting as part of an international project on historical archaeology in Antarctica. We focus our attention on the occupation of the South Shetlands Islands, not only in the case of its first visitors in the 19th century but also in the case of the archaeologists who work in the region now. The occupation of the South Shetlands was traditionally analyzed from a cartographic and objectivist perspective which underestimated the diversity of human experience (Salerno et al. 2010). In this presentation we develop a phenomenological approach, reintegrating the relationships between the body and the surrounding world in the past and present of the islands. For the people who occupied/occupy the South Shetlands, the "appropriation" of the landscape was/is not such (at least not in the sense of an object which was/is distinct from oneself, and could/can be possessed as a mere good). Daily contact and familiarity with the islands offered/offer the opportunity to "in-corporate" them, "making them flesh" and transforming them into part of oneself (sensu Warnier 2001 and Merleau-Ponty 1993). Our work attempts to analyze the multiple ways in which people perceived/perceive and go round the territory. As a first step we consider the experiences of the different members of the project during the 2010, 2011 and 2012 fieldwork summer seasons. Considering that, as well as other sources of information (archaeological, documentary), we subsequently reflect on the experiences that could have lived the first inhabitants of the islands (sealers and whalers who were after oil and skins). The advantages and disadvantages of the approach will be evaluated in the presentation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: The Black Antarctic: Race and Labour in the South African Antarctic

Forename: Lance Surname: van Sittert

Authors: van Sittert, Lance;

Presentation Allocated: 10 oral

abstract: Nearly twenty years on from the end of apartheid, South African Antarctic history is still told in the original white heroic mode in which it was first framed at its genesis in the mid-twentieth century. According to this history the South African Antarctic begins with the annexation of the Prince Edward Islands in 1948 and consists of the subsequent heroic struggles of naval commanders and scientists to overcome the extreme environment in pursuit of prestige and knowledge. By changing the narrative settings from 'bridge' to 'deck', 'baas' to 'boy' and 'white' to 'black' an earlier and very different history can be brought into view. This is the history of the 'black Antarctic' which begins fully a quarter century before Transvaal Bay and unfolds in the liminal transnational space of the international pelagic whaling fleets working the southern ocean after World War I. These fleets used Cape Town as their forward base and recruited large numbers of black South African men as seasonal labour in the floating processing factories at a time when the so-called 'civilised labour' policy was increasingly excluding them from wage employment in the national space ashore. The paper offers a preliminary periodisation of the black Antarctic and suggests the implications of a history of the South African Antarctic from below for the hegemonic 'white Antarctic' national history.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: The history of SCAR – influence through independence

Forename: David Surname: Walton

Authors: Walton, David;

Presentation Allocated: 6 oral

abstract: Although SCAR came into existence in 1958 after IGY there have been few papers on its work or its development until the publication of “ Science in the snow” in 2011. Researching the archives exposed the limitations in developing a full history of its activities and made clear the difficulties it had had in seeking to maintain a non-political independence throughout the last 50 years. Communication difficulties with its widespread diaspora have not been helped by ineffective national committees. The varying importance of SCAR in each of its member countries has influenced both the national representation and input into SCAR and the relationship between national science objectives and international science collaborations. The close linkage to the Antarctic Treaty has ensured that much of the legislation on the Antarctic environment has been firmly grounded in good science but SCAR’s contribution has too often been overlooked.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: The scientific and environmental diplomacy of Antarctica's marine living resources and ecosystem, 1968-1980

Forename: Alessandro Surname: Antonello

Authors: Antonello, Alessandro;

Presentation Allocated: 11 oral

abstract: In May 1980, after several years of discussions and negotiations, 15 states agreed to the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). Negotiated in response to growing fisheries interest, this convention created a structure of principles and institutions to provide for the conservation of the whole Southern Ocean ecosystem, to manage its exploitation as a nascent and promising fishery, and to insist on the continuing centrality of the Antarctic Treaty of 1959 and parties to that Treaty in the management of Antarctic affairs. This paper takes advantage of recently-opened government archives in several of the leading Antarctic Treaty parties to present a narrative of CCAMLR's negotiation in the latter half of the 1970s. It is especially concerned with three elements of that negotiation: first, the novel codification of the ecosystem, rather than of individual species, as the unit of conservation, and the transfer of this idea from American and British science and conservation sources into the Convention; second, the longer-term development of environmental and scientific ideas about Antarctica during the 1970s, especially surrounding resource exploitation and conservation; and third, the work of individual scientists and the Scientific Committee on Antarctic Research (SCAR), and their relationship with the national bureaucracies of the Antarctic Treaty signatories (especially the United States, United Kingdom and Australia) and with diplomats working within the structures of the Antarctic Treaty Consultative Meetings. This paper will also necessarily place these developments within the fraught politics of Antarctica's territorial character, comparing how political geographies relate to the geographies of science. This paper, as with the broader research it is situated in, aims to contribute to and bring together environmental history, the history of science and international history. The negotiation of CCAMLR is a notable case study of the relationship of scientific ideas with international environmental protection and management; it is a fundamental tenet of the Antarctic Treaty System, and a fascinating story which insists on the dynamic and controversial nature of many aspects of Antarctic history.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: The triple burden of masculinity: A gender analysis of South African Antarctic and sub-Antarctic science, c. 1961-2011

Forename: Heidi Surname: Prozesky

Authors: Prozesky, Heidi; Van der Watt, Lize-Marié;

Presentation Allocated: Lewander Lecture (1 Keynote) 40 mins

abstract: The signing of the Antarctic Treaty (AT) in 1959 codified science as the sole-sanctioned activity on Antarctica. In South Africa too, the Antarctic (and sub-Antarctic) have been designated as access-controlled 'frozen laboratories.' However, the notion of scientific exceptionalism begs the question: who produces this science, which has been promoted as the main mode of human being in Antarctica? We frame this question in a gender perspective, following a multi-disciplinary approach that includes bibliometric analysis as well as historical narrative. For much longer than other geographical sites, Antarctica has revealed the masculine bias of even the most progressive of countries. Gender ideologies were used to exclude women, and the polar laboratory was arguably the most prohibited site. Science, with its stereotypical image as a male domain, consolidated a masculine presence of scientists. Moreover, disciplines closely associated with Antarctic research, including earth sciences, are still portrayed as more suitable to men. Thus, there has been an unfortunate fusion between exclusion mechanisms functioning in both the Antarctic and in academic science, including individual disciplines. This, we argue, places a triple burden of masculinity on women scientists who work on Antarctic-related topics. Although bibliometric analysis of Antarctic and sub-Antarctic science on a regular basis is considered necessary to help visualise the functioning of the AT System, and although South Africa has contributed strongly to worldwide Antarctic science research output, bibliometric research on that contribution has yet to be conducted. We used South African peer-reviewed research articles on Antarctic science published over a period of 50 years as data source to construct a bibliometric dataset. The South African women and men authorships of these articles will be compared over time in terms of scientific activity, field in which the research has been conducted, and impact of the research. The bibliometric data are then combined with social history to illuminate important aspects of the triple burden of masculinity that women, and specifically women scientists in South Africa, have to negotiate.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Unsung Heroes of the Chilean Antarctic, circa 1948

Forename: María Consuelo Surname: León Wöppke

Authors: León Wöppke, María Consuelo; Moore, Jason Kendall;

Presentation Allocated: 9 oral

abstract: This project addresses the activities of Chile's Antarctic personnel during the nation's first expeditions. This issue has been almost wholly neglected by Chilean historians and indeed historians of every nationality. The first documentary-based account, *Jalonando Chile Austral Antártico: El Ejército en la Antártica, 1948*, was published last year by the present author in collaboration with Mauricio Jara Fernández and Eduardo Villalón Rojas. That book presented the establishment of Base O'Higgins in 1948 as the culmination of Chile's Antarctic rights dating back to the fifteenth century. Due to its political orientation, it ignored the activities carried out as part of the nation's attempt to reinforce its territorial claim. The current paper, based primarily on army archives, discusses those activities based on the accounts of individuals who were active in the field and often lacked any formal scientific training. Short biographies of some of these individuals will be discussed, in addition to their portraits by Andrea Araneda, an artist based in the Magallanes region. This methodology is consistent with the "history from the bottom up" approach, whereas that of the *Jalonando Chile Austral Antártico* emphasized the role played by political elites.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 36

Title: Who discovered Antarctica? The history of exploration as political performance

Forename: Peder Surname: Roberts

Authors: Roberts, Peder;

Presentation Allocated: 4 oral

abstract: During the 1930s debate raged over who discovered the Antarctic continent, and when. Arthur Hinks joined the Australian explorer Douglas Mawson in rejecting the claims of the American sealer Nathaniel Palmer. These debates encompassed Mawson's own recent exploration, which downplayed the achievements of the American expedition led by Charles Wilkes in 1838-42, a venture championed by the American William H. Hobbs. The Norwegian Bjarne Aagaard – who forcefully advanced his own nation's claims to Antarctic glory – soon joined the fray, echoing the claims of Hobbs, Mawson, and Hinks to be conducting disinterested and neutral historical scholarship. But talk of an independent commission of historical experts to resolve historical questions of discovery was futile; the 'experts' were never going to settle their differences by recourse to mutually agreed objective facts. The question of who discovered Antarctica was a vehicle for articulating tensions in the present. Debates over who discovered the Antarctic are more illuminating for the historian of "cultures of exploration" than the chronicler of Antarctic discovery. In doing so I join scholars such as Graham Burnett and Matthew Edney in emphasizing the political and cultural location of cartographic enterprises. Feats in the Antarctic became objects of prestige, backed by scholarly weight, when they appeared in maps and reports and were located within longer narratives of achievement. Factual statements were bolstered by claims to authority from scientific training, personal experience in the field, and the quantity of time spent in archives and libraries. Denying the validity of Wilkes's discoveries meant legitimizing the discoveries of Mawson ninety years later as genuinely novel, further establishing the Antarctic as a European rather than an American space. Assertions that particular individuals discovered Antarctic territory were geopolitical acts even more than the actual voyages of discovery themselves. I conclude the paper by noting the persistence of tropes such as these into the present, linking with the scholarship of Klaus Dodds, Adrian Howkins, and others.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 37

Title: From Greenaway to Moore: Using Antarctic Theatre in the Classroom

Forename: Jason Kendall Surname: Moore

Authors: Moore, Jason Kendall;

Presentation Allocated: Oral

abstract: This presentation analyzes the pedagogic value of theatre based on the author's experience both as a playwright and an as academic. Two of his Antarctic-related plays have appeared in Polar Record and a third is currently being rehearsed in Valparaíso, Chile. Greater attention will be placed on Tierra de San Martín which the University of Tasmania's drama society produced many years ago, and which the author successfully incorporated into his course on British culture last semester at Universidad de Playa Ancha. The students knew nothing of the Chilean Antarctic, much less of the British Antarctic or the Cold War geopolitics that overshadowed the Treaty's formation. By watching a video recording of the play and then analyzing the script, they were able to relate to the nationalistic sentiment that continues to motivate much of the scientific activity in the far south. This presentation analyzes the love-hate relationship shared by Latin Americans, the British, and "Americans," many of whom continue to view each other in adversarial terms for political reasons. The Antarctic-related unit of the previously mentioned course was preceded by another dealing with Peter Greenaway's 1989 film *The Cook, the Thief, his Wife and her Lover*. Parallels between Greenaway and Moore will be explored as a means of maximizing the use of Antarctic theatre in the classroom. Excerpts of Tierra de San Martín will be shown during the presentation. CD-ROMs of the complete performance will be available upon request.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 37

Title: Greku family: three generations with Antarctica (1955-2012)

Forename: Rudolf Surname: Greku

Authors: Greku, Rudolf; Greku, Dmitry; Greku, Tatiana;

Presentation Allocated: Poster

abstract: Ukraine, 1996-2012 Every year the National Antarctic Scientific Centre accepts approximately 100 applications from different specialists who would like to work in Antarctica. Only 12-14 persons work and live at the Vernadsky Antarctic Station whole year round from 1996. All of them that have come back home would like to return back. WHY? Why did my father Khariton Greku (aged 41) accept an offer of Ivan Papanin in 1955, which was a legendary explorer of Arctic, to go to Antarctica as a part of the 1st Soviet Antarctic expedition in 1955-1957? Back then he was a director of the Kaliningrad Sea Port during 10 years after the World War II. Why did he do it? Because it was a very new initiative and he had a chance to build something which did not even exist. And it was still the heroic epoch of the first explorers including Faddey Bellingshausen, Robert Scott, Roald Amundsen and Richard Byrd. Indeed, they were building a new Mirny science station where Khariton Greku was a principal of the coast station of the expedition and the First Mayor of Mirny. They looked for a particular spot to establish the Vostok Station near the Pole of Cold. Some tragic events took place as well, two members of the expedition perished in accidents. (Historical photos). Later 40 years, Professor Peter Gozhik, Director of the Institute of Geological Sciences in the name of the Ukrainian Government signed the agreement in the British Foreign Office in regards to the handover of the Faraday British Antarctic Station to Ukraine. The new Ukrainian station was named as Vernadsky Station. One day in 1997 Dmitry and Rudolf Greku arrived to Antarctica as a part of the First Ukrainian Antarctic Expedition by the Ernst Krenkel rv. It was clearly that the research in Antarctica must be complemented with the satellite data. We received a special grant from the European Space Agency to use the radar altimetry and SAR interferometry data. We are graduates of the Arctic Faculty of the Marine Academy/University in Saint-Petersburg, Russia as the oceanographer and the hydrographer accordingly. Dmitry also took part at the joint Russia-Germany expedition on board of the Boris Petrov rv. Some years later my daughter, Tatiana Greku, joined our Antarctic studies and took PhD degree on Geomorphology of the West Antarctic Shelf (2005). Now she brings up two my granddaughters. We think that one day they will pay some interest to Antarctica and they will not have reasons to ask: "Why?".

SCAR OSC 2012 - Portland July 16th-19th

Session number: 37

Title: Punta Arenas and Ushaia seen through the eyes of some early polar explorers

Forename: Aant Surname: Elzinga

Authors: Elzinga, Aant;

Presentation Allocated: Oral

abstract: The advent of steamships in the late 19th century impacted strongly on the regions of the Magellan Strait. Access to the two colonial outposts originating as deportation centres and missions became much easier as a network of transportation lines evolved. Gold rushes followed by sheep farming added wealth but also contributed to a decimation of native Indian populations. Merchants and traders exploited opportunities afforded by the role of Punta Arenas as an important node for steamship lines connecting major cities on the globe. After 1905 a rapidly expanding whaling industry was an additional boon for polar explorers. Apart from the convenient location of Punta Arenas and Ushaia as sites for loading coal and renewing supplies on the way to Antarctica or additionally places to overhaul and repair their vessels upon return, some polar explorers also found the Tierra del Fuego region of scientific interest in its own right. This is documented in several travel reports, e.g. ones written by Nordenskjöld (1895-1897), Amundsen (Belgica), J.G. Andersson and Duse (1901-1903), Charcot (Pourquis Pas?) and Skottsberg (1907-1909). Shackleton ended up using Punta Arenas as his headquarters for the rescue operation that finally with a Chilean vessel brought back his Endurance expedition men from Elephant Island 1916. Using such reports the paper highlights some facets in a mix of geographical, economic, political and technological conditions in the history of two Antarctic gateways.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 37

Title: The Classroom as a “Gateway” to Antarctica: Teaching Antarctic history in the past, present, and future

Forename: Adrian Surname: Howkins

Authors: Howkins, Adrian;

Presentation Allocated: Oral

abstract: Drawing on the author’s experiences of teaching university level Antarctic history classes in the United States, this paper will explore the idea of the classroom as a gateway to Antarctica. The classroom is arguably one of the most accessible places for students to experience the Antarctic continent, and such engagements can be quite profound and have a lasting impact. The paper will begin by considering the ways in which Antarctic history has been taught differently at different times and in different places over the past one hundred years, paying particular attention to the politicized nature of much Antarctic history pedagogy. The paper will then examine strategies used by the author for teaching Antarctic history in the present. It will think about the challenges and opportunities offered by Antarctic history, and consider how an awareness of the politicized nature of much teaching in the past can inform the practice of teaching in the present. Finally the paper will consider opportunities for teaching Antarctic history in the future. It will suggest that Antarctica offers numerous possibilities for interdisciplinary education with a focus on the environment, and that the classroom has been an important “gateway” to Antarctica in the past and will continue to be so in the future.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 37

Title: The Emergence of the door-port cities to Antartic

Forename: Nelson Surname: Soto Santibáñez

Authors: Soto Santibáñez, Nelson;

Presentation Allocated: Oral

abstract: The work addresses in a comparative way the Antarctic features of three cities that have been named as gateways to Antarctic. What is and what are the characteristics of a gateway to Antarctic? Is it just casually an intermediate-scale of Antarctic paths and flows? Or does it involve a deliberate area that concentrates a wide range of goods and services essentials to the international Antarctic activity? Considering the cases of Punta Arenas, Ushuaia and Christchurch, it describes the Antarctic elements that constitute every city and having the reference of them, common and specific elements are established of each of these cities in the dynamic Antarctic of the Southern Hemisphere. Link cities have been understood as national areas, which starting from its establishment as articulators nodes of international Antarctic activity, they reflect a political, administrative, bureaucratic, economic, academic and social complex web that are constituted in Antarctic practices and discourses specific of these cities. In order we know these practices and discourses we have used qualitative methods of social research. Documentary and Ethnographic Research has been conducted in the three cities, listening to their Antarctic agencies and agents through visits, interviews, observations, photographs, public and institutional documents. The results indicate that each of these cities have been shaped as a gateway to Antarctic, according to their particular and internal histories, and at same time in terms of how Antarctic has been becoming an area increasingly visited and occupied by humans. The inclusion of these cities in the dynamic and global flows and capitalists, has allowed the specialization of these as connectors door-ports in Antarctic, and gestation and assembly of a number of institutions, public policies and businesses capable of providing logistics, goods and services required by international Antarctic activities to take place. As much as there are differences in their specificities, these cities are also subject to management and projection models that fade between them. The discussion revolves around how these cities have become more specialized, concentrating multiple Antarctic activities, receiving international recognition of link gates, perhaps competing with each other, but at same time diffusionism some of their innovations and practices. Is it possible to identify a general model related to enabling of these cities as Antarctic nodes?

