Acronym of the project	**L-IPSL**
Titre du projet en français	LabEx Institut Pierre Simon Laplace (IPSL): Comprendre le climat et anticiper les futurs changements
Project title in English	LabEx Institut Pierre Simon Laplace (IPSL): Understand climate and anticipate future changes
Coordinator of the project	Name: CNRS Institution: CNRS/INSU Laboratory: IPSL Unit number: DGS1619
Requested funding	**7 500 000 Euros**
Disciplinary field	□ Santé, bien-être, alimentation et biotechnologies / Health, well-being, nutrition and biotechnologies X Urgence environnementale et écotechnologies / Environnemental urgency, ecotechnologies □ Information, communication et nanotechnologies / Information, communication and nantechnologies □ Sciences humaines et sociales / Social sciences □ Autre champ disciplinaire / Other disciplinary scope
Scientific areas	Climate change and climate impacts: observation, modelling, analysis
Participation in an « Initiatives d'excellence (IDEX) » project	X oui ☐ non

Organisation of the coordinating partner

Institution(s)	Unit number	Research Organisation reference
CNRS / INSU (Partner 1)	DGS1619	
IPSL (Partner 2)	FR 636	CNRS/UPMC/UVSQ/IRD/UPEC/UPD

Organization of the partner(s)

The L-IPSL partnership is composed of the 6 laboratories federated by IPSL and two additional laboratories with a similar level of participation. The L-IPSL partners are ordered by unit number.

Laboratory/Institution(s)	Unit number	Research Organisation reference
LPMAA (Partner 3)	UMR 7092	UPMC/CNRS
LOCEAN (Partner 4)	UMR 7159	UPMC/CNRS/IRD/MNHN
LISA (Partner 5)	UMR 7583	UPEC/CNRS/IRD/UPD
LATMOS (Partner 6)	UMR 8190	UVSQ/CNRS/UPMC /
LSCE (Partner 7)	UMR 8212	CEA/CNRS/UVSQ
LMD (Partner 8)	UMR 8539	ENS/CNRS/EP/UPMC
SISYPHE (Partner 9)	UMR 7619	UPMC/CNRS/EPHE
IDES (Partner 10)	UMR 8148	UPSUD/CNRS

A list of acronyms is given in the Appendices (Chapter 7.2.)

TABLE OF CONTENTS

1. SUMMARY

Context of the proposal

The global climate change that results from the anthropogenic emissions of greenhouse gases (GHG) is one of the important factors, which will affect the future development of our societies. After several decades of research climate change is considered by the very large majority of the scientific community as “unequivocal”, as underlined by the last IPCC assessment report. Most of the warming over the last century results from anthropogenic GHG emissions into the atmosphere, which strongly accelerated after 1950. Most of these GHG remain several decades or centuries within the atmosphere, with consequences for our climate that will further develop and increase throughout the coming century and beyond. Since the 70’s or the 80’s model projections have anticipated global climate modifications that manifested themselves later in the real world. The progress of the research over the last 40 years has been sufficient to raise the alarm about global climate risks on a solid scientific basis.

However recent scientific advances remain insufficient for decision making, which would require better predictions of climate change and climate impacts over the next decades at the regional scale. Improving such predictions requires a new dedicated effort in our capacity to observe, understand and model the climate system, and constitutes the goal of the present proposal.

This is also a key objective of the international research community for the years to come, and it is important that France plays a key role in this joint but competitive effort. With their capacity to both model and observe all the components of the climate system, the IPSL laboratories can play a decisive role in this new phase of climate research. Such a project is required for a step change in our modelling capability of the climate system and add value to the developing “climate services”.

The IPSL federation: history and present situation

The Institut Pierre Simon Laplace (IPSL) is federating six laboratories of the Paris area dealing with global environmental issues. In its 15 years of existence, IPSL has managed to aggregate the capabilities of these laboratories to develop new trans-disciplinary research projects. IPSL has successfully developed dedicated research tools, as a result of a very collective but integrated process. These tools include state-of-the-art architectures for climate models, instrumented observing sites and a common observational strategy, joint space mission projects, and data processing and archiving facilities at the interface between models and observations. All these achievements have created a very strong linkage between the participating laboratories.

IPSL has therefore served as a structure to engineer successfully ambitious collective projects. The present proposal is to set up to create a new ambition, to meet the demanding and urgent scientific needs which are in front of us. This LabEx proposal will be refered to as L-IPSL below.

The L-IPSL partnership

The 6 laboratories of the IPSL federation are: LPMAA (UPMC/CNRS), LOCEAN (UPMC/CNRS/IRD/ MNHN), LISA (UPEC/CNRS/IRD/UPD), LATMOS (UVSQ/CNRS/UPMC), LSCE (CEA/CNRS/UVSQ), LMD (ENS/CNRS/EP/UPMC), CNES is also a sponsor of the federation. These laboratories will all integrate the L-IPSL proposal, with an average 70% of their teams being involved.

To enhance the hydrological component of the project two additional laboratories will join the partnership: SISYPHE (CNRS/ UPMC) and IDES (UPSUD/CNRS).

L-IPSL stands at the centre of an active array of national and international collaborations. It will be a prominent actor in the model intercomparison exercices promoted by the World Climate Research Programme (WCRP), the International Geosphere Biosphere Programme (IGBP) and the IPCC throughout the next decade, and will serve as an active partner to promote interdisciplinary links between observations and model studies.

L-IPSL is also strongly engaged in other proposals to the “Equipements d’Avenir”: Equipex (GHG-Scope, SOFRAEX, PACEC), IEED (CLAIRE), and is connected to other LabEx proposals focusing on other dimensions of climate research in fields such as biodiversity, agronomy, or socio-economics,

and will contribute to three IDEX proposals. The research, which is put forward in the present LabEx proposal, is key to the scientific success of these proposals. The different proposals have been carefully designed to complement each other.

The research project

The goal of the project is to provide an assessment of the potential consequences of climate change at the time and space scales which are the most pertinent for political or economical decisions, e.g. a few decades ahead (the time scale of infrastructure planning) with a strong focus on the local or regional scales (which are those of climate impacts on environmental resources).

A “quantum” leap effort is necessary to make significant progress in that direction. It concerns areas of science where research has been progressing at a slow pace, as it faces a number of unresolved or ill-resolved blocking problems. Going from the main concern (GHG increase) to the consequences, a number of important questions are still open. L-IPSL researches will be organized as Work Packages (Wps) with these open questions:

- (WP-1) How far can we really anticipate the future evolution of the atmospheric composition, which depends on a very large number of factors including socio-economic drivers?
- (WP-2) How can we determine what is really predictable in terms of future climate evolution, in a system that combines anthropogenically induced changes and natural fluctuations?
- (WP-3) What are the relations between the global evolution of the climate and its regional consequences?
- (WP-4) How much do these local or regional climate evolutions impact environmental resources such as freshwater availability, air quality, and oceanic and terrestrial ecosystem services including the maintenance of biodiversity?
- (WP-5) How can we assess the potential impact of unpredictable “climate surprises” that may result from the rapid non-linear behaviour of Earth System components that usually tend to evolve more slowly, such as the oceanic circulation, the continental or oceanic biosphere, glaciers and ice sheets?

The L-IPSL project is also organized around 3 transverse actions (or TWPs) essentialto tackle the folwing challenges:

- (i) to improve the physical content and realism of numerical climate models and take advantage of the continuous and rapid increase in computer capacities. Models now couple atmospheric, oceanic and continental components of the Earth System, through a representation of relevant physical, chemical or biochemical processes. Model inter-comparison programmes have been organized under the auspices of the WCRP and IGBP. The successive IPCC reports have very largely based their assessments (every 5 to 6 years) on these programmes, which have grown each time one-order of magnitude in complexity and size, with a huge increase in the volume of exchanged data (1 Petabytes of data archived by the IPSL for the present exercise, and much more to expect 5 to 10 years from now).
- (ii) to evaluate models and climate change projections taking advantage of the large amount of data that become available through established observational programmes coordinated at the international level (GCOS and GEO). These programmes are based both on the continuity of key measurements (for a few decades now) and on process-oriented field campaigns. A number of important measurements are still missing (such as high precision measurements of carbon dioxide, water vapor or active gases in the troposphere or the stratosphere, ocean currents, ocean composition, continental carbon content). L-IPSL will be a driving force to propose new actions on the time scale of the next 10 years.
- (iii) to develop methodologies to asses uncertainties or determine the degree of confidence in climate change projections and design appropriate communication methods to disseminate the results of the huge and complex amount of information that arises from researches. This will permit to respond to the needs of end-users who will access this information through different knowledge transfer and advice mechanisms.

Innovation

L-IPSL will produce a very large amount of data and results, with a strong value for decision-making for both the public and private sectors. These results are subject to strong uncertainties and continuous scientific updating, which requires L-IPSL to be closely associated to their dissemination and utilisation.

At the same time L-IPSL cannot by itself satisfy the growing demand of information and advice on climate. The strategy of L-IPSL will therefore be to participate directly to a few demonstrator projects, but also to seek close collaboration with partners, such as KIC Climat, IEED CLAIRE or start-up companies, which are able to organize this knowledge transfer on a larger scale.

The Research and Development activities of L-IPSL in terms of models and instrumentation will also bring focused technological advances, which will allow research valorisation actions with industrial partners.

Training, education

The laboratories participating to L-IPSL organize, within their host Universities and Grandes Ecoles, the quasi-totality of the Master and Doctoral educational offer of the Paris area on the climate system. Teaching at the M2 level is distributed over several Masters (but the courses are very often taught by professors who cross the boundaries of their own institutes, and there exists a true “teaching community” in the Paris area). The doctoral studies are also distributed over a few Ecoles Doctorales, but the ED129 (“Sciences de l’Environnement en Ile-de-France”, co-accredited by UPMC, UVSQ, ENS, with an association of UPD), strongly connected with the IPSL community, plays a central and unifying role.

The action of L-IPSL will be to generate new collective projects addressing what may constitute the main weaknesses of the present system:

- (1) The lack of an M2 project which would be able to attract a significant amount of non-French speaking students on the issue of “Climate and Environmental resources”.
- (2) The need of a more systematic approach to training through summer schools and dedicated seminars for different professionals.
- (3) The production of dedicated material: reference books based on the large number of courses, which are presently taught, e-information based on the scientific results of L-IPSL.

Management structures

The L-IPSL an ambitious project centred on the anticipation of climate changes for the coming years which emanates from the IPSL federation, with an extension to the new partners to address the keys question of continental surfaces and hydrology..

The L-IPSL management will benefit from the long experience in collaborative research within the IPSL federation. A dedicated project board, which will gather the leaders of the different work packages and the directors of all L-IPSL laboratories will be set up to tackle the specific challenges of the L-IPSL project. This board will report to a “Conseil des Tutelles” which will have the highest authority. The board will arbitrate the choices to be made between the various WP.

The IPSL Scientific Council, an external committee composed of recognized leader in their field, will follow the progress of the L-IPSL project, propose new evolutions and guaranty it success

2. APPLICATION TO THE ACTIONS OF THE PROGRAMME « INVESTISSEMENTS D'AVENIR »

By its vocation of coordinating climate sciences in the Paris area (Ile-de-France), essential to reach the critical required to tackle the challenges of climate change anticipation, the L-IPSL project is transverse to the various Initiative D'EXcellence (IDEX), which will be developed by the major consortiums (or PRES for Pôles de Recherche et d'Enseignement Supérieur) of Universities and Grandes Ecoles in the Paris area. However, because of the importance of those questions, and because of the strong link of the L-IPSL teams with other teams of other disciplines and of their implication in environmental interdisciplinary studies developed in these PRES, IPSL will actively and fully participate to three of the IDEX project in preparation: PRES Paris Sorbonne, Campus Paris-Scalcay and Idefix.

L-IPSL is also strongly involved in the "Institut d'Excellence en Energie Décarbonée" CLAIRE, which aims at sponsoring relationships between academic, institutional and industrial actors as regards the questions of anthropic and natural emissions monitoring, anticipation of climate change and mitigation.

L-IPSL teams are also involved in a series of Equipments (or services) proposed in the frame of the Equipex programme. Equipex and IEED are listed below, separating in a first part those in which L-IPSL teams act as a coordinator or have a strong contribution and in a second part those with minor importance for L-IPSL and which are part of other LabEx.

Action name	***Project acronyme***	***Objectives***	***Coordinating Organization***	***Scientific coordinator***	***Consortium***
Actions proposed for the Equipex application, in which L-IPSL teams act as a coordinator or have a strong contribution.					
EquipEx	**FONCE**	Network of coastal observations	Ifremer	P. Farcy (Ifremer) & G. Reverdin (LOCEAN)	Ifremer / INSU All French coastal observatories
EquipEx	**GHG- SCOPE**	To enlarge ICOS objectives to the calibration and validation of satellite greenhouse gas measurements	CNRS-INSU	N. Papineau (IPSL)	IPSL (LSCE, LMD) and major labs in France (EPHYSE, Eco et Sols, EEF, EGC, UREP, ESE, OMP, ANDRA, CNRM, OPAR)
EquipEx	**NAOS**	Novel ocean floats with physical/ biogeochemical sensors	Ifremer	P.Y. Le Traon (Ifremer)	INSU, UPMC (LOV et LOCEAN) and all major oceanography labs in France
EquipEx	**PACEC**	To conduct joint competitive and innovative research activities in the fields of geochronology, climate and hydrology). Set of mass spectrometers laser spectrometers, cathodo-luminescence system, XRF core scanner and ICP-MS-HR	UPSUD	C. Colin (IDES) & E. Cortijo (LSCE)	UPSUD, CEA, CNRS, UVSQ
EquipEx	**SeineARIO**	To monitor the microbial and chemical dynamics of the larger streams in the Seine Basin in the long term. 10 autonomous stations to measure in real time a large number of parameters (Nutrients, inorganic and organic	UPMC	JM. Mouchel (Sisyphe)	CNRS-INEE, UPD, MNHN, UPEC. SISYPHE + 5 French laboratories DT INSU

		forms of carbon).			
EquipEx	**SOFRAEX**	To study processes in the atmosphere related to aerosols, clouds and precipitation using a combination of fixed sites and mobile equipments.	CNRS- INSU	P. Keckhut (IPSL OVSQ)	IPSL (LATMOS LSCE LISA LMD) Major labs in France (LOA, LAMP, CNRM, LA, LACY, LGGE, ANDRA, ICARE, INERIS)
IEED	**CLAIRE**	to build an ecosystem of academic, institutional and industrial actors on the Saclay plateau which will profit by a major strategic lead in the world competition of green growth.	FCS (Fondation de Coopération Scientifique)	Y. Caristan (CEA)	AgroParisTech, CEA, CNRS, Ecole Polytechnique, Ecole Centrale Paris, ENS Cachan, ENSTA ParisTech, INRA, Mines ParisTech, PRES Paris Tech, PRES Univ. Sud Paris, Supélec, UPSUD, UVSQ.
Actions with minor importance for L-IPSL and which are part of other LabEx					
EquipEx	**IAOOS**	To implement and maintain a network of drifting buoys at the regional scale, to simultaneously monitor oceanic, sea-ice and atmospheric parameters over the arctic region and complement satellite observations for climate change studies.	UPMC	C. Provost (LOCEAN) & J. Pelon (LATMOS)	INSU, IPEV, ICARE
EquipEx	**PAPRICA**	Supercomputer for the development of advanced numerical prediction for prevention of meteorological, oceanic and climate risks	Météo - France	Ph. Bougeault (Météo-France)	Météo-France, SHOM, IFREMER, SCHAPI, INERIS, CEREA, LA, LEGOS,LMD
EquipEx	**REFIMEVE**	To provide distribution of the best optical frequency standard with a relative accuracy from a few 10-16 (today) to about 10-17 in the next years to a set of laboratories located in many places in France	Univ. Paris 13	C. Chardonnet	LPL (Univ. Paris 13, CNRS), SYRTE (OBSParis, CNRS, UPMC), GIP RENATER, IDIL, LPMAA (IPSL, UPMC, CNRS) and LKB, LCFIO, ISMO, APC, P2IM, LCAR, UTINAM, FEMTO-ST, PHLAM
EquipEx	**URBATRON**	To develop analytical capabilities experimental analytical capabilities tools simulation tools and numerical models devoted to urban environment	ENPC	B. Tassin	LEESU (UPEC-ENPC); LISA (UPEC-UPD-CNRS) CEREA (ENPC-EDF)

3. MANAGEMENT OF THE PARTNERSHIP

3.1. COMPOSITION OF THE PARTNERSHIP

Name of the partner	*Affiliation*	*Staff number by category*
IPSL (Partner 2)	CNRS	Researcher: 1 ITA: 18 CDD: 3
	UVSQ	IATOS: 1 CDD IATOS: 1
	UPMC	Researcher: 1 IATOS:1
	CNES	Researcher: 1
LPMAA (Partner 3)	UPMC	Teachers-researchers: 3 IATOS: 3 PhD students: 1
	CNRS	Researchers: 2 ITA: 5 CDD: 3 PhD students: 4
LOCEAN (Partner 4)	UPMC	Teachers-researchers: 9 IATOS: 8 CDD: 8 PhD students: 32
	CNRS	Researchers: 19 ITA: 22 CDD: 16 PhD students: 2
	IRD	Researchers: 23 ITA: 16 CDD: 2 PhD students: 16
	MNHN	Researchers: 4 ITA: 4
	Other	Teachers-researchers: 6 CDD: 4 PhD students: 5
LISA (Partner 5)	CNRS	Researchers: 11 ITA: 13 Post-docs:1 CDD: 1
	UPEC	Teachers-researchers: 12 IATOS: 5 Post-docs: 3 PhD: 3
	UPD	Teachers-researchers: 8 IATOS: 4 Post-doc: 1 CDD: 1 PhD: 4
	IRD	Researchers: 2
LATMOS (Partner 6)	UVSQ	Teachers-researchers: 14 IATOS: 2 PhD student: 2
	CNRS	Researchers: 25 ITA: 33 CDD (engineers): 10 Post-docs: 6
	UPMC	Teachers-researchers: 4 IATOS: 3 PhD students: 16

LATMOS (to continue)	Other: CNES University Paris 8 Foreign country	Post-doc: 1; PhD student: 1 PhD student: 1 PhD student: 1
LSCE (Partner 7)	CEA	Researchers/Engineers: 75 Technicians: 17
	CNRS	Researchers: 27 ITA: 27
	UVSQ	IATOS: 1 EC: 5 CNAP: 2
	IRD	Researcher: 1
LMD (Partner 8)	CNRS	Researchers: 36 ITA: 37 CDD: 1
	ENS	Teachers-researchers: 2 IATOS: 1 Post-docs: 2 PhD students: 4
	UPMC	Teachers-researchers: 10 IATOS: 3 PhD students: 11
	Ecole Polytechnique	Teachers-researchers: 2 IATOS: 3 Post-docs: 4 PhD students: 4
	Other: UPSUD, Univ. Paris 13, Meteo-France, ENPC, CNES, IRD, ADEME, ESA, volunteers	Researcher: 2 Teachers-researchers: 2 ITA: 1 CDD: 19 Post-docs: 14 PhD Students: 25
SISYPHE (Partner 9) (including the permanent staff of the FIRE federation)	UPMC	Teachers-researchers: 15 IATOS: 6 ATER/ Post-docs: 5 CDD: 3 PhD students: 34
	CNRS	Researchers: 5 ITA: 8 Post-doc: 1 CDD: 1 PhD students: 4
	EPHE	Teachers-researchers: 3 ITA: 2 PhD students: 2
IDES (Partner 10)	CNRS	Researchers: 5 CNRS IT: 9 PhD student: 1
	UPSUD	Teachers-researchers: 35 IATOS: 14 PhD students: 15 ATER: 5
	Other: CNES, CEA, IRSN, AREVA, Marie Curie, BGF, Foreign country...	PhD students: 15

The 8 laboratories and the IPSL federation that constitute the L-IPSL partnership are all involved at 65 to 100% in the LabEx.

The relative contribution of the partners to the L-IPSL and to other LabEx initiatives is summarized in the table below.

	Lab	permanent staff	involved in L-IPSL	50 100 150	Contribution to other Labex
	IPSL staff	*22*	*20*		_
IPSL labs	LPMAA	22	13		*MiChem(8) /AASG(1)*
IPSL labs	Locean	111	103		*Odyssee (8)*
IPSL labs	Lisa	67	34		*Urban Futures (21)/ Esep(12)*
IPSL labs	Latmos	134	81		*Esep (53)*
IPSL labs	LSCE	165	155		*Acte (10)*
IPSL labs	LMD	99	95		*Esep (4)*
New labs	Sisyphe	49	39		*Odyssee (10)*
New labs	Ides	63	63		_
	Total	**732**	**603**		

The implication of the various teams of the L-IPSL laboratories to the WPs and TWPs presented in Section 5 is detailed below.

	WP1	WP2	WP3	WP4	WP5	TWP1	TWP2	TWP3
IPSL								
IPSL technical support						■	■	■
LPMAA								
Atmosphere Biosphere through CO2 Isotopes	■	■					■	
GHG Spectroscopy	■						■	■
Tracers for Atmospheric Change	■	■					■	
Satellite, balloon and groundbased observations	■		■				■	
Remote sensing and radiative transfer	■		■				■	
LOCEAN								
Climatic variability		■				■	■	■
Climate variability regionalisation and impacts			■	■			■	
Polar ocean study		■	■				■	
Ocean processes (surface and interfaces)		■	■			■	■	
Biogeochemical processes, proxies and paleoclimate		■			■		■	
Ocean dynamics - biogeochemistry and carbone cycle	■			■		■		
Ocean modelling - NEMO system team						■		
LISA								
Mineral dust cycle	■	■	■	■		■	■	
Atmospheric spectroscopy	■	■					■	
LATMOS								
associated radiative effects	■	■	■	■		■	■	
troposphere/stratosphere	■	■	■			■	■	■
atmospheric water cycle components		■	■			■	■	
surface/atmosphere energy exchanges			■			■	■	
LSCE								
Biogeochemical cycles and climate	■					■	■	
Climate-aerosols retroactions	■					■		
Quantify natural climate variability		■			■	■	■	■
Climate variability and predictability		■	■			■		■
Climate extremes			■	■		■		■
Hydrological implications of climate change				■	■			
Biogeochemical fluxes from land to ocean				■	■			
LMD								
Tropical Energy and Water Cycle		■	■	■			■	
Global modeling and climate change		■	■			■		■
Climate variability and predictability		■	■		■			
Stratified rotating fluids		■				■	■	
Atmosphere-Biosphere-Climate remote sensing	■	■					■	
Interfaces of the troposphere	■		■			■	■	
SISYPHE								
Hydrology and Hydrogeology			■	■	■	■		■
Biogeochemistry	■			■			■	■
Geophysics				■			■	■
IDES								
Paleoclimates and biogeochemistry		■			■		■	
Hydrology and hydrogeology			■	■			■	
Geophysics and arctic regions (Earth/planets)		■	■		■		■	
Volcanism-climate relationship					■		■	

3.2. RELEVANT EXPERIENCE OF THE PROJECT COORDINATOR

The project coordinator is Professor Hervé LE TREUT

Curriculum Vitae

Present positions

Hervé Le Treut is Professor at Université Pierre et Marie Curie and Ecole Polytechnique. He is the current director of Institut Pierre-Simon Laplace (IPSL federation). He has 8 year experience in managing research structures and is the author or co-author of more than 100 reviewed papers.

Honours

Member of the French Academy of Sciences (since 2005)

Member of the Academia Europeae (since 1999)

Education and elements of scientific trajectory

Studies of Physics at Ecole Normale Supérieure (1976-1980)

PhD (Doctorat d'Etat), University Pierre et Marie Curie (1985)

CNRS permanent position since 1984

Creation and direction (with Pascale Delecluse) of the IPSL Modelling Group (1995-2002)

Director of the Laboratoire de Météorologie Dynamique (LMD), 2002-2008.

Various scientific committees in France, most notably: Meteo-France (1999-2003), Institut de Recherche pour le Développement (2001-2003), Gaz de France (since 2005)

Administrative Council of Commissariat à l'Energie Atomique (since 2009) and of Institut Français du Pétrole (since 2009)

Main international commitments

Participation to the IPCC: Review Editor (5th Assessment), Coordinating Lead Author (4th Assessment), Lead Author (3rd Assessment) and contributing Author (1st and 2nd Assessments).

Member of the Joint Scientific Committee of the WCRP

Past member of several WCRP Panels: WGCM, VAMOS

Vice-President of EGS (Climate Section – up to the transformation into the EGU)

Board member of several European projects (CIRCE, ENSEMBLE, CLARIS). Past directions of several EU projects (Cloud-Feedbacks and Diagnostics, Climate Changes over South America)

Creation, with B. McAvaney of the CFMIP project

Science Panel of several space missions: CALIPSO (CNES/NASA), ACE+ (ESA), etc.

Experience outside France

Internship at Courant Institute (New-York Univ.) and Goddard Space Flight Center (1981)

Consultant, ECMWF (about 1 year of presence, distributed over 1989, 1990, 1991)

Invited Professor, Université de Louvain-la-Neuve (1995)

Invited Scholar, UCLA (Summers 1997 and 1999)

Continuous interactions with various Argentinian teams since 1991, on a yearly basis.

Deputy director of the Franco- Argentinian Unit IFAECE

4. DESCRIPTION OF THE EXISTING

4.1. PRÉSENTATION OF THE PARTNERS

The L-IPSL partnership is composed of the 6 laboratories federated by IPSL and two additional laboratories with a similar level of participation. Here are presented relevant figures summarizing the L-IPSL proposal.

Laboratories	***Evaluation AERES /other***	***Total permanent staff in the labs***	***Permanent staff in L-IPSL***	***Equipment and infrastructure available***	***Contracts public / private (K€, from 2009) Excluding salaries Nb of projects 2010***	***Quantifiable elements Bibliography***
IPSL (Partner 2)	*AERES: A (2009)*	22	20	CLIMSERV and CICLAD platforms: computal services, data archival and distribution centers SIRTA Atmospheric Research Observatory	Public: 270 k€ Private: 0 N° of project: 5	
LPMAA (Partner 3)	AERES: A (2008)	22	13	QUALAIR Platform – FT, Laser and Mass Spectrometers Mechanics and Electronics Workshops Computing Clusters	Public: 823 k€ Private: 0 N° of project: 10	14
LOCEAN (Partner 4)	AERES: A+ (2008, vague C)	111	102	NEMO, CARAUS, SNAPO-CO2, MEMO, SSS Palateformes: ALISES, participation to geochemistry platforms of UPMC pole 3	Public: 2 153K€ Private: 274K€ Nb of project: 5	128
LISA (Partner 5)	AERES: A (2008 vague C)	67	34	PI in several space instruments for planetary exploration or for Earth observations (IASI, MIPAS), platform of atmospheric simulation chambers (as CESAM labeled by CNRS-INSU), SDT observing network, as analytical instruments (electronic microscopes, ICP-AES, ICP-MS, GC-MS, IRTF, Heliostat, clean rooms…)	Public: 1 500 k€ Private: 100 k€ N° of project: 49	64
LATMOS (Partner 6)	AERES: A (vague C CETP and SA), 2008)	134	81	NDACC French responsibility (instrument network for survey of atmospheric composition change) - Numerous instruments for atmospheric remote sensing - Contribution to the IPSL Earth System simulator (stratospheric part) - PI-or CoIship in 10 satellite Earth observation missions	- 4 R&D European FP, mean annual income 225 k€ - 10 ANR contracts: mean annual income: 574 k€ - 2 ESA contracts mean annual 200 k€ - 1 CEA contract (80 k€) - CNES contracts (740 k€ in 2009 - 1 industrial CIFRE contract (Thales)	89
LSCE (Partner 7)	AERES: A+ (2009 vague D)	165	155	ICOS infrastructure and GHG scope PACEC analytic platform IPSL earth system	Public: 6 M€ Private: N° of project: about 80	222

				model components (biogeochemical cycles (ORCHIDEE, PISCES, INCA) Lidar systems, aerosols and VOC facilities		
LMD (Partner 8)	AERES: A+ (2009 vague C)	99	95	- MOBILIS facility (mobile lidars for aerosols and cloud observations) - PI-or CoIship in numerous satellite Earth observation missions	Public: 5 070 k€ Private: 240 k€ N° of project: 45	119
SISYPHE (Partner 9)	AERES: A (2008)	49	39	Hydrogeology Biochemistry Geophysics	Public: 1400 k€ Private: 200 k€ N° of project: 25	63
IDES (Partner 10)	AERES: A (2009 vague D)	63	63	- 3 platforms : i) Geochemistry (8 instruments, including 4 mass spectrometers) ii) Mineralogy (6 instruments : XFR, MEB, …) iii) Geophysics (6 instruments : sismometer, radar, …) - White room - Hydraulic channel in cold chamber	Public: 936 k€ Private: 209 k€ N° of project: - Public (ADEME): 1 (8k€) - Private (TOTAL, AREVA, ADEQUA): 3 (209 k€) - European: 1 (196 K€) - ANR: 7 (679 K€) - CNES: 1 (53 K€)	55

4.1.1 PARTNER 1: CNRS (CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE)

4.1.1.1 DESCRIPTION

The Centre National de la Recherche Scientifique (CNRS - National Centre for Scientific Research) is a government-funded research organization, under the administrative authority of France's Ministry of Research. Founded in 1939 by governmental decree, CNRS has the following missions:

- To evaluate and carry out all research capable of advancing knowledge and bringing social, cultural, and economic benefits for society.
- To contribute to the application and promotion of research results.
- To develop scientific information.
- To support research training.
- To participate in the analysis of the national and international scientific climate and its potential for evolution in order to develop a national policy.

CNRS employs **33,300** staff of which **25,700** are CNRS tenured employees: **11,500** researchers **14,200** engineers and support staff. As the largest fundamental research organization in Europe, CNRS carried out research in all fields of knowledge, through its seven institutes:

- Institute of Biological Sciences (INSB)
- Institute of Chemistry (INC)
- Institute of Ecology and Environment (INEE)
- Institute for Humanities and Social Sciences (INSHS)
- Institute for Computer Sciences (INS2I)
- Institute for Engineering and Systems Sciences (INSIS)
- Institute of Physics (INP) and three national institutes:
- National Institute for Mathematical Sciences (INSMI)
- National Institute of Nuclear and Particle Physics (IN2P3)
- National Institute for Earth Sciences and Astronomy (INSU)

The 8 laboratories involved in the L-IPSL consortium are CNRS Joint laboratories, ("Unités Mixtes de Recherche" {UMR}), working in partnership with universities (UPMC, UVSQ, UPEC, UPD), other research organizations (CEA, IRD and CNES), or Grandes Ecoles (ENS, Ecole Polytechnique). The IPSL federation, which coordinates common projects within 6 of the 8 UMRs involved in the project is also a CNRS unit. The laboratories of the L-IPSL constitute an important component of INSU and also contribute significantly to scientific objectives of INEE. CNRS also encourages collaborations to open new fields of enquiry and meet social and economic needs. CNRS has developed interdisciplinary research actions, which bring together various CNRS Institutes as well as other research and industrial institutions, and from which the L-IPSL project is expected to benefit. The National Programmes managed by INSU also constitute an important framework to develop scientific projects within the L-IPSL laboratories.

In partnership with Universities, CNRS is operating OSUs (Observatoires des Sciences de l'Univers), and has established labelled "observation services" "observation sites" "national facilities". The L-IPSL will benefit from the action of 3 OSUs: ECCE TERRA (with UPMC), OVSQ (with UVSQ), and EFLUVE (with UPEC).

4.1.1.2 EXPLOITATION OF RESULTS

The CNRS has an active politics of favouring innovation, dissemination of results, and the creation of start-up companies. Several companies (Climpact, Estellus) have been created by L-IPSL researchers using the support of CNRS help structures.

The CNRS/INSU is also communicating very actively the research results of its laboratories, through journals, participation to exhibitions, contacts with press, with educational institution.

The L-IPSL innovation and communication activities will contribute to and take the benefit from the action of the CNRS in these areas.

4.1.1.3 HIGHER EDUCATION

Although the CNRS primary mission concerns scientific research, CNRS is strongly involved in higher education thanks to its association with universities and "Grandes Ecoles" through UMRs and OSUs. It contributes also to permanent formation and communication.

The CNRS supports doctoral studies, with French and international partners – from bilateral programmes to "Unités Mixtes Internationales". The IPSL is strongly linked with the IFAECI UMI, which is based in Buenos-Aires and involves the CONICET and the University of Buenos-Aires.

4.1.1.4 ORGANISATION

The CNRS has a dual organization:

- thematic, through its Institutes
- territorial through its "Délégations Régionales" (DR). The L-IPSL laboratories are managed by DR4 and DR5. The IPSL federation is managed by DR5.

Budget for 2010

- **3.116** billion Euros of which 600 million come from revenues generated by CNRS contracts

Organisation

- **10** institutes (2 of which have the status of national institutes)
- **19** regional offices, ensuring decentralized direct management of laboratories
- **1,074** research units (**90 %** are joint research laboratories with universities and industry)

International Relations

- **85** exchange agreements (with 60 countries)
- **5,000** foreign visiting scientists (PhD students, post-docs and visiting researchers)
- **1,714** permanent foreign researchers of whom 1205 come from Europe
- **295** permanent foreign engineers and technicians
- **368** International Programs for Scientific Cooperation (PICS)
- **123** European and International Associated Laboratories (LEA/LIA)
- **90** European and International Research Groups (GDRE/GDRI)
- **22** International Joint Units (UMI)
- **9** CNRS offices abroad (Beijing, Brussels, Hanoi, Johannesburg, Moscow, Santiago de Chile, Tokyo, Washington)

Industrial relations (2009)

- **1,663** contracts signed by CNRS with industry in 2009
- **27** current agreements with major international industrial groups
- **3,765** patent families
- **828** licenses and other financially remunerating active acts
- **58,2** million euros royalties
- **503** companies created with CNRS between 1999 and 2009

(Information extracted from the CNRS web site)

Description of the Institut des Sciences de l'Univers (INSU)

The institute's mission is to develop and coordinate research with a national and international dimension in astronomy, earth sciences, ocean sciences, atmospheric and space sciences. Since 2002, interdisciplinary researches on environment are also part of the INSU domain of investigations linked with other CNRS institutes. INSU is one of the funding and strategic organisation of many laboratories involved in this project. INSU funds:

- research investigations based on attractive projects in coordination with other organisms;
- 2 national prospective exercises that are used to define strategic plan about national and international systems;

INSU is a research institute in support of the scientific community with an observing approach of natural systems through:

- OSU coordination (Observatoires des sciences de l'univers)
- Space research support

4.1.2 PARTNER 2: IPSL (FR636 - INSTITUT PIERRE SIMON LAPLACE)

4.1.2.1 RESEARCH AND INNOVATION

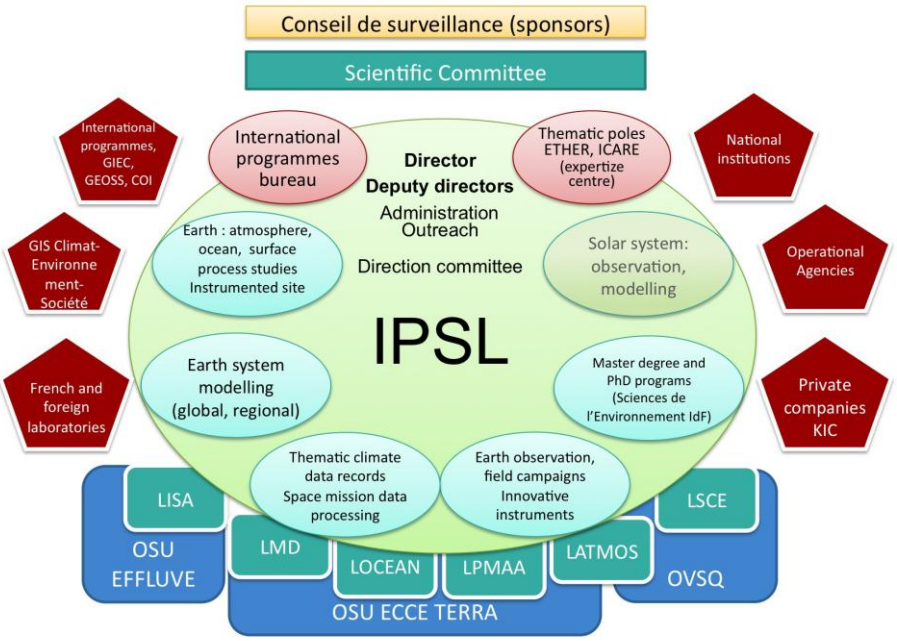
Description

The Institut Pierre Simon Laplace (IPSL) was founded 15 years ago by Gérard Mégie, director from 1995 to 2001. The IPSL is a "CNRS Research Federation", linked by a convention with 10 sponsors:

- CEA (Commissariat à l'Energie Atomique et aux Energies Alternatives)
- CNRS (Centre National de la Recherche Scientifique)
- CNES (Centre National d'Etudes Spatiales)
- ENS (Ecole Normale Supérieure)
- EP (Ecole Polytechnique)
- IRD (Institut de Recherches pour le Développement)
- UPMC (Université Pierre et Marie Curie)
- UPD (Université Paris Diderot)
- UPEC (Université Paris Est Créteil)
- UVSQ (Université de Versailles Saint-Quentin-en-Yvelines)

IPSL is federating six laboratories of the Paris area dealing with global environmental issues. These 6 laboratories are the LPMAA (UPMC/CNRS), LOCEAN (UPMC/CNRS/IRD/MNHN), LISA (UPEC/ CNRS/IRD/UPD), LATMOS (UVSQ/CNRS/UPMC), LSCE (CEA/CNRS/UVSQ), LMD (ENS/CNRS/ EP/UPMC). CNES is also a sponsor of the federation because of the very strong role of space science and observations in the activity of all participating laboratories.

The LISA and LPMAA laboratories have joined the federation recently, with also a new involvement of the UPEC and the UPD. IPSL has also been transitorily (2001-2008) an OSU (Observatoire des Sciences de l'Univers), when the Paris area was covered by a unique OSU.



Most IPSL laboratories have been labelled A+ by the AERES evaluation. The coordination brought up by the IPSL federation has been labelled A+ (for model and planetology studies) and A (for other activities). One of the main recommendations has been to improve the overall coordination of the observational activities, and especially the instrumental development and space research – a recommendation, which has lead to the hiring of N. Papineau, from CNES, as IPSL deputy director.

Research and innovation

The role of IPSL is to develop inter- or trans-disciplinary projects, which go beyond the capacity of a single laboratory (or a single OSU). The action of IPSL can be described as "subsidiary" (in the sense that this word has taken at the European level): it acts to engineer new demanding and collective projects, with a full respect of the initiative and independence of the participating laboratories.

Over the last decades the study of the Earth global environment has become increasingly multidisciplinary, and requires a very close association of modelling and observational tools. IPSL was created to meet those new challenges, drawing on the very large expertise of the participating laboratories, and building bridges between theoretical and applied approaches, between studies of past, present and future climate evolution, or between the study of the Earth and that of other planets. To achieve those goals, IPSL has been engineering a number of translaboratory projects – in the form of "Poles", Groups, or Projects internal to the federation. They concern three main areas:

A: Model studies:

The "Pôle de Modélisation de l'IPSL" was created to couple models of the different components of the climate system. IPSL is now maintaining one of the very few comprehensive Earth System models worldwide, which includes representations of the atmosphere, the oceans, the continental and iced surfaces, and their physical, chemical or biochemical interactions. IPSL was among the two first institutes to develop coupled approaches of the climate and carbon-cycle evolution, and it has been playing a prominent role in the French participation to the various IPCC exercises. IPSL has been at the origin of important international model intercomparison projects such as PMIP, CFMIP C4MIP.

The modelling activities at IPSL have had other objectives than the study of global climate. A dedicated group has developed a model version adapted to the stratospheric physics and chemistry. A regional Earth System model (monitored by a Pole for Regional Environmental Studies) has been applied to specific areas such as Europe and the Mediterranean basin, West Africa, South-East Asia, Southern South-America. Finally, the model study of other planets is organized by the "Pôle Système Solaire", a very active component of IPSL, acting in close relation with Earth studies.

The international organisation for model activities at the international level has created alliances between laboratories: the IPSL teams, for example, have privileged collaboration with laboratories in Africa, South America, India, as well as European countries. IPSL is also a member of the ENES-IS project (coordinated by S. Joussaume, LSCE) to strengthen the modelling community organisation on a European scale.

Also IPSL has a strong involvement in GMES projects. In this framework, IPSL has the leadership in France and in Europe for the NEMO code both for operational oceanography, climate modelling and seasonal prediction (it is used for example by ECMWF and the Hadley Center). IPSL is a model and data provider for the MACC project, to set-up the GMES atmospheric services.

B. Observational and instrumental studies

Observations are carried out by the 3 OSU of the Paris area. But there is a need of coordination and overall strategy, which is the task of the Instrumental and Spatial Pole of the IPSL ("Pôle Instrumental et Spatial"). Three kinds of measurement can be considered:

- ***Process-oriented measurements:*** They generally involve a combination of in-situ measurements (at the surface, from aircrafts or balloons), and remote sensing measurements from space. Process-oriented campaigns have also accumulated a large amount of data. A campaign such as AMMA, in which IPSL has been heavily involved, has combined a geographical target (West Africa), process-oriented measurements (continental convection, ground hydrology, and surface fluxes) and a regional approach of interdisciplinary issues. This will also be a characteristic of the new Mediterranean Hymex/Charmex/Mermex campaigns.

A non-exhaustive list of process-oriented measurements at IPSL concern:

- (i) cloud/aerosol/energy budget measurements, both in situ (IPSL operates the SIRTA Atmospheric Research Observatory site at Ecole Polytechnique) or from space (CALIPSO, Cloudsat, Parasol, ADM-Aeolus, Megha-Tropiques)
- (ii) atmospheric or oceanic CO2 in situ measurements (ICOS/CARAUS/RAMCES projects)
- (iii) active gas concentration (QUALAIR at UPMC, collaborations with the LACY and the OHP), measurements from balloons such as those launched from Kiruna during all European campaigns or in the tropical regions. IPSL has also been strongly involved in the observations of dynamic parameters through projects like INDOEX, AMMA or VORCORE and CONCORDIASI with BPS balloons or dropsondes launched from airborne platforms.

***- Continuous measurements of key parameters over long periods of time*:** IPSL is actively participating to in situ observatories and to the design of space studies. The in situ observatories are generally an extension of the instrumental effort mentioned in the previous section. IPSL has a strong responsibility in NDACC (active gases). It is also participating in the establishment of data archival and analysis centres that are able to treat and distribute long series of data, and in particular data from space observations. For example, IPSL is maintaining the central facility of the "Pôle Thématique National" ETHER (trace gases) and is involved in ICARE (clouds and aerosols), for technical expertise, provision of data and computing facility.

Continuous climate records can also be obtained from the study of past climates: this is another area where the IPSL laboratories have made important contributions at the highest international level, by exploring glacial, oceanic or continental archives.

***- Laboratory measurements*:** These concern, for example, isotopic measurements (see the EquipEx proposal PACEC), biogeochemistry of the ocean water, and spectroscopic properties of different molecules in the atmosphere. This last activity, which is heavily developed at LISA and LPMAA plays a key role, since the knowledge of atmospheric gases largely depends on molecular spectroscopic data (LISA is also the group that runs the simulation chamber CESAM, a national instrument) and LPMAA. These results have been used to design, analyze or validate space missions, either targeting other planets (VENUS, Mars – the relevant coordination is also ensured by the "Pôle Système Solaire") or dedicated to Earth observation (ENVISAT, IASI for example).

C: Archival, distribution and analysis of observed or simulated data

The combined analysis of the very large number of modelled or observed data requires a dedicated effort of data archival and distribution. Many climate studies now involve the simultaneous use of long time series of data from different satellites and different captors, the use of reanalysis such as those from ECMWF and NCEP, or the access to the results of the 20 existing climate models. The project ESPRI uses two dedicated (and articulated) archival and distribution centres set up by IPSL (CICLAD at UPMC and CLIMSERV at Ecole Polytechnique), which also provide a computing service on the same machines where the archives are in-line. The development of this facility is a priority for the future.

A dedicated group (SAMA) has also been actively propagating new analysis methods though the IPSL (assimilation methods, neural networks, statistics of rare events, …)

4.1.2.2 EXPLOITATION OF RESULTS

IPSL has developed dedicated research tools, in three broad areas (model architectures, observational sites and a common observational strategy including common spatial projects, facilities for data treatment and archival at the interface between models and observations) All these achievements have created a very strong linkage between the participating laboratories, and facilitated the emergence of a wide range of trans-laboratory scientific projects: IPSL is therefore in charge of projects funded by the European Framework Programme (e.g. ENSEMBLES, AMMA), French National Agency for Research (ANR) projects and projects with the EpE ("Entreprises pour l'Environnement").