SCAR OSC 2012 - Portland July 16th-19th

Session number: 37

Title: The Influence of the Third German Antarctic Expedition

Forename: Cornelia Surname: Lüdecke

Authors: Lüdecke, Cornelia; Summerhayes, Colin;

Presentation Allocated: Keynote 20 mins

abstract: The Third German Antarctic Expedition (1938-39) to Dronning Maud Land is little known outside Germany, because war broke out just before the first volume of preliminary results was published, in German, so the results were not widely distributed. Of the scientific party of nine, four were killed on military duty in World War II, so could not write up their work. Others replaced them and following the war produced a final results volume, also in German, in 1958 for the International Geophysical Year. The main result was the widely known discovery by German aircraft of the Mühlig-Hoffman Mountains around 200 km inland from and parallel to the coast, and of the lakes of the Schirmacher Oasis. Less well known is that the expedition's research vessel, the Schwabenland, equipped with the latest Atlas echo-sounder, added significantly to the bathymetry of the South Atlantic, and discovered the first Antarctic seabed channels, now known to be the upper reaches of submarine canyons. The expedition recovered pebbles from penguin stomachs that enabled them to relate the geology to that of the Ross Sea area, though they were mistaken in assuming that the basalt samples were Recent. The new technique of radiosonde launches, made routinely from the ship, contributed to the first ever north-south transect through the atmosphere, a major contribution to meteorology. The discovery of the mountains and their associated glaciers and ice streams opened the door to a new area of research and influenced the design of subsequent expeditions to Dronning Maud Land, starting with the Norwegian-British-Swedish Expedition of 1949-52, and moving through those of the IGY to the present day.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: "We Leave It As We Found It": Value Motivations and Pro-environmental Behaviour in the Ross Sea Region

Forename: Gary Surname: Steel

Authors: Steel, Gary; Neufeld, Erin;

Presentation Allocated: Poster

abstract: The natural environment of Antarctic is inhospitable to human life. At the same time, it is an indicator of global climate conditions, a vital field location for various disciplines in science, and a focus of often strong personal and professional passions. It is quite obviously a place to which human beings attach values. Yet, these values have never been formally studied. The study to be reported begins to address this gap in our knowledge. Using a combination of a semi-structured interview protocol and laddering techniques, 41 (f=15 m=26 mean age=37.6yrs sd=10.4) field scientists and support personnel were interviewed about the values that underpin their environmentally related behaviours in Antarctica. The data were analysed via thematic coding using definitions derived from Schwartz's (1994) value theory. The results indicate that participants tended to use Self-Transcendent values to guide their pro-environmental behaviours. Other possible influential values were connected to the Conservative value domain. These results suggest that, in order to be most effective, messages directed towards scientific personnel need to emphasize the more global benefits of acting in a pro-environmental manner.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: Antarctica Values and the Repositioning of Malaysia's Public Policy

Forename: Adnan A. Surname: Hezri

Authors: Hezri, Adnan A.; Nor, Norizan Md.; Koshy, Kanayahtu C.;

Presentation Allocated: Poster

abstract: Malaysia has long held the belief that Antarctica is a priceless human heritage of global stature. Beginning in 1983, together with Antigua and Barbuda, Malaysia has strategically flexed its diplomatic muscle within the United Nations General Assembly to argue that Antarctica symbolizes our common heritage on Earth. Because Antarctica is a region extending beyond the jurisdiction of any nation, Malaysia's foreign policy championed its equitable access for the promotion of peace and science. Guided by the argument 'common heritage value', a criticism was level against the governance of the Antarctic Treaty Consultative Parties (ATCP) for its lack of transparency and participation. Malaysia also championed the need to preserve the fragile environment and natural resource of the Antarctic. Over the years, Malaysia's position on the 'Question of Antarctic' has evolved from challenging the ATS to a constructive engagement with the ATCP. This constructive turn happened in 1996 when a bilateral scientific cooperation between Malaysia and New Zealand was signed whereby Malaysia was offered logistical support and scientific collaboration. The establishment of the Malaysian Antarctic Research Programme (MARP) in the areas of climate change and biodiversity followed suit which was endorsed by the Cabinet in November 1997. MARP is funded under the Eight Malaysian Plan with an allocation of RM 10 million to initiate and set up Malaysian research in Antarctica. Malaysia then was invited, and took up the invitation, to observe Antarctic Treaty Consultative Meetings. More recently, Malaysia ratified the Antarctic Treaty on October 31, 2011. Deeper institutional response such the promulgation of an Antarctica statute and the establishment of a national polar institute is currently being debated in Malaysia's policy domain, mainly to ensure the continuity of research on Antarctica in the country. This paper examines the evolution of Malaysia's normative connection to Antarctica. Through a qualitative case study methodology, this paper explores the salient features of Malaysia's policy development on Antarctica, from merely using diplomacy for science to the recent functional adaptation in institutionalizing Antarctica research within the Ministry of Science, Technology and Innovation. Specifically, the study highlights the role of Malaysian scientists as 'policy entrepreneurs' in the quest to mainstream Antarctica in Malaysia's public policy.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: Climate Change and Uncertainty: What is the Role of Values in Antarctic Policy?

Forename: Sira Surname: Engelbertz

Authors: Engelbertz, Sira; Liggett, Daniela; Steel, Gary;

Presentation Allocated: Oral

abstract: Global change, and climate change in particular, have created an urgent need for effective decisions. However, these decisions involve assessing complex data and can generate high degrees of uncertainty about critical outcomes. Such a situation leaves greater scope in the decision-making process for influences other than what might be regarded as objective knowledge. This paper will give a critical review of one of the factors at play in decision-making in contexts of uncertainty – human values – and provides an overview of a current study that attempts to identify values in political discourses attached to Antarctica. Values are understood as internalized codes that affect human behavior and include the moral element of what is considered as good and right. The paper presents the first results of a document analysis on the basis of the more recent political discourse on climate change. The main sources of data are documents that were submitted by the participants and stakeholders in the 2010 Antarctic Treaty Meeting of Experts (ATME) in Svolvær, Norway. Several questions will be discussed: In what manner do decision-makers' values influence their decisions? How is the phenomenon of climate change perceived and evaluated by the various parties? Are there different interpretations of the same situation, and is this due to different values? The tentative answers to these questions will be discussed in terms of their implications for decision-making in the near- and long-term.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: Perceptions and Opinions of Antarctic Values in Chile

Forename: Juan Francisco Surname: Salazar

Authors: Salazar, Juan Francisco;

Presentation Allocated: Oral

abstract: The paper presents preliminary results of an exploratory study aimed at mapping public perceptions of Antarctica in two Chilean cities. A survey of public opinions and attitudes was implemented with the intention to have an indicative notion of what the core values of Antarctica might be for a representative section of the Chilean population. The survey administered in July 2011 with 600 residents in Santiago (n300) and Punta Arenas (n300) signposts that Antarctica is perceived as having a place in the shaping of national and regional identities. The survey also asked respondents to identify the most important values associated with Antarctica to which respondents ranked science and the environment as the most important. Paradoxically, an important proportion of respondents felt that the cultural value of Antarctica is as important as its political value or economic value. The interest in this paper is to advance a notion of Antarctic values informed by recent anthropological theories in which values are recognised as the meaning of actions or as meaning-making actions. In which case the question that arises is whether it is possible to develop action-based value systems to account for differing knowledge practices in/of Antarctica which in turn may be useful to develop better understandings of management of human-related activities [actions] and decision-making in - or engagement with - the Antarctic.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: Quantitative Characteristics of Values in Antarctica and Threats for Antarctica

Forename: Oleksandr Surname: Kuzko

Authors: Kuzko, Oleksandr; Leonov, Mikola; Savchenko, Valeria; Fedchuk, Andrii;

Presentation Allocated: Oral

abstract: In consequence of the human activity increasing in Antarctica the need has been arose in the cataloguing the range of values human beings place in Antarctica and in the explaining the importance of each value or category of values. To answer the arising questions the Social Science Action Group (SSAG) SCAR has been established. The SSAG has pre-formed categories of such values with specific values inside each category. With respect to SCAR's mission "to provide scientifically-based advice to the Antarctic Treaty System and other policy makers" it is the great interest to consider simultaneously categories of threats for Antarctica and to define the importance of each threat. This study is devoted to: Clarification of more specific values within certain SSAG categories of values; Formation of categories of threats and specific threats within each category; Determination of quantitative characteristics of both categories of values and categories of threats. To determine the required quantitative characteristics the experts' judgements evaluation method is used which has proposed in [Thomas L. Saaty. Mathematical models of arms control and disarmament. John Wiley&Sons Inc., 1968].

Correlation is discussed of the obtained quantitative characteristics of Antarctica values and threats as well as quantitative characteristics of Antarctic Treaty Consultative Meetings (ATCM) Recommendations during the period 1961 – 2011.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: Teaching/learning or living Antarctica?

Forename: Viviana Andrea Surname: Alder

Authors: Alder, Viviana Andrea;

Presentation Allocated: Oral

abstract: This session addresses the potential enhancement of two powerful tools for understanding nature and helping to build a more equitable future for global society: Science and Education. When referred to Antarctica, science is recognized worldwide as the priority activity, as it is secured and encouraged by the peace and cooperation framework provided by the Antarctic Treaty. The real value of Antarctica can not be taught by, learned from or felt through a book. Antarctica is the real spirit of life and, as such, it should be lived, discovered and interpreted with passion and creativity. Education, on the other hand, is perhaps the strongest force that can be used to reach a better world. The relatively low wildlife biodiversity of Antarctica contrasts with its high workforce diversity. In a world plagued by uncertainties and with diminishing global resources, this seed of international cooperation still remains almost unexplored but stands as a light of hope for young scientists, now encouraged by the SCAR strategic plan 2011-2016 to assume leadership roles. Fresh perspectives and strategies are necessary in order to promote the involvement of future generations. To this end, the proposal considers the creation of a multicultural, cross-disciplinary pool integrated by young representatives from all nations currently developing research activities in Antarctica, and it is aimed at providing a commonly agreed, apprehensible answer to the concerns posed by global society on Antarctic issues. An inclusive attitude and a permanent concern for the needs of society will be its founding principles.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: The Value of Clean Ice: Environmental Worldviews and Beliefs of New Zealand Antarctic Field Scientists

Forename: Gary Surname: Steel

Authors: Steel, Gary; Neufeld, Erin; Stewart, Emma;

Presentation Allocated: Oral

abstract: Field scientists in Antarctica work in an environment that is highly sensitive to anthropogenic disturbance. Thus, the factors that determine their environmentally oriented behaviours while in the field are critical to understanding and managing the impact of data collection. Adopting the theoretical structure outlined in Stern and Dietz's (1994) Value-Belief-Norm Theory, this study sought to catalogue and analyse the environmental worldview, concerns, and beliefs of a group of field scientists operating through Scott Base, Antarctica. During the 2010/11 and 2011/12 seasons, 75 scientists and other field researchers ($f = 27$, $m = 48$; mean age = 39.7 years, $sd = 12.0$) completed the New Ecological Paradigm scale (NEP; Dunlap et al., 2000) and Snelgar's (2006) environmental beliefs and concerns scale. Analyses of the data indicate that NZ Antarctic field science personnel possess a dominantly ecocentric (vs. anthropocentric) worldview. This orientation is most strongly and positively correlated with beliefs about the connection between the Antarctic environment and the global biosphere. It is also positively related to altruistic and, to much lesser extent, egoistic beliefs. These results will be discussed with respect to the theory of pro-environmental behaviour and the practice of environmental management in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 38

Title: Transformation of Antarctica Scientific Research into Environmental Protection Policy

Forename: Rohani Surname: Mohd Shah

Authors: Mohd Shah, Rohani; Hashim, Rugayah;

Presentation Allocated: Oral

abstract: Transformation of Antarctica Scientific Research into Environmental Protection Policy. Rohani Mohd Shah & Rugayah Hashim. Faculty of Law Universiti Teknologi MARA, 40450 Shah Alam, Selangor. Scientists can uniquely contribute to diplomatic efforts on issues such as climate change, by informing elected officials and policymakers of the latest evidence, opinion and analysis. Increasingly, science is recognized by most industrialized nations for its less personal contributions to foreign policy. Regardless of jurisdiction issues on Antarctica, the hope of the scientists that their research findings to be taken into account prior to any other interests when drafting legislation and building public policy of preservation of the environment. Antarctic Scientists through dialogue had envisaged the institute of marine sanctuaries and individual protected areas to counter the vulnerable impact of urbanization activities and the impact of climate change. International involvement in Antarctica is now rising. These developments pose a potential threat to the fragility of the Antarctica pristine environment. However, with the accuracy and confidence acquired by the scientist for the last 50 years we now know the challenges confronting the nature. With the discovery of the scientists, we now know the complexities of the degrading environment. Scientists devotion to the story finally managed to convince the public that the ozone layers of the world need careful consideration to undertake a practical framework for future generation. It is imperative for any State to set up an established policy that are available, combining scientists research finding with law on Environmental Protection in order to protect the Antarctica environment. Malaysia has a limited audience and capacity on Antarctica still, Malaysia participates and plays her role, locally and internationally, as a State that is genuine concern with maintenance of the environment. Malaysia since 2011 agreed to accession to the Antarctica Treaty 1959 and now drafting its Antarctica Act to incorporate scientists recommendations adopted through the comprehensive Protocol on Environmental Protection to The Antarctic Treaty (The Madrid Protocol 1991) to conserve the Antarctic continent for future generations as the current conservation place on Earth. The study will indicate the areas where Malaysia needs to

SCAR OSC 2012 - Portland July 16th-19th

Session number: 39

Title: Alaska on the Move? Perspectives on Changing Mobilities of People and Resources

Forename: Peter Surname: Schweitzer

Authors: Schweitzer, Peter;

Presentation Allocated: Oral

abstract: From increasing rates of rural-to-urban human migration, to the prospect of exploding volumes of ship traffic through Bering Strait, to the spread of invasive species, Alaska seems to be on the move. Triggered by climate change and globalization, increased mobility characterizes many aspects of northern social-ecological systems. This presentation will look at the current evidence for changing patterns of movements and flows of “agents” (be they people or biota) and commodities, in the context of existing infrastructure and natural environments. Likewise, future developmental scenarios for the North – from large-scale industrial development, to a massive influx of transnational migrants, to increased competition for critical resources – will be discussed. Ultimately, we are interested determine which dynamics make systems vulnerable to failure, and which elements and their interactions enable systems to maintain the stability that facilitates resilience. In the context of Alaska, this invites the bigger question whether the state’s rural communities are sustainable in the long run. While the presentation focuses on the U.S. American Arctic, we will explore whether trends in Alaska have parallels in other parts of the circumpolar North. Finally, the presentation invites comparisons with the polar regions of the southern hemisphere.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 39

Title: Anticipating the flood: Arctic community exposure to flooding and obstacles to adaptation

Forename: Elizabeth Surname: Marino

Authors: Marino, Elizabeth;

Presentation Allocated: Oral

abstract: The Arctic is experiencing rapid changes that have made an already dynamic coast increasingly unstable. While habitation along the coast of Alaska has been ongoing for millenia, permanent year-round settlement in rural, primary Inupiat areas has been relatively recent and coincides with United States government's programs to establish schools, education, and exposure to the market economy. In some communities today, the infrastructure developed in the last 100 years is threatened with inundation by increasingly tumultuous storms, high seas and flooding -- exposing communities who live here to risk. This paper explores a case study of one such village -- where risk is high and adaptation response possibilities are limited. Shishmaref, Alaska is an Inupiat village of approximately 600 people. Government agencies, researchers and the local community believe that permanent habitation of the island is increasingly dangerous because of erosion and potential flooding. Relocation off of the island as a community is difficult due to a series of factors including: mistrust and misunderstanding among local community members and government agency planners; federal and state policy that is inflexible to climate change disaster scenarios; and lack of institutional memory and intra-agency cooperation among state and federal government agencies. This paper will investigate and elaborate the structural obstacles to successful adaptation.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 39

Title: Assessing Change in the Arctic: The Human Development Report and the Arctic Social Indicators Project

Forename: Gail Surname: Fondahl

Authors: Fondahl, Gail; Larsen, Joan;

Presentation Allocated: Oral

abstract: Change - climatic and otherwise – is a longstanding feature of human existence in the Arctic. However, the tempo and drivers of change have dramatically shifted in recent decades. How can one measure and assess such change? This paper discusses two projects: the Arctic Human Development Report-II, and the Arctic Social Indicators project, that aim to contribute to the study and monitoring of change. The AHDR-II has as its objective to contribute to our increased knowledge and understanding of the consequences and interplay of physical and social global change processes for human living conditions and adaptability in the Arctic. It seeks to offer a comprehensive overview of human development in the Arctic in a time of rapid global change processes (climatic and otherwise), as well as to provide an instrument that can be used in assessing progress toward sustainable human development. The Arctic Social Indicators project identified a set of Arctic-specific indicators to monitor Arctic human development and quality of life in the Arctic. It then tested, validated and refined the indicators, evaluating how well they work across the Arctic and at various scales. This presentation reviews the two projects, the Arctic Social Indicators project nearing completion and the Arctic Human Development Report II in its initial full year. It considers how concern regarding climate change as a driver has been moderated by other challenges to Arctic communities and institutions, and how these are captured in the arctic social indicators and assessed in the Arctic Human Development Report II.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 39

Title: Building Antarctic Social Sciences: A Playbook from the Arctic?