IPSL is also involved in projects to offer climate predictions (DRYAS) to monitor the surface carbon fluxes (ICOS, over the continents or the oceans), or air pollution (Operational service Prev'air using Chimere) and its potential impact on health. It is also involved in operational oceanography (Mercator-ocean or all other European regional projects) through NEMO modelling code. These initiatives are not

only national, but also carefully articulated with international projects: at the international or European level (for example, the European GMES – Global Monitoring of Environmental Security, see above examples of IPSL participation - or the Climate KIC of the EIT), and nationally (DRYAS). The project of the IEED CLAIRE is an extension of these activities in the direction of companies and decision-makers.

Several start-up companies have also grown from the IPSL: Climpact, Leosphere, Estellus. These companies concern instrumental techniques, as well as the use of climate-oriented information.

4.1.2.3 HIGHER EDUCATION

Coordinating high education within its laboratories does not belong to the stated missions of IPSL. However, as a result of the very specific scientific culture that it has helped develop, IPSL is playing a role in three different areas:

- (i) It is providing elements of courses that can be used by all its members, in particular at the Master level (concerning for example instrumental experimentation)
- (ii) It is helping the regular organization of Summer Schools, or of courses intended for specific professionals
- (iii) It is strongly linked with the Ecole Doctorale 129: “Environnement en Ile-de-France”

4.1.2.4 ORGANISATION

Total recurrent budget of IPSL is 270 k€ of Euros excluding salaries (varying from one year to another).

The IPSL action is organized through 3 main committees:

- The “Conseil de Surveillance” gathers the representatives of all the 10 institutes, universities and Grandes Ecoles sponsoring the federation. IPSL is represented by its director (currently: H. Le Treut), and it has been decided that the president of the Scientific Council (currently: E. Brun, from Meteo-France) would be invited. It meets twice a year, under the chairmanship of the INSU director, who is also representing the CNRS. The “Conseil de Surveillance” appoints the director and supervises its action.

- The Scientific Committee (“Comité Scientifique”) provides long-term scientific guidance, and to evaluates the response to internal calls for project. It counts 8 researchers external to the federation and 8 researchers from the IPSL laboratories (*intuitu personae*). It meets 4 times per year, in the presence of the IPSL direction, and the persons in charge of IPSL actions. Its chairman may invite all necessary experts.

- The Direction Committee (“Conseil de Direction or CD”) involves the directions of the participating laboratories and the persons in charge of IPSL actions. It is the main body ensuring the everyday continuity of IPSL action and meets monthly (since 1995, and informally before that date, without any notable interruption). The CD has ensured over the years that IPSL actions would remain subsidiary to those of its participating laboratories.

The director is assisted by 4 deputy directors: P. Bousquet (UVSQ/LSCE) (communication, links with doctoral and master studies), J.-L. Dufresnes (Models), P. Keckhut (Data Bases, in situ Observations), and N. Papineau (Intrumental Development and Strategy, Space Research). They overlook the actions of the “Poles” or projects mentioned above, and assist the director to maintain the links with all the sponsors of the federation, and all its partners.

IPSL draws its main strength from the participating laboratories, but also counts on about 28 dedicated support people who are directly affiliated with IPSL. They are in charge of different tasks common to all laboratories: project administration and support, communication, computer infrastructure, modelling and instrumental facilities, database handling, etc. Among them 21 are permanent: 19 from CNRS, 1 from UVSQ, 1 from UPMC, and in addition one of IPSL deputy directors (N. Papineau) is from CNES. Those IPSL members meet with the IPSL direction every 3 months through an open assembly.

4.1.3 PARTNER 3: UMR 7092 – LABORATOIRE DE PHYSIQUE MOLÉCULAIRE POUR L'ATMOSPHÈRE ET L'ASTROPHYSIQUE

Partner 3: LPMAA

Identity: LPMAA laboratory is a joint research laboratory depending on CNRS, and Université Pierre et Marie Curie (UPMC). It is located at UPMC campus. It is one out of six members of the joint Institute for Environment and Climate Research IPSL (Institut Pierre Simon Laplace), coordinator of the present proposal. LPMAA staff includes about 21 permanents employees (11 researchers, 10 engineers and technicians), 32 in total including PhD students (4), post-docs (5), and non-permanent technical staff (2).

Involvement in L-IPSL: Permanent staff contributing to the present LabEx represents 62% of the total. The rest is involved in the LabEx proposal MiChem, dealing with chemistry

Field of research: LPMAA laboratory has an international reputation in the field of high-resolution infrared spectroscopy and the research activities of LPMAA focus on molecular physics and its applications for the study of the terrestrial atmosphere and the understanding of molecular processes in astrophysical environments (comets, planets, interstellar medium). Our expertise longs from experimental and theoretical studies (IR and UV spectrometry, mass spectrometry, cryogenic surfaces, spectral analyses) to measurement campaigns (ground, balloon and satellite based remote sensing of the troposphere and the stratosphere).

4.1.3.1 RESEARCH AND INNOVATION

Main research themes

There are three research groups at LPMAA with the following activities:

- **Gas-surface interactions:** The interaction between gas and the surface of small particles are known to play a central role in the physics and chemistry of planetary and cometary atmospheres. Our investigations are based on laboratory experiments that are aimed to characterize the nuclear spin conversion processes induced by gas-surface interactions at very low temperatures (10-200 K). The processes investigated include thermal and photon-induced desorption of molecular ices, and are aimed at determining the thermal history of the gas in atmospheres through their interactions with cold surfaces.
- **Molecular dynamics and high resolution VUV molecular spectroscopy**: The vacuum ultra-violet (VUV) spectra of small molecules such as H_2, CO or H_2O and their isotopologues, which are observed with recent satellite telescopes (Cassini, HST, FUSE) are important probes of planetary atmospheres. High-resolution spectra with absolute values of the line intensities and of the various decay channel yields (emission, dissociation and ionisation) are determined with high accuracy by combining measurement using Synchrotron facilities (SOLEIL, BESSY) and ab-initio MQDT calculations.
- **Isotope anomalies:** The triple (simultaneous ^{16}O, ^{17}O, ^{18}O) oxygen isotope composition of some terrestrial and extraterrestrial materials is an interesting tracer for molecular processes in diverse environments with a wide range of applications from molecular physics to climate research. Our activities in the framework of the INTRAMIF (FP7) project focus on the molecular physics aspects and the applicability towards climate relevant questions (transfer to carbon dioxide).
- **Molecular metrology and high-precision spectroscopy from UV to the IR:** Next generation instruments and the climatology of greenhouse gases (monitoring of ozone recovery, CO_2 and water isotopes) require accurate and traceable molecular spectroscopic data. Current data are not coherent or suffer from uncertainties that are too large to respond to key questions of climate research. The SMILE team is active in developing new instruments for in-situ measurements (SIMCO) and laboratory techniques in support of satellite missions (high resolution IR laser

spectrometer coupled to UV photometer), which are up to the mark. One focus is on the measurement of isotopic compounds of climate relevant gases (O_3, CO_2, N_2O).

- **Spectroscopy and modelling of atmospheric spectra, and atmospheric remote sensing:** The "Atmosphere" team of LPMAA has designed and developed several innovating experiments dedicated to in-situ and remote sensing of key atmospheric species for climate, chemistry, and air quality studies, from ground and balloon; it participates in several satellite experiments from design to validation. An accurate radiative transfer code implementing the most accurate molecular parameters (such as line-mixing, narrowing, line positions, etc.) is continuously improved to produce reference simulations which are compared with spectra recorded by atmospheric instruments onboard of ground, balloon or space platforms.

Main equipments

Based on his strong experience in the field of spectroscopy, LPMAA designed and spread out balloon-borne experiments using Fourier transform interferometry. Initially dedicated to probe the stratosphere (LPMA), a nadir looking optical setup has been developed to prepare the IASI mission (IASI-balloon). More recently, the SWIR-balloon experiment has been proposed and tested to green house gases remote sensing in the troposphere and is used to GOSAT validation studies. LPMAA also develops and employs high-resolution spectroscopic instrumentation (Fourier transform spectrometer HR125, interferometrically wavelength controlled diode laser spectrometer, diode laser spectrometer for isotope measurement of atmospheric CO_2 (SIMCO), Fourier Transform spectrometer based platform for in-situ and remote air quality measurements (QUALAIR Platform)). The laboratory is equipped with a molecular beam mass spectrometer for the investigation of reactive species.

The SMILE team participates in the EquipEx project REFIMEVE, which will lead to a major upgrade of its laboratory laser spectrometer operating in the atmospheric window at 10 μm. REFIMEVE will provide an optical frequency standard which, based on femto-laser technology, gives a direct link to a frequency standard allowing to acquire molecular spectroscopic data of unprecedented accuracy. These precise data are required in turn by the next generation of observational platforms for the atmospheric composition and GHG monitoring (water vapour, CO_2, N_2O, O_3, and isotopic variants).

Laboratory scientific value and international influence

- AERES ranking: A (2008);
- Mean number of publications/per year is 20;
- H factor (considering only staff in the field of this proposal): 5 higher than 10, 1 higher than 20;
- LPMAA is a young and dynamic laboratory with only 2 senior researchers above 60 (H > 20), all other members being less than 45 years old (except one).
- Quite junior members of LPMAA from each team have important positions in international and national projects (P.I. of ANR, paper in Science, node leader for FP7 project, etc.).
- More senior members are involved in various national/international boards.
- C. Camy-Peyret, recognized expert in remote sensing using IR spectroscopy, is involved in preparation of space missions for Earth observations.
- Foreign post-doc scientists: 2;
- ANR projects: 2 with high responsibility;
- R&D European Framework Programme projects: 1 with high responsibilities;
- Participation/organisation in summer schools, workshops, networks, etc.: Participation at: Atelier du savoir (CNRS) "chimie dans les milieux astrophysiques" (22-24, Sept 2010); Participation at: STEPS TWO Academic Network (Stakeholders Tune European Physics Studies, EUPEN European project); Lectures and workshop in INTRAMIF summer school 2010.

4.1.3.2 EXPLOITATION OF RESULTS

LPMAA is in charge of numerous research contracts in the frame of partnerships with institutions or national organisms (CNES, CEA, ANR…), with international institutions (European framework programs, ESA, NASDA…) and with enterprises (NOVELTIS).

In additional to the standard way of dissemination of results through publications in international journals, LPMAA contributes to dissemination of observations to national or international data bases: ETHER, HITRAN, GEISA, …

4.1.3.3 HIGHER EDUCATION

- Associated Doctoral School: “Sciences de l'environnement d'Ile-de-France” (ED129); “La physique, de la particule à la matière condensée” (ED389);
- Total number of supervising researchers (Number of HDR among them)/total number of teachers with teaching CNRS staff included: 6 supervisors (5 HDR)/total 10 teachers;
- Number of PhD, PhD co-tutelle/M2/other students supervised (Number of international students among them): 4 PhD, 2 PhD co-tutelle;
- Administrative tasks for teaching at UPMC: S. Payan, mobility for students, coordinator and joint-director of physics bachelor department. C. Boursier, head in 3rd year level in Physics. J.-H. Fillion, head of research Master “LuMMex” spécialité Optique, Matière, Plasmas. S. Payan, administration of physic master websites. M. Glass, head in 1st year level in Physics;
- Teaching at UPMC: main levels and themes: a) Bachelor: Thermodynamics, classical mechanics and quantum physics, optics, atmospheric sciences. b) Master: molecular physics, atmospheric chemistry, laser physics, laboratory works. c) Teaching education in physical sciences (CAPES / AGREGATION);
- Innovative practices (tutoring, e-learning, etc.): M Glass, introduction to e-learning, 1st year level in Physics, UPMC;
- Teaching at other institutions: X. Michaut, “Examinateur concours communs polytechniques”. C. Boursier, “Examinatrice concours AGREGATION physique”;
- Reference contents (courses documents, Books, etc.): S. Payan, Cours de transfert radiatif, École thématique CNRS SPECATMO "de la SPECtroscopie à l'ATMOsphère: Mesures et modèles", Ile de Ré, France, 9-12 juin 2009. S. Payan, Cours sur les algorithmes d'inversion, École thématique CNRS SPECATMO "de la SPECtroscopie à l'ATMOsphère: Mesures et modèles", Ile de Ré, France, 9-12 juin 2009. J.-H Fillion, Lecture “Gas-Surface. Chemistry and heterogeneous chemistry on interstellar analogues” (http://www.astrohp2010.u-psud.fr/)

4.1.3.4 ORGANISATION

Total budget of LPMAA is around 700 k€ of Euros excluding salaries (varying from one year to another), including about 50 kEuros of recurrent budget from CNRS and UPMC. The main external budget resources come from the National Space agency (CNES), European research programs, ANR, INSU. This budget is managed at CNRS and UPMC. LPMAA is organized in 3 scientific teams and 1 technical or administrative department. The scientific teams have their own equipments and benefit from the very high quality of the LPMAA team of engineers in instrumentation, mechanics, electronics, and computing sciences (see http://www.lpmaa.upmc.fr for details).

4.1.4 PARTNER 4: UMR 7159 – LABORATOIRE D'OCÉANOGRAPHIE ET DU CLIMAT: EXPERIMENTATION ET APPROCHES NUMÉRIQUES

Partner 4: LOCEAN

Identity: LOCEAN is a joint research laboratory of Université Pierre et Marie Curie (UPMC), Centre National de la Recherche Scientifique (CNRS), Institut de la Recherche pour le Développement (IRD), and Muséum National d'Histoire Naturelle (MNHN). It is located on two sites of the Jussieu campus, and at the Bondy IRD center in the North of Paris. Its personnel include 111 permanent employees (61 of whom have a researcher or teaching researcher status), and a total of nearly 200 employees (including 55 graduate students, and 30 post-docs and CDDs).

Involvement in L-IPSL: Most of the persons in the institute will be included in this LabEx, with the exception of a few persons (9 permanent employees, 2 docs and 1 post-doc), whose research are more ecosystem-oriented and who will join another LabEx project on ecology and environment (ODYSSEE, PI L. Abbadie).

Field of research: The research done at LOCEAN is mainly devoted both to the study of the variability of the ocean and the role of the ocean on climate. Another topic is biochemistry for ocean and for paleoclimatology (proxies). For the first topic of research, the focus is on improving our understanding of ocean dynamics and its impact on major chemical compounds (in particular, carbon, both inorganic and organic) in relation to the investigation of some bio-geochemical processes and cycles and their impact on climate. For the second topic of research, the focus is on the role of the ocean (both physical and chemical) on climate variability on seasonal to centennial time scale for past, present and future periods. The regions investigated include the Arctic, the Austral Ocean, tropical regions (with specific field experiments/studies in the Arctic, west Africa, South America, and Indian basin), the Mediterranean region, as well as global ocean circulation and biogeochemical model developments. The paleoclimate studies focus on the rapid climate variability in the past, mainly in high latitudes and in the tropics

4.1.4.1 RESEARCH AND INNOVATION

Main research themes

The research done at LOCEAN covers the main fields of the L-IPSL proposal:

- For the carbon cycle, this includes the monitoring and study of ocean inorganic carbon, both natural and anthropogenic, in particular in the Atlantic (North and tropical) and in the south Indian Ocean. It also includes the investigation of some of the large world upwelling areas (Arabian Sea, West Africa, Chile-Peru). The link with ocean ecosystems and resources is studied in the same areas, in cooperation with other teams (link with ODYSSEE LabEx project).
- For the mechanisms of climate variability and predictability, this includes Holocene paleo-climate fast variability (decades to centuries), the investigation of the thermohaline circulation, of its variability and its role on climate, at different time scales, and in different world regions (Arctic and North Atlantic, tropical regions, Austral Ocean). It also includes participation to IPSL studies of decadal variability and predictability in IPSL climate model, and development and maintenance of the ocean component of the IPSL climate model.
- Regionalization of climate variability and climate change is investigated at LOCEAN, in particular in the tropical regions, at scales from intra-seasonal to interannual. As an extension of these topics, the impacts of climate variability on resources in developing countries are studied, and issues on interactions with the society for agriculture and health.

These research axes rely on observation and analytical activities: le laboratory is strongly involved in in situ observations of the ocean (relying on long term observing systems labelled by INSU, and new projects, supported by ANR, FP7 and submitted to EquipEx call), as well as on analytical platforms supported by the University, CNRS and IRD, and by ANR/UE-ERC to study bio-geo-chemical

processes and build paleo-climate time series. Understanding ocean processes and monitoring its variations cannot be achieved without space missions: LOCEAN participates in several space missions from CNES and ESA, some of them with high responsibilities (eg SMOS for surface salinity). Activities cover pre-launch specifications, cal-val methodologies inversion and scientific exploitation. Combining in situ measurements with satellite overpasses is used to better interpret satellite data.

Modelling the ocean and the coupled ocean-atmosphere system is the other major approach to insvestigate the climate and ocean functioning

Main equipments

LOCEAN contributes to the recently created “Observatoire des Sciences de l’Univers” (OSU) Ecce-Terra in UPMC with three national services (CARAUS, SNAPO-CO2 and NEMO) under LOCEAN scientific and technical responsibility, and participation to analytical platforms in geochemistry:

- The NEMO ocean model system is used both for research and for operational oceanography. It is one of the very few ocean circulation models in the world used by a large community (more than 400 users), from research (oceanography, climate) and operational agencies (Mercator, ECMWF, UK Met Office, among others). The NEMO system tem is lead by a LOCEAN team, who coordinates the model improvements for the international consortium. The model simulates the physical and bio-geochemical properties and evolution in a large range of space and time scales (used from paleo-climate to coastal ocean forecasting).
- CARAUS is an in situ national services dedicated to high accuracy monitoring of ocean inorganic carbon measurements in the South Austral ocean. The SNAPO-CO2 service is a laboratory analytical service, which provides CO2 inorganic measurements for the community. They contribute to the international observatory of the ocean carbon cycle. In France, these services, completed with the continuation of measurements performed within EU projects (CARBOCEAN) in the tropical Atlantic, will be grouped with the ICOS observatory coordinated at LSCE.
- Scientific coordination of the national ocean in situ observing system “CORIOLIS”, to which LOCEAN directly contributes through participation to SO SSS (in situ surface salinity measurements) and MEMO (physical oceanographic measurements using marine mammals).
- Participation to Northern Mediterranean Sea monitoring SOERE MOOSE.
- Participation to the GIS GOPS (monitoring and multidisciplinary investigation of the West pacific environment and climate).
- LOCEAN is one partner and coordinator of the regional ALIZE analytical platform at the IRD Bondy center, and contributes to the analytical platforms of UPMC on the Jussieu campus.

Some LOCEAN staff participate in EquipEx projects: IAOOS (Arctic), NAOS, FONCE”.

Laboratory scientific value and international influence

- AERES ranking: A+ (2008 vague C);
- Mean number of publications/per year: LOCEAN contributed to about 110 publications per year (A-level) in 2007-2010 (126 in 2009);
- H factor: LOCEAN includes 28 scientists with H-factor exceeding 10 including one IUF senior scientist. LOCEAN includes 6 scientists with H-factor exceeding 20 (including two older than 60);
- Foreign post-doc scientists: 20 (on October 1, 2010);
- Awards:
    - CNRS Medals: 1 bronze medal since 2005
    - Two retired scientists recently got the “Legion d’Honneur” (L. Merlivat / M. Fieux)
- Foreign scientist of high level: No high-level foreign scientist for a long period (but 2 or 3 visiting the lab each year for a one/ hree month period);
- Pis of ANR projects: 11 as coordinator, 14 participations in ANR with lead actions;
- Pis of EU projects: 4 as coordinator, 10 who have been WP leaders in large EU projects; One ERC young scientist award (2009);
- Participation to international research bodies: within CLIVAR, IMBER, IGBP working groups;

- Membership of CNES (CPS) and CNRS (CS) scientific committees (1);
- Scientific coordination of the AMMA phase 2 programme and of the SECAO observation; network under progress in West Africa;
- Lead of the NEMO ocean model European consortium;
- Participation in IPCC next report preparation (2 persons);

Principal investigators of space missions (7): SMOS, JASON1/2, ALTIKA, Megha-Tropiques, OKAPI, ENVISAT.

4.1.4.2 EXPLOITATION OF RESULTS

LOCEAN has one free licence (Cecill licence) for the NEMO system.

The laboratory maintains contacts with different industrial PMEs for a transfer of:

- technological developments (Carioca pCO2 sensors), methodological or algorithm development (neural networks, processing of SMOS satellite data), coastal modelling (EDF, SHOM);
- expertise for CNES and ESA (inversion algorithms, instrument calibration/validation methodologies in altimetry, microwave radiometry, surface reflectance), as well as to computer developers as Cray company (parallel / multi-processor modelling : tests with NEMO);
- 1 CIFRE theses in partnership with companies (ACRI)
- analytical chemical analyses for industrial partners or agencies (Agence du bassin de la Seine, among others).

4.1.4.3 HIGHER EDUCATION

A large part of the teaching is done at UPMC (1034 hours): chemistry, physics, environmental sciences and geochemistry, electronics, computing, fluid dynamics at licence levels; oceangraphy and climate, physics, chemistry and geochemistry, environmental sciences, waves, signal processing at master levels. Some teaching is also done at Paris7 (150 hours in physical geography) and at UVSQ (Tried master M2: 100 hours). Out of France, teaching is done at M2 level in Dakar, Senegal (200 hours) and in Peru (Universidad Peruana Cayetano Heredia, Lima) and Brazil (Universidade Federal Fluminense, Niteroi). IRD researchers are also involved in teaching activities at the doctoral level in Chile (Universidad de Antofagasta) and Brasil (Univ. Fed. Fluminense

- Faculty: 12 (3 professors UPMC, 1 professor UVSQ, 1 MC Paris7, 7 MC UPMc), in addition, 2 CNAP, 1 professor MNHN, and 2 MC MNHN;
- Specific responsibilities in teaching at M1 and M2 levels:
    - UVSQ: M2 Tried
    - UPMC: M1 SDUEE (“Sciences de l’Univers, environnement et écologie”) (options “dynamique océans et atmosphères, biologie, chimie”)
    - UPMC: M2 SDUEE (Option OACOS)
- Number of researchers or teachers-researches involved in these trainings: 15
- Number of PhD: 55 PhD (October 1, 2010)
- Number of invited foreign teachers-researchers: 1 for 1 month/year
- Mean annual number of undergraduate trainees: 15 (of which 5 foreigners)
- Number of thesis defended per year (2007-2010): 12 (of which 4 foreign thesis per year)
- CIFRE fellowships (2006-2010): 3
- Foreign theses under co-supervization: 5

Mean duration between doctorate degree and stable position: 2 to 4 years

4.1.4.4 ORGANISATION

Total budget of LOCEAN is around 3 million of Euros excluding salaries (varying from one year to another), including about 593 kEuros of recurrent budget (from UPMC, CNRS/INSU, IRD, CNES).

LOCEAN is organized in 8 scientific teams (one of them participating to the LabEx project ODYSSEE), 3 National Services (INSU label) groups, 2 technical support teams and 1 administrative team (see https://www.locean-ipsl.upmc.fr/ for details).

4.1.5 PARTNER 5: UMR 7583 - LABORATOIRE INTER-UNIVERSITAIRE DES SYSTÈMES ATMOSPHÉRIQUES

Partner 5: LISA

Identity: LISA laboratory is a joint research laboratory depending on the University of Paris-Est Créteil (UPEC), the University of Paris 7 - Denis Diderot (UPD) and CNRS, founded on September 1st, 1994. It is located in two university campus: Centre Multidisciplinaire de Créteil (CMC) and Paris Rive Gauche (PRG). It is one out of six members of the joint Institute for Environment and Climate Research IPSL (Institut Pierre Simon Laplace), partner 2 of the present proposal. LISA staff includes about 67 permanents employees [23 from CNRS, 26 from UPEC, 16 from UPD and 2 from IRD (Institute for Research and Development)], 120 in total including PhD students (30), post-docs and non permanent technical staff.

Involvement in L-IPSL: 50% of the employees will be involved in the L-IPSL LabEx. 30% will be involved in the Labex project "Urban Futures", proposed by PRES Paris-Est University and coordinated by Ecole Nationale des Ponts et Chaussées, and 20% will be involved in the Labex project "Planetary Space Exploration", coordinated by the Observatoire de Paris.

Field of research: LISA is mainly involved in atmospheric sciences and with a special focus on physical chemistry of the Earth and other planets atmosphere. Similar approaches, based on both (i) *in-situ* or remote sensing observations, (ii) experimental simulation in lab and (iii) numerical simulations are used for providing new insights in our major research domains.

Five main fields of research are addressed at LISA: 1) Mineral dust cycle, 2) Reactivity and fate of atmospheric organic carbon, 3) Air pollution (photooxidants and aerosol), 4) Astrobiology, 5) Atmospheric spectroscopy

4.1.5.1 RESEARCH AND INNOVATION

Main research themes

Mineral dust cycle

The main objectives of the studies on the atmospheric dust cycle consists in describing and quantifying the emissions, transport and deposition of mineral aerosols, from their sources in arid and semi-arid regions of the Earth up to remote oceanic areas. More precisely, a special attention is given to understand the processes controlling the spatio-temporal variability of mineral dust in the atmosphere and to evaluate their radiative and biogeochemical impacts. During the last years, a large part of these activities have been mainly developed in the framework of the international project AMMA (Multidisciplinary Analyses of the Africa Monsoon).

Reactivity and fate of atmospheric organic carbon

Inside this topics, we mainly investigate the transformation pathways of the tropospheric organic compounds in both gaseous and condensed phases and their impacts on i) the production of secondary organic aerosol and the evolution of their properties with time ii) the oxidative capacity of the atmosphere iii) the production of organic nitrogen species and their impact on the long-range transport of NOx.

Photooxidant and Aerosol pollution

This theme aims at better understanding and quantifying the processes governing the evolution of photo-oxidants and particulate matter in the lower atmosphere, in particular at local regional and continental scales. It also deals with the simulation of pollution events in 3D models, in scenario studies and in evaluation of the impacts of air pollution, especially on built surfaces.

Atmospheric spectroscopy

The recent spatial observations obtained during the missions on the Earth atmosphere (MIPAS/ENVISAT, IASI/METOP-1), and on the other planets (CIRS/CASSINI…) produce high quality

spectra. A correct and complete interpretation of these atmospheric spectra requires appropriate theoretical and spectral analysis tools, as well as experimental data in the laboratory. The spectroscopic parameters obtained from these studies on molecules having an atmospheric interest are then gathered in international data bases (HITRAN, GEISA, MIPAS, IASI, JPL…).

Astrobiology

This theme deals with astrochemistry, with specific interest for astrobiology (study of processes that generate chemical evolution and/or Life on Earth or in other environments). Approaches developed at LISA are of two types:

- study of organic material reactivity and molecular evolution in extraterrestrial environments
- search for molecular structures using remote sensing or in situ measurements

These activities contribute to the strategic mission of the OSU EFLUVE" operated by UPEC in close cooperation with UPD, ENPC and CNRS/INSU. The "OSU EFLUVE" was established in 2010 and is devoted to examine environmental issues from local (urban) scales to regional (continental) scales and topics related to astrobiology.

Main equipments

LISA manages and/or is involved in national and international platforms of observations in connection with the present proposal:

- SOFRAEX EquipEx proposal
- Scientists from LISA are also PI in several space instruments for planetary exploration or for Earth observations (IASI, MIPAS)
- The large ensemble of atmospheric simulation chambers, dedicated to the study of chemical mechanisms acting in both gaseous and solid phases or at the surface of various material (glass, stone, concrete…). One of them, CESAM, is labelled from 2008 as a National Instrument by CNRS-INSU.
- LISA has deployed an observing network in the sahelian belt for monitoring of the atmospheric dust content for decadal periods. The three stations respectively in Niger, Mali and Senegal are located on the main pathway of the dust when transported from their source regions to the Atlantic ocean. This observing system is working from 2006 with a recovery rate of data greater than 90%
- Important array of analytical instruments (electronic microscopes, ICP-AES, ICP-MS, GC-MS, IRTF, Heliostat, clean rooms…), as well as clusters for computation and important data storage systems.
- UPEC is building a new infrastructure of 4000 m^2 dedicated to environmental sciences. This new building will be mainly occupied by LISA and will offer equipments and services for the technical department, clean rooms, very large simulation platforms, new analytical poles for organic and mineral chemistry
- LISA contributes to development of chemistry-transport model CHIMERE, working on chemical codes and assimilation methods.

Laboratory scientific value and international influence

- AERES ranking: A (2008 vague C);
- Mean number of publications/per year (4 years average based on a study from INSU/CNRS in the 2005-2008 period) is 75;
- H factor (considering only staff in the field of this proposal): 20 higher than 10, 7 higher than 20; even if the mean age of the staff is quite low (2/3 of the staff are less than 45 years old);
- Foreign post-doc scientists: 6;
- Awards:
    - International prizes: Prix Gentler-Kastler; Prix Gay-Lussac Humboldt (J.M. Flaud; Issol Fellowship (F. Raulin)
    - CNRS medals: 2 (1 bronze (B. Marticorena), 1 cristal (B. Chatenet))
- ANR projects: 2 with high responsibility (more than 10 in progress);
- R&D European Framework Program projects: 4 with high responsibilities (Co-PI);

- Coordination of research at international level: European Panel on Atmospheric Sciences (1).

Lastly, researchers from LISA are involved in various tasks dealing with the research management at national level (President of Ocean-Atmosphere division of the National Committee of Research, President of the Commission for Atmospheric and Oceanic Sciences of the National Institute for Universe Sciences (INSU), President of the TOSCA committee (Earth-Ocean-Continental surfaces-Atmosphere) of the CNES (National Centre for Spatial Research), President of evaluation committees of ANR programs or AERES, deputy-director at INSU, President of the French Society of Astrobiology, etc. More than 30 researchers from LISA contribute each year to more than 50 invited papers in international conferences.

Staff people involved in “Photooxidant and aerosol pollution” and “Atmospheric fate of organic carbon” (18 people from the permanent staff, 10 PhD students and 3 post-docs) do not participate to the present LabEx. They are involved in the LabEx project “Urban Futures”, which is proposed by PRES Paris-Est University and coordinated by Ecole Nationale des Ponts et Chaussées. Staff people involved in “Astrobiology” axis (12 people from the permanent staff, 3 PhD students and 2 post-docs) are involved in the LabEx Project “Space Exploration for Planetary Environments”, which is coordinated by Paris Observatory.

4.1.5.2 EXPLOITATION OF RESULTS

LISA is in charge of numerous research contracts in the frame of partnerships with institutions or national organisms (ADEME, INERIS, Ministries, CNES, ANR…), with international institutions (European framework programs FP6 and FP7; ESA; NASA…) and with enterprises (EDF, Alsthom, S^{t} Gobain…) or with design offices (Aria Technologies, Numtech…).

LISA also contributed to the development of the CHIMERE model, today transferred at INERIS for exploitation in the frame of air quality survey and predictions (Prev’air platform).

Several analytical developments were patented from LISA staff (especially in chromatography and X fluorescence spectrometry).

There is also one PhD thesis in progress jointly supported by Industry (Astrium) and CNES (French Space Agency).

In additional to the standard way of dissemination of results through publications in international journals, LISA contributes to dissemination of observations to national or international data bases: HITRAN, GEISA, SCOOP…

4.1.5.3 HIGHER EDUCATION

LISA contributes to higher education in environmental sciences, planetology and engineering. LISA is main promoter of the master “Sciences et Génie de l’Environnement (SGE)” established in 2005 and operated by UPEC, UPD and ENPC. The master SGE is based on a long-standing experience (more than 20 years) in the education of environmental sciences, especially in the field of air and water pollution as well as in the field of environmental policies. About 15 professors and assistant professors at LISA are involved in the SGE training, where 150 to 200 students are enrolled each year.

LISA professors or assistant professors contribute also to courses applied in inter-disciplinary cursus.

- Number of Master 2 training at LISA: average of 8 per year
- CNES fellowship: 2
- PhD thesis jointly supervised by two countries: 3

4.1.5.4 ORGANISATION

The total budget of LISA is about 3 millions of Euros excluding salaries, including about 150-200 k€ of recurrent budget from CNRS, UPEC and UPD. Additional funds are also provided by these institutions based on projects, especially for equipment. The main external budget resources come from the National Space Agency (CNES), European research programs, ANR, INSU. This budget is managed at CNRS, UPEC, and UPD.

LISA is organized in 5 scientific departments, 1 technical and 1 administrative departments (see http://www.lisa.u-pec.fr for details).

4.1.6 PARTNER 6: UMR 8190 – LABORATOIRE ATMOSPHÈRES, MILIEUX, OBSERVATIONS SPATIALES

Partner 6: LATMOS

Identity: LATMOS laboratory is a joint research institute of Université of Versailles Saint-Quentin en Yvelines (UVSQ), CNRS, and Université Pierre et Marie Curie (UPMC). It was founded on January 1st, 2009 by merging the former Service d'Aéronomie and about half of CETP. It is located at two university campus: Guyancourt (UVSQ) and Paris (UPMC). It is one out of six members of the joint Institute for Environment and Climate Research IPSL (Institut Pierre Simon Laplace), coordinator of the present proposal.

LATMOS staff includes about 134 permanents employees (65 researchers, 69 engineers and technicians), 201 in total including PhD students (29), post-docs (13), and non permanent technical staff (25).

Involvement in L-IPSL: Permanent staff contributing to the present LabEx represents about 58% of the total. The rest is involved in the LabEx proposal ESEP, dealing with planetology.

Field of research: Two main fields of research are addressed at LATMOS: 1) Physics and Chemistry of Earth environment, 2) Physics and Chemistry of Planets and small bodies of the solar system, sun irradiance and diameter

4.1.6.1 RESEARCH AND INNOVATION

Main research themes

As for Earth environment, which deal with the L-IPSL project, the main goals are to improve the understanding and description of processes, which contribute to climate variability, and to develop new methods for the analysis of related observations. Variables and processes of interest are those contributing to the transport of heat and momentum, to the water cycle, to radiative effects, and to air composition (troposphere, stratosphere). For these objectives, LATMOS develops experimental approaches mainly based on original remote sensing techniques (radar, radiometer, lidar, optical spectrometers): design of instruments, long-term deployment and analyses of observations from ground, analyses of space-borne observations, organization or participation to regional campaigns dedicated to vulnerable regions (Arctic, West Africa, Mediterranean area). This activity contributes to the strategic mission of Observatoire de Versailles Saint-Quentin (OVSQ), Observatoire des sciences de l'Univers (OSU) of UVSQ and INSU. It will also contribute to the activity of OSU Ecce Terra at UPMC. These observations are used, combined with numerical models, to i) characterize the natural variability from short time scale up to decennial time scale and from local to global scales, ii) improve the parameterization in numerical models, iii) validate numerical results on atmosphere and climate predictions.

Main processes investigated at LATMOS are: air/sea exchanges, deep convection, non precipitating clouds (cirrus, stratus) and their impact on radiative forcing, coupling between aerosols, dynamics and radiative effects, thermodynamics and composition of the stratosphere, exchanges between troposphere and stratosphere, relation between atmospheric circulation and air composition, impact of solar variability on the stratosphere and climate, in particular at the scale of a 11-year solar cycle.

Research in the domain of planetology is closely related to this activity, with same competences in instrumentation or models developed for studying atmosphere and surface of planets.

Main equipments

LATMOS contributes to national and international platforms of observations in connection with the present proposal:

- NDACC (Network for the Detection of Atmospheric Composition Changes-international), French section created in 1991, recognized as a CNRS-INSU Observation System in 1994. Major scientific responsibility at LATMOS (French PI-ship P. Keckhut, responsibility in the international committee S. Godin-Beeckman), and technical responsibility (6 lidars, 11 spectrometers);
- Set of instruments for atmospheric and surface remote sensing (about 7 radars, 3 lidars, 2 microwave radiometers) with renewal/extensions a submitted in the SOFRAEX EquipEx proposal (see section 2);
- Instruments of the QUALAIR site of observation (lidars, radar and spectrometers for air composition and pollution monitoring);
- Scientific responsibility of an air/sea interface instrumental package managed and open for use at the national level (turbulence and meteorological package, development of new unmanned marine vehicles);
- LATMOS contributes to improvement of the Earth system simulator of IPSL by its contribution to the modelling of processes in the stratosphere;
- LATMOS has also major responsibilities (PI/CoI) in past, present and future satellite missions dedicated to the monitoring of essential variables: ozone (GOMOS/ENVISAT), sun-climate link (PICARD), aerosols and clouds (CALIPSO, CLOUDSAT, EARTHCARE), precipitations: MEGHA-TROPIQUES, surfaces (SMOS, CFOSAT), air composition monitoring: IASI/METOP, and the atmosphere GMES sentinels 4 (MTG) and 5 (post-EPS);
- Scientists from LATMOS are also PI in several space instruments for planetary exploration;
- OVSQ is in charge of the Integration and Test Platform (PIT), which offers equipments and services for the test of new sensors and their integration in space-borne satellite conditions. Presently LATMOS is the principal user of this service.

Laboratory scientific value and international influence

- AERES ranking: A (2008) (CETP and Service d'Aéronomie, and the LATMOS project, evaluated in 2008);
- Mean number of publications/per year (2 year average since the creation of LATMOS) is 190;
- H factor (considering only staff in the field of this proposal): 23 higher than 10, 9 higher than 20;
- Foreign post-doc scientists: 9
- Awards:
    - International prizes: 3 (JL. Bertaux: EGU Christiaan Huygens medal 2010, B. Lembège: European Physical Society - Plasma Physics Innovation Prize 2009, C. Clerbaux shared as IPCC member: Peace Nobel prize with IPCC and Al Gore
    - CNRS medals: 4 (1 silver, 2 bronze, 1 cristal)
- Foreign scientist of high level: 1
- ANR projects: 1 with high responsibility (10 in progress);
- R&D European Framework Programme projects: 3 with high responsibilities (12 total): GEOMON (co-PI LATMOS), ACCENT (PI LATMOS), SCOUT-03 (LATMOS PI of 1 Activity including 10 Institutes), MACC (co-PI LATMOS);
- Coordination of research at international level: WMO/UNEP Scientific Ozone Assessment (9 scientists), IPCC (1 scientist);
- Organization of congress: ISARS 2010 (atmospheric boundary layer), ISSS9-2009 (numerical simulation for plasma physics), Mars Water Cycle 2008.

4.1.6.2 EXPLOITATION OF RESULTS

The technology transfer department of UVSQ, composed by two IP legal advisers, a European Project Manager, three financial managers and a director, aims at promoting the work of the researchers and facilitating partnerships with economic and institutional partners.

The technology transfer department provides administrative, legal and financial support to UVSQ' laboratories for answering the calls for proposal, whether local, national, European or international. It

is in charge of the drafting and negotiations of different types of agreements (consortium, collaboration, NDA, MTA, service transaction, hosting agreement, which concern researchers or companies,…), the administrative and financial management of the funds such agreements generate, and the management of the patent portfolio (presently, around 30 patents, two-third of such patent applications having been filed during the last 3 years, which indicates an increasing activity). The department also participates to strategic transverse projects by making legal studies and proposing adequate solutions.

In 2009, the technology transfer department of UVSQ dealt with around hundred agreements, which together generated 8 million €. It has participated to the creation of a public-private laboratory with

INTEL, French Commissariat à l'Energie Atomique (CEA) and GENCI in the field of High Performance Computing and to the hosting of three companies in UVSQ's premises.

Our university, renowned for its works in the domain of environment and sustainable development and benefiting from the support and experience of its European Project Manager, is the only French university member of the European Climate Knowledge and Innovation Community, which addresses in priority the area of climate change mitigation and adaptation.

Furthermore, during the last two years, the department provide legal and administrative support for the creation of two foundations (known in French law as "fondation partenariale") in which our university is a fondating member, which demonstrates our partnership with the industrial world: Fondaterra (Initial allocation: 1,4 million €, Partners: EDF, GDF-SUEZ, VINCI CONSTRUCTION) and Mov'eoTEC (Initial allocation: 2 million €, Partners: RENAULT, PSA, VALEO, SAFRAN, IFP, INRETS, CETIM, ESIGELEC, ESTACA).

The department is a member of the Ile-de-France incubator, Incuballiance, which helps our innovating concepts to become high potential development companies and this support would be enhanced by the creation of a SATT on the Saclay Campus (Société d'Accélération du Transfert de Technology – Technology Transfer Increasing Company) in the framework of the "Investissements d'Avenir": such SATT would aim at developing the maturation of research projects and increasing the technology transfer from the academic to the industrial world, especially to the Small and Medium Enterprises. This new offer would complete the supports proposed by the department, which aims at providing to its members all the tools for the successful development of their research, including technology transfer.

The technology transfer department of UVSQ is therefore the contact point for the implementation of the research projects, their protection and exploitation.

Three patents are authored from LATMOS staff (technology in lidar, hydrometeorology, and optical spectroscopy). Valorization is also carried out through collaborations with small enterprises for instrument development (CIMEL), software development (ACRI, Noveltis), end-users applications (NOVIMET in the field of hydrometeorology). There is also one PhD thesis in progress jointly supervised by Industry (Thales) and LATMOS (CIFRE grant).

In additional to the standard way of dissemination of results through publications in international journals, LATMOS contributes to dissemination of observations to national or international data bases: NDACC international service and ETHER national service for air composition in the stratosphere and atmosphere, ICARE national service for aerosol, cloud and precipitation, contribution to the "essential climate variable" data base of ESA, national air/sea exchange data base.

4.1.6.3 ENSEIGNEMENT SUPERIEUR / HIGHER EDUCATION

LATMOS contributes to teaching at the master level in the field of Earth environment, planetology, astrophysics, engineering. In the Earth environment domain, 12 professors or assistant professors contribute to one of the following masters: ICE (UVSQ), Master Pro "Arctic" (UVSQ- co-responsibility LATMOS), Master Pro Qualub (UVSQ), master Pro TRIED (responsibility LATMOS), Master SDUE/OACOS ("Océan, Atmosphère, Climat et Observations Spatiales") - (UPMC). Most of them also contribute to physics courses applied to geophysics and earth environment and 4 to courses in interdisciplinary cursus (Science politics, arctic studies, geography, etc.)

- Number of Master 2 training at LATMOS: average of 8 per year
- CIFRE fellowship: 1
- PhD thesis jointly supervised by two countries: 2 (among which 1 PED)

4.1.6.4 ORGANISATION

The total budget of LATMOS excluding salaries is 3 to 6 million of Euros (varying from one year to another), including about 550 k€ of recurrent budget from CNRS, UVSQ, UPMC. The main external budget resources come from the National Space agency (CNES), European research programs, ANR, INSU. This budget is managed at CNRS, UVSQ, and UPMC. LATMOS is organized in 6 scientific departments and 3 technical or administrative departments (see http://www.latmos.ipsl.fr for details).

4.1.7 PARTNER 7: UMR 8212 – LABORATOIRE DES SCIENCES DU CLIMAT ET DE L'ENVIRONNEMENT

Partner 7: LSCE

Identity: LSCE is a joint research unit between the Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA), le Centre National de la Recherche Scientifique (CNRS) et l'Université de Versailles Saint-QuentinenYvelines (UVSQ). The laboratory is located on two sites (Saclay, site CEA de l'Orme des Merisiers, and Gif-sur-Yvette, CNRS Campus). About 320 persons work at LSCE, including about one half of permanent researchers, teachers, engineers and administrative people, one quarter of Master and PhD students and one quarter of post-docs or visiting researchers.

Involvement in L-IPSL: An interdisciplinary group of 10 permanent researchers will not contribute directly to the L-IPSL because of their involvement in another project on Agro-ecology, Climate Change and Territories (LabEx ACTE coordinated by INRA).

Field of research: LSCE studies climate variability at various timescales and climate change over the coming decades and centuries, with a specific leadership on the major biogeochemical cycles (C, N) in the various compartments of the Earth system and their role in climate. LSCE is also a leader in the study of several aspects of climate impacts on the environment at different scales, from global (ocean acidification, atmospheric oxidative capacity, land use,…) to regional (atmospheric pollution, hydrology, permafrost,…). Researches at LSCE rely on both theoretical approaches, instrumental development for observation, numerical modelling and assimilation/inversion methods.

4.1.7.1 RESEARCH AND INNOVATION

Main research themes

Five major scientific axes are developed at LSCE:

- Study of the climate dynamic at different timescales using geochemical and isotopic measurements on natural archives (continental ices, ocean or lake sediments, speleothems, pollens,…).
- Study of the evolution of the atmospheric composition (greenhouse and reactive gazes, aerosols) and estimation of regional to global greenhouse gas fluxes using the ICOS European research infrastructure.
- Study of the transfer of major geochemical and isotopic tracers in the environment, using an analytical platform and an hydrological model, and the development of new tracers to improve natural archives.
- Study and simulation of past, current and future climate variability, with a focus on the integration and role of major biogeochemical cycles using numerical models developed within IPSL.
- Study of the interactions between humans, climate and environment by promoting interdisciplinary approaches.

Main equipments

LSCE is involved in several regional, national and international networks and platforms:

- A collaborative analytical platform for environmental and climate studies (PACEC). This instrumental platform, shared between IDES and LSCE laboratories, has been proposed as an EquipEx in the frame of the Paris-Saclay Campus to support our scientific activities on natural climate archives and environmental transfer of water and matter.
- A national network of stations SOFRAEX, submitted as an EquipEx, for the study of aerosols and clouds using a wide range of instruments (lidars, mobile platforms,…). LSCE contributes mostly on the measurement of aerosols and water vapour isotopes.