Forename: Igor Surname: Krupnik

Authors: Krupnik, Igor;

Presentation Allocated: Keynote 20 mins

abstract: On the occasion of the 20th anniversary of the International Arctic Social Sciences Association (IASSA), a group of IASSA veterans produced a collection of papers featuring the beginning of the 'social sciences' in the Arctic in the 1980s and the establishment of IASSA in 1990 (http://www.iassa.org/images/stories/newsletters/northern_notes_33_anniversary_issue_2010.pdf). The process in the mid-1980s was triggered primarily by some external drivers and by the growing realization by many players in Arctic research and policy that a new field was needed to accommodate the growing spectrum of societal and human research in the North. The name for the field, 'Arctic social sciences,' was rather unplanned but became a useful banner to mobilize the community and to circumvent internal arguments. The process culminated with a bottom-up establishment of a new professional organization at the fortuitously chosen meeting. That sequence of events (field recognition by peers from other disciplines—finding proper name—establishment of units/programs bearing a new name—institutionalization and grassroots build-up) offers a playbook to the peer community of Antarctic social scientists. The paper examines IASSA experience in promoting the Arctic social sciences and some specific steps and challenges that the Antarctic social science community may face during a similar process.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 39

Title: Many Strong Voices: Climate change and resilience in the Arctic and Small Island Developing States

Forename: John Surname: Crump

Authors: Crump, John; Kelman, Ilan;

Presentation Allocated: Oral

abstract: The poles are no longer places to just do research. Knowledge gained through the International Polar Year and through other natural and social science investigations is increasingly in demand, and increasingly needed as the changing climate alters the environmental, social and economic landscapes of the Arctic. In a 2003 Governing Council decision, the United Nations Environment Programme (UNEP) characterized the Arctic as barometer for global environmental change. The next year, the Arctic Climate Impact Assessment was released and the Arctic became part of the agenda of policy makers in the Arctic states -- and increasingly other nations around the world. What happens in the Arctic matters to the rest of the world. Like Antarctica, the region is a major driver of the global climate system. Changes in the Arctic mean changes elsewhere around the planet. And those changes are happening right now. To respond, UNEP/GRID-Arendal and the Center for International Climate and Environmental Research - Oslo (CICERO) are co-coordinating the Many Strong Voices (MSV) programme. MSV brings together people and organizations in the Small Island Developing States (SIDS) and Arctic to take collaborative and strategic actions on climate change mitigation and adaptation at the local, national, regional and international levels. Its goal is the wellbeing, security, and sustainability of communities and provides a platform for people in these regions to tell their stories to the world. Lessons learned through MSV will support policy development at local, regional, and international levels. They will provide decision makers in the two regions with the knowledge to safeguard and strengthen vulnerable social, economic, and natural systems. Societies and livelihoods in both the Arctic and the SIDS are particularly vulnerable to climate change because of their close ties to land and sea environments [IPCC, 2007]. While climatically and geographically distinct, the Arctic shares many characteristics with other parts of the world. This paper will examine efforts by MSV participants to: Communicate similar challenges faced in their respective regions through an innovative youth photography project called Portraits of Resilience; Share knowledge and experience through a series of structured thematic workshops; Develop new research focussed on resilience building and human rights; and Lobby for policy and practice changes through the UNFCCC and IPCC.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 39

Title: The Legacies and Lessons of International Polar Year 2007-2008

Forename: Julie Surname: Brigham-Grette

Authors: Brigham-Grette, Julie; Dunlea, Edward;

Presentation Allocated: Keynote 20 mins

abstract: International Polar Year (IPY) 2007-2008 was an intense, international campaign for polar observations, research, and analysis designed to further understanding of the polar regions. A 2012 National Research Council (NRC) report, *The Legacies and Lessons of International Polar Year 2007-2008*, identifies the major cross-cutting lessons of the IPY and discusses why these lessons are important today in planning for the future. Specifically, the report highlights the outcomes of the multi-faceted IPY campaign from a U.S. perspective, integrates the lessons from different activities, and records U.S. IPY efforts so they are available to a broad audience. Based heavily on information generated at a large community workshop, the report looks across disciplines at both poles to illustrate how the many pieces of IPY combine to move polar understanding forward in significant and sometimes unexpected ways. The report addresses the IPY from the perspectives of discoveries made, tools developed, people involved, knowledge translated to action, and overall reflections. Note: We'd like to submit this abstract for general consideration, not necessarily the two sessions chosen below.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: Antarctic Climate Change Education through Meteorological Measurements at Schools (ACCEMMS)

Forename: Ryan Surname: Fogt

Authors: Fogt, Ryan;

Presentation Allocated: Oral

abstract: ACCEMMS (Antarctic Climate Change Education through Meteorological Measurements at Schools) is a one-year project funded by the Ohio Space Grant Consortium. The project has two objectives. Firstly, to actively participate in science, engineering, technology, and mathematics (STEM) education for middle school Earth Science in schools in southeastern Ohio, an underserved and poorly meteorologically sampled region. Secondly, to conduct preliminary research on Antarctic climate change, the results of which will be used in future grant proposals. This presentation will focus on the educational component, whereby automatic weather stations are installed at six participating schools. In turn, the teachers use these weather stations to expand the weather curriculum over the next several months, focusing especially on dramatic real-time changes. A synthesizing presentation is given by the lead project investigator at each school to link the changes the students have been observing at their schools with ongoing Antarctic climate change, the latter which crucially depends on data collected from automatic weather stations in remote places across Antarctica. It is anticipated that the use of real-time observations in the classroom will substantially provide more meaning and depth in understanding Antarctic climate change, and ideally bring the experiences of the icy continent closer to home. Successes and lessons learned during the project will be presented, including improvements to be made in future iterations of the project. As of submission of this abstract, the project is in the phase of installing weather stations at various schools.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: Antarctic Science Curriculum of Hokkaido University

Forename: Shigeru Surname: Aoki

Authors: Aoki, Shigeru; Sugiyama, Shin; Fukui, Manabu; Yamamoto, Masanobu; Toyota, Takenobu; Sawagaki, Takanobu; Mizuta, Genta; Ohshima, Keiichiro; Matoba, Sumito; Shimoyama, Kou; Iizuka, Yoshinori; Endo, Tomoko;

Presentation Allocated: poster

abstract: In April 2007, the Graduate School of Environmental Science, Hokkaido University, has launched a new program, the Antarctic Science Curriculum. This unique program offers graduate students an opportunity to study a broad field of polar sciences, including ocean and atmospheric processes in polar regions, ice and snow sciences, glaciers, sea ice, permafrost, and global environmental changes. This curriculum was initiated as our contribution to the international program of education in cryosphere science, international Antarctic Institute (IAI). IAI aims to offer international standard education programs at undergraduate and graduate level with a special emphasis on Antarctic and cryosphere sciences. The universities and institutions share their curriculums within the framework of IAI partnership so that the students are able to take lectures and courses internationally. Our curriculum consists of two special lectures given by polar scientists from IAI partner institutions, three field courses held on Swiss glaciers etc., and more than ten lectures offered by the staff of the graduate school. Those who complete the program will be awarded a Diploma of Antarctic Science, independently of the master's degrees and doctorates. The diploma certifies that the student has acquired special knowledge and experience in polar science. Those who completed the curriculum actively participate in the Japanese Antarctic Research Expedition. Further cooperation with IAI partners will strongly merit in enhancing understanding for cryospheric and global environments.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: Connecting Adélie Penguin Field Research to the K-12 Classroom and General Public Audiences Using an Interactive Website.

Forename: Jean Surname: Pennycook

Authors: Pennycook, Jean;

Presentation Allocated: Oral

abstract: Field research is exciting and engaging, but students rarely experience it. Through the use of an interactive website and multiple classroom activities related to the research, we provide a virtual field trip to a penguin breeding colony in Antarctica. Students experience what scientists really do, how they gather and analyze data and what tools and skills are required to be a successful field scientist. During the austral summer, Dr. David Ainley and the Penguin Science team travels to Ross Island, Antarctica to study Adélie Penguins. Using the penguins as a hook we engage students in the research giving them an opportunity to use a field journal as they gather data on selected penguin families. Students record weather, date of first egg, chick hatch, length of foraging trips by the adults and how many days until the chicks fledge, comparing data between breeding pairs and breeding seasons. Pictures and individual penguin information is posted daily on the website for students to record their own data and create their own graphs. In addition classrooms are given the opportunity to take part in the annual penguin count using satellite photos of the colony. Providing the broader impacts of our outreach efforts, this program engages over 300 classrooms resulting in 1M hits a month on the project webpage during the breeding season. It is our hope these activities engage and excite students in scientific research encouraging them to continue in a STEM related educational pathway and career field.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: From the ice world to the classroom: Multi-collaborative efforts to bring Antarctic science education to students

Forename: Stephen F. Surname: Pekar

Authors: Pekar, Stephen F.;

Presentation Allocated: Oral

abstract: During the austral spring, 2008 (October-December, 2008), an IPY NSF funded Offshore New Harbor Project collected multi-channel seismic data using a sea ice platform in the Ross Sea, Antarctica and successfully implemented an integrated educational and outreach program, which engaged tens of thousands of students and teachers and reached millions of people across the U.S. This program was supported by an interdisciplinary collaborative effort that involved ten educational, outreach, and media organizations and had an inner city schoolteacher from Harlem, NYC who accompanied the expedition. The result was a comprehensive educational experience with a six-week curriculum using various media platforms. Activities included having: weekly live video conferencing in collaboration with the Global Nomad Group (GNG) to scores of schools across the country; two students trained in film making and video blogging at the Exploratorium (hands-on museum), enabling them to create video blogs on ice that were shown at the museum and posted on their web; live webinar teacher training and interactive lessons with classrooms in collaboration with the U.S. Satellite Inc. NSF funded SPRINTT Project; a weather station at the remote field camp and posting 24-hour weather data onto the GLOBE website; writing blogs to inner city students via Reach the World and for the general public by the Center for Teaching and Learning at Queens College; and teacher interactions through the Project Circle (ANDRILL Program). An added bonus was the media interest the expedition received that included: a front page article in the New York Times; a segment on CBS TV; an article in the NY Daily News; as well as numerous segments on the TV, radio and newspapers. The key to our success is rooted in engaging with organizations that have previous experience in doing various types of activities and having previously built networks of teachers, schools, etc. that we could immediately access. Additionally, we had an off ice (Louise Hoffman Ed. Director for ANDRILL), on ice (technician from GNG) personnel and the teacher coordinating the educational activities. I also held a two-day pre-expedition workshop that brought together all of the educational groups, the two PI's, and others participants from the expedition. Finally, the creation of a website acted as a clearinghouse of information for disseminating the types of educational opportunities and providing general information about the science.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: From the Trenches to the Tundra – How to Develop Scientifically Rigorous Outreach Materials for Secondary School Students

Forename: Mark A. Surname: Walsh Jr.

Authors: Walsh Jr., Mark A.;

Presentation Allocated: Poster

abstract: With an increased awareness of the changing Polar Regions, our polar scientific community must broaden their outreach and communication efforts to educate our secondary school students with timely, accurate information and analyses. The majority of available outreach material is focused on elementary and middle school students, who have little ability to immediately influence policy. The abundance of resources suitable for these younger age-groups often overshadow the need for educational support appropriate for our high school students who are uniquely positioned to turn this knowledge into more-timely action. These gaps were first identified after spending 5 years trying to incorporate polar science into my high school science curricula, but only during the last three years observing weather at McMurdo Station has my collaboration with polar scientists allowed this problem to be formally addressed, possible solutions discussed, and age-appropriate outreach products to be developed. Consistent interaction with polar scientists has been the driving force behind this collaboration, and is the key component needed to developing deeper, more scientifically rigorous outreach materials for our high school students. However, this interaction is both difficult and expensive to accommodate in Antarctica, and only through the addition of a centralized Education and Outreach Coordinator based at McMurdo can the outreach products be developed that are both suitable for our high school students, and within the budgets of our grants and government.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: How education and outreach can stimulate polar science in non polar Countries?

Forename: Jose Surname: Xavier

Authors: Xavier, Jose; Lourenço, Sílvia; David, Ana; Jorge, Marco; Nogueira, Marta; Rei, Vanessa;

Presentation Allocated: Oral

abstract: The Association of Polar Early Career Scientists (APECS), created in 2007, was considered by the Joint Committee for the International Polar Year (IPY) as a major legacy of IPY. APECS is a worldwide association of early career scientists interested in the polar regions and the cryosphere generally. Its mission is to raise the profile of polar scientists by providing a continuum of leadership that is both internationally and interdisciplinarily focused, and to stimulate collaborative projects. Within 3 years, APECS became a highly polar respected association, providing a strong voice for young researchers in polar research issues while enable information sharing between early career scientists, promoting and organizing science, education and outreach events, and having an active involvement within other polar organizations. This presentation aims to show how APECS in Portugal, how it became established within IPY, provide evidence of APECS Portugal interdisciplinary and educational innovative activities/events in a non polar country in collaboration with numerous countries, within the national educational programme LATITUDE60!, and how actively played an important role in promoting Portuguese Polar science beyond IPY. This presentation will also aim to look to the future and identify new directions for polar science lead by early career scientists in Portugal in order to shape the future of polar research.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: PLANTscape: a new project to map Cretaceous to Neogene vegetation data in support of research and education.

Forename: Steven Surname: Babcock

Authors: Babcock, Steven; Warny, Sophie; Nitsche, Frank; Bowman, Vanessa; Carbotte, Suzanne;

Presentation Allocated: poster

abstract: There is a growing emphasis on science, technology, engineering and mathematics (STEM) integration in secondary earth and environmental science classrooms. Access to Antarctic research affords new opportunities for teachers and students to improve their understanding of a range of topics including: climate change timing and intensity during the past 34 Ma, the use of microfossils to infer past vegetation, and application of GIS tools to understand the physical environment. PLANTscape, a new initiative funded by a 2011-2016 NSF CAREER grant, is being developed to create databases and maps that teachers and students can use to study Antarctica. This project is being conducted via three Louisiana State University Master of Natural Science (MNS) theses. The MNS theses are part of a program tailored for school teachers seeking an advanced degree in geology or biology. This program provides the depth and breadth of study in the sciences that is required of science educators and school teachers. Each teacher will be responsible for creating maps and other educational materials based on published paleovegetation data using the resources available online or at the Center for Excellence in Palynology (LSU CENEX, U.S.) and at the Leeds Centre for Polar Science (University of Leeds, U.K.). The mapping is done using the Southern projection of GeoMapApp, an earth science exploration and visualization application developed at the Lamont-Doherty Earth Observatory of Columbia University. This application provides direct access to Antarctic base maps including the BEDMAP compilation of under-ice topography (Lythe et al., 2000) and high-resolution bathymetry from multibeam data for adjoining ocean areas.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: Science is Cool: The Crow Education Partnership

Forename: Susan Surname: Kelly

Authors: Kelly, Susan; Vick, Trista; Michuad, Alex; Priscu, John; Foreman, Christine;

Presentation Allocated: Poster

abstract: Polar science is the focus of a developing science education partnership on the Crow Indian Reservation, in South Central Montana. Through this partnership we are designing STEM science enrichment activities that focus on extreme environments for the Upper Elementary grades in the Hardin School District. The district encompasses three intermediate schools in a rural setting, with a largely Native American student body. Intermediate School teachers from Hardin and Crow Agency school, scientists and graduate students at Montana State University, and Crow tribal members are working together to develop inquiry-based science activities for students and teachers. Through the use of hands-on interactions, online technologies and field experiences, we are providing monthly science interaction for the classroom, and modeling inquiry-based activities for the teachers and community members. In addition to developing activities, we are working with Crow tribal members and teachers to tie science activities to the national standards and school district curriculum, while at the same time connecting science activities to Crow history and culture. Our blended education model utilizes face to face interactions and some video-conferencing connections and is designed to engage graduate students in the teaching process. Graduate students are developing science communication skills and learning the importance of cross-cultural communication, while the teachers and intermediate students are gaining science content knowledge and direct interactions with authentic science experiences. We are developing a true partnership and community of learning through our efforts.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: Teaching polar science in Brazil: the diffusion of multidisciplinary knowledge about glaciers and climate change to undergraduated students

Forename: Adriano Surname: Lemos

Authors: Lemos, Adriano; Gobel, Christian; Santos, Virginia; Bicca, Cleidir; Arigony-Neto, Jorge;