- The European infrastructure (ESFRI) Integrated Carbon Observing System ICOS, which is also a TGIR of the MESR and a part of a SOERE of INSU, for the monitoring of greenhouse gazes and the inversion of their sources and sinks.
- A national network of specific measurements, submitted as the EquipEx GHG-SCOPE, that aims at enlarging ICOS objectives to the calibration and validation of satellite greenhouse gas measurements.
- The IPSL Earth System model in which LSCE contributes to the development of the biogeochemical models for the various compartments (ocean, vegetation, atmosphere). LSCE is also responsible for the integration and coupling of these models within the earth System model.
- The development of lidar systems in collaboration with the LEOSPHERE private company.

Laboratory scientific value and international influence

- AERES ranking: A+ (2009, vague D);
- Mean number of publications of about 200 per year (peer-reviewed journals);
- H factor: 66 researchers above 10 and 26 researchers above 20;
- 17 foreign post-docs and 5 foreign senior scientists as for 2010;
- International awards: Prix Descartes, 9 IPCC authors (among which 2 Chapter Lead Author for the 5th assessment report), 12 researchers involved in coordinating groups of several international organization (IPCC, IGBP,…);
- CNRS medals: 3 bronze since 2000 and one gold (J. Jouzel, 2002);

12 PI of ANR projects and 3 PI of European projects.

4.1.7.2 VALORISATION / EXPLOITATION OF RESULTS

- LSCE has deposed a patent on lidar technology, which is currently used under licence by the LEOSPHERE private company.
- LSCE is also strongly involved in both academic and private advisory and expertise activities as well as in impact studies on extreme climate events, air quality, long-term geologic storage, environmental impact, etc.
- LSCE is also a contractor for public institutions and private industries to perform analytical measurements in the fields of atmospheric chemistry, isotopes and environmental radioactivity.
- LSCE has collaborations with several private companies (NOVELTIS, HYGEOS, LEOSPHERE, ACRI-ST,…) through the co-funding of PhD Thesis and coordination of research projects.

Z. Poussi, who was engineer under contract at LSCE, has created a start-up company, CLIMMOD Engineering, on the carbon cycle activities and on assimilation methodology for Earth sciences.

4.1.7.3 HIGHER EDUCATION

- Seven teachers (2 Professors and 5 Maîtres de Conférence) from the UVSQ are performing their research at LSCE. They account for more than 1000 hours of teaching in Licence and Master, mostly at UVSQ but also at UPSUD and UPMC, in the fields of Earth system physics and chemistry, geosciences (geology, geophysics, geochemistry) and general physics.
- About 30 researchers and engineers from CEA and CNRS have teaching activities in their scientific fields at the university.

4.1.7.4 ORGANISATION

The total budget of LSCE excluding salaries is 6 to 8 million of Euros (varying from one year to another), among which about 5 million of Euros are obtained from external funding. The main external budget resources come from the FP7 European research programs, National Space agency (CNES), ANR, INSU and other national programs and industrial contracts. This budget is managed at CEA, CNRS and UVSQ. LSCE is organized in 4 scientific departments, one transverse scientific theme, one large infrastructure project (ICOS) and 3 technical or administrative departments (see http://www.lsce.ipsl.fr/for details).

4.1.8 PARTNER 8: UMR 8539 - LABORATOIRE DE MÉTÉOROLOGIE DYNAMIQUE

Partner 8: LMD

Identity: LMD Laboratory is a joint research unit whose main supervisory authorities are Ecole Nationale Supérieure (ENS), University Pierre et Marie Curie (UPMC), Ecole Polytechnique and French National Center for Scientific Research (CNRS). The laboratory has strong relation with the French national space centre (CNES). It is located at three sites (at Ecole Polytechnique in Palaiseau, at ENS and at UPMC, in Paris). About 200 persons work at LMD, including one quarter of permanent researchers and teachers, one quarter of engineers and administrative people, one quarter of doctoral students, and one quarter of post-doc or visiting researchers.

Involvement in L-IPSL: 11 persons will be involved in Esep LabEx, all the others will be involved in L-IPSL.

Field of research: LMD mainly studies climate, pollution and the atmosphere of planets using theoretical approaches, numerical modelling as well as remote sensing and instrumental development for observation and numerical modelling. It is a leader on the research about dynamical and physical processes to study and forecast the meteorological and climatic phenomena. LMD is working along two main axes: (i) study of climate change and anthropic effects and (ii) study of dynamical and physical processes in fluid envelopes and at the surface. LMD is working along two main axes: (i) study of climate change and anthropic effects and (ii) study of dynamical and physical processes in fluid envelopes and at the surface. The dynamics of the atmosphere is mainly studied at the global scale; but to understand and forecast the atmospheric processes, LMD also deals with smaller scales, always combining modelling, theoretical studies and observations

4.1.8.1 RESEARCH AND INNOVATION

Main equipments

The laboratory develops software largely distributed inside the community:

- LMDZ is a general circulation model of the atmosphere used both for climate studies and simulation of the atmosphere of other planets;
- Orchidée is a “Land Surface Model “ co-developed with LSCE (Partner 7 of this proposal),the laboratory has the responsibility of the exchanges of water between vegetation, soil and atmosphere, the soil humidity scheme and the water transport through the river network to ocean.
- CHIMERE is a chemistry-transport model with an operational use by INERIS for air quality forecast;
- 4AOP is a fast and accurate radiative transfer model;
- Ixion is a software dedicated to orbitography and sampling, to exploit and prepare satellite missions;
- Calipso/Parasol simulator is a flexible tool to simulate active instruments in models and facilitate the exploitation of A Train data in numerical models, used in the context of the CMIP5 simulation.

The laboratory manages huge databases and provides thematic climate data records :

- GEISA is an international spectroscopic database;
- Mars Climate Database is used by all spatial agencies to prepare Martian mission.
- .Atmospheric and surface properties from space observations

The laboratory develops instruments:

- Lidars, with a new focus on the development of a lidar to measure the CO2 fluxes;
- Airborne sensors to monitor the photosynthetic activity through passive and active vegetation fluorescence measurements;
- ScaraB is a space instrument dedicated to radiative budget, the third instrument will be launch next year on the franco-indian mission Megha-Tropiques;

- Instrumentation for long duration balloon is also developed: ozonometer and hygrometer.

The laboratory operates a world class Atmospheric Research Observatory: SIRTA in Palaiseau (Site instrumental de recherche par télédétection atmosphérique). It is a multi-instrumented observatory for atmospheric remote sensing research, climate monitoring, and atmospheric process exploration.

The laboratory is part of two EquipEx proposals: Sofra-ex (an observing system dedicated on Aerosols, Clouds and Precipitations) and Paprica (a high-performance computing platform for the development of advanced numerical prediction for prevention of meteorological, oceanic and climate risks).

Laboratory scientific value and international influence

- AERES ranking: A+ (2009 vague C);
- Mean number of publications is around 130 per year (peer-reviewed journals);
- H factor: 26 higher than 10 with 15 higher than 15 and 5 higher than 20;
- Awards:
    - CNRS medals: 6 (3 silver: B. Legras 1995, O. Talagrand 2004, D.-D. Rousseau 2007 and 4 bronze: H. Letreut 1990, D.-D. Rousseau 1990, F. Hourdin 1997, F. Forget 2001)
    - Académie des Sciences: H. LeTreut (2005)
    - Academia Europaea: M. Ghil (1998), H. Le Treut (1999), M. Farge (2005), B. Legras (2006)
- ANR projects 13 with high responsibility (17 in progress)
- R&D European framework programme projects: 1 with high responsibilities (5 in total)
- Coordination of research at international level:
    - AMMA, Hymex, Strateole/Vorcore, Concordiasi
    - GEWEX Cloud Assessment
    - - WCRP Joint Steering Committee (JSC))
    - - WCRP Working Group on Coupled Models (WGCM)
    - - Cloud Feedback Model Intercomparison Project (CFMIP)
    - - Partner Investigator of the newly funded Australian Centre of Excellence on climate and climate change (2010-2017)
- Satellite mission: LMD has also major responsibilities (PI/CoI) in past, present and future satellite missions dedicated to the monitoring of essential variables: ISSWG for IASI (Eumetsat), Science Team Calipso (NASA and CNES), MAG ADM-Aeolus (ESA) MAG Earthcare (ESA and JAXA), MAG AEOLUS (ESA), PI Megha-Tropiques (ISRO and CNES), PI MERLIN (DLR and CNES)...
- Workshop, symposium and conference organization: The laboratory organize on average two or three national or international events are organized by the laboratory per year.

4.1.8.2 EXPLOITATION OF RESULTS

The laboratory has deposed a patent (N° Enregistrement national 08 02668; 16 mai 2008): “Sonde automatique atmosphérique et océanique”. Invention: J.P. Duvel. Ref.: 65360 (Ref. Prov. 10366).

The Laboratory develops joint research with ONERA and CNES.

The laboratory is in contact with many economic actors both in area of space: Thales, Astrium, Noveltis, but also in the area of climatic expertise like Climpact and Aria, or lidar makers like Leosphere.

P. Aires, member of the laboratory, has participated to create a new society (Estellus) to valorise the expertise on the area of the use of microwave to observe the earth or other planets. Y. Goulas is involved in the society Force-A dedicated to the observation of the plants growth.

4.1.8.3 HIGHER EDUCATION

LMD is deeply involved in teaching both at Ecole Normale Supérieure with J.-P. Duvel, who is responsible for studies for the Geoscience Department, at Ecole Polytechnique with C. Basdevant who

is President of the Department of Mechanic, and at UPMC with H. LeTreut who is in charge of the "École Doctorale des Sciences de l'Environnement d'Île-de-France" and with L. Picon and V. Zeitlin in charge of the domain "Océan, Atmosphère, Climat et Télédétection".

There is 34 HDR in the lab and the members of the laboratory (not only teachers but also researchers) are teaching not only in these trainings but also in engineer schools.

In the past 4 years, members of the laboratory have written more than 170 chapters of books.

- Thesis: 45 PhD now in the lab (in a context of regular increase), in the past years there were 9 PhD defended per year
- Master 2 training: average of 8.5/year
- Erasmus mundus student: 5 since 2002
- CIFRE fellowship: 1 and 5 with industrial partnership 5 (CEA, CNES)

PhD thesis jointly supervised by two countries: 8

4.1.8.4 ORGANISATION

Total budget of LMD is 2.5 to 3.5 million of Euros (varying from one year to another), including about 400 kEuros of recurrent budget from CNRS, ENS, Ecole Polytechnique and UPMC. The main external budget resources come from the National Space agency (CNES), European research programs, ANR, INSU. This budget is mainly managed at CNRS. LMD is organized in 7 scientific teams, a technical pole, a computing group and an administrative team (see http://www.lmd.jussieu.fr/ for details).

4.1.9 PARTNER 9: UMR 7619 – STRUCTURE ET FONCTIONNEMENT DES SYSTÈMES HYDRIQUES CONTINENTAUX

Partner 9: SISYPHE

Identity: Sisyphe is a joint laboratory of the Université Pierre et Marie Curie (UPMC), the Centre National de la Recherche Scientifique (CNRS) and the Ecole Pratique des Hautes Etudes (EPHE), founded in 1997. It belongs to the UFR 918 "Terre, Environnement, Biodiversité" (TEB) and the Observatoire des Sciences de l'Univers (OSU) Ecce Terra of UPMC. Within CNRS, Sisyphe is supervised by the "Institut Ecologie et Environnement" (INEE) and secondarily by the "Institut des Sciences de l'Univers" (INSU). It is one of the 14 laboratories of the Research Federation on the Environment FIRE, led by J. Garnier (Sisyphe). Sisyphe is also at the head of a Laboratoire Européen Associé (LEA: University Paris 6 & University of Brussels).

Sisyphe is composed of about 45 permanent members (28 researchers, 17 engineers and technicians), 40 PhD students and 6 Post-Docs/ATER and 4 non-permanent technical staff.

Involvement in L-IPSL: Among these 95 members, 19 (i.e. 20%) are secondarily involved in the LabEx project ODYSSEE on Ecosciences, Ecology and Environment (PI L. Abbadie). The staff of the FIRE Federation (4 engineers) and the associated CDD, Ph-D and post-docs (presently 7 persons) are also involved in both LabEx L-IPSL and ODYSSEE, and included here in the Sisyphe staff.

Field of research: The research carried out at Sisyphe addresses challenging questions, namely the interactions between subsurface structure and hydrological and biogeochemical processes, and the anthropogenic impacts on water resources and water quality. This interdisciplinary focus fits perfectly well with goals and organization of the L-IPSL based on interdisciplinary approaches and modeling tools.

4.1.9.1 RESEARCH AND INNOVATION

Main research themes

Sisyphe provides a strong disciplinary expertise in quantitative hydrology over land. It encompasses many specific environments (karstic systems, wetlands, permafrosts, glaciers and mountain hydrology), with two transversal research focuses: the importance of coupling surface and ground waters to properly understand the dynamics of water resources (groundwater, soil moisture, river discharge), over time scales that can be long (anthropogenic perturbations, paleo-hydrology, up to diagenesis); and numerical modelling to increase the hydrological skills of land surface models, to implement new coupled processes in hydrogeological models and to develop integrated models of river basins, with groundwater, land surface and human influences.

The geophysicists of Sisyphe describe and characterize different media (soil, subsoil, vadose zone and groundwater), and different transfer processes (water and chemical elements) to provide an expertise on societal issues such as storage (hydrocarbon, water, waste, CO2 ...) and resource estimation (mining, water ...). Many studies concern the inverse problem to determine the distribution of the physical properties that gave rise to the geophysical signals (gravimetry, seismic, electric, electromagnetism, magnetism). The challenges include the development of 4D (three spatial dimensions and time dimension) numerical models of physical property distributions (temperature, soil moisture, …) based on geophysical survey data. Sisyphe also develops new sensors to obtain more precise information on the physical behaviour of materials and to adapt the sensors to urban media.

Sisyphe specialists in biogeochemistry develop numerical model for studying the circulations and transformations of biogenic, xenobiotic element at pluri-regional scales from land to sea. The main goal is the functioning of the regional hydroecosystem in which the fluxes of the biogeochemical compounds (from particulate to dissolved, from organic to inorganic) are estimated, reconstructed and predicted in relation with human activities in the watersheds and the hydrological cycle. The interactions between climate changes and human activities, and their impacts on continental systems,

soil, water, costal zones and atmosphere (GHG, PAH, PCB, etc.) are presently a major challenge. Many of the microcontaminants represent a real threat for both human health and ecosystems but are still difficult to quantify. Further, in surface waters, the particulate phase and sediments constitute an important vector of contamination able to clearly increase the time response of the systems by various processes of storage and release.

Main equipments

Instrumental platforms and observing services

Platform of subsurface geophysics

Sisyphe manages many sub-surface geophysical devices (unique in France), composed of commercial equipments and prototypes developed in the laboratory. It includes direct current resistivimeters, time domain electromagnetic sounding devices, ground penetrating radars, electromagnetic conductivitimeters, electrostatic equipments, gradiometers, micro-gravity, seismic unit and sources, unit of induced polarization, temperature sensors to 1/1000th of °C. These equipments correspond to imaging tools from the nearby area for any type of environment (urban, polluted soil, frozen soil ...) and provide information on the quantity and quality of water in the soil.

Platform of Biogeochemistry

To study the transfer and behaviour of organic micropollutants in the environment, the team has equipped a laboratory suited to the treatment and analyse of xenobiotic compounds found in the air/soil/water compartment and the related biote. To improve the research capacity regarding emergent pollutants, the team has recently acquired new specific equipment for chromatographic analysis: two GC/MS, one GC/MS/MS, one HR HPLC/MS/MS. These equipments are completed by one GC/NPD and two HPLC DAD/Fluorescence detector and specific materials for sample treatments (extraction, purification, concentration). Regarding the biogeochemical C, N, P, Si cycles, auto-analysers for dissolved inorganic forms, DOC and CHNS, are available with analysers. Liquid scintillation technique for radioactive tracing (β^-) is also possible, in full respect to administrative rules. Equipments also exist for studying microorganisms by classical microbiological techniques and molecular biology. The research Federation FIRE has acquired, since its creation in 2007, a number of outdoors equipments that can be shared among the member laboratories (piezometry, meteorological station, ADCP, NIRS field spectrometer, multiparameter probes, XRF-p field fluorimeter, etc.).

Observing Systems in the Seine River watershed: the PIREN Seine program

The PIREN-Seine program (resp. J.-M. Mouchel) is one of the Zone Atelier (ZA) of the CNRS/INEE. Numerous monitoring projects developed by this program since 1989 have been gathered in comprehensive geospatial and time indexed databases, characterizing the functioning of the hydro-ecosystem at the regional scale (water level, flow and quality for numerous types of organisms and chemicals, historical land-use, quantitative water uses and emissions of contaminants). They are regularly updated, and used in many modelling exercises, including the simulation of various scenarios (climate change, evolution of agricultural practices and productions etc...).

EquipEx SeineARIO

The project SeineARIO (resp. J.-M. Mouchel) was proposed to the EquipEx call for proposal. It aims at monitoring the microbial and chemical dynamics of the larger streams in the Seine basin in the long term. It will be based on 10 autonomous stations capable of measuring in real time a large number of parameters including nutrients, inorganic and organic forms of carbon in order to precisely assess the response of the trophic functioning of the fluvial system to anthropogenic and climatic changes and the contribution of the hydrosystem to the regional CO2 cycle. An additional proposed monitoring set of devices is devoted to the understanding of organic contaminant transfer at the regional scale inside the atmosphere/soil/water circulating system. An environmental sample bank will be devoted to organic contaminants in all compartments and to microbial populations through their DNA, which will regularly preserved from river waters.

Laboratory scientific value and international influence

- AERES ranking: A (2008)
- Mean number of publications per year: 60 (peer-reviewed journals)
- H factor: 3 higher than 20, 13 higher than 10.
- Invited foreign scientists: more than 3 per year
- Foreign post-docs: 2 per year
- Awards: G. de Marsily (Académie des Sciences, 2003; Prix Meinzer de la Geological Society of America, 2004), Ph-D Award ASTEE to J. Némery (2006), G. Tallec (2007).
- ANR projects: a mean of 4 projects per year (1 with high responsibility)
- R&D European framework program: 1 in progress (3 during the last 4 years)
- Cooperation programmes with Vietnam, 1 UNESCO Program
- Organization of meeting, symposium, congress: around 3 per year
- Responsibilities in research organization:
    - Steering committees of national/international programs: 10
    - Learned societies: 5

4.1.9.2 EXPLOITATION OF RESULTS

Sisyphe provides expertise and develop research projects for a number of private and public companies (EDF, GDF, Arkema Total, Veolia, Suez, Statoil, Sedif, Mairie de Paris, Agences de l'Eau, Ademe, …) in the area of water and environmental sciences. More than 20 contracts are signed every year.

The PIREN-Seine program has set-up a exploitation structure aiming at disseminating research results to stakeholders and water managers mainly in the river Seine basin. This structure is made by two engineers, part time, one from CNRS, one from Agence de l'Eau Seine-Normandie (AESN) and is presently editing and publishing a series of thematic booklets (9 already published, 9 more under preparation). The biogeochemical Seneque/Riverstrahler model developed is taken in hand by the AESN for evaluating the EU-water framework directive.

A researcher of Sisyphe, Michel Dabas, set up a company GEOCARTA in 2001 to develop technologies for sub-surface mapping applied for agriculture applications (precision agriculture) and archaeology. It originates from different developments undertaken in collaboration with Sisyphe. Some devices (continuous resistivity profiling, automatic magnetic profiling) were patented by GEOCARTA.

4.1.9.3 HIGHER EDUCATION

PhD students at Sisyphe are in majority integrated to the Doctoral School "Géosciences et Ressources Naturelles" (ED398) of UPMC.

Sisyphe is deeply involved in teaching at UPMC. A. Tabbagh is responsible of the mention of Master SDUEE "Sciences de l'Univers, Environnement, Ecologie". J.M. Mouchel is co-responsible of the speciality "Environnements Continentaux et Hydrosciences" of Master SDUEE, in which L. Oudin and P. Ribstein are in charge of Master 2 "Hydrologie, hydrogeology". C. Camerlynck is responsible of Master 2 "Géophysique appliquée, Ressources, Environnement" inside Master SDUEE. F. Rejiba is responsible of Master 2 "Géotechniques". R. Guérin is responsible of the speciality "Sciences de la Terre" at Polytech'Paris UPMC engineer school.

Some quantitative information is given below:

- Number of foreign teachers invited: 1 per year
- Number of PhD students at Sisyphe on 1st October 2010: 40
- Number of PhD thesis defended (last 4 years): 10 per year (including 4 foreign students)
- CIFRE fellowship: 4 on 1st October 2010
- PhD thesis jointly supervised by two countries: 2 on 1st October 2010
- Number of Master 2 students: about 10 per year

4.1.9.4 ORGANISATION

Total budget of Sisyphe is about 2 millions of Euros excluding salaries (with the budget of the PIREN-Seine Program), including about 100 k€ of recurrent budget from CNRS and UPMC. The external budget resources come from the various contracts with public and private companies, and also ANR, INSU, EU. The laboratory is organized in three research axes pertaining to hydrology, geophysics and biogeochemistry, which work together to address challenging fundamental and applied research questions (see http://www.sisyphe.upmc.fr/ for details).

4.1.10 PARTNER 10: UMR 8148 – INTERACTIONS ET DYNAMIQUE DES ENVIRONNEMENTS DE SURFACE

Partner 10: IDES

Identity: IDES is a joint laboratory of the "Centre National de la Recherche Scientifique" (CNRS) and the "Université de Paris-Sud 11" (UPSUD) created in 2004. It is structured in 5 scientific teams and 2 transversal themes. Within CNRS, IDES is supervised by the "Institut des Sciences de l'Univers" (INSU), secondarily by the "Institut Ecologie et Environnement" (INEE). Within UPSUD, IDES belongs the "UFR des Sciences" and is member of the "Département des Sciences de la Terre", whose it is the only member. IDES is composed of 63 permanent employees and about 45 non-permanent people. The permanent employees consist of 35 teachers-researchers, 5 researchers and 23 engineers and technicians. The non-permanent people include ~35 PhD students and ~10 post-docs/ATER. IDES is a young laboratory, with one half of scientists less than 40 years old.

Involvement in L-IPSL: The whole IDES staff will be involved in the L-IPSL LabEx.

Field of research: The main fields of research at IDES are climate variability, continental hydrology, water and matter transfers in the geosphere and geochronology.

4.1.10.1 RESEARCH AND INNOVATION

Main research themes

One of the main strength of IDES is its ability to conduct multidisciplinary studies of the geological processes occurring and/or recorded at the surface of the Earth and of terrestrial-type planets (characterization, tracing, measurement and modelling of the interactions between internal and external processes in surface environments or their reconstruction in the past). The main themes studied by researchers of the IDES laboratory are: 1) the continental part (rivers, groundwater) of the water cycle from the perspective of the preservation of water resources, ecosystems and natural resources; 2) the characterization of Siberian and Martian permafrosts, the processes at the subsurface-atmosphere interface on planets, and the ancient paleo-environments favourable to the appearance of life; 3) the physical chemistry of biominerals and the reconstruction of the evolution of environments and past climates on Earth; 4) the study of climate change impacts in arctic regions; 5) the history of volcanic systems and the risk factors associated to their evolution; 6) the quantification of the vertical movements of terrestrial surfaces (mountain ranges and sedimentary basins). Themes 1 to 4 are directly relevant to the two major scientific axes of the LabEx. Theme 5 will come in support to the elucidation of volcanism-climate relationship, relevant to climate natural variability studies. Theme 6 presents connections with the study of long-term climate and hydrological cycle evolutions, synergistically with themes 1 and 3.

Main equipments

The equipments of the laboratory are distributed over 3 platforms:

Geochemistry	Mineralogy	Geophysical measurements & analogic modelling
- IRMS mass spectrometer and quadrupole - K-Ar and Ar-Ar mass spectrometers (coupled with a furnace and a laser) - Noble gas mass spectrometer - Thermal Luminescence and Optically Stimulated Luminescence device - Liquid and gas chromatrographs - Atomic emission spectrometer using inductively coupled plasma (icp-oes) - Atomic absorption spectro-photometer. - b spectrometer	- X-ray diffractometer - Scanning electron microscope with EDS detector - Atomic force microscope - Laser granulometer - Fourier transform infrared spectrometer - Cathodo-luminescence device	- Sismometer - Geoelectrical equipment - Geological radar - Differential GPS - Spontaneous potential equipment and cesium magnetometer - Hydraulic channel in cold chamber - 3-D digital laser scanner (shared with FAST laboratory)

Instrumental platforms and observing services

Collaborative IDES-LSCE Analytical Platform (EquipEx PACEC)

A collaborative analytical platform shared by IDES and LSCE (Partner 6 of this proposal) has been developed during the last three years. This platform, created in 2008 and first dedicated to hydrology, took advantage of scientists and engineers with complementary areas of expertise in isotopic hydrogeology and water dating. Today, the analytical platform includes instruments from LSCE (spectrometer for noble gas, TIMS, ICP-MS, LA-MC-ICPMS) and IDES (H_2O-Max platform, X-ray diffractometer, laser grain-size). The installation of a clean laboratory at IDES for sample preparation for isotope analyses is underway and will complement the existing one at LSCE.

An EquipEx project called PACEC ("Plateforme Analytique Collaborative pour l'étude de l'Environnement et du Climat"), devoted to the further development of the analytical platform, has been submitted to ANR. This project, coordinated by C. Colin (IDES), and co-coordinated by E. Cortijo (LSCE), is led by UPSUD. The new equipment requested will make it possible for researchers from LSCE and IDES to conduct joint competitive and innovative research activities in the fields of geochronology, climate and environmental research (hydrology). It consists of a set of mass spectrometers (noble gas, CHONS, $d^{17}O$, dD, $d^{13}C$, Ar-Ar dating), laser spectrometers dD (water, water vapour), cathodoluminescence system, XRF core scanner and ICP-MS HR.

Collaborative IDES-FAST geophysical platform

The "Plateforme de Modélisation Physique de Processus de Sciences de la Terre", has been initiated by IDES and the FAST laboratory ("Fluides, Automatique et Systèmes Thermiques", UPSUD/P6/CNRS) in 2006. This platform combines the theoretical, numerical and experimental modelling with the in-situ studies of several geological processes observed at the surface, or in the subsurface, of the Earth. Its main scientific topics are the erosion of frozen islands in perigacial context (IDES) and the measurements of disruption and erosion surfaces and the characterization of impact cones (FAST). The equipments of the geophysical platform are: (i) hydraulic channels in cold chambers, (ii) geophysical imaging device (electrical resistivity tomography and high resolution ground penetrating radar, (iii) high resolution camera, (iv) computing cluster, (v) 3-D digital laser scanner.

New OSU context and IDES projects of observing services

The OSU "Institut d'Astrophyique Spatiale" (IAS) is presently being broadened to a wider OSU including both IAS and IDES. The new OSU should be officially created on mid-2011. The two major objectives of IDES, as a member of this OSU, are: (i) to develop and obtain the labelling of "Services d'Observation" (SO), (ii) to reinforce scientific cooperation with IAS in the field of planetology.

Two SO projects are presently under submission to obtain a label of SOERE ("Systèmes d'Observation et d'Expérimentation pour la Recherche en Environnement"):

The IDES-led arctic observatory HYPERARCTIC ("HYdrologie et PERgélisol en milieu ARCTIC"), focused on two major objectives: (i) hydrological and climatic monitoring of a small glacial catchment basin in polar environment (West-Spitsberg), (ii) automatic monitoring of permafrost temperatures in Yakutia on the islands of the Lena river.

The joint IDES-BRGM observatory of water isotopes in rain water at a series of selected sampling sites in France.

In the field of planetology, the "Photothèque Planétaire d'Orsay", including specific software developed for the automatic treatment of planetary space data, will constitute a significant contribution of IDES to the new OSU.

Scientific strategy of IDES on the Paris-Saclay campus

The three cooperative efforts previously described: (i) IDES-LSCE analytical platform, (ii) IDES-FAST geophysical platform and (iii) IAS-IDES OSU, are strongly structuring for IDES and will (partly) shape the future scientific orientations of the laboratory. To increase their efficiency, wider synergies are being created:

At Orsay campus scale, IDES wishes to be located in an "Environment district" of the future Orsay campus, regrouping laboratories developing research in the field of environment, including ecology and biodiversity (members of the GEREPS: "Groupe d'Enseignement et de Recherche en

Environnement de l'Université de Paris-Sud"). Such a geographical proximity will allow the development of scientific and analytical links between IDES and laboratories of biology, chemistry and physics.

At regional scale, IDES wishes to reinforce cooperation with IPSL laboratories and the SISYPHE laboratory (in the field of hydrology) in the frame of the L-IPSL LabEx.

Laboratory scientific value and international influence

- AERES ranking: A (2009, vague D);
- Mean number of publications per year over the last 4 years: 60 (peer-reviewed journals);
- H factor: 2 higher than 20, 15 higher than 10;
- Invited foreign scientists: 3-4 per year;
- Number of foreign post-docs (last 4 years): 1-2 per year;
- Awards:
    - "Prix Van Straelen" of the SGF (2000),
    - "Huésped Distinguido" of Salamanque, Spain (2003),
    - "Médaille de bronze" of CNRS (2006);
- ANR projects: 11 during the last 4 years (5 with high responsibility);
- PCRD/ESF projects: 2 during the last 4 years with high responsibility;
- ESA/CNES projects: 2 during the last 4 years with high responsibility;
- Organization of meeting, symposium, congress: ≈2 per year. Next conference co-chaired by a member of IDES: Polar Worlds International Conference, 2011;
- Responsibilities in research organization at national and international levels (last 4 years):
    - Steering committees of national/international programs: 6
    - Editorial board of scientific journals: 7
    - Learned societies: 7
    - GDR ("Groupements De Recherche" of CNRS): 3
    - NASA and ESA space exploration committees: 4
    - "Groupe Ad-Hoc Système Solaire" (CNES): 1

4.1.10.2 EXPLOITATION OF RESULTS

One patent is authored by a member of IDES (system for in-situ datation of Martian rocks). The members of the laboratory provide expertise for a number of private and public companies (ANDRA, AREVA, Gaz de France, IFP, Total, CEA, IRSN, Ifremer, Polynesian service of pearl oyster culture, pearl oyster farmers, etc.). The French representative of the "International Permafrost Association" (IPA), involved in climate change and related societal impact studies, is a member of IDES. A close partnership has been established with the "isotopic hydrology" section of the International Atomic Energy Agency (IAEA), under the form of laboratory analyses and training of foreign students. Four researchers are working as experts for the IAEA on technical aspects and application of isotopic hydrology methods to the evaluation and management of water resources. One of them is the "focal point" for France of the "Joint International Isotope in Hydrology Programme" (UNESCO-IAEA), and chairman of "H2i", the French committee of isotopic hydrology (AIH-AISH).

4.1.10.3 HIGHER EDUCATION

The IDES teaching team is composed of 24 university lecturers (2 presently on secondment) and 14 professors (1 on secondment), with therefore 35 teachers-researchers present in the laboratory. These teachers are providing all training courses in Earth Science at UPSUD, from L1 level (PCST and BCST common portals) up to the masters of "Sciences de la Terre et de l'Univers" (STU) and "Environment", including the licence of "Géosciences". These courses are both fundamental (masters "Recherche" of STU) and professional (master "pro" of Environnement). The special fields of the STU master are: "Hydrologie, hydrogéologie, sols" (jointly with the master "Environnement"), "Environnements Sédimentaires et Volcaniques" and "Planétologie" (speciality at the regional level), and in the master "Environnement": "Génie Géologique". Several teachers are also involved in

professional licences, at the ”Institut Universitaire de technologie” (IUT) of UPSUD, in masters of physics, and in the cursus “Pollutions chimiques et gestion environnementale” of the master “Environnement”. We are involved in training courses of geology in the special field “Formation des professeurs de SVT” of the masters of biology, STU and Environment. Finally, we are providing geoscience courses in the double degree of the master “Environnement”, jointly hosted by UPSUD and Tomsk Polytechnical University (West Siberia).

More quantitative information is given below:

- Number of teachers-researchers and researchers contributing to teaching activities: 35 teachers-researchers et 5 CNRS researchers;
- Number of PhD students at IDES on 1st October 2010: 35;
- Number of foreign teachers invited: 3-4 per year;
- Number of teachers-researchers involved in training courses in foreign countries: 5 per year, mostly at master and PhD levels (Slovakia, Spain, Poland, Hungary, Brazil, Russia);
- Number of Master 2 students (last 4 years): 12 per year, including 3 foreign students;
- Number of thesis defended (last 4 years): ≈8 per year, including 2 foreign students;
- Number of HDR defended since 2005: 7;
- Number of Erasmus, Erasmus Mundus (and other) students: 4 Russian students (partnership with Tomsk since 2008);
- Students under joint advising (last 4 years): ≈1 per year (Brazil, Ivory Coast, Italy);
- Professional insertion: average delay between PhD and stable employment of 2 to 4 years.

4.1.10.4 ORGANISATION

The global budget of the IDES laboratory, including about 250 k€ of recurrent budget from UPSUD and CNRS, the public and private contracts, the European and international programs, is of 900 k€ for 2010, excluding salaries. The laboratory is structured in 5 scientific teams and 2 transversal themes. The instruments are distributed over 3 platforms. From an administrative point of view, IDES is managed jointly by the UPSUD University and the CNRS “Délégation Ile-de-France Sud”. The financial management is shared between UPSUD and CNRS (see http://ides.geol.u-psud.fr/ for details).

4.2. EXISTING COLLABORATIONS

Intensive collaborations inside the IPSL federation are a key of ambitious projects such as the development of the Earth System Model, participation to international field programmes like Hymex or AMMA, or coordination of satellite missions like Megha-Tropique. The federation was in fact created to respond to such challenges, and in particular to develop the coupled atmosphere-ocean global modelling in the 90s.

Collaboration between IPSL laboratories and the two “new” laboratories are also already deep, around the questions of continental hydrology, biogeochemical cycles and paleoclimates.

At a national level the L-IPSL laboratories have for a long time strong relations with Meteo France, as a major actor on climate and atmospheric science. Relations with other French institutes, as Ifremer, Cemagref are also important for L-IPSL activities (ocean, land surface). However, many scientific projects in which L-IPSL teams are involved are coordinated at a national level, within INSU programmes. L-IPSL teams thus collaborate with most of the French laboratories in the corresponding domains.

Partner 3: LPMAA

- ANR IDEO: funded by ANR under contract no ANR-09-BLAN-0022-03, between 3 French laboratories (LPMAA, PAris, GSMA, Reims and LSP, Grenoble)
- ANR Strapolete: funded by ANR under contract no ANR-BLAN08-1-31627, between 4 French laboratories (LPMAA, PAris; LPC2E, Orléans; LATMOS, Paris; LOA, Lille) and one German laboratory (IUP, Heidelberg)
- FP7-ITN INTRAMIF: funded by CEC (Commission of the European Communities) under grant agreement no 237890 with 8 international scientific laboratories, one of which LSCE (IPSL), and 8 associated international partner organizations (private enterprises/non-profit organizations)

Recent participation to space mission:

- GOSAT science team by the way of the joint research announcement of Japanese Space Agency and National Institute of Environmental Studies.
- IASI-NG New Generation Mission Group founded by CNES
- IASI Sounding Science Working Group (CNES and EUMETSAT consultative scientific group).
- SIMCO: funding by diverse sources, collaboration intra-IPSL with LSCE on the development of an optical CO2 isotope analyzer (SIMCO - Spectrometer for the Isotope Measurement of CO2).

Partner 4: LOCEAN

- LOCEAN has been a member of IPSL since the origin. Inside IPSL, main collaborations are with LMD and LSCE on modelling (ocean - atmosphere climate model), with LMD on tropical climate, with LSCE on marine biogeochemistry and paleoclimate.
- Collaborations with LATMOS concern the ocean surface characteristics (mass and energy fluxes, ice, waves) from in situ and satellites.
- Within UPMC, LOCEAN collaborates with LOV, LOMIC, AD2M in the three marine stations (phytoplancton characterization)
- In France and in Europe, the NEMO ocean model has permitted the development of numerous collaborations. Cruises generally involve scientists from various labs (LEGOS, LPO, COM, LOV, LOMIC...). LOCEAN is also strongly involved in european collaborations on polar research (IPY projects, FP6/7,...), in the ocean GMES project (MyOcean).
- As a laboratory depending on IRD, LOCEAN has a strong involvement in collaborative research with developing countries in tropical latitudes (South America, West Africa, India, Indonesia), in oceanography, paleoclimate, impacts of the global change on resources and agriculture.

Partner 5: LISA

- LISA is a member of IPSL since January 2009, and was associated to IPSL from 2001 to 2009. Inside IPSL, main collaborations are with LSCE and LMD on air quality and regional modelling, with LPMAA on atmospheric spectroscopy, with LOCEAN on ecosystems…
- LISA is in charge in the frame of FP7- MACC with LATMOS, LMD, INERIS, Meteo-France…, FP7-Megapoli
- SDT: LISA has deployed an observing network in the sahelian belt for monitoring of the atmospheric dust content for decadal periods. The three stations respectively in Niger, Mali and Senegal are located on the main pathway of the dust when transported from their source regions to the Atlantic ocean. This observing system is working from 2006 with a recovery rate of data greater than 90%
- LISA is PI in several space instruments for Earth observations (IASI, MIPAS) and is responsible of several spectroscopic research networks, for example funded by CEC (Commission of the European Communities)
- LISA also contributed to the development of the CHIMERE model, today transferred at INERIS for exploitation in the frame of air quality survey and predictions (Prev'air platform).
- LMD has involved in collaborative research with many European countries, USA, China, Russia, Mexico, Korea,… and also West and North Africa.

Partner 6: LATMOS

- LATMOS (formed in 2009 by merging former Service d'Aéronomie and part of former CETP) is a member of IPSL since the origin. Inside IPSL, main collaborations are with LMD (properties and distribution of cloud, precipitations, water vapour from satellite, physical processes at the troposphere-stratosphere interface), boundary layer processes) LSCE (observation and modelling of air composition, representation of stratospheric processes in climate models), LPMAA (air composition satellite observation) LOCEAN (ocean surface mass and energy fluxes, ice, waves from in situ and satellites),
- In France, numerous collaborations exist with Toulouse laboratories (CNRM, Laboratoire d'Aérologie), with GSMA (Reims), with Laboratoire d'Optique Atmosphérique (LOA), with LAMP (Clermont-Ferrand), LPC2E (Orléans), LACY (La Réunion). Common experimental campaigns or analyses of observations (among which the NDACC national observing system and AMA campaign), and synergy between modelling and observations, are the main subjects of theses collaborations
- In the context of European projects, or European satellite missions, collaborations with German (e.g. DLR), English (e.g. University of Reading), Finish laboratories are numerous.
- Outside Europe main collaborations are with NCAR (US) on processes in the upper atmosphere and air composition, Climate institute in Melbourne (Australia) on clouds and precipitation, China, India and Brazil for cooperative satellite missions dedicated to observation of atmosphere (water cycle) or ocean surface.

Partner 7: LSCE

- LOCEAN has been a member of IPSL since the origin. Inside IPSL, main collaborations are with LMD and LOCEAN on modelling (ocean - atmosphere climate model), with LMD on tropical climate, with LOCEAN on marine biogeochemistry and paleoclimate, with LISA and LMD on air quality and regional modelling, with LATMOS on atmospheric chemistry and with LATMOS and LMD on lidar developments.
- Outside IPSL, LSCE has also strong links with the two other partners of the L-IPSL project, with SISYPHE on hydrology, paleoclimatology and biogeochemistry and with IDES on paleoclimatology and hydrology. A shared analytical platform of geochemistry with IDES is under construction through the EquiPex project PACEC.

- LSCE hosts and supports the European Infrastructure ICOS for the observation of the carbon cycle. ICOS is also a French TGIR, which regroups a large number of national laboratories.
- LSCE hosts and animates the Climate-Environment-Society consortium (GIS Climat), which relays on the expertise of 14 laboratories in Paris area (6 of them in IPSL federation + Sisyphe).
- LSCE researchers are strongly involved in the national scientific animation through their participation at several INSU committees (PNTS, LEFE, MISTRALS). LSCE is strongly involved in the various projects of the Mediterranean Programme of INSU.
- LSCE has a long history of collaboration with the national Space agency (CNES). It is responsible since 1994 for the development of the operational processing codes of the French POLDER/PARASOL satellites. LSCE is also leading the development of the "Micro-Carb" concept of a satellite designed to measure atmospheric CO2.
- LSCE has a strong European culture and has been coordinating several projects in the last decade and participating in tens of other projects.

Partner 8: LMD

- LMD has been a member of IPSL since the origin. Inside IPSL, main collaborations are with LOCEAN and LSCE on modelling (ocean - atmosphere climate model), with LISA on atmospheric chemistry, with LATMOS and LSCE on lidar development, with LOCEAN on tropical climate, with LATMOS on satellite missions' analysis, and with LPMAA on IASI.
- LMD hosts SIRTA: the IPSL multi-instrumented observatory for atmospheric remote sensing research, climate monitoring, and atmospheric process exploration.
- LMD is also active member of Climate-Environment-Society consortium who relays on the expertise of 14 laboratories in Paris area (6 of them in IPSL federation + Sisyphe). It aims to encourage, support and coordinate interdisciplinary research into climate change and its repercussions on society and the environment.
- LMD has strong relations with Meteo-France, with exchanges of persons to work on common representation of physic processes and on geostationary satellite products distribution.
- LMD develops the air quality prediction code CHIMERE operated by INERIS.
- LMD has involved in collaborative research with many European countries, USA, India, China, Russia, Argentina, Mexico and also West and North Africa.

Partner 9: SISYPHE

SISYPHE is an active member of the GIS Climat - Environnement - Société with the six laboratories (LPMAA, LOCEAN, LISA, LATMOS, LSCE, LMD) of the IPSL. SISYPHE and LSCE have carried out extensive collaborative research in the field of hydrology, paleoclimatology and biogeochemistry, including the co-supervision of 4 PhD thesis and participation to different projects: project COORBASSE (supported by Région Ile de France), ANR ORACLE, project MEDISIS (INSU/EC2CO). LSCE participates to the PIREN Seine programme leaded by SISYPHE. Also LMD, LOCEAN and SISYPHE are cooperating in ANR ESCAPE. LMD and SISYPHE cooperate also in the project HYDROSOL with co-supervision of a PhD student. IDES and SISYPHE are cooperating in the field of hydrology, with the co-supervision of 1 PhD thesis, common teaching at M2 level, and involvement in the GEOFCAN network on subsurface geophysics.

Partner 10: IDES

Over the last decades, IDES and LSCE have carried out extensive collaborative research in the field of paleoclimatology, with the co-supervision of over 10 PhD thesis. IDES, LSCE and LOCEAN are cooperating since 2006 on the ANR NEWTON, whose main objective is to investigate deep-water corals. In the fields of polar science and hydrology, collaborative works between IDES and LSCE are combining field studies (e.g. PERGELENA project, Syster/INSU), cold chamber analytical simulation, geochemistry and numerical modelling. All these collaborations have led to the development of common analytical platforms in paleoclimatology and hydrology (dating of groundwater), which acted as a nucleus for the Equipex project PACEC. IDES and SISYPHE are cooperating in the field of

hydrology, with the co-supervision of 1 PhD thesis, common teaching at M2 level, and involvement in the GEOFCAN network.

- Regional collaborations: Main Ile-de-France collaborations (paleo-climatology, geophysics, hydrology): MNHN, FAST (Orsay), LGE (IPG, Paris 7), CSNSM (Orsay), Soleil (Saclay).
- Main national collaborations (paleoclimatology, hydrology): EPOC (Bordeaux), CEREGE (Aix Marseille, Nîmes), PBDS (Lille), LDL (Montpellier), Lab. de Chrono-Ecologie (Université de Franche-Comté), IRD (Montpellier), LiMos (Nancy), LEM (Nancy), CNAB (Bordeaux), ISTO (Orléans), Géosciences (Rennes).
- Main international collaborations (paleoclimatology, hydrology, arctic regions): State Key Laboratory Marine Geology (Tongji Univ., China), Renard Centre of Marine Geology (Univ. Gent, Belgium), Univ. Pise (Italy), Permafrost Institut of Russian Academy of Science (Yakutsk, Siberia), Univ. Laval, Dawson Collège (Québec), Swansea University (U.K.), african partners : Morocco (Univ. Agadir, Univ. Marrakech), Algeria (Univ. Blida), Tunisia (ENIS), Tanzania (IRA, Dar es Salaam), Ivory Coast (Univ. Cocody, Abidjan), Djibouti (CERD).