Presentation Allocated: poster

abstract: A group of MSc students from the remote sensing laboratory of the Brazilian National Institute of Cryospheric Science and Technology (INCT da Criosfera, in Portuguese) proposed, as part of their activities in the Graduate Program in Oceanography of the Federal University of Rio Grande, a new course on "Glaciers and Climate Change" to be offered for undergraduate students of Geography and Oceanography. In this paper we discuss the challenges involved in the creation of the program of lectures and offering the course for the first time. The main motivation of the course is the spreading of information about climate change and the impacts on the Cryosphere, engaging students in this subject few discussed in a specific discipline in Brazil. The program of lectures was developed in order to build a basic knowledge about the glaciers and climate change in such a way that would enable a proper understanding of global climate processes and their influences in this component of the Cryosphere. For example, one of the teaching approaches introduces the environments that integrate the Cryosphere, following with the presentation of concepts on the dynamics of the ice masses and climatic and oceanographic factors that control it and completes connecting with regional processes related to global climate. A second approach was to clarify how studies in this area are developed, through seminars, presentations, and practical applications of remote sensing techniques for monitoring the Cryosphere. The challenge of this new experience is the dissemination of knowledge to interested students with almost no contact to this environment, making it tangible for their understanding. The creation of a discipline as this became more necessary since the subject is emerging and gaining increasing attention by media. Nationally, this course was a pioneer in addressing a focus exclusively for Cryosphere at undergraduate level, explaining the importance of studying and monitoring these environments, and aiming the motivation of a new generation of future cryospheric scientists and/or citizens informed about the dynamics of our planet.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: The International Antarctic Institute

Forename: Andrew Surname: McMinn

Authors: McMinn, Andrew; Virtue, Patti;

Presentation Allocated: Oral

abstract: The International Antarctic Institute is a consortium developed by leading global Antarctic educational and research-intensive institutes. Its purpose is to facilitate cooperation and collaboration between member universities in undergraduate and postgraduate multi disciplinary education in Antarctic and Southern Ocean sciences. As has been seen over the past half-century, international cooperation is the key to the success of large-scale research programs in Antarctica and the Southern Ocean. By sharing teaching resources between international partner universities we can create educational opportunities on a scale unattainable by any one institute or through traditional bilateral alliances. The International Antarctic Institute facilitates multi-institute degrees whereby students enrol in their home institutions (an International Antarctic Institute -affiliated university) and take up to an agreed proportion of their course units at other member institutions. The units taken during this exchange are credited through their home university. Courses and degrees are 'jointly badged' by the participating institutions of the International Antarctic Institute. Members and associated members presently include institutes from: Australia, Brazil, Canada, Chile, China, France, Germany, Italy, Japan, Malaysia, New Zealand, Norway, Spain, United Kingdom and the United States of America. The International Antarctic Institute is open to institutes who presently or potentially have an Antarctic educational mandate.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: The Italian Museo Nazionale dell'Antartide: National and International Contribution to education, outreach and training

Forename: Giuseppe Surname: Orombelli

Authors: Orombelli, Giuseppe; Albertelli, Giancarlo; Bernat, Paolo; Cattadori, Matteo; Folco, Luigi; Montenegro, Maria Eugenia; Müller, Jacqueline; Olmastroni, Silvia; Ossola, Carlo; Povero, Paolo; Pugliese, Nevio; Palmeri, Rosaria; Protopsalti, Ioanna; Ricci, Car

Presentation Allocated: poster

abstract: The Italian Museo Nazionale dell'Antartide (www.mna.it) was established as a consortium of three universities (Genova, Siena, Trieste) in 1996 with the aim to preserve, study, and increase the value of all material collected during the Italian Antarctic expeditions, and to promote public understanding of Antarctic science. All three sections hold a permanent exhibition to promote the knowledge of the Antarctic continent. The Genova section is dedicated to biology and ecology, Siena to Earth sciences and Trieste to history of exploration and marine geology. The contribution of the museum to education, outreach and training is devoted to promote the polar knowledge to schools through lectures, guided visits and didactic experiments to all-level students, from kindergarten to PhD level. Recent and ongoing initiatives are: Travelling exhibition Support to the PhD school on polar science Polar summer school for teachers Organization of workshops and congresses on polar topics, climate change, extreme environments; Editing of proceedings and special issues of scientific journals Theatrical performances on the exploration of Antarctica. The travelling exhibition was realized as a contribution to IPY 2007-2008 aiming at attracting the interest of the public, media and students on the role of the polar regions for our planet. The exhibition visited several Italian cities and a few European and Mediterranean countries. The PhD school on polar science, based at the University of Siena, a partner of the International Antarctic Institute, benefits from the support of the museum in terms of access to the library, biological and abiological specimens and financial support to fellowships. Within the frame of an agreement with the Italian National Antarctic Programme and the Ministry of Education, University and Research, a polar summer school for teachers has been established. The school aims at teaching polar science topics and giving tools and techniques to be included in science curricula. Participation to a scientific experiment in Antarctica is offered to the teacher, winner of a contest on an original laboratory activity on polar science. The museum is also partner of international initiatives devoted to the dissemination of information on Antarctic biology and biodiversity (SCAR Marine Biodiversity Information Network, Encyclopaedia of Life, Antarctic Field Guides). The museum publishes scientific journals, volumes, and multimedia.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: The Magic of Endurance, Integration and Recognition: Lessons Learnt from a Formal Assessment of Education, Outreach and Communication during the 4th IPY

Forename: Daniela Surname: Liggett

Authors: Provencher, Jennifer; Baeseman, Jenny; Carlson, Dave; Zicus, Sandra; Liggett, Daniela;

Presentation Allocated: Keynote 40 mins

abstract: The International Polar Year 2007-2008 (IPY) saw unprecedented collaboration between scientists, educators and communities and prioritized science communication alongside the diverse research programme. Occurring in more than 70 countries around the world multi-disciplinary IPY education, outreach and communication (EOC) represents one of the largest investments in polar science outreach to date. In order to understand and learn from these outreach efforts, a thorough assessment of IPY EOC projects, sponsored by the International Council for Science and managed by the Association of Polar Early Career Scientists, was undertaken. This paper will present the results of this IPY EOC assessment, which addressed four main questions: (1) Was IPY EOC successful?; (2) Did IPY EOC increase polar EOC efforts, during and after IPY?; (3) What were the contributing factors to the success of IPY EOC?; and (4) What lessons can be learned from IPY EOC experiences and applied to science EOC programmes in general? To answer these questions, we conducted a detailed document analysis of a range of publically available IPY reports and other IPY materials, and a questionnaire survey delivered in four languages and completed by 250 participants. The quantitative data gathered allowed us to develop a global inventory containing more than 530 outreach events including endorsed outreach programmes, science-partnered outreach projects and simply IPY inspired science outreach events. Qualitative data, collected primarily through our questionnaire survey, enabled us to critically assess the effectiveness of different approaches taken to EOC as well as the contribution of a range of factors (e.g. timeframe, scale, branding, coordination, partnerships, level of integration into science programmes, etc.) to the success of IPY EOC. Generally, through the integration of science outreach from budget to results, the dedication of outreach personnel and an inclusive approach to all aspects of science outreach, IPY has demonstrated that the public wants to be engaged in polar issues and that science can incorporate both good science and effective outreach.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: The NSF Antarctic Biology Course: An International Program with an Integrative Approach for Training Early Career Scientists to Take New Directions in Polar Research

Forename: Donal Surname: Manahan

Authors: Manahan, Donal; Karentz, Deneb;

Presentation Allocated: Keynote 20 mins

abstract: Firsthand field experience is an essential factor in developing a successful polar research project. For nine seasons (since 1994) the US National Science Foundation has sponsored an advanced biology course in Antarctica to provide field training for early-career scientists. This formal graduate education program was established primarily for graduate students and post-doctoral researchers who are interested in polar research, but have not had an opportunity to work in Antarctica. Participants are introduced to topics at the frontiers of polar science while being exposed to the many possibilities, and limitations, of Antarctic fieldwork and logistics. The course format combines field and laboratory research with lectures to enhance understanding of the unique physiological, biochemical and molecular biological aspects of the ecology, diversity and adaptations of Antarctic organisms. The US Antarctic Program's Crary Science and Engineering Center at McMurdo Station provides state-of-the-art laboratory facilities close to field sites for biological observations and collections. In total, there have been 228 participants from 126 institutions representing 24 countries (and 29 nationalities). Participants are from a wide variety of academic and research backgrounds: from climate modeling to field ecology and molecular biology; from microbiology to vertebrate physiology. The success and vitality of this program is based on both the cultural diversity of the participants and the scientific range of their research interests and expertise. A highly positive synergy develops when such groups of early-career scientists come together, having a common focus on polar biology and working together in the isolated environment of an Antarctic research station. A significant outcome is that many course alumni have established new research projects in a number of national polar science programs. The course has served to 1) create new research directions, collaborations, and opportunities for a large number of early-career scientists; 2) recruit young researchers into the international polar community with these 'next generation' scientists bringing new ideas, methods and technologies; and 3) increase awareness of the global importance of Antarctic science in academic curricula at many home institutions and in public presentations given by participants.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 40

Title: The UK Polar Network: inspiring the next generation of polar scientists in the UK and abroad

Forename: Coleen Surname: Suckling

Authors: Suckling, Coleen; Darlington, Ella; Dolan, Aisling; Gales, Jenny; Henley, Sian; Hobbs, Laura; Kirchgaessner, Amelie; Kunz, Matthias; Pope, Allen;

Presentation Allocated: poster

abstract: The UK Polar Network is the UK national committee of APECS (Association of Polar Early Career Scientists) and actively brings together the next generation of polar scientists and enthusiasts through an integrated education and outreach program. Our activities include school visits, special events in local museums and national science centres and regular exhibitions at the British Science Association Science Festival. We will provide examples of our education and outreach work to share ideas on how researchers, educators and science communicators can conduct successful outreach initiatives. Recent examples of our ever-growing outreach success include three Antarctic Open Days held in conjunction with the 11th International Symposium on Antarctic Earth Sciences at 'Our Dynamic Earth', UK, and several visits to local schools across the UK and in rural India. The success of our outreach events is underpinned by the energy and enthusiasm of our members for entertaining and educating the public about the vast importance of polar science. All events are fully inclusive and include informative presentations, interactive activities, hands-on displays and lively group discussions. In the past six months, we have reached out to over 2000 members of the public, received positive feedback from every event and been featured in local and national media. The UK Polar Network has over 400 members from across the UK, all of whom are actively encouraged to become involved in education and outreach, either at a UK Polar Network event or to organise their own event in their local area. We provide training in education and outreach through events such as our ongoing 'Career Skills Workshop Series' which has recently included 'Science Communication' and this year, we have started to offer grants to our members to organise their own educational activities. The UK Polar Network aims to be a key player in polar science education and outreach and would like to share ideas and collaborate with other similar organisations and science communicators to inspire the next generation of polar scientists!

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: "To the South Pole" - Postcards and Stamps Related to the First German Antarctic Expedition (1901-1903): Fiction, Reality and Consequences

Forename: Lüdecke Surname: Cornelia

Authors: Cornelia, Lüdecke;

Presentation Allocated: Poster

abstract: When the "Gauss" of the first German South Polar Expedition of 1901-1903 was to set sail, five painted postcards were produced. Four of them used Antarctic landscapes and symbols of polar research known from earlier expeditions, added by a portrait of the expedition leader Erich von Drygalski, the official flag of the German Reich, "Gauss" sailing south or in drift ice with seals and penguins. A fifth postcard symbolized the arrival at Kerguelen, a small more or less unknown archipelago in the southern Indian Ocean, where a base station should be installed. A pole in the centre of the postcard directs to Cape Town, South Pole and New Amsterdam. Some dressed animals carrying instruments and equipment meet welcoming penguins, seals and insects. Two seals in a car show the way to the interior of the island. Although four postcards only reproduced an imagination of what might be found in the German working area. However they influenced the public opinion a lot in such way that The German Emperor was disappointed, when Drygalski reported that the ship was trapped in the ice close to the Polar Circle for a year and no attempt was made to reach the South Pole. A hundred years later photographs from the expedition were taken to produce German and French stamps with realistic depictions of the past for commemoration of the expedition. However a close look at a stamp released in the West Germany on the occasion of the establishment of the Georg von Neumayer station in 1981 unveils that the original plan to set up the station was not realized. The presentation will focus on how ideas are transported by fictional pictures of the still unknown Antarctic continent and the consequences resulting from it.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: Antarctica, a place to explore & connect science with one's creativity

Forename: Stephen F. Surname: Pekar

Authors: Pekar, Stephen F.;

Presentation Allocated: Oral

abstract: Antarctica is a place of wonders, not only about the natural world but also about being a place to connect with, inspire, and explore one's creativity. Being in the most pristine and isolated place on earth, awakens hidden wonders to explore, allowing us to enter a territory of the unknown regarding the creative realms, which, way too often, remain unexplored and repressed within the hectic daily lives of being an "urban scientist". In this presentation, I uncover my personal trajectory, as a scientist who typically writes about the geological world (and therefore external and objective) into becoming a subjective being. What does it take for a scientist to become not only be engaged in the science of Antarctica, but also in the beauty of the surrounding milieu? How do we become more aware, as human beings, of the untangible connections between the self and the magic of this 'white planet' and its still uncovered scientific gems? Based on my two recent trips to Antarctica, my work will reveal the process through which I began to connect science and the arts, first in the form of a journal and photography while on the ice. This allowed me to connect the different realms of artistic expression of my inner self and the physical power of the scientific discoveries that occurred during these expeditions. Upon returning from these expeditions, I was able to more fully explore my creativity within through painting, music composition, and creating a video documentary. In the end, I hope to show a marriage between art and science, by proposing new liaisons to bring them together, by connecting one's own sense of curiosity, desire to explore, with the sense of wonder of the beauty of the world around them. Indeed without passion, there would be no scientific discoveries, and without a love for seeking out beauty, there would be no search for the unknown.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: Cultural arts return to Antarctic science: Scientists engage the public

Forename: Julianne Surname: Stafford

Authors: Stafford, Julianne; Cooper, Alan; Cornelia, Lüdecke;

Presentation Allocated: Poster

abstract: From the earliest forays of Captain Cook (late-18th century) until the mid-20th century, leaders, scientists and crews of Antarctic expeditions, as a matter of course, used their cultural arts skills to describe and interpret their experiences, observations and discoveries in the region. Their narrative, drawing, painting, poetry, music and later photography and film skills allowed them to recount experiences, illustrate observations, and communicate with colleagues and an interested public. We use images, text-narrative and live music to briefly review and exemplify how some key cultural arts (e.g., art/drawing, photography, music) have supported successful exploration, scientific research and national collaborations throughout Antarctica's history since the 18th century. Technological advances over the last hundred years have improved the scientist's ability to accurately measure and interpret Antarctic systems as indicators of Earth's history and climate. Concurrent with this increasing data accuracy, scientists increasingly struggle to communicate the results to the public effectively. The public commonly fails to understand the complex results and therefore loses interest in the science. Scientists can readily engage the public and colleagues by reaching out in creative ways using personal skills in cultural arts. Educational outreach is one form of teaching that incorporates some arts (e.g. photography, film), but other ways that can be more effective include what we call the "evoking arts." Narrative, music, poetry, or dance evoke a sense of 'feeling' to the science message and may more successfully engage the public in understanding and accepting the message. A highly effective way for Antarctic scientists to convey their messages is by narrating their research and experiences live to the accompaniment of high-quality images, video and music performed live. Our presentation illustrates the link between science and arts, and is intended to inspire research colleagues to bring forward their cultural arts skills to complement live presentations of their research.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: Physics of Glaciers in G major

Forename: Richard B. Surname: Alley

Authors: Alley, Richard B.;

Presentation Allocated: Oral

abstract: Based on personal experience, singing the science is well worth the effort. Translating research to something vaguely resembling art exposes weaknesses that might be obscured by the comfortable frame of a technical paper, and motivates greater understanding. A quiz review through a few rhyming verses often motivates non-science students, and surely weakens the excuse that the material is too hard and too long. And, for the general public, effort by a scientist to translate through art often opens a door for communication that otherwise might have been closed, especially in a time of rather polarized public discussions.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: Reflections on a frozen face - contemporary arts and humanities in Antarctica

Forename: David Surname: Walton

Authors: Walton, David;

Presentation Allocated: Keynote 20 mins

abstract: Since IGY there has been growing recognition of the value of including artists and writers in exploring the Antarctic continent. Pioneered by the USA this has slowly spread to other nations and there is now a developing diversity of work with an Antarctic focus. This has not only drawn Antarctica to the attention of non-scientific audiences but also in many cases provided a link to the science. I will discuss the development of opportunities to visit, illustrate some of the diversity and comment on opportunities in the future.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 41

Title: There is more Antarctic wildlife than just the “charismatic megafauna”: education through art.