5. TECHNICAL AND SCIENTIFIC DESCRIPTION OF THE PROJECT

5.1. STATE OF THE ART

International context and general aims

Mitigation of and adaptation to climate change are among the largest collective challenges that our societies need to face during the next decades and beyond. The last IPCC report stated that global warming is unequivocal and will amplify in the coming decades due to the increase in atmospheric concentrations of long-lived greenhouse gases. The design of adaptation policies and strategies for energy use and production, as well as the management of limited environmental and energy resources require all a rapid increase in our understanding of the climate system and our capacity to predict its evolution with the largest possible accuracy. This is why climate research centres with worldwide visibility have emerged, over the past two decades, in all major countries.

In France, the consortium (federation) Institut Pierre–Simon Laplace (IPSL) is gathering about 1000 staff and the skills of 6 laboratories of the Paris area. Over the past 20 years, it has developed a unique capability to address most climate-related scientific issues, ranging from climate forcings and processes all the way to climate impacts. As an active partner in the international research effort, which has lead to the successive IPCC assessments, IPSL has established itself as a recognised leader on a number of international projects. IPSL is currently among the about 10 centres which have developed a fully coupled and comprehensive approach to the earth system modelling and observation.

It is the responsibility of scientists to improve the capability to study and project the evolution of climate and its consequences over the next decades. We already know that carbon dioxide accumulates in the atmosphere much faster than natural sinks can remove it, and we also know that its effects will last for several centuries. Thus, there is a need to increase the pace at which this research is pursued, in both its fundamental and interdisciplinary aspects, because delaying studies and actions can only increase the burden placed on future generations. At the present time, science has established that anthropogenic global warming due to increased radiative forcing will induce specific well-defined climate patterns at the planetary scale. However, models have still a very limited skill in assessing the potential consequences of climate change **at the temporal and spatial scales that are the most relevant for political or economical decision-making, namely a few decades ahead (the timescale of infrastructure planning), and on the local or regional scales (which are those of climate impact on environmental resources).** This information is needed both to adequately determine the level of permissible GHG emissions, and to define adaptation policies to the now inevitable component of future climate change.

The goal of the L-IPSL project is to address this problem over the next 10 years with an efficient problem solving strategy. The project will integrate research on bottleneck processes, using observations of present climate, proxy-based reconstruction of past climates, and an earth-system modelling capacity, from global to local scales to provide climate projections for the next decades with accuracy as much compliant as possible to society needs.

This strategy can only be developed using the strength of a federation of laboratories such as IPSL, which has the expertise, the means and the experience of coordinating large projects. The L-IPSL, which emanates from the IPSL federation will gather teams from all the laboratories of the IPSL federation (70% or more of each laboratory is involved). Collectively, these laboratories possess the capability to both observe and model all components of the climate system, which is unique in the world. The L-IPSL will also include two new laboratories: IDES (CNRS/ University Paris 11) and SISYPHE (CNRS/ UPMC), who will bring added expertise required in the study of land surfaces. Our ambition is to place our teams **within the leading 5 worldwide institutes able to provide observations, model projections and key analyses for policy advice.**

These objectives are fully consistent with those the SNRI which emphasizes “improved understanding and modelling of climate and biodiversity, using both observations (in particular from satellite) and high performance computation” as a priority axis to answer environmental urgencies. The L-IPSL proposal

is focused on climate and articulated with other proposals dealing with biodiversity and agrotechnology**.**

Detailed research objectives

The Earth system is a complex system that integrates the atmosphere, the ocean, the cryosphere, continental surfaces, and the biosphere and through a large variety of processes that can be physical, chemical or biological. Its complexity is reminiscent of the human body and cannot be studied simply as the sum of its components. This has induced the development of a new branch of science, sometimes called Earth System science, which gathers a continuum of theoretical, numerical and observational studies. The ability to observe and comprehend the functioning of such an integrated system under different conditions (on other planets or on the Earth at earlier ages) has also brought a large body of questions and answers, for example, to address the long-term stability or instability of the Earth's climate system The spectrum of interacting scales within the climate system issues is wide, ranging from the scale of a cloud to that of planetary atmospheric or oceanic waves, and the system is highly nonlinear, so a very large amount of processes have to be considered in order to fully represent the whole system.

However the L-IPSL project will not address this whole complexity on an equal basis, but will focus on a set of questions, which go from the main initial concern (GHG increase) to the consequences of climate change:

- (1) How far can we really anticipate the future evolution of the atmospheric composition, which depends on a very large number of factors including socio-economic drivers?
- (2) How can we determine what is really predictable in terms of future climate evolution, in a system that combines anthropogenically induced changes and natural fluctuations?
- (3) What are the relations between the global evolution of the climate and its regional consequences?
- (4) How much do these local or regional climate evolutions impact environmental resources such as freshwater availability, air quality, and oceanic and terrestrial ecosystem services including the maintenance of biodiversity?
- (5) How can we assess the potential impact of unpredictable "climate surprises" that may result from the rapid non-linear behaviour of Earth System components?

Answering these questions (from which we will derive the main work packages of this project) relies on a combination of improved theoretical understanding, dedicated in situ or space-borne measurements, and more application-oriented modelling.

New tools and new possibilities

The L-IPSL project comes at a time when there is a profound evolution in the modelling and observation of the climate system, and the combination of both. IPSL has been participating in this evolution, first through its early involvement in the international coordination of modelling studies, but also by its strong links with the French national space agency (CNES) and the European Space Agency (ESA) or the Global Monitoring for Environmental Security (GMES). IPSL is also contributing to international measurement networks (NDACC, RAMCES).

(i) *Modelling*

There has been a continuing progress in computing capacity and associated model development over the last 40 years. This development has modified climate modelling to a point where it is entering a new era, in which only a few groups worldwide will have the capability to remain at the forefront of research. Increased computer capacity has been used to bring at least three types of improvement: model complexity, model resolution and the statistical significance of model studies (by increasing the number and length of the simulations). At the time of the IPCC First Assessment Report (1990), model horizontal resolution was about 500 km. Now it is quite often 100 km, and some models are run at a resolution nearer to 10 km. At this scale, model are not yet "cloud-resolving" (cloud formation also critically depends on dynamical features which are much smaller) but some effect of local orography, costal effects (both in the ocean and atmosphere) or coupling of rainfall with surface processes start to be represented in a more explicit way. This change in resolution however requires renewed effort in

model development. Today's climate models also include coupled representations of the atmosphere, the ocean, the continental and ice surfaces, and increasingly include chemical or biochemical processes. The resulting model architectures are often referred to as “Earth System models” or ESM. They are developed by multidisciplinary groups of scientists, which may gather 50 to 100 scientists—with a much larger group of people involved in their validation at different time and space scales. Those figures correspond to the present situation at IPSL.

Model evaluation has become much more structured. It is now mainly carried out at the international level, through model inter-comparison programmes that are organised under the auspices of the WCRP (World Climate Research Programme) and the IGBP (International Geosphere-Biosphere Programme). The successive IPCC reports largely base their diagnostics (typically every 7 years) on these collaborative exercises, which have grown each time one-order of magnitude in complexity and size, with a huge increase in the volume of exchanged data (1 Petabyte of data is being archived by IPSL for the sets of simulations that will be used in the IPCC AR5 report, and much more is expected during the next 5 to 10 years). Part of the model comparison exercises that are developed under the CORDEX project now concern regional models—an area in which IPSL has developed regional ESM that are the counterparts to the global ESM.

(ii) *Observations*

The observational data sets on which climate studies rely also have changed significantly. Observations are coordinated through established programmes at the international, in particular GCOS (Global Climate Observing System), now inserted into the wider GEOSS (Global Earth Observation System of Systems), which are mostly developed under the auspices of WMO, United Nations and Space Agencies (coordination through CEOS). We can differentiate 3 types of data, through their different role in climate studies (the past contribution of IPSL is detailed within the description of the IPSL Federation)

- ***Process-oriented measurements****:* The prediction of global or regional climate evolution requires a sufficient understanding of the key processes that control it. This is generally achieved through a combination of in-situ measurements (at the surface, from aircrafts or balloons), field campaigns, and remote measurements from space.

- ***Continuous monitoring*****:** Climate is a statistical concept defined over at least a few decades. Measurements from space began in the 70s or the 80s, and they are now providing a very useful complement to surface data. IPSL is actively participating to situ observatories and in the design of space studies. The in situ observatories are generally an extension of the instrumental effort mentioned in the preceding section.

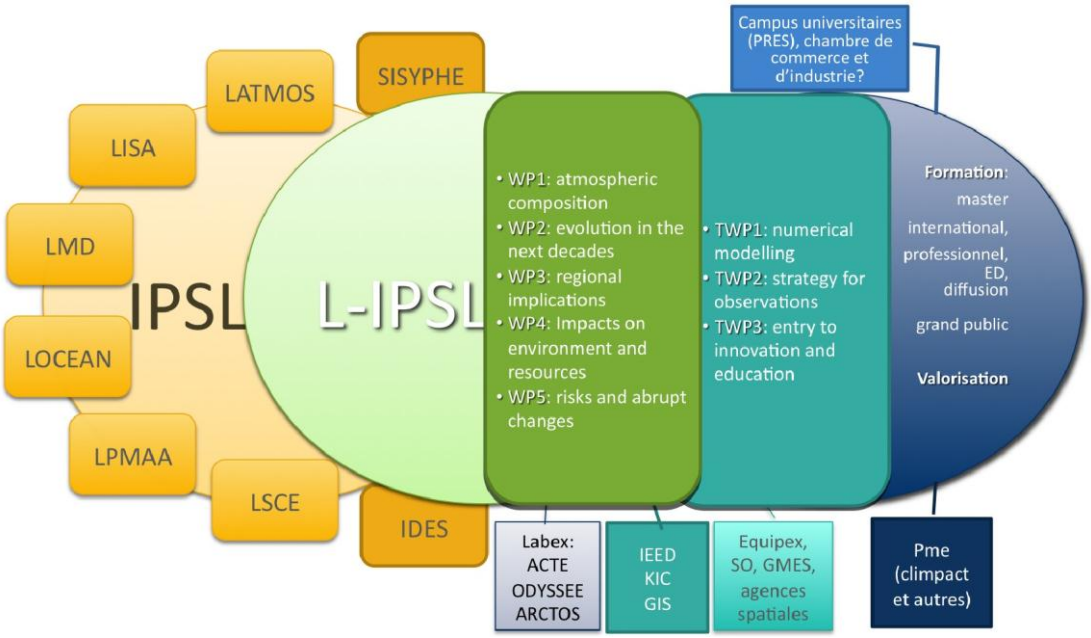
- ***Instrumental development*****:** Laboratory instrumental developments are essential for the design of new instrumentation. IPSL laboratories have developed specific skills in a variety of fields, including: lidar instrumentation, infrared spectroscopy, instrumentation at sea (gliders), balloon-borne sensors, and mass spectrometry. These developments have a variety of applications: measurement of clouds, aerosols, CO_2, surface fluxes of energy, water or trace gases over the ocean or the continents.

- *Laboratory measurements*: IPSL also has also developed a range of laboratory measurement techniques to characterize the environment in the geosphere (elements in soils or sediments) and the atmosphere (chemical compounds), to reconstruct climate and ecosystem functioning from proxies (elements and isotopes) over periods without instrumental records (eg using ice, sedimental cores, corals, speleothems and other climate archives).

(iii) *Synthetic studies at the interface between models and data*

The synergetic use of simulations and observations has always been at the core of the development of Earth environment studies. Data are necessary both to design models and to validate them. Conversely, models and data assimilation methods constitute an essential tool to analyse observations of different origin and nature. Because of its distribution between thematic laboratories that are each studying different climate sub-components (atmosphere, ocean, …) through a range of observational and modelling tools, IPSL is probably one of the very few leading institutes in the world that has resisted the tendency to specialization and maintained such close links between observations and models—an approach which is also shared by the IDES and SISYPHE institutes.

The CMIP5 experiments (on which the IPCC is expected to base its AR5 assessment report) includes in a single concept different studies designed to validate various aspects of climate models: AMIP (Atmospheric Model Intercomparison Programme), CFMIP (Cloud Forcing), PMIP (Paleoclimate), and C4MIP (Coupled Carbon Cycle and Climate). IPSL scientists have been among the initiators of PMIP, CFMIP and C4MIP. These projects provide an estimate of the uncertainties affecting current climate projections, and condition the ongoing efforts to offer "climate services" or "environmental services".



5.2. OBJECTIVES OF THE PROJECT COMPARED TO THE STATE OF THE ART AND IN RELATION TO THE SNRI

5.2.1 SCIENTIFIC PROGRAMME

The L-IPSL project

The objective of the L-IPSL project is to assess and improve the French capacity to predict climate evolution at the time scale of a few decades and to determine some of its regional consequences, particularly in terms of environmental resources. This objective is ambitious, and significant progress is expected within the next 5 or 10 years.

To tackle this very ambitious challenge 5 major hurdles were identified above, both for their scientific relevance, and because of the specific capacity of L-IPSL to address them, thanks to the dual culture of modelling and observational studies that is characteristic of L-IPSL laboratories. They will define the 5 scientific work packages (WPs) that will structure the LabEx proposal.

Transverse, methodological work packages (TWPs) are also necessary to deal with the development aspects of the model architecture, to establish how the observational analysis and strategy should reflect the key objectives of L-IPSL, or to determine a consistent approach of the uncertainties affecting all the results.

Work packages (WPs)

WP-1) Factors controlling the atmospheric composition

The future evolution of the Earth radiative forcing will depend upon anthropogenic activities, reflecting economic development pathways and the structure of energy production systems, as well as the response of natural biogeochemical cycles.

Over the past two decades, 80% of the increased radiative forcing is caused by the emissions of CO_2 from fossil fuel burning and land use change. This illustrates how crucial is the **carbon cycle** in

controlling the future rate of climate change. Roughly half of these anthropogenic CO_2 emissions are absorbed by natural sinks in the ocean and in terrestrial ecosystems. But models of the coupled climate-carbon system, such as those of the C4MIP experiment, consistently predict that future climate change will reduce the ability of natural sinks to continue to absorb anthropogenic CO_2.

Like the carbon cycle, **other long lived greenhouse gases** with a global warming effect, CH_4 and N_2O, also have an anthropogenic and a natural component, which are important to quantify and understand, including the underlying processes

Short-lived aerosols and reactive gases are produced by a variety of processes and transported away from emission regions. Unlike long lived greenhouse gases, these species exert a regional climate forcing, which can be either positive or negative in the case of aerosols. Locally, the climate forcing of aerosols and reactive gases can be larger in magnitude than that of greenhouse gases. Measures to improve air quality worldwide may release the 'aerosol brake', and foster the warming induced by greenhouse gases.

The science of the Earth System is still in infancy in its ability to describe and undestand the economic forces and the natural processes controlling atmospheric composition changes, in the recent past, the current decade, and into the future.

Given the modest resources allocated to a LabEx, this workpackage on atmospheric composition and radiative forcing cannot pretend to address the whole complexity of model development, model validation and model-data integration. Rather, we have chosen to focus our activities around three main outstanding research questions during the next 5 years. Each question will be tackled by using an integrated approach that combines both observations and models.

Question 1: Can we **attribute the radiative forcing of increasing atmospheric CO_2 and CH_4 to the underlying regional processes?** For example, can we discriminate the separate effects of the natural carbon cycle (e.g. CO_2 fertilization, nitrogen and water availability to plants, ocean biota changes) and to the economic drivers of fossil fuel emissions?

Question 2: Can we **attribute the radiative forcing of aerosols and short-lived reactive gases to their precursor emissions?** The main goals are to separate anthropogenic and natural sources, and to identify the relative contribution of different continental regions, using large scale transport-chemistry models, and inverse methods.

Question 3: What are the covariations between the regional **climate effects of aerosols and reactive gases and the natural greenhouse gas fluxes**? For instance, how does the climate cooling induced by sulfate aerosols downwind of industrialized regions or the exposure to high ozone levels, impacts forest primary production, which may limit carbon uptake by forests?

Question 4: Can we provide **a full uncertainty budget for the biogeochemical components of Earth System models**, and effective ways to reduce these uncertainties by using observations? For instance, can we reject and improve carbon-climate models of the C4MIP suite, and coupled climate-atmospheric chemistry models by using satellite observations (e.g. IASI, GOSAT, and forthcoming GHG space observations), in-situ ocean and terrestrial measurements and ground-based observations, such as ICOS for greenhouse gases, IAGOS for reactive gases, and EARLINET for aerosols.

Each question will be addressed by forming a project team, tasked to write a concise and realistic work plan, combining LabEx resources and resources from existing or forthcoming EU and national projects, with the goal to deliver research breakthroughs. The criteria for success and evaluation will be A-ranking publications, attractiveness to PhD and post-docs, and a number of successful projects created by each team. The emergence of new outstanding questions that may be incorporated in future steps, will be favored by organizing / contributing to meetings.

WP-2) The predictable part of climate evolution for the next decades considering anthropogenically induced changes and natural fluctuations

A large component of the recent global warming is now attributed to human activities. Global warming will continue during the next decades at a rate depending primarily on the anthropogenic emissions discussed in the previous section. However, the mechanisms and the respective role of internal variability, of natural or anthropogenic forcings on most aspects of recent climate changes (such as

sea-ice decrease in the Arctic and precipitation changes in the Sahel) are currently not established. This lack of understanding limits our ability to predict climate evolution over the next few decades.

For the future, the predictability of regional climate for the next decades to century will primarily depend on three following points (e.g. *Hawkins and Sutton 2009*):

- (1) the response to changes in long-lived greenhouse gases. This response highly depends on climate feedbacks for all time scales and therefore on how the various processes are represented in climate models. The emission scenarii will have little influence over the next few decades but a much larger influence at the end of the century
- (2) the response to regional changes in aerosols and other short-lived species. Indeed, the geographical distribution of the associated radiative forcings is very heterogeneous, with strong forcings often close to densely populated regions
- the low-frequency modes of natural variability (eg ENSO, Atlantic Meridional Circulation...). This requires these modes of variability to be well understood and simulated in models in current climate but also under climate change. For the near future, this also requires to accurately initialize the model, which requires good quality observations as well as appropriate initialisation techniques for coupled models.

In view of these major scientific and societal concerns, L-IPSL will focus on three related key objectives:

- **Quantify and understand the internal and natural variability of climate.** Climate varies at all time scales, from days to hundreds of thousands of years. The frequency and amplitude of these changes are very variable. They are mostly irregular in time and can be slow or abrupt. They often involve the various components of the Earth system and complex interactions between them. Understanding these climate fluctuations, their dependencies on the mean climate state and their response to external forcings is of prime importance to understand and to anticipate possible future climate change – and how an anthropogenic signal may be superimposed. This is already addressed within IPSL by considering a wide range of time scales *using both model and observations*. **Under this L-IPSL labex, a specific effort will be devoted to the study of the last millennium,** a period for which high-temporal (decadal to sub-decadal) climate variations may be reconstructed from various natural archives (*Jones and Mann 2004*), and for which some estimates of forcings associated with solar variations and volcanic eruptions are available (e.g. *Muscheler et al. 2007*). Understanding the natural, high-frequency paleoclimate variability will benefit from the recent progress in **observations of the ocean variability** (deep corals, molluscs), which give access to the direct recording of multi-annual to decadal changes. In particular, an important task will be to bring together paleoclimate data and recent observations in order to better unravel the natural variability of key oceanic features such as the **Atlantic Meridional Overturning Circulations**, its relation to mean climate conditions and its sensitivity to forcings. Another important effort of L-IPSL will be **to improve our understanding of the sun-chemistry-climate interactions** and, therefore, of the role of solar activity on climate variability. Recent and future observations of the solar activity and of stratospheric characteristics as well as modelling of chemistry-climate interactions will make it possible to identify and quantify the contribution of different processes.
- **Quantify and understand climate changes due to anthropogenic forcing.** The change in atmospheric composition is the main driver of human-induced climate evolution. The GHG radiative forcing is positive and determined with a reasonable accuracy. By contrast, aerosol radiative forcing is subject to a larger uncertainty. During th 20th century, it may have attenuated the GHG warming by 20% to 50% (*Forster et al. 2007*). This attenuation effect is poorly constrained and raises a first question: **how might the aerosols radiative forcing change in the future?** Even if the anthropogenic forcing was perfectly known (a case that could be considered in idealised numerical experiments), our estimate of the global warming may vary by a factor two (the current dispersion of climate models) due to radiative feedback uncertainty (*Bony et al., 2006*). This raises a second key question: **what are the mechanisms that primary explain the spread of climate feedbacks?** Open questions also concern other climate parameters. In the tropics, the **precipitation change** estimated by different models varies both in sign and in amplitude, both over oceans and continents: what, then, are the respective roles of the atmospheric circulation, interactions with the surface (continent or ocean) or rain processes in these diverging results? How might the monsoons change? **Oceanic**

processes and circulation (such as the Atlantic Meridional Overturning Circulation) may also be affected by global warming, with related questions on how this may modify both the mean climate conditions and their variability. **The possible melting of ice sheets** may strongly impact the sea level and the ocean circulation via fresh water flux (*Swingedouw et al., 2007*). Many of these questions are interconnected: **the L-IPSL treatment of those issues will first of all rely on the analysis of the international CMIP5 multi-model database** that includes a wide variety of numerical experiments (such as idealised experiments, future scenarios, 20th century reconstitution, paleoclimate simulations, and decadal projections). The L-IPSL will play a leading role in a number of specific projects: radiative forcing, cloud feedback studies (CFMIP), and paleoclimate modelling (PMIP). **Dedicated sensitivity experiments** using the IPSL models, or process-oriented model/data intercomparisons, will receive a particular attention.

- **Predict and assess climate changes at decadal time scales.** Recent, ongoing and future climate changes result from a complex combination of natural and anthropogenically-induced variations. Unravelling these two contributions is a difficult challenge but necessary: (i) to identify and assess mechanisms that drive climate variability and trend and (ii) to increase our confidence in climate change projections. Addressing these questions requires a joint use of models and observations, and to consider the coupled Earth system as a whole. L-IPSL will enable us to sustain the long-term observations performed by IPSL, to reinforce its contributions to international networks, and to perform dedicated and coupled analyses of observations and model simulations. In particular, the possibility of forecasting the climate 1-30 years ahead will be tested. For such timescales, climate models need to be realistically initialized, in particular the low components of the climate system. Challenges lie in the choice of these observations and in the development of new methodologies of coupled model initialization.