Forename: Mitsuo Surname: Fukuchi

Authors: Fukuchi, Mitsuo; Marchant, Harvey;

Presentation Allocated: Oral

abstract: Penguins and whales are Antarctic icons - known and loved world-wide. But ask the mythical “person-in-the-street” what else lives in Antarctica and you might get a short list that would most likely include seals, albatross and perhaps krill. Those of us who work on Antarctic biology know that the sea is teeming with a great diversity of living things and that although the terrestrial environment generally looks depauperate it too is rich in life when examined at high magnification. The diversity of life and therefore the role of living things in Antarctica are generally poorly known. Antarctic wildlife has long captured the imagination of artists. Since the days of the early explorers the more conspicuous wildlife has been painted in water-colours and oils as well as sculpted. Beautifully photographed documentaries as well as the highly popular computer-animated movies have brought Antarctic wildlife to the attention of the general public. Significantly these computer-animations have also had a conservation message. Importantly in our view, artists are depicting some of the less conspicuous organisms. For example, the intricate patterning of the surfaces of some microorganisms has provided inspiration for silversmiths and jewelers. We have been associated with the gyotaku artist, Boshu Nagase, to produce a book illustrating Antarctic fishes using this elegant Japanese fish printing technique. The book, published both in English and Japanese editions, has proved popular providing a window on the fish that swim in Antarctica’s icy waters that are rarely seen other than by those undertaking research on them and by commercial fishers. We advocate researchers, when ever feasible, associating with artists to communicate the fascination of Antarctic organisms, their interactions and to place them in the wider sweep of Nature for a broad public audience.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: A WEB OF INTERESTS, DIPLOMACY AND SCIENCE IN THE SOUTHERN OCEAN

Forename: Tosca Surname: Ballerini

Authors: Tosca, Ballerini;

Presentation Allocated: Oral

abstract: Prior to the inception of the Antarctic Treaty (AT), marine mammals and fish stocks were commercially overexploited in the Southern Ocean (SO) without regard for the consequences for individual species and for the ecosystems. The AT resulted in the development of bodies with an interest in ecosystem-based management, which in turn stimulated a large number of marine ecology studies. These studies, largely undertaken under the umbrella of the Committee for Environmental Protection (CEP) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), have been ongoing for 30 years and resulted in the development of a wealth of scientific knowledge on SO marine ecology. Despite the knowledge acquired, effective protection measures for SO marine ecosystems are still lacking and recent development of a Ross Sea Antarctic toothfish fishery has the potential to alter ecosystem structure and function of regions of the SO until today relatively untouched by human activities. The Antarctic toothfish is a top predator with slow growth rates and delayed maturity. Removals of corresponding species in other marine ecosystems altered the equilibrium of the food webs, determined trophic cascades, and reduced the value of the ecosystem services. Concern for the expansion of the Antarctic toothfish fishery has been expressed by the SO scientific community and by Non-Governmental Organizations (NGOs). Despite the importance of these issues, the general public and the non-specialized scientific community seem not understand that even with the high level of environmental protection assured to the Antarctic continent through the AT the threats to SO ecosystems still remain. A way to ensure protection of SO ecosystems is through development of a network of representative marine protected areas (MPAs) where fishing activities are strictly regulated or excluded. More than 500 Antarctic and non-Antarctic scientists supported designation of a MPA for the whole Ross Sea and 15 environmental NGOs started a worldwide campaign in support of establishment of a network of SO MPAs. CCAMLR and the AT have agreed to work toward the development of a network of SO MPAs by 2012. They have the support of the scientific community in this and it is important that action occurs rapidly to mitigate the effects of expanding fisheries. This is an opportunity to develop for SO marine ecosystems the same level of protection as that provided for the Antarctic continent.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Antarctic krill fisheries - past, present and future.

Forename: Keith Surname: Reid

Authors: Reid, Keith;

Presentation Allocated: Keynote 20 mins

abstract: The fishery for Antarctic krill *Euphausia superba* is currently at a very low level compared to the catch limits in place and, as an 'under-exploited' fishery, has the potential to expand to meet the rising demands of global food production. The management of the Antarctic krill fishery is undertaken through the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), a 25 Member inter-governmental commission that is an integral part of the Antarctic Treaty System. CCAMLR's primary objective is the conservation of marine living resources of the region and the ecosystem approach taken by CCAMLR includes explicit recognition of the effects of fishing on the ecological relationships involving target, dependent and related species. In the case of the krill fishery many of the management measures implemented by CCAMLR are designed to ensure that those ecological relationships are not negatively impacted by the actions of the fishery. Given the central role of krill in the Antarctic marine ecosystem concern has been expressed that the 'imminent and uncontrolled expansion' of the krill fishery could have dire consequences for the regions marine environment. In this presentation I will describe the history of the krill fishery, the current management regime and the potential future scenarios for the fishery. In doing so this will provide an explanation of the way in which the management regime that is in place can allow the fishery to expand at a rate that does not exceed our ability to understand the consequential ecosystem impacts.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: ASSESSMENT OF ANTHROPOGENIC IMPACTS AT SUB-ANTARCTIC AND ANTARCTIC ISLANDS: A REVIEW

Forename: Lúcia Surname: Campos

Authors: Campos, Lúcia; Montone, Rosalinda; Weber, Rolf; Kawall, Helena;

Presentation Allocated: Oral

abstract: Human activities and their associated impacts in the southern high latitudes started in the 18th century with sealing, whaling and fishery industries. After the International Geophysical Year in 1957-58, there was the establishment of many permanent research stations and more recently other industries, such as tourism, increased the anthropogenic impacts in Antarctica. These impacts are highly felt in the mid-latitudes than in the Antarctic, mainly because these region are more accessible, have a milder climate, and are controlled by different national jurisdictions. Also, nearshore marine habitats, adjacent to human settlements, are more subjected to accumulated litter, contamination and organic enrichment because of the risk of spills, and also sewage output. Furthermore, these areas are exposed to climate changes and associated increase in ocean temperature and acidification, and effects on the biota, both marine and terrestrial are currently observed. Major efforts were carried out during the International Polar Year 2007/08 and beyond, in order to attempt the distinction between natural variability from anthropogenic activity, and to understand the ecology and biodiversity in the Polar Regions. King George Island is located near the Antarctic Peninsula, at 62oS, thus strongly influenced by Sub-Antarctic features. It has 10 research stations and possibly is one of the most visited island on South Shetlands, being a stepping stone for many scientists and tourists to other parts of Antarctica. A long term evaluation of the marine environment, taking into account physical and biological characteristics of the area, has been established by Brazilian scientists in order to assess local and global environmental impacts. Past information but also a multidisciplinary approach using integrated data sampling provided subsidies for the management of Admiralty Bay Especially Managed Area. This paper intends to present a general overview of the consequent impacts of human activities in Antarctic islands and adjacent areas and to describe a successful program for management established by the Brazilian Antarctic Program.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Ecosystem services of the Southern Ocean: informing trade-offs in decision-making

Forename: Susie Surname: Grant

Authors: Grant, Susie; Hill, Simeon; Trathan, Phil; Murphy, Eugene;

Presentation Allocated: Poster

abstract: The Southern Ocean is a globally important marine region, supplying a range of ecosystem services that benefit humans worldwide, including the provision of marine living resources and the regulation of global climate. Changes in ecosystem services affect human life, health and well-being, and are influenced by the increasing pressures of human populations and ecosystem degradation. Management and policy interventions can reduce or reverse ecosystem degradation, and enhance the contributions that ecosystems make to human well-being. However, such action must be informed by a good understanding of the ecological systems involved; and this principle is an important foundation of the instruments of the Antarctic Treaty System (ATS). The development of an assessment framework for ecosystem services aims to translate the complexity of the environment into functions which can be more readily understood, for example by policy-makers and non-scientists. Based on the conceptual framework developed by the Millennium Ecosystem Assessment, we have undertaken a preliminary study to characterize Southern Ocean ecosystem services. We use published data on the current state of ecosystem processes, marine biodiversity, physical environmental processes and human activities to identify key services and to estimate their relative importance at a global scale. We review current knowledge on the distribution and status of the ecosystem services we have identified, and assess how these parameters may change over time. We also assess the types of data that would be required to provide measures of the intrinsic and comparative value of specific ecosystem services. Finally, we examine whether and how individual ecosystem services have been specifically recognized and valued by the instruments of the ATS, and we consider the extent to which this has facilitated decision making. We conclude that processes equivalent to the identification and comparative valuation of ecosystem services are already well developed within some aspects of the ATS. For example, scientifically informed trade-offs are made in the management of the krill fishery between catch, long term stock productivity and predator populations. A comprehensive regional assessment of the status, trends and value of all Southern Ocean ecosystem services would generate further benefits by providing a common currency for balancing marine conservation and management objectives across the ATS.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: EXPLOITING THE SOUTHERN OCEAN: RATIONAL USE OR TRAGEDY OF THE COMMONS?

Forename: Cassandra Surname: Brooks

Authors: Brooks, Cassandra; Ainley, David;

Presentation Allocated: Oral

abstract: The tragedy of the commons, first described by Garrett Hardin in 1968, arises in situations where multiple individuals, acting in their own self-interest, deplete shared limited resources, even when it is evident that it isn't in anyone's long-term interest to do so. Antarctica is a true global commons, being the only continent without a native human population. Through a long history of science and exploration, 12 countries signed the Antarctic Treaty in 1959, essentially creating a de facto 'world park'. Yet the Treaty left the Southern Ocean open to exploitation as part of the high seas. In the past, fishing decimated Southern Ocean whales, seals, King Penguins, and several fish species, some of which have yet to recover. In the 1970s the advent of a fishery for krill, a key forage species in the ecosystem, gave rise to CCAMLR. The Convention came into power in 1982 proposing to manage marine living resources under the guise of "rational use". Quite rationally, fishing was constrained through the goals of precautionary, ecosystem-based management. Yet, over time, owing to fishing nations' increased desperation to find new fish stocks, CCAMLR's concept of "rational use" has evolved to simply "use". In 1996 New Zealand initiated a longline fishery for Antarctic Toothfish (*Dissostichus mawsoni*) in the Ross Sea. In doing so humans were now extracting an ecologically important species from the last remaining unexploited stretch of ocean on Planet Earth. The fishery has grown despite the paucity of life history information about toothfish as well as increasing evidence of ecosystem impacts and interfering with longterm research. The proposal has been made that the Ross Sea should swiftly be designated a Marine Protected Area to preserve its value for science. There is value, isn't there, in forgoing the tragedy of the commons and having at least one major oceanic wilderness devoted to peace, science, and future generations?

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Fish in the diet of Gentoo Penguin (*Pygoscelis papua*) at Esperanza/Hope Bay (Antarctic Peninsula) during breeding season

Forename: Marcela Mónica Surname: Libertelli

Authors: Libertelli, Marcela Mónica; Barrera Oro, Esteban Rodrigo; Favero, Marco; Coria, Néstor Rubén;

Presentation Allocated: Poster

abstract: The occurrence of fish in the diet of Gentoo Penguin (*Pygoscelis papua*) at Esperanza/Hope Bay, Antarctic Peninsula, was investigated by analysis of otoliths found in stomach contents obtained from stomach-flushing method. A total of 151 samples were collected from adults breeders from early January to mid February in consecutive breeding seasons of 2003, 2004 and 2005 (N= 50, 51 and 50 respectively). Fish remains appeared in 144 stomach contents, 133 of which contained otoliths. From a total of 9438 otoliths found, 18 fish species, most of them demersal-benthic, were represented. Fish size was estimated from otolith measurements using allometric equations taken from the literature. Nototheniids, with 12 species, were clearly dominant followed by Channichthyids, with 4 species. Myctophids and Harpagiferids were minor fish components of the gentoo's diet. The pelagic *Pleuragramma antarcticum* and the demersal *Trematomus newnesi* and *Gobionotothen gibberifrons* were the most abundant prey species in the three seasons studied. The highest fish prey diversity was recorded in 2003 season, with 15 fish species represented. The high incidence of *G. gibberifrons* in the gentoo's diet at Esperanza/Hope Bay contrasts with its scarce representation or absence in the diet of the same bird at South Shetland Island's localities (in 25 de Mayo/King George Island and Nelson Island). For the last area this is not surprising, since this species have decreased markedly over the last 23 years, presumably due to the offshore commercial exploitation at the end of the 1970s. Thus, this study reflects higher availability of one of the main fish preys of the gentoo penguin, in an area of the Antarctic Peninsula remote from the main historical fishing grounds (Elephant Island and north of Livingston/King George Islands). It is expected that scientific studies on the predator-prey interactions of Antarctic species will constitute an important tool for the management and conservation of the Antarctic marine ecosystem.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Iron Limitation Effects On The Water To Water Cycle In The Chlorophyte Alga *Dunaliella Tertiolecta*

Forename: Hannah Surname: Traggis

Authors: Traggis, Hannah; Jahnke, Leland;

Presentation Allocated: Poster

abstract: Ubiquitous in the neritic ocean, it is now believed that iron-limitation is the most important factor controlling primary production in oceanic phytoplankton. To investigate the effects of iron deficiency, *Dunaliella tertiolecta* was cultured under limiting (100 nM Fe) and replete (1 μ M Fe) iron concentrations. The physiological status and the Water-Water antioxidant defense system were evaluated. Iron limitation effected a 21% drop in PSII efficiency (replete= 0.634 ± 0.012 ; limiting= 0.507 ± 0.012) concurrent with a 17.5% reduction in photosynthetic rates (replete= $265.8 \text{ umol O}_2/\text{mg chl/hr} \pm 5.7$; limiting= $219.3 \text{ umol O}_2/\text{mg chl/hr} \pm 5.7$). Growth rates in replete and limited cultures show no significant differences at 0.84 ± 0.37 and 0.62 ± 0.37 , respectively. Both heme and non-heme based antioxidant enzyme activities were assessed. Heme-based Ascorbate peroxidase (APX), exhibits an 84% iron limited rate reduction (replete and limited = 36.23 and $5.72 \text{ umol ascorbate mg prot}^{-1} \text{ hr}^{-1} \pm 2.96$, respectively). Conversely, the flavin-based Monodehydroascorbate reductase (MDHAR), exhibits a significant rate increase, 2.16 ± 0.19 (replete) to $3.86 \pm 0.19 \text{ umol NADH mg prot}^{-1} \text{ hr}^{-1}$ under iron-limitation. These investigations suggest that *D. tertiolecta* is able to maintain a stable growth rate under iron limitation by re-allocating its subcellular usage of available iron. Further investigations will determine the presence of additional iron/flavin based molecules involved in the photosynthetic apparatus and anti-oxidant scavenging mechanisms.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Precautionary protection for marine areas under ice shelves

Forename: Susie Surname: Grant

Authors: Grant, Susie; Trathan, Phil;

Presentation Allocated: Oral

abstract: Regional climate change is now known to be well established in the Antarctic. One of the most evident signs of climate change has been ice shelf collapse and glacial retreat in the Antarctic Peninsula region; overall, 87% of the Peninsula's glaciers have retreated in recent decades. Ice shelf collapse will lead to new marine habitats and to biological colonisation. Colonisation of these habitats may include species from areas that are immediately adjacent to the collapsed ice shelf, as well as causing local extinction of the original fauna, creating a shift in community composition. Other complex processes may also take place as warmer waters may create opportunities for species to return that were last present during the last interglacial. Altered ecosystem dynamics may also allow new alien species to invade as ocean warming potentially removes physiological barriers that have previously led to the isolation of the Antarctic benthos.

□

The complexity of these ecosystem interactions necessitates the scientific study of marine areas under ice shelves in the absence of other human induced perturbations. The Commission for the Conservation of Marine Living Resources (CCAMLR) has recognised the importance of setting aside scientific reference areas so that processes may be studied in the absence of harvesting. The 2011 CCAMLR Workshop on Marine Protected Areas (MPAs) agreed more specifically that marine areas under ice shelves and ice tongues warrant special consideration, particularly in relation to the need to understand the processes that govern change and recovery in benthic habitats and for protection from invasion by alien species. The protection of such areas could also potentially increase resilience in the face of climate change, particularly in regions that may be the focus of multiple stressors including science, tourism and harvesting. We present a series of candidate sites under ice shelves in the Antarctic Peninsula region, for consideration as preliminary proposals for protection. We recommend that these should be created as fully protected (no-take) MPAs, and that the boundaries of these areas should henceforth remain fixed, even if the ice shelves recede or collapse in the future. Scientific research would not be prohibited in these areas, but could be undertaken with consideration for their special importance, to provide a scientific baseline and allow observation and monitoring of natural processes and change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Slow recovery of previously depleted demersal fish at the South Shetland Islands, 1983-2010

Forename: Nadia Surname: Alescio

Authors: Alescio, Nadia; Marschoff, Enrique; Barrera-Oro, Esteban; Moreira, Eugenia; Ainley, David;

Presentation Allocated: Poster

abstract: Following seals and baleen whales prior to the 1970s, demersal fish stocks were depleted off the South Shetland Islands by intensive industrial fishing during the late 1970 - early 1980s. Little has been reported since about how these stocks have fared, after international agreement closed this fishery in 1990. We report changes in size and abundance of the commercially exploited *Notothenia rossii* and *Gobionotothen gibberifrons* relative to the ecologically similar but unexploited *N. coriiceps* at Potter Cove, South Shetland Islands, over a 28-yr period, 1983-2010. *N. rossii* abundance declined from 1983 to 1991, and an increase in mean size during 1983-84 is consistent with weak cohorts during preceding years. Modal age changed from 2-3 to 6-7 yr. Length data of *G. gibberifrons*, available from 1986, exhibited a similar pattern, showing a decrease until 1991-92. After a period of relative stability (1992-94), a sharp increase in length and a continued decline in relative abundance indicated low recruitment. The length-frequency distribution of unexploited *N. coriiceps* through the whole period showed no change in modal size or mean length of the fish. We relate these patterns to the fishery and suggest that a further two decades will lapse before these stocks recover. Using the South Shetland fisheries as an example, current management rules for Southern Ocean fisheries, deemed to be precautionary and disallowing depletion beyond which a stock can recover in 2-3 decades, may be unrealistic in an ocean profoundly altered by numerous stock depletions and rapid climate change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: The hidden conservation tools within Antarctic marine life.

Forename: Viviana Andrea Surname: Alder

Authors: Alder, Viviana Andrea; Franzosi, Claudio Atilio; Gómez, María Inès; Santoferrara, Luciana Fernanda;

Presentation Allocated: Poster

abstract: Conservation Biology is a cross-disciplinary mission focused on how to protect life and its environment and how to restore them in the face of both global biodiversity threats (harvesting, habitat loss or degradation, introduced species) and the uncertainties associated to global driving forces such as Climate Change and Economy. In consequence, Conservation Biology also means proactive or reactive cross-disciplinary measures to be taken with swiftness and effectiveness. Although overfishing and the transport of non native species are known to have a strong impact on the World Ocean, these problems remain unsolved. In this context, the Antarctic Marine System probably represents the only multi-decade, regional-scale conservational approach worldwide. In this study we will present a snapshot of the Antarctic Marine System based on a review of the main biodiversity threats, and aimed at updating the research agenda. An emergent issue of this review is the need of emphasizing on those organisms which constitute the food of krill and ichthyoplankton, and/or are usually transported by ships via ballast water. Such organisms, mostly unicellular, are immediate indicators of chemical, oceanographic, climatic, and biological processes and ecosystem changes, either natural or anthropogenic, occurring in the water column of the open ocean and beneath ice shelves. Among other aspects involving Antarctic and adjacent waters, we will provide consistent examples of: 1) the sudden, extreme growth of some communities as a response to unexpected processes, and the potential alteration of the global trophic web structure; 2) how some of the strongest hotspots of productivity (and diversity) relate either with typical community structures or the dominance of potentially toxic species, a topic often underestimated in conservation efforts; 3) the limitations of chlorophyll concentration as a bioindicator of fishery yields, phytoplanktonic biomass and primary productivity. In order to identify trends and patterns in human-induced biodiversity fluctuations, to build predictive models that consider future scenarios of Global Change, and to keep a sustainable management of natural resources, it will be necessary to develop conservation measures centered in filling this gap by addressing small spatial scales with a long-term vision.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Toxicity of diesel and fuel oil on sensitive early life stages of Antarctic marine invertebrates

Forename: Kathryn E. Surname: Brown

Authors: Brown, Kathryn E.; King, Catherine K.; George, Simon C.; Harrison, Peter L.;

Presentation Allocated: Poster

abstract: One of the most serious threats to the Antarctic marine ecosystem is the accidental release of petroleum fuel. The risks of a major spill occurring have been highlighted by the continuing expansion of human activity and repeated incidents in Antarctic waters including the grounding and sinking of ships. Little is known of the sensitivities of Antarctic marine organisms to hydrocarbon contaminants. Hydrocarbon levels that may affect marine species cannot be determined without extensive toxicity testing. Accordingly, replicated bioassays were completed at Davis Station, East Antarctica in the summers of 2010 and 2011 to determine lethal and sub-lethal effects of fuels on reproduction and early life history stages of a range of marine invertebrates. Developmental stages are often the most sensitive to pollution and effects at this level impact recruitment and may result in population level impacts. Three fuel types were investigated and mixed with seawater to generate water accommodated fractions (WAF): Special Antarctic Blend (SAB) diesel; Marine Gas Oil (MGO) diesel; and an intermediate fuel oil (IFO 180). WAFs of all three fuels were toxic to biota, resulting in decreased reproductive success, altered behaviour and mortality of a range of marine invertebrates including amphipods, sea urchins and a bivalve. SAB was the most toxic fuel, while MGO and IFO WAFs tended to show increased toxicity to early life stages during longer-term exposures. The response of the sea urchin *Sterechinus neumayeri* at key stages of development showed decreased fertilization success, increased abnormal embryo development, decreased larval development success and increased mortalities. Juveniles of the amphipod *Paramoera walkeri* were more sensitive than adults of the same species. These results provide important data to be used in the development of water quality guidelines for Antarctic marine ecosystems and remediation targets for hydrocarbon contaminated areas.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 42

Title: Where have all the fish gone: could *Notothenia coriiceps* of the Prince Edward Islands be a victim of climate change?

Forename: Ofer Surname: Gon

Authors: Gon, Ofer; Mwale, Monica; Moloji, Tshoanelo;

Presentation Allocated: Oral

abstract: Once a common shallow-water species at Marion Island, *Notothenia coriiceps* has not been seen or collected for almost two decades. This fish species is widespread in the Southern Ocean, from continental Antarctic waters to the sub-Antarctic islands of the Atlantic and Indian sectors of this ocean. Regularly fished by overwintering teams at the meteorological and research station at Marion Island during the 1970–80s, it was rarely encountered by 1992 and no confirmed sightings or catches have been reported since then. During three recent visits to the island, attempts to find this species, using fishing, snorkeling and underwater video camera, were unsuccessful. The apparent disappearance of this species from Marion Island could be attributed to a rapid increase in the fur seal population, an increase in inshore sea temperature, and the biology of this species, or any combination of these factors. It could also be that the abundance of *N. coriiceps* has decreased to the extent that a much greater effort is needed to find it. Either way, it is evident that the population of this species at Marion Island has undergone a significant, possibly alarming change.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Antarctic Conservation Biogeographic Areas: Policy implications of a new bioregionalisation approach for terrestrial Antarctica.

Forename: Aleks Surname: Terauds

Authors: Terauds, Aleks; Chown, Steven; Bergstrom, Dana;

Presentation Allocated: Oral

abstract: Early biogeographical studies of terrestrial ice-free Antarctica tended towards more simplistic classification systems, with most identifying the clear differences between the Antarctic Peninsula and the rest of the continent. More recently, it has been suggested that this classification is too simplistic, and that the biogeography of terrestrial Antarctica is more complex. Concomitant with this recognition is an increased understanding of the biology of Antarctic ice-free areas. Nowhere is this more clearly demonstrated than in the McMurdo Dry Valleys. Here, an area that was once considered barren and devoid of life is now known to contain a complex suite of microorganisms and other biota, inextricably linked to environmental patterns and change. The vulnerability of these terrestrial ecosystems is also becoming more evident, particularly in the face of increasing human presence and a changing climate. Here we provide an entirely new perspective on the biogeography of the Antarctic. By using a comprehensive biodiversity dataset, the first of its kind for continental Antarctica, in conjunction with previously unpublished spatial frameworks, we identify a set of Antarctic Conservation Biogeographic Areas that best represent biodiversity across the terrestrial Antarctic. These areas not only highlight the differences between the biota of the Antarctic Peninsula and the rest of continental Antarctica, but also show that there are obvious biological differences within the Peninsula region. Furthermore, areas of continental ice-free Antarctica are clearly differentiated on the basis of their biology. Such differences have been supported by recent molecular studies that are increasingly clarifying our understanding of ice-free Antarctic biota. Our work provides a novel, first tier set of sites that should form the basis of a systematic- environmental-geographical framework, as is explicitly called for in Annex V of the Protocol on Environmental Protection to the Antarctic Treaty. It shows that the current network of ASPAs fails to represent the continent's biodiversity adequately. These areas also provide a first tier set of sites among which biosecurity measures within Antarctica should be improved to prevent homogenisation of biodiversity. It is our view that this work will change fundamentally the way area protection and conservation is undertaken in Antarctica and be a powerful tool in the future development of evidence-based Antarctic policy.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: ASPAs at risk: conservation planning and non-native species in the Antarctic protected area network

Forename: Justine Surname: Shaw

Authors: Shaw, Justine; Terauds, Aleks; Possingham, Hugh; Bergstrom, Dana; Chown, Steven;

Presentation Allocated: Oral

abstract: Antarctic Specially Protected Areas (ASPAs) are designated to protect outstanding environmental, scientific, historic, aesthetic or wilderness values, any combination of those values, or ongoing or planned scientific research. To what extent these ASPAs meet these multiple management aims is yet to be fully evaluated. At the present time, the ASPA system is the main area protection and management framework for Antarctic biodiversity conservation under Annex V of the Protocol on Environmental Protection to the Antarctic Treaty System. Currently, there are 71 ASPAs recognized for Antarctica, and while most of these intend to protect environmental and scientific values, some are designed to protect historic and to a lesser extent wilderness and aesthetic values. Establishment of non-native species in the terrestrial Antarctic has the potential to alter ecosystem function and ultimately biodiversity values. The ability of the current protected area network to adequately conserve terrestrial biodiversity and more specifically, minimize the risk of non-native species introductions has recently been questioned. Here we examine the current Antarctic conservation framework and identify the threat to terrestrial biodiversity. We do this by utilizing a risk assessment of the likelihood of non-native species establishment that has recently been developed for the entire continent. Our analysis shows that most ASPAs are at low risk from non-native species establishment under the current regime of human visitation. However, we have identified ten ASPAs that are at high risk of non-native species establishment. These ten ASPAs are located on King George and Deception Islands and in the West Antarctic Peninsula. The designation of seven of these high risk ASPAs (as described in their management plans) is based on the terrestrial vegetation they support, specifically the rarity, diversity or abundance. Given the nature of the plant assemblages, particularly the presence of native vascular plants and the high nutrient availability (due to animal enrichment) these sites are prime locations for non-native plant introductions. We examine the spatial connectivity amongst these ASPAs and other ice-free areas more generally and discuss their implications for future development of protected area networks in Antarctica.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Bioinformatics for Antarctic terrestrial conservation

Forename: Steven L. Surname: Chown

Authors: Chown, Steven L.;

Presentation Allocated: Oral

abstract: Bioinformatics for Antarctic terrestrial conservation Steven L. Chown Conservation actions are most defensible, and therefore often most effective, when they are underpinned by sound evidence. Such evidence is available from a variety of sources, including single studies to large meta-analyses. The latter are usually considered best practice in fields such as medicine. Largely because of the paucity of investigations, meta-analyses have not been applied broadly to the Antarctic terrestrial conservation arena. However, the use of data from a variety of sources over large spatial scales is now proving to be exceptionally valuable from a management perspective. Here I outline four areas where considerable management insights have been gained by using data rich, or informatics, approaches: understanding the risk of establishment of non-indigenous species across the region, informing intra-regional biosecurity arrangements using both distributional information and genetic data, forecasting climate change impacts on individual species and communities using trait-based approaches, and understanding terrestrial ecosystem responses to change over the long term. In doing so, a global context is provided for each of these areas demonstrating how bioinformatics approaches have helped guide management responses elsewhere, and how these might be integrated with meta-analytical studies as more investigations become available. Moreover, the outcome of each of the current studies is also related back to specific requirements of the Environmental Protocol to the Antarctic Treaty and its various annexes, and their current requirements for information, so completing the science-policy feedback loop.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Confirmation of establishment and local dispersal of a previously unrecorded family of Diptera, Trichoceridae, at a research station in the maritime Antarctic

Forename: Odile Surname: Volonterio

Authors: Volonterio, Odile; Ponce de León, Rodrigo; Convey, Peter; Krzeminska, Ewa;

Presentation Allocated: Poster

abstract: In 2006/7 abundant larvae and adult *Trichocera maculipennis* were found in the sewage system of Artigas Base, King George Island. Non-indigenous trichocerids are established on some islands in the sub-Antarctic, but this is the first record in the maritime Antarctic. Despite intensive cleaning, the fly continues to occur around Artigas, and adults have been noted more widely around Maxwell Bay. While the apparent distribution strongly suggests a human introduction, the origin remains unclear. Members of this predominantly saprophagous and coprophagous northern boreal genus are generally well adapted to colder conditions than those that are experienced on the South Shetland Islands.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Evaluation of the genetic diversity of *Sanionia uncinata* among open access and ASPA sites in King George Island, South Shetland, Antarctica.

Forename: Ingrid Surname: Hebel

Authors: Hebel, Ingrid; Galleguillos, Carolina; Dacasa-Rüdinger, Maria del Carmen;

Presentation Allocated: Poster

abstract: Mosses play an important ecological role. One of the most widespread moss species in Antarctica is *Sanionia uncinata*, occurring on peri-Antarctic islands and archipelagoes as well as in the Antarctic Peninsula. Habitats with impeded drainage in the maritime Antarctic are typically dominated by four carpet-forming pleurocarpous species (*S. georgicuncinata*, *S. uncinata*, *Warnstrofia fontinaliopsis*, *W. sarmentosa*) (Ochyra, et al 2008). Germination and subsequent development and survival are possible by those species genetically and physiologically pre-adapted to tolerate relatively unstable conditions, but the success at this extreme environment is not given only by the tolerance to the extreme conditions where they live, it is also given by the multiple dispersion methods they have in order to colonize surfaces free of ice. Thus, it is conceivable that the rain of spores on the Antarctic region creates a bank of propagules on the soil and, probably, over the glaciers draining into the crevices, some of which remain viable for many years. If they have success to be redistributed to the ice free niches where the temperature and humidity are favorable, it may be able to germinate. The aim of our project is to determine the genetic diversity of populations in *S. uncinata*, paying special attention to the differentiation between Antarctic Specially Protected Areas (ASPA) and open access areas, looking for migration and fragmentation due the human activity. During the Chilean Antarctic Scientific expedition in January 2010 and 2011, organized by the Chilean Antarctic Institute (INACH), we collected samples of *S. uncinata* from different localities in King George Is. taking into account the ASPA sites and the boundaries as buffer zones. Significant migration is expected to occur in response to climate change and progress in molecular techniques in recent decades has contributed to explain changes in species distribution in cold areas. Whereas sexual reproduction is common in Tierra del Fuego, in Antarctica it is very rare so that a strong clonality is expected. In this way the level of inter- and intra-population genetic diversity must be analyzed by using a powerful DNA fingerprinting tech. applicable to any organism like AFLPs. The results support that there is not an obviously high clonality and that gametophytes very near from each other represents not necessarily clones. The genetic variability and the incidence of it in managements plans will be discussed

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Floristic diversity and environmental aspects of Lions Rump and Hope Bay, Maritime Antarctic

Forename: Lucas Surname: Marinho Poeiras

Authors: Marinho Poeiras, Lucas; Gonçalves Reynaud Schaefer, Carlos Ernesto; Carlos Carreiro Almeida, Ivan; Bastista Pereira, Antônio;

Presentation Allocated: Poster

abstract: The plant diversity of cryptogamic flora in the Antarctic includes several species of algae, lichens and mosses, in addition to *Deschampsia antarctica* Desv. and *Colobanthus quitensis* (Kunth.) Bart. The majority of this diversity is found in ice-free areas in the northwest of the Antarctic Peninsula and in the South Shetlands Islands. This study aimed to list the plant species found in two contrasting areas, Hope Bay (Antarctic Peninsula) and Lions Rump (King George Island), relating them to environmental aspects observed in each area. The identification of plant material was performed using specific literature and available keys to identify algae, lichens and mosses species. The environmental characteristics of each area were recorded, and a total of 56 species were collected at Lions Rump (28 species) and Hope Bay (28 species). We identify only six species occurring in both locations: the alga *Prasiola crispa* (Lightfoot) Kützing; lichens *Heaumatomma erythroma* (Nyl.) Zahlbr. and *Usnea antarctica* Du Rietz; and the mosses *Bryum argenteum* Hedw.; *Sanionia uncinata* (Hedw.) Ochyra and *Sytrichia princeps* (De Not.) Mitt. The others species are restricted to either locations. The alga *Prasiola crispa* was the most widely distributed plant in both areas. This occurrence can be attributed to the ability to tolerate high levels of nitrogen and phosphorus coming from the penguin rookeries present at both sites. The colder and drier climate of Hope Bay, compared to Lions Rump, severely limits the occurrence of phanerogams (*Deschampsia antarctica* and *Colobanthus quitensis*), which are abundant at Lions Rump. The bryophytes, although having equal number of species in both areas, occupy much less area in Hope Bay, restricted mainly to a few waterlogged areas around the Buenos Aires and Flora Glaciers. The Lions Rump plant communities tend to be larger and more diverse than those of Hope Bay, however, the frequency of vegetation mosaics in Hope Bay is higher due to the existence of a wider range of microhabitats compared with Lions Rump area.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Management of Antarctic Specially Protected Areas (ASPAs): assessing the effectiveness of current permitting and information exchange practices

Forename: Pertierra Rodrigue Surname: Luis

Authors: Luis, Pertierra Rodriguez; Kevin A., Hughes;

Presentation Allocated: Oral

abstract: The Protocol on Environmental Protection to the Antarctic Treaty designates Antarctica as a 'natural reserve devoted to peace and science' and Antarctic Specially Protected Areas (ASPAs) represent the highest level of protection within the Treaty area (south of latitude 60oS). Visitors to each of the 71 ASPAs must be permitted by an appropriate national authority and must comply with the ASPA management plan to reduce environmental impacts. In theory, Parties to the Protocol are obliged to exchange information on the number of permits allocated for the forthcoming season (to enable planning of activities to reduce environmental impacts in the ASPAs) and information on the number of visits to ASPAs during the previous season (for cumulative environmental impact assessment purposes). We assessed the effectiveness of current permitting and information exchange practices by examining the ASPA visitation data supplied to the Electronic Information Exchange System (EIES) for the years 2008/09 to 2010/11. Provision of information by Parties varied greatly with some providing no data during the period studied. Parties also interpreted and implemented the legislation concerning protected areas inconsistently, which reduced the usefulness of the data for environmental management purposes. Areas experiencing high levels of visitation by personnel from several different Parties included ASPA 150 Ardley Island, ASPA 128 Western Shore of Admiralty Bay and ASPA 140 Parts of Deception Island, all of which lie within the South Shetland Islands on the Antarctic Peninsula. More co-ordinated management of activities within these ASPAs and a wider review of the permitting and information exchange systems for protected areas is recommended.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Protected areas – have we failed to manage them adequately?