WP-3) The regional climate implications of global warming

Characterizing the implications of global warming in terms of regional climate changes as experienced by the human societies is needed to make appropriate adaptation decisions. A major challenge for the L-IPSL project will be to investigate regional climate processes and their evolutions under climate warming and to reduce the uncertainties in future projections with a focus on a few key issues**:**

- **The anticipation of regional changes in rainfall and in the water cycle,** which is a prerequisite for adaptation decisions concerning water resource availability. The L-IPSL project will in particular develop improved numerical models, focusing on land/atmosphere/ocean/aerosols interaction processes at global and regional scale, benefiting from the experience that will build up or be acquired in major regional projects such as AMMA, HyMex and ChArMex;
- **The anticipation of changes in extreme events** such as heat and cold waves over Europe, storms or cyclones (with a focus on the Indian ocean), wind stagnations, droughts and heavy rainfall. The L-IPSL project will in particular provide a quantification of the evolution of climate extremes from the few past centuries into the next decades, using statistical analysis of instrumental and paleoclimate proxy records, re-analyses, and climate projections;
- **The anticipation of changes in the polar Arctic climate,** where changes occur at the highest rate, and in particular where we expect to have stronger signals of climate change for climate model evaluation: The L-IPSL project will provide an integrative and comprehensive picture of observed changes through monitoring (sea ice, glaciers, permafrost, ocean circulation, water and carbon cycles, atmospheric composition), analysis of available observations and coupled climate modelling.

These challenges will be addressed, in each case, by a process-based approach with questions specific to each region under study. Over **Western Africa** and **Indian Monsoon regions**, the focus will be to understand the relative role of global coupled climate and regional land-ocean-atmosphere-aerosols processes and associated feedback loops in driving the changes in precipitation regimes at intraseasonal to decadal time scales (*Janicot et al., 2010*). Over the **Mediterranean area** and **Europe**, the focus will be to quantify the interactions between land surface, soil moisture, groundwater fluxes, sea and atmosphere (including aerosol composition), in order to investigate droughts and heat waves (*Seneviratne et al., 2006*). The role of land use changes will also be considered in each case. In the **polar Arctic region**, emerging issues concern the interplay between the retreating sea ice, the

evolution of atmospheric circulation regimes [*Houssais et al, 2007; Francis et al., 2009*] and the modification of atmospheric composition. Their interaction with temperature over neighboring continental areas, their land surface and the hydrological and bio-geochemical processes linked to the permafrost melting will be studied. As a new challenge, the **representation of individual processes and their interplay in global and regional high resolution models** will be evaluated and improved.

Detection of changes in surface climate, dynamical weather regimes, and frequency and amplitude of extreme events will be carried out through **advanced statistical methods.** These will use both observations and reanalyses (benefitting of the framework of the future ERA-CLIM reanalysis), involving data rescue, reconstruction, and interpretation of historical archives, and high resolution records of past climate variability from natural climate archives (e.g. drought reconstructed using tree rings, speleothems, lake sediments).

Finally, the L-IPSL project will use the available and future capacity of **observing and monitoring regional climate changes** with fixed sites such as SIRTA (*Haeffelin et al., 2005*), regional or global networks (SECAO, CARAUS, ICOS, HYPERARCTIC, FONCE, NAOS) and a mobile observation platform (SOFRAEX, IAOOS), benefitting from new space missions (Megha-Tropique, EarthCare, among others). It will also exploit the development of novel approaches of water cycle monitoring based on water vapour stable isotopes, using new laser technologies for observations and improved modelling of stable isotopes within the earth system model.

Improved models and new observations will enable regional projections with uncertainty estimations for the next decades, through the ensemble approach provided by the participation of the international exercises like CMIP5 or CORDEX.

WP-4) The expected impacts of climate change on natural resources and environmental changes

The natural environment has been modified by human activities for centuries (deforestation, urban sprawl, river channelling, wetland drying, overuse of groundwater, overfishing in the coastal zone, pollution and waste disposal). A crucial question about climate change is to understand and anticipate its impacts on natural resources, ecosystems, and their services, in the wider context of anthropogenic stresses. By combining leading expertise in both climate and impact science, L-IPSL will be in a unique position to diagnose past and ongoing environmental changes, and provide scenarios for the future. To this end, a large fundamental research effort will be devoted to better characterize the processes which control the evolution of the environment, by combining observations, tracers, process studies, and a hierarchy of models developed within the L-IPSL. The upscaling from local to regional scales will be a key issue to fully benefit from the regional climate projections provided by WP.3, including major advances on extreme events, and the carbon and water cycles. Future environmental impacts will then be elaborated by combining the impacts of climate change to the ones of human activity evolutions (*Ducharne et al., 2007*), owing to well-established interdisciplinary collaborations with social sciences and stakeholders (e.g. GIS-Climat, PIREN-Seine, FIRE research federation, Climate KiC), as well as other Labex projects (ACTE, ODYSSEE, ARCTOS). In this framework, we will focus our efforts on four specific challenges:

- **Impact of climate change and anthropogenic drivers on water resources.** With a growing population, water resources (surface and ground water, including both quantitative and qualitative aspects) are largely under stress, especially in vulnerable regions such as Sub-Saharan Africa (*Roudier et al., 2010*), the Mediterranean surroundings, or South-East Asia. Anthropogenic influences (withdrawals, damming, etc.) also hinder climate change detection and attribution (*Piao et al., 2007*). **To separate these effects, L-IPSL will develop new approaches combining geochemical tracers, geophysical tools, and an array of models** developed for different scales, with important applications regarding ground water (renewal rate, overexploitation, salinization). This framework will also support the improvement of ground water and river discharge representation in the models of the L-IPSL. Owing to these conjugated actions, L-IPSL will be better armed to address past and future changes in water resources and hydrological extremes (floods and droughts), from the local to the global scales, and to **explore adaptation options** between different uses (irrigation, drinking water, navigation, industries, habitat for aquatic species, etc.).

- **Impact of climate change on biogeochemical fluxes and ecosystems along the land-ocean continuum.** Ecosystem functioning and their related services (carbon, contaminants and nutrient control; water quality; food production; green-house gas control) are very sensitive to climate. In the aquatic continuum from the upper watersheds to the estuarine/delta interface with the ocean, the changes in rain pattern and intensity, and the frequency of extreme events (heat waves, freezing, drought, floods, etc.) are the main drivers of erosion and leaching, and of material transfer, retention and transformations. In the open ocean, acidification and changes in ocean circulation and stratification could provoke important changes on marine ecosystems, their productivity and fluxes. **A challenge will be to extend the specialized models of the L-IPSL** (e.g. *Garnier et al., 2010*) to the global scale, and to extend the ocean modelling to critical segments of the trophic chain. These developments will be supported by combination of *in situ* observations, process studies with new tracers to assess models. They will largely rely on the Equipex PACEC and SeineARIO, and on collaborations with the Labex ODYSSEE. **Retrospective analysis of human and climatic impacts** on aquatic ecosystems will be carried out over the last centuries. It will serve as a valuable validation of the proposed approaches and as an essential reference to assess **future changes**.
- **Impact of climate change on energy resources and infrastructures.** Local climate is a key factor for renewable energies (wind power, solar energy, hydro-electricity, bio-fuels) and an important limiting factor for non-renewable ones (plant cooling, efficiency of geological storage options for CO_2 and radwastes). Extreme events (storms, floods, droughts, hot spells) are also crucial to the vulnerability of infrastructures, as well as permafrost melting in Arctic areas. The L-IPSL will offer a significant contribution to this emerging research field by providing **comprehensive diagnostics, with likelihood/uncertainty assessment,** of climate change impacts on the energy sector, using global and regional projections from the IPSL models and retrospective analyses (*Vautard et al., 2010*). These diagnoses will then be used to develop adaptation and mitigation strategies in relation with IEED CLAIRE.
- **Impact of climate change on sources of regional and global air pollution.** Climate change has an impact on air pollution through a variety of processes: changes in atmospheric chemistry, aerosol formation, changes in transport and dispersion, stratosphere-troposphere exchanges, and changes in biogenic (vegetation) and natural sources (dust, fires). Air quality is also changing due to evolution in anthropogenic emissions, linked to population growth/wealth as well as to energy use patterns. Biogenic emissions are also impacted by land-use change and practices (*Coll et al., 2009*). In return, such emissions depend on human activities influenced by climate. Current knowledge of emissions has large uncertainties. In order to improve regional and global evolution of air quality, the L-IPSL will focus researches on **sub-grid scale variability and a better understanding of possible feedbacks between atmospheric concentrations and emissions.** Better flux estimates (spatially at the regional and global scales, and temporally on annual, seasonal, daily and hourly time scales) with associated uncertainties will improve results on trends analysis and scenarios for the future. **Emissions for gases and aerosols, which depend on dynamic vegetation, land-use change *and* climate model variables, need to be developed**. The provision of emissions at ever increasing spatial and temporal scales requires efficient database structures with interactive processing which build and extend existing capabilities developed at national, European and international level.

WP-5) The risks of abrupt unpredictable climate evolutions

In the previous sections, we have made the implicit assumption that the behavior of the climate system would remain rather regular, and that the anthropogenic component would linearly add up to natural climate variability, e.g. that is strength would be dimensioned by the future evolution of the radiative forcing. But a more complex behavior is possible. Past climate archives have documented many dramatic changes and bifurcations, occurring sometimes in less than a few decades, which clearly attest the nonlinear nature of the Earth's climate system and the existence of multiple equilibria and tipping points, that determine the risk of abrupt transitions (*Rial et al., 2004; Lenton et al., 2008*). Reaching such tipping points may occur within the current century, possibly triggering yet unpredictable, rapid evolutions of the climate system. Potential mechanisms are related to ocean

circulation changes, ice sheet instability, carbon storage and CH4 release from permafrost, major changes in the water cycle with increasing desertification and modifications of the biosphere (as may have happened over the Sahara 5,000 years ago. Those potential drivers can be illustrated, here, by one example, that of the dramatic swings, which involved changes in the North Atlantic oceanic circulation. These changes result from the extreme sensitivity of this ocean to the fresh water budget, and from its additional capacity to trigger potential positive feedbacks (clathrate destabilization, change in planetary albedo).

The perspective of such dramatic evolutions has raised a large amount of public concern, and the role of L-IPSL will be to document the conditions in which they may occur by tackling two major questions:

- **(i) What are the potential mechanisms for abrupt changes?**
- **(ii) How can we determine that we are nearing the conditions in which this may happen?**

To answer those questions, past climates, and climates of other planets provide important references to investigate the relevant mechanisms, and quantify positive and negative feedbacks. They make it possible to address thresholds and tipping points with special focus on ice sheet instability under warming conditions, ocean circulation reorganization under variable fresh water fluxes, carbon release from permafrost and biosphere, volcanic eruption frequency and punctuated cooling associated to aerosols. Based on this knowledge, enhancing our capacity to predict future climate bifurcations will require to better integrate feedbacks and nonlinearities in climate models (i.e. more accurate ice-models) and conduct data-model comparisons as well as detailed inter-comparison of model outputs (PMIP–like approach).

The needed large-scale research efforts exceed the frame of L-IPSL, and are subject to numerous international research efforts in which we participate. At the L-IPSL scale, however, we gather a unique force of expertise to advance very significantly our knowledge by focusing on a few scenarios, which carries a greatest likelihood of causing abrupt climate changes during the next century:

- (i) Abrupt cooling situations during interglacial conditions (for example, the 8.2 ka BP event, or the Younger Dryas), which give indications on the possible future disturbance of the Atlantic circulation;
- (ii) Abrupt warming situations during glacial conditions, which tell us about the processes, which may potentially affect the polar ice sheets;
- (iii) Rapid variability during past interglacials warmer than the present day (e.g. MIS 11, polar climate during the last interglacial), which may constitute a partial analogue to the situation of the next decades.

One objective is to improve -the acquisition of paleoclimatic information –especially obtain high resolution information (the need of high resolution information was explicitely stated in the last IPCC report) and use this paleo-information into transient, long climate simulations in an attempt to benchmark climate models against transient sequences of events, on time scales which are relevant for future climate risks (e.g. centuries). The IPSL model is considered a state of art model in climate science, but its capacity to generate realistic climate swings has not been fully assessed. It will be improved by a better integration of key non –linear processes (ice dynamics, snow representation, carbon cycle in the atmosphere, the continents and the oceans, ocean deep water formation).

This allow for exploring the potential climate bifurcations that might occur at the century scale.

Achieving this objective will only be possible though the integration of the L-IPSL obervationnal and instrumental capacity. A strong partnership already exists between L-IPSL members and recent successful or planned initiatives (SESAME-ALYSES platform, ERC-ICEPROXY, MC-ICPS, PACEC equipex project) allow for the creation of a state of the art analytical platform.

This joint effort will favour a dramatic improvement (in number, quality and type) of key climate parameters paleo-reconstructions through a better understanding of signal acquisition, and the developpement/improvement of new proxies (ocean circulation, sea ice, precipitation, winds).

This state of the art equipment will also allow for the development of chronologically well-constrained (radio-, magneto- and tephro-dating) multi-variate database to reconstruct high-temporal resolution, transient sequences of events.

This capacity to reconstruct past climates (or climate of other planets) constitutes an outstanding feature of the IPSL federation and will warrant that L-IPSL will use original high quality observational information to evaluate the possible occurrence of rapid climate fluctuations during the next century

Transverse work packages (TWPs)

TWP-1) Numerical modelling of the climate system

The ability to better understand and to anticipate the modifications of climate on decadal timescales and beyond depends for a large part on major developments and improvements of the predictive capabilities of climate models. In the absence of established analogues of GHG-driven climate change, numerical modelling based on a physically-based representation of the key processes and components that govern the dynamics of the climate system is increasingly recognized as the most valuable approach to anticipate the future climate changes, at both global and regional scales, and to improve the predictive capabilities of climate models. IPSL is currently one of about ten climate modelling centres in the world that develop Earth System Models (ESM), and has a leading position in many of these aspects (such as ocean modelling, carbon-climate coupling and cloud feedback studies).

The L-IPSL project will address the following key issues, in order to improve and develop more comprehensive climate models.

- **Improving the representation of physical processes and their couplings:** The inclusion of new interconnected components (carbon cycle, chemistry and aerosols) into climate models and the need of more reliable regional climate-change projections require improved representations of the basic physical processes, both in the atmospheric and oceanic circulation models of ESMs. For instance, precipitation is an essential characteristic of a regional climate and is critical for the coupling with other components and for water resources. However, precipitation is currently not well simulated in climate models (*Hourdin et al. 2010*). Therefore, special effort will be made to **improve the representation of cloud-convection-turbulent processes** in the IPSL climate model (*Marti et al., 2010*) based on the development of new parameterizations (*Rio et al., 2009*, *Grandpeix et al, 2010*). Attention will be paid to the representation of the radiative effects of climate-forcing compounds (e.g. aerosol direct and indirect effects). This will be accompanied by an **improvement of land-surface representations** (vegetation, subsurface hydrology, snow...) and the generalised inclusion of water stable isotopes in the models as a powerful tool for process and climate evaluation. IPSL is also at the origin of the NEMO consortium that develops the ocean model currently used in many international climate models. The **improvement of key oceanic processes** (coastal upwelling, vertical mixing at high latitudes) and of the fast coupling with the atmosphere (cyclones, diurnal cycle) will also be a major step forward in the realism of the coupled-climate model. Another step towards a finer representation of physical processes at regional scales is the **development of regional coupled models at higher resolution** (up to a few kilometres over zoomed areas). It should improve our understanding of scale interactions and the reliability of the projected potential impacts of climate change at regional scales.
- **Improving the representation of biogeochemistry processes and their coupling with physical processes:** To account for the potential feedback between biogeochemical cycles and climate, new components (carbon cycle, chemistry and aerosols) have been included in Earth system models. They are developed and assessed separately or in less interactive configurations in order to identify the processes directly influencing climate but also to improve the understanding of biogeochemical cycles or the radiative effect of each climate forcing agent. Hence, **to better represent the ability of natural sinks to absorb anthropogenic CO_2, key processes will be included/improved** (land-vegetation phenology, phytoplankton physiology, carbon-nitrogen cycle interactions) in the terrestrial and oceanic carbon cycle models. Beyond CO_2, **other climate forcing agents** (aerosols, methane, ozone, N_2O…) **will have to be more explicitly represented**, which requires both interactive atmospheric chemistry and representation of biospheric fluxes (oceanic DMS or VOC production as well as methane production by anaerobic soil respiration). These developments will not only lead to a better climate-sensitivity quantification but also to the understanding of the environmental vulnerability to climate change. Hence issues such as the

impact of oceanic acidification on marine ecosystems, air pollution and its subsequent health impact, and agricultural vulnerability or adaptation will be investigated thanks to these components.

- **Developing new algorithms and models to take advantage of new computer performance**: Increased computer power in the next years is expected to come from new architectures and an increased number of CPUs. A major effort will be made in **rewriting the "dynamical cores"** of the atmospheric and oceanic models, using new approaches (e.g. finite volume on "cube spheres" or "icosahedral grids"), in **developing new tools** for the Inputs-Outputs and model infrastructures. The increased power will enable increased model complexity, resolution, and the number or length of the simulations. The **development of high-resolution models** will be of direct interest for many climate uses but also to answer important questions of geophysical fluid dynamics both on Earth and on other planets: the role of frontogenesis in the general circulation, dynamics of super-rotating atmospheres (Venus, Titan) and giant planets.

TWP-2) Strategy for observational studies: instrumentation, analyses, dissemination

The work packages 1 to 5 defined above mostly rely on a combination of model and observational studies. IPSL has a strong potential for research concerning Earth observation (about 60 researchers and 50 support staffs). The instrumental and observation strategy of L-IPSL relies on this capability.

The main evolution within the next 10 years will be to handle the interdisciplinary dimension of environmental research with partners in hydrology, ecosystems, medicine, and economics.

This will require new observations and measurements, taking advantage of next-generation sensors and improved laboratory analytical capacities, and therefore of **an important R&D programme, including: prototype instrument** development and realisation**, the calibration of instruments or sensors,** which will likely demand acquisition or calculation of **new molecular spectroscopic data, and development of data processing** methods (retrieval, algorithms), and the development of utilization methods**.** These progress will benefit from the various EquipEx proposed by the L-IPSL laboratories such as GHG-Scope, SOFRAEX. **The L-IPSL priorities will help coordinate these efforts and distribute them over different types of vehicles or analytical platforms** (ground-based instruments, balloon and airborne sensors, autonomous ocean systems, space observations, platforms in the laboratories). For example, the result of WP-1 may be that the determination of surface carbon fluxes imperatively requires the measurement of CO_2 with a precision of a few ppmv, requiring in turn the improvement of the capacity of instruments on board satellite missions like IASI/MetOp, or lidar, instruments or laser diode sensors. On the other hand,to achieve such precision, observation of CO_2 required unprecedented challenges on the quality of the underlying spectroscopic data. Similarly, future high precision molecular spectroscopic data on water vapor and ozone isotopes are prerequisites to realize novel approaches of global monitoring of cycles. Instrumental development, observations and data analysis must thus be accompanied by the next generation of experimental and theoretical molecular studies in the laboratory.

The L-IPSL project will also require some enhanced analysis capacity to improve the synergy between models, and models and data, in a few areas:

- **New strategies for observation and analysis of multi-parameters series**. The synergy between a long series of parameters observed through different sensors is the key to the development of application-oriented studies. The challenge is multiple: there is first a need to define and optimise in situ networks, link them together on specific sites, and define the nodes between several complementary networks. This type of synergy has been developed through the ongoing European GEOMON project and will continue, for example, with the project SOFRAEX or GHC–Scope recently proposed in the framework of the EquipEx. In the Tropical area (focus on West Africa, the Indian ocean and South America), active collaborations will allow for studying the water cycle including in situ and satellite (SMOS) clouds and water vapour from a variety of means (lidar techniques, laser diode for isotopic composition, satellite observation with Megha-Tropique) to better analyze the variability mechanisms and feedbacks from the surface. The in situ data or aircrafts/balloons observations will also be used to validate space-borne instruments and to diagnose model deficiencies using observation simulators.

- **Long-term in situ and satellite observations on a decadal scale.** The new availability of these time series also brings new scientific opportunities and associated challenges. The continuity of the measurements is necessary to ensure a significant estimate of inter-annual changes and the detection of an anthropogenic component, with a considerable effort to determine the data series on a global scale through the adjustment of successive sensors following international standards (GEO/WMO), or to use the complementarities and synergies between satellite and in situ observations. This corresponds to work that is carried out at the international level, with the participation of IPSL laboratories, for example for clouds (ISCCP/GEWEX), ozone and temperature in the stratosphere (SPARC), and ocean (CLIVAR/IMBER). Although the existence of this work is a prerequisite for the L-IPSL project, the LabEx contribution will be more methodological, and will deal with analysis methods to extract significant climate change information from these time series. Such coupling will be performed using SMOS/ALTIKA-JASON missions together with SSS/Coriolis networks, CO2/CHG monitoring from the OCO, GOSAT, then Merlin, MICROCARB missions together with ICOS, Calipso / Earthcare, Megha-Tropiques / GPM missions on clouds and water cycle, together with SIRTA, and the projected SECAO network.
- **Long term observations of natural climatic variability and environmental changes.** Climate variability requires to place the short instrumental period into the broader perspective offered by the evidence of past natural climatic and environmental changes and to learn from changes observed in the past to better understand and model the present processes. New scientific questions regarding pressures on our present environment, ecosystems and societies necessitates the development of new scientific strategies to better understand the sensitivity to climate of continental hydrology, environmental transfers and processes on land and in the ocean, These challenges require the building of a beyond state-of-the-art analytical capacity, which is proposed in the framework of the EquipEx PACEC and the ALISES platform: multiple elemental and isotopic proxies, higher accuracy measurements, high resolution temporal and spatial analysis, new tracers and archives, improved calibration, in the perspective of better integration between data and models.

Intensive observation campaigns are the only way to accurately document specific events or processes. The L-IPSL project will focus its activity on a small number of national and international campaigns:

- The Ile-de-France area, which is appropriate for hydrological and air-quality studies based on the OASIS (UPEC) and QUALAIR (UPMC) platform complementing the SIRTA, in addition to the Piren-Seine hydrologic observing sites.
- The Mediterranean area, a key area to test emerging regional Earth System Models (HYMEX/CHARMEX/MERMEX).
- The Arctic area, where the climate-change signal is the stronger and the most rapidly increasing. Several field activities will be planned through the INSU Arctic programme within the next 5 to 10 years (Siberia, North Canada, Svalbard, North Pole). These campaigns will benefit from the proposed instrumental systems (EquipEx IAOOS, ANR OPTIMISM) and will include paleoclimatological activities (permafrost, ice sheet, sea ice).

One of the other challenges consists in developing **added-value products through well documented, interoperable databases,** but remaining independent to preserve their specificities as suggest through the GEOSS/GMES strategy. IPSL has the capability to actively contribute to this strategy, in interaction with the other French laboratories