Forename: David Surname: Walton

Authors: Walton, David;

Presentation Allocated: Poster

abstract: The legislation for Antarctic protected areas began in 1964 as part of the Agreed Measures, with Specially Protected Areas designated to conserve specific habitats. In 1972 a further category of Sites of Special Scientific Interest was added, providing a way of protecting on-going science experiments and monitoring. Two other categories – Specially Reserved Areas and Multiple-use Planning Areas were also legislated for but never enacted. In 1991 the Protocol on Environmental Protection melded the first two into a single category – Antarctic Specially Protected Areas - and added a new category of Antarctic Specially Managed Area for those with multiple uses. The growth of importance of CCAMLR introduced a new basis for jurisdictional disagreements with the ATCM when protected areas had a marine component, whilst CCAMR itself has slowly edged towards designating its own Marine Protected Areas. The paper will discuss how and why this system was developed, its weaknesses and its potential.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Soil Surface Recovery from Vehicle and Foot Traffic in the Ross Sea region of Antarctica

Forename: Tanya Surname: O'Neill

Authors: O'Neill, Tanya; Balks, Megan; López-Martínez, Jerónimo;

Presentation Allocated: Oral

abstract: With visitors to the Antarctic continent increasing, it is important to identify ice-free areas that are vulnerable to disturbance and surfaces that are more resilient. Sites of past human occupation and activity were investigated to assess the impacts of, and recovery from, foot and vehicle traffic. Disturbed and nearby control sites were assessed using comparative photo-records and visual site assessments. Nine sites were studied including: vehicle tracks at Marble Point; walking tracks at the Taylor Valley Visitor Zone; a tent site and walking tracks at the Loop Moraine campsite; an experimental treading trial site near Lake Vanda; vehicle tracks at the former Vanda Station site; vehicle tracks in the Wright Valley; and vehicle and walking tracks at the Cape Roberts Drilling Project ice-free storage area. Study sites comprised a variety of landforms, soil parent materials and climates. The time since last disturbance ranged from 3 months to 50 years prior to assessment. We investigated pavement resilience and rehabilitative capability, and also attempted to answer the long-standing question: What has the greatest lasting impact, dispersed trafficking or confined human movements which form a "track"? Walking tracks remained visible in the landscape (due to larger clasts concentrating at the margins of the track) long after the disturbed desert pavement had recovered. However, randomly dispersed footprints on surfaces were often recovered to be undetectable within five years. For many sites, allowing widespread trampling will give a lower medium term visible surface impact than concentrating traffic flow by forming a walking track. For steep sloped sites and sites where repeated visits occur, such as the Taylor Valley Visitor Zone, use of a single track is recommended. Late 1950s vehicle tracks and physical impacts associated with base construction, surface recontouring, and geotechnical studies at Marble Point, along with 1960s and 1970s vehicle tracks in the Wright Valley floor, remain visible in the Antarctic landscape. However, where site remediation did take place, such as the former Vanda Station site, and the ice-free storage area for the Cape Roberts Drilling Project, evidence of former occupation is near undetectable. Raking to smooth disturbed surfaces and concentrating activity on resilient parent materials, or active surfaces where recovery is aided by wind, water, and freeze-thaw cycles, will also assist pavement recovery.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: The non-native chironomid *Eretmoptera murphyi* in Antarctica: erosion of the barriers to invasion

Forename: Kevin Surname: Hughes

Authors: Hughes, Kevin; Worland, Roger; Thorne, Michael; Convey, Pete;

Presentation Allocated: Poster

abstract: Antarctica is the continent least affected by invasive species, but climate change and increasing human activity are increasing this threat. Antarctic terrestrial ecosystems generally have low biodiversity with simple community structures and little competition for resources. Consequently, species with pre-adaptations or capabilities that allow them to tolerate polar conditions may have disproportionately large ecosystem impacts when introduced to Antarctica compared with other regions of the Earth. Here we investigate the invasion risk associated with the flightless chironomid midge, *Eretmoptera murphyi*, which was accidentally introduced from South Georgia (54oS) to Signy Island, South Orkney Islands (61oS), probably during plant transplantation experiments in the 1960s. Larval size class distribution analysis suggested that *E. murphyi* has a two year life cycle on Signy Island, supporting previous suggestions. Estimates of litter turnover show that recent large increases in *E. murphyi* population density and extent are likely to increase nutrient cycling rates on Signy Island substantially. Existing physiological adaptations may allow *E. murphyi* to colonise higher latitude locations. Growth rate and microhabitat climatic modelling showed that temperature constraints on larval development on Anchorage Island (68oS) are theoretically similar to those on Signy Island even though it is ~750 km further south. Establishment of this non-native midge at climatically similar intervening locations along the western Antarctic Peninsula is therefore plausible. Currently, lack of effective natural dispersal mechanisms is probably limiting the spread of the midge. However, dispersal to other areas of the Antarctic Peninsula may occur via human-assisted transportation, highlighting the importance of appropriate biosecurity measures.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: The non-native *Poa annua* could become invasive in the Antarctica? Assessing with a cellular automata model

Forename: Marco A. Surname: Molina-Monteneg

Authors: Molina-Montenegro, Marco A.; Razeto-Barry, Pablo; Díaz, Javier; Oses, Rómulo;

Presentation Allocated: Poster

abstract: Biological invasions are a major threat to the integrity of native biodiversity in all biomes, including remote regions such as Antarctica. Some introductions have occurred in Antarctica, where increased human activity and accelerated climate change are fostering their number, extent and impact. Currently invasion process in the Antarctic is not easy for test but different mathematical models have been conducted in order to predict these process and its effects. Cellular automata models have been proposed as one of the most realistic and suitable models to predict invasion process. In this study we evaluated in situ and under two climatic scenarios the competitive impact of *Poa annua* on the vascular native flora of Antarctica, *Colobanthus quitensis* and *Deschampsia antarctica*. Manipulative experiments showed that, while this exotic plant strongly reduced biomass of *C. quitensis* and *D. antarctica*, both native plants had very weak competitive effects on *Poa*. Similarly, we found that *Poa* significantly reduced the percentage of survival of native species. Finally, we showed by the cellular automata model that under current climatic conditions *Poa* could displace to *C. quitensis* but not to *D. antarctica*. Nevertheless, under a future scenario of climate change, *Poa* will displace to both native plant species, colonizing the Antarctic continent. Results suggest that if current patterns of increased human pressure and regional climate change persist, *Poa* could become a successful invasive species and others non-native plant species are likely to spread across Antarctic Peninsula with significant consequences for this ecosystem. Acknowledgments to INACH project G_22_12.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: The role of human activity in the introduction of non-native soil species and in the distribution of soil organisms within the Antarctic Peninsula

Forename: David Surname: Russel

Authors: Russel, David; Hohberg, Kartin; Hertel, Fritz; Otte, Volker; Christian, Axel; Bruckner, Alexander; Potapov, Mikhail; McInnes, Sandra;

Presentation Allocated: Oral

abstract: Neither the role of human activities in the unintentional introduction of non-native soil species, nor the distribution of soil organisms within the Antarctic by visitors has been sufficiently studied. The German Federal Environment Agency commissioned research aimed at assessing the influence on Antarctic terrestrial ecosystems primarily by ship-based tourism. The main goals were to estimate anthropogenic influence on the distribution of organisms within as well as on the introduction of non-native species into Antarctica. In the Antarctic summers 2009/2010 and 2010/2011, substrate samples were taken from 14 localities in the Antarctic Peninsula; ten frequented by tourists, four by researchers. Sampling occurred in a block design comparing areas of high and low human impact. Wildlife densities were equal in both area types. Soil animals were extracted from the samples, sorted into Collembola, Oribatida, Gamasina, Actinedida, Nematoda and Tardigrada and determined to species level. Ground vegetation was determined per sample. Soil analyses ensured comparability of the contrasted sampling areas. Over 100 species of soil organisms were identified. Potentially introduced species were found among Collembola and Actinedida in localities with high tourist intensity. Differences within communities, major taxonomic groups or individual species were greatest among localities and between years, being larger than anthropogenic influence. Most sites visited by tourists are also frequented by wildlife (i.e. seals, penguins). Thus, detectable human influence must be above and beyond that of wildlife. Effects of humans on soil organisms were nonetheless distinguishable. Although no influence on species richness was detected, significantly higher total densities were found in most animal groups in non-influenced areas, albeit only in one year. Differences in individual species' densities were species-specific, with many species showing a negative impact, while others exhibited a positive influence. At the community level, only Actenidida showed significant anthropogenic effects, indicating altered community composition. However, in most groups, animal communities tended to be more variable in anthropogenically non-influenced areas. Humans therefore obviously impact soil organism communities in the Antarctic Peninsula, albeit subtly, reducing total densities, altering communities composition and structure and decreasing local heterogeneity (lower overall biodiversity).

SCAR OSC 2012 - Portland July 16th-19th

Session number: 43

Title: Understanding lichen diversity on the Antarctic Peninsula using parataxonomic units as a surrogate for species richness

Forename: Paula Surname: Casanovas

Authors: Casanovas, Paula; Lynch, Heather;

Presentation Allocated: Poster

abstract: Expert collection of specimens in the field and further determination of species is the best method for determining species richness. However, the relative paucity of botanists working in Antarctica makes this approach impractical for broad-scale surveys of Antarctic floral biodiversity. In order to accelerate assessments of local biodiversity and help select areas for conservation, cost-effective survey methods and surrogate methods for the prediction of species richness are needed. A combination of a photographic "citizen scientist" approach for the collection of data, and the use of parataxonomic units (PUs) richness as a surrogate method for the prediction of species richness might be a possible solution to effectively collect preliminary information and rapidly build databases on ecosystems diversity. We applied this technique to catalogue the dominant macrophytes of the terrestrial Antarctic ecosystem, lichens. The protection of the flora of the Antarctic Peninsula is important to the Antarctic Treaty Parties, and visitor site guides explicitly mention the vegetation of some landing sites as a priority for conservation (e.g. Barrientos Island), with trampling and damage of vegetation as one of the potential human impacts at several popular tourist landing areas. However, it is difficult to identify appropriate areas for conservation because comprehensive data on flora are not available for most of Antarctica and nor compiled for most Antarctic lichen species. As part of the Antarctic Site Inventory Project (ASI), we have developed a database and gathered photographic information on lichen richness for sites that are frequently visited by tourists. Thirty-two ASI sites were photographically surveyed by ASI researchers and tourists during the past three Antarctic Peninsula field seasons. Five of the sites surveyed have historical data available, Whaler's Bay at Deception Island and Pourquoi Pas Island, both of which are regularly visited by tourists. From the photographs, different lichen PUs were isolated in the lab, and cataloged as "specimens". To date we have collected ~1,000 of these specimens, with variable quality for identification purposes. We estimated PU richness as a proxy for species richness for each of the 32 sites surveyed. These surveys provide preliminary information useful for identifying areas for protection and priorities for future research.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Antarctic Environments Portal

Forename: Ceisha Surname: Poirot

Authors: Newman, Jana; Gilbert, Neil; Chown, Steven;

Presentation Allocated: Oral

abstract: The Protocol on Environmental Protection to the Antarctic Treaty (the Protocol) affords comprehensive protection to Antarctic environments and designates Antarctica as a natural reserve devoted to peace and science. The Committee for Environmental Protection (CEP) is charged with providing advice to Antarctic Treaty Consultative meetings (ATCMs) on the implementation of the Protocol, including on minimising or mitigating environmental impacts of activities in the Antarctic Treaty area, on the state of the Antarctic environment and on the need for scientific research related to the implementation of the Protocol. The CEP works with the Scientific Committee on Antarctic Research (SCAR), whose mission includes the provision of independent, sound, scientifically based advice to the Antarctic Treaty system (ATS). Antarctica's status as a natural reserve requires wise management of the region, which in turn, requires readily available, defensible and up-to date information to inform that management. Antarctic environments are changing due to global and local pressures. Rapid changes in ocean and air temperature, sea ice extent and species distribution and abundance have been observed in parts of the Antarctic in recent decades. Changes in the next century are expected to be remarkable in speed (SCAR 2009). Climate induced pressures in the Antarctic may be compounded by pressures from increasing human activity there. There is currently no centralised or standardised means of bringing information together on Antarctic environments to inform discussions in the ATS. If policy debate and management decisions are to keep pace with the change in Antarctic environments, a robust means of collating summary information is needed. New Zealand and SCAR are developing an on-line portal for information on Antarctic environments to meet this need. The project aims to be the primary source of collated information on Antarctic environments. It will improve the link between Antarctic science, policy and the public, enhance the CEP's advisory role to ATCMs, enhance SCAR's advisory role to the ATS and support effective policy and management in the ATS.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Characterization of the first *Thermococcus* isolate from hydrothermal vents of Deception Island Antarctica.

Forename: Maximiliano Surname: Amenabár

Authors: Amenabár, Maximiliano; Correa-Llanten, Daniela; Blamey, Jenny;

Presentation Allocated: Poster

abstract: Antarctica is an extreme continent composed of cold environments but also of several geothermal sites, among them Deception Island. Despite the presence of geothermal sites in Antarctica there is no information about the presence of hyperthermophilic microorganisms on this continent. The aim of this work was to investigate the presence of hyperthermophilic archaea in submarine hydrothermalism from Deception Island in order to isolate the first member of the genus *Thermococcus* from a hydrothermal site of Antarctica. Submarine samples were taken from two sites of the flooded caldera of Deception Island and analyzed by denaturing gradient gel electrophoresis (DGGE) of 16S rRNA gene in order to detect the presence of archaea belonging to the genus *Thermococcus*. After the molecular detection of these archaea, culture attempts were performed using a special media for *Thermococcus* microorganisms. Enrichment cultures were subsequently subjected to dilution-to-extinction method until obtaining a pure culture of uniform morphology. Isolated microorganism was named BX13. The purity of the strain BX13 was tested microscopically and confirmed by DGGE (single band was observed). Despite the wide distribution of this genus in geothermal areas, including deep-sea and shallow marine hydrothermal vents, to date, this genus has never been reported in Antarctica. Transmission electron microscopy of BX13 cells showed irregular cocci, with a diameter generally between 0.6 to 2 μm . Cells as large as 3 μm in diameter with a similar appearance were also observed. BX13 cells grew at 50-90°C and at NaCl concentration of 1-5%. Phylogenetic analysis of the 16S rRNA gene revealed that the strain BX13 clustered within the Thermococcales clade showing that *T. celericrescens* and *T. siculi* were its nearest neighbours. Here we presented the first report of hyperthermophilic archaea belonging to the *Thermococcus* genus from hydrothermal sites of Antarctica. This work was funded by the project Innova-Corfo grant #07CN13PXT264, 2008-2012.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Cultivable micro flora of the Coelomic fluid of the Antarctic Sea urchin, *Stereochinus neumayeri*

Forename: Rocío Surname: Urtubia

Authors: Urtubia, Rocío; Rojas, Jeanina; Del Campo, Karina; Gonzalez-Rocha, Gerardo; Lavin, Paris; Asencio, Geraldine; Gimpel, Carla; Gonzalez, Marcelo;

Presentation Allocated: Poster

abstract: *Stereochinus neumayeri* represents one of the most abundant benthonic species in the Antarctic submareal waters, with a bathymetric distribution between 5 and 750 m deep. Availability, abundance and wide distribution, have contributed to the use of this sea urchin as a model in evolutionary biology, embryology, ecology, physiology and toxicology (Lee et al., 2004). We now report the first characterization of its cultivable microflora and present it as a potential bioindicator, based on its osmoconformity characteristics. Coelomic fluid was extracted and homogenized from invertebrates kept at 0°C. Three solid media were used. During ten days the grown, 276 microbes were isolated, according to observable characteristics, to create pure cultures after. Gram dye and microscopic analyses were performed. Phylogenetic analyses from 55 isolates were made from the corresponding 16S rRNA partial sequences obtained, after a selection due to RFLP profiles. The most representative groups, and consistent with environmental reports from Michaud et al. (2004), resulted to be Flavobacteria (50%), Gammaproteobacteria (45%), as expected (Bauer y Agerter, 1987), Actinomycetes (3%) and 2% of not identified sequence. From all isolated strain only one, belonging to not identified sequence group, showed antimicrobial activity against *Staphylococcus aureus*. Curiously no *Vibrio* strains were recovered. In order to characterize the resistance of cultivable bacteria to heavy metals, all strains (55, 100% of identified strains) are being analyzed by minimal inhibitory concentration (MIC) method. Actually, 19 of the selected strains were determined by serial dilution on agar Mueller-Hinton (MH) or MH supplemented with 2% NaCl for halophylic bacteria. The assayed MIC ($\mu\text{g}/\text{mL}$) ranges were: ZnSO_4 (32-1024), HgCl_2 (2-16) and AgNO_3 (2-128). The breakpoint used to define resistance were ($\mu\text{g}/\text{mL}$) 800 for Zn, 16 for Hg and 128 for Ag. The reported levels of Zn for the ocean are: 0,01 $\mu\text{g}/\text{mL}$. All plates were incubated at 15°C for at least 48 h and any evidence of bacterial development was considered a positive growth. No strains resistant to mercury and silver, with $\text{MIC}_{50} < 2 \mu\text{g}/\text{mL}$ and $< 32 \mu\text{g}/\text{mL}$, respectively, were found. Only two from analyzed strain, belonging to Flavobacteria, showed resistance to zinc (MIC 1024 $\mu\text{g}/\text{mL}$) and the MIC_{50} for this metal was 256 $\mu\text{g}/\text{mL}$.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Investigating *Escherichia coli* pathotypes and antimicrobial-resistance patterns in wild populations of southern elephant seals, Antarctica

Forename: Tiffanie Surname: Nelson

Authors: Nelson, Tiffanie; Rogers, Tracey; Brown, Mark; Fairbrother, John;

Presentation Allocated: Poster

abstract: Human wastes have the potential to introduce agents that can cause disease in local animal populations. This is of particular concern in pristine wilderness regions, inhabited by populations of endemic wildlife. In Antarctica, human sewage has the potential to transfer novel bacteria or genetic elements into wild mammals. Samples of Antarctic seawater, incorporating contamination from a human sewage outfall, and faecal material from wild southern elephant seals, *Mirounga leonina*, were collected to identify human wastes as a potential transmission source. Virulence factors in *Escherichia coli* and antimicrobial resistance (AMR) were indexed for isolated bacteria. We identified the presence of potentially pathogenic extra-intestinal and enteropathogenic *E. coli* (ExPEC, EPEC, respectively), and AMR in southern elephant seals. AMR in isolates from seawater correlated with human sewage contamination. This study identifies southern elephant seals as a host of the *E. coli* pathotypes ExPEC and rarely EPEC and reports the occurrence of AMR in these hosts. AMR, including multiple resistant isolates, are prevalent in the seawater surrounding sewage outfalls from scientific stations, highlighting this as a possible route for gene transfer. Given the biodiversity value of the Antarctic environment and its extant fauna, the findings of this study warrant further investigation and management.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Out of sight, out of mind ? Diversity of microscopic organisms as an overlooked criterion for conservation purposes

Forename: Annick Surname: Wilmotte

Authors: Mano, Marie-José; De Carvalho Maalouf, Pedro; Verleyen, Elie; Obbels, Dagmar; De Wever, Aaike; Namsaraev, Zorigto; Willems, Anne; Vyverman, Wim; Wilmotte, Annick;

Presentation Allocated: Oral

abstract: The network of ASPAs (Antarctic Specially Protected Areas) that is presently under construction in the frame of the Committee for Environmental Protection of the Antarctic Treaty is intended to protect "outstanding environmental, scientific, historic, aesthetic or wilderness values, any combination of those values, or ongoing or planned scientific research" (http://www.ats.aq/e/ep_protected.htm). When the Madrid Protocol was signed, twenty-one years ago, the knowledge on the biodiversity of tiny and microscopic organisms was much less extensive and molecular methods for biodiversity assessments were only in their infancy. The majority of the permanent inhabitants of Antarctica are, however, essentially microscopic. During the ANTAR-IMPACT, BELDIVA and AMBIO projects, we studied the cultivable and uncultured diversity of cyanobacteria, heterotrophic bacteria, green algae and diatoms in Antarctic lakes and soils using state-of-the-art methods and up-to-date species identifications. We discovered many new microbial species and a taxon-specific, relatively large incidence of endemism. Some taxa even occurred in a single ice-free region. Multivariate analyses of culture-independent biodiversity data from lakes situated along a limnological gradient revealed that the microbial communities were structured by the climate-related variables salinity (and related variables), lake water depth and nutrient concentrations. These parameters might vary in the future in response to climate change. Because most taxa are well-adapted to the extreme and cold Antarctic conditions, our results have obvious consequences for predicting the trajectory of microbial biodiversity under changing climatic conditions. Moreover, our findings call for the continued assessment of the biodiversity of these unique ecosystems and highlight that microbial biodiversity data should be considered as an additional criterion for the delineation of ASPAs, despite the difficulties associated with assessing their diversity compared to that of birds, mammals, plants or multicellular organisms in general. An assessment of the microbial biodiversity would also be useful for monitoring the environmental impact of human activities, like the construction of new stations, field research, or tourism.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Polar Sustainability and the Treaties: Implications for Malaysia

Forename: Rugayah Surname: Hashim

Authors: Hashim, Rugayah; Mohd Shah, Rohani; Abu Hanifah, Norha; Ismail, Zulhabri; Sheikh Ahmad, Sabarinah;

Presentation Allocated: Oral

abstract: The Polar Regions promise infinite resource gains for countries that are willing to reap the unconditional assets from the world's largest biological laboratory. Staking polar sovereignty will ensure the amassing of natural wealth but that is not to be as the poles are stateless. Agreements such as the Antarctic Treaty System (ATS) and the Madrid Protocol were drawn up to ensure just distribution of biodiversical riches among the member countries and others who intend to be part of the polar pacts. For instance, the Antarcitics pose great challenges and beneficial implications for Malaysia thus, determining the sustainability challenges in the preservation of Antarctica and suggesting some environmental policy matters on preserving the Antarctic is the main concern of this paper. Qualitative methodology and content analysis will provide the rigor and rich, in-depth information to substantiate and support the problem statement. The study is significant for national and international legislation as the findings will allow for policy drafting and updating on sustainability of Antarctica according to both the ATS and the Madrid Protocol. This will ensure Malaysia's presence and contribution towards the good of mankind and the environment by preserving the last, untouched wilderness in the interest of international relations, polar governance and science.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: The Antarctic soil microbiome: abundance and diversity of bacteria in ice-free zones of Keller Peninsula

Forename: Luiz Fernando Surname: Roesch

Authors: Roesch, Luiz Fernando; Fulthorpe, Roberta; Pereira, Antonio; Pereira, Clarissa; Lemos, Leandro; Barbosa, Anthony; Suleiman, Afnan; Gerber, Alexandra; Pereira, Marcos; Loss, Arcângelo; Costa, Elias;

Presentation Allocated: Poster

abstract: The Antarctic is the most untouched region of the planet but the most vulnerable to global environmental changes. In this regard, the monitoring of terrestrial environments is fundamental for the evaluation of such changes. This exploratory study aimed to provide baseline information against which to monitor changes in the Antarctic soil microbiome caused by global environmental changes or human activities and to find patterns in microbial diversity and community composition in ice-free zones of Antarctica. To achieve this goal we applied a high-throughput pyrosequencing based analysis of amplified 16S rRNA genes from twelve soil samples from the most prominent plant communities and soil types collected in the Keller Peninsula, King George Island, Antarctica. Quantitative and qualitative bacterial diversity measures were calculated and combined with metadata describing the samples. The dataset was used to find clusters of similar bacterial communities by applying a Jackknifed PCoA analysis. Two well-defined clusters were observed in our tests. Biotic and abiotic environmental factors like the diversity of plant communities, soil composition and chemical features can be associated with the differences found between these two groups. However the most significant association found was related to the soil pH. Once we established that the soil microbial assemblage patterns were related to soil pH, we further explore the co-occurrence of OTUs in the soil samples using a network-based approach coupled with an exact Chi-square test based on 50 000 Monte Carlo iterations. Twenty-two bacterial taxa were found to have statistically significantly higher abundances in the acidic soil samples compared to the neutral samples. Of these, Sphingobacteriales, Gp4 and Gemmatimonas were the most abundant with 9.72%, 6.42% and 4.22%, respectively, of the total number of sequences. Furthermore, seven bacterial taxa were found to have statistically significantly higher abundances in the neutral soil samples. Of these, the most abundant were Gp3 and an unclassified family of Burkholderiales making up 7.36 % and 5.30%, respectively, of the total number of sequences. Despite the differences in soil properties or plant cover the best predictor for the microbial community structure was the pH gradient. Our results provide evidence of no correlation between bacterial community and plant cover in Antarctic ice free zones.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: The Endemic Fauna of Terrestrial Victoria Land and the Transantarctic Mountains: Sentinels of Global Change and Environmental Policy?

Forename: Byron Surname: Adams

Authors: Adams, Byron;

Presentation Allocated: Oral

abstract: The ice-free areas of Victoria Land and the Transantarctic Mountains comprise the largest ice-free terrestrial environments in Antarctica. Some of these areas have been managed since 2004 under the Protocol on Environmental Protection to the Antarctic Treaty. Accordingly, managed and protected areas such as "Scientific" and "Restricted" zones have been established based in part on their perceived scientific, environmental, and ecological value. However, there are very few metrics that can be used to assess the effectiveness of established management policies in preserving these values. As the spatial and temporal scales of sampling efforts increases and technological and analytical tools improve, the distribution and diversity of nematodes, tardigrades, rotifers, mites and springtails is vastly improving. Improved molecular tools and expanded exploratory field collections are revealing cryptic and heretofore undiscovered taxa. As these data emerge, so too does our opportunity to use this information to monitor and measure their responses to global and local drivers of ecological change, including the direct impacts of science activities. By identifying uniform, core sets of measurements and coordinating their research activities, scientists working in these landscapes on disparate science missions can also inform management policy - not only by detecting changes to Antarctic terrestrial ecosystems, but also by providing a means of assessing the effectiveness of current management practices.

SCAR OSC 2012 - Portland July 16th-19th

Session number:

Title: Trampling strategies in Antarctica: how to avoid the consequences of a miss-step.

Forename: Tejedo Sanz Surname: Pablo

Authors: Pablo, Tejedo Sanz; Luis, Pertierra Rodriguez; Javier, Benayas del Alamo; Ana, Justel Eusebio;

Presentation Allocated: Oral

abstract: Trampling has become one of the most direct impacts of humanity in Antarctica. Ice free areas are a minimal fraction of the whole continent, and so most of human activities concentrate on them. Thus, cumulative trampling is inherent. Ice free areas sustain most of the terrestrial diversity in Antarctica. Trampled ice free areas comprise vegetation mats, shallow fresh water bodies, or just open soils, for each case trampling is leading to diverse environmental impacts. In all cases soil fauna is sustained in those soils. Springtails, mites and other micro invertebrates populate them even in remote areas such nunataks. Soil fauna is highly sensible to human pressures after soil compression. We have observed impacts on soil fauna at remote field camps and different paths used by tourist and scientist. Moreover, even soil chemical processes can be affected such microbial respiration and nutrient cycling. Damage on vegetation has been easily observed in subantarctic islands. Due to the almost absence of vascular plants, Antarctic vegetation is highly dominated by cryptogams. Meadows of mosses and lichens are widespread. These formations have shown high sensibility to trampling with little resistance to disturbances. With a few walks we observe both coverage and biomass loss. The effects on water bodies are not widely studied but precautionary principle call for dedicated research before using them as human corridors. Benthic weeds and microbial mats loose their attachment to the substrate and are continuously disaggregated in a similar way than terrestrial meadows. Trampling not only erodes soils and cumulatively disturb native biology but also promote introduction of new species. In the context of the regional warming and increasing human presence this becomes a major threat for the future. For all these reason basic and site specific strategies to minimize trampling impacts need to be revised. Soil and vegetal communities' trampling resistance and resilience must be assessed and combined in a vulnerability index. Considering the resulting vulnerability levels and existing trampling pressures on a certain area we can design a sustainable strategy that promotes the minimal effects and reversibility capacities necessary to ensure a real minor and transitory impact. In this study we present results obtained by our group in past years with some developed tools to achieve this goal.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 47

Title: DECOMPOSITION OF ORGANIC CARBON AND INORGANIC CARBON BENEATH EUPHOTIC ZONE IN PRYDZ BAY, ANTARCTICA

Forename: Zhengbing Surname: Han

Authors: Han, Zhengbing; Pan, Jianming; Chuanyu, Hu;

Presentation Allocated: Poster

abstract: As the most important carbon pool in the ocean, particulate organic carbon (POC) plays an important role in marine carbon cycling. During the 25th Chinese National Antarctic Research Expedition (CHINARE-25), the decomposition ratio of organic carbon and inorganic carbon of Prydz Bay was calculated with a mathematical model. The results showed that the POC concentration of Prydz Bay ranged from 24.38 to 446.40 $\mu\text{g}\cdot\text{dm}^{-3}$, with an average of 118.16 $\mu\text{g}\cdot\text{dm}^{-3}$, decreasing offshore. Based on the observed data (dissolved inorganic carbon, dissolved O₂ and nutrients), during the burial processes of organic matter, the ratio of the decompositions of organic carbon and inorganic carbon was 1.27 (mole ratio), and the decomposition ratio of N/P elements was 19.29, at the P2 section on the continental shelf of Prydz Bay.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 47

Title: Spatial Variations in the Pelagic ^{13}C Benthic Coupling of Prydz Bay Revealed by Sedimentary Pigment Biomarkers

Forename: Zhao Surname: Jun

Authors: Jun, Zhao; Chuanyu, Hu; Han, Zhengbing; Pan, Jianming;

Presentation Allocated: Poster

abstract: Phytoplankton community structure and primary production in the Southern Ocean are sensitive to global climate and environmental change. Photosynthetic pigments and stable isotopes from suspended particulate organic matter and surface sediment of Prydz Bay were studied during the 28th Chinese National Antarctic Research Expedition (CHINARE-28). This multiple-biomarker approach led to an increased understanding of spatial variation in pelagic-benthic coupling, as these 2 biomarkers reflect inherent differences in the time scales over which they integrate. Sedimentary pigments highlighted the importance of local water-column production as a source of phytodetrital inputs to the sea floor. The disappearance of sea ice coincided with a sharp increase in *Phaeocystis antarctica* and grazing, as indicated by increasing pheophytin-a and pheophorbide-a. Stocks rapidly declined, apparently due to grazing krill that moved southward following the retreating sea ice. This study stresses the importance of both physical factors (water depth and current) and biological production in the determination of organic matter inputs to the benthos.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 47

Title: BIOGENIC SILICA RECYCLING IN SURFACE SEDIMENTS OF PRYDZ BAY, ANTARCTICA

Forename: Hu Surname: Chuanyu

Authors: Chuanyu, Hu; Han, Zhengbing; Zhang, Haisheng;

Presentation Allocated: Poster

abstract: The biogenic silica (BSi) of marine sediments presents a potential proxy for past oceanic changes. The processes controlling preservation and recycling of BSi in surface sediments must be understood before BSi is used as a proxy in paleoceanographic studies. The Southern Ocean is certainly a key region of seafloor BSi deposits in the World Ocean. In order to understand the processes controlling preservation and recycling of BSi, sediments were collected with a multi-corer in the Prydz Bay during the CHINARE cruises. BSi concentrations in sediments, and pore water profiles of Si(OH)_4 and DSi@Si were determined. The biogenic silica dissolution recycling in sediments were discussed based on pore water silica measurements and laboratory-based sedimentary BSi solubility experiments in batch reactors. The results show that the pore water concentrations of DSi display a larger range of variation, which range from 229.00 to 759.57 $\mu\text{mol/dm}^3$. Sharp gradients were observed near the sediment-water interface. The DSi concentration increased from 74.35 μM , which represents the mean DSi bottom water concentration to the value of 349.08 $\mu\text{mol/dm}^3$ at 0.5 cm below surface, and the concentration of DSi in pore water increased with depth, exponentially approached to a stable asymptotic concentration (C_d). The content of biogenic silica is ranged from 4.89% to 85.41%, and no strong decreasing trend of BSi in sediments was observed as would be anticipated by the extent of dissolution suggested from the pore water concentration profiles. The results of batch experiments indicate the apparent solubility of BSi in the top sediments were much higher than the value of C_d , and the apparent solubility decrease as sediment depth below the sediment-water interface increase.

SCAR OSC 2012 - Portland July 16th-19th

Session number: 47

Title: Fur seals, vegetation and geomorphology: Investigating biogeomorphologic links

Forename: Trevor Surname: McIntyre

Authors: Hausmann, Natalie; Rudolph, Elizabeth; McIntyre, Trevor; Isenegger, Gareth;

Presentation Allocated: Poster

abstract: On sub-Antarctic Marion Island (46°54'S, 37°45'E) the fur seal (*Arctocephalus gazella* and *A. tropicalis*) numbers have increased dramatically since the ceasing of seal culling in the early 1900s. Previous studies have shown that such rapid increases can have negative consequences on an island's terrestrial ecosystem, which prompted a study to quantify the effects of current fur seal activity on Marion Island's coastal vegetation and soil. This research provides a record of the type and state of vegetation (vascular and bryophyte) as well as soil bulk density of the major sites of *A. gazella* and *A. tropicalis* presence around the Island. Control sites are dominated by the indigenous species *Blechnum penna-marina*, whereas invasive species, such as *Poa annua* and *Sagina procumbens* are more prominent in seal-influenced sites. No significant difference in bulk density was detected between seal and control sites. Future conservation research and monitoring areas are identified, based on the assumption that current fur seal population trends will continue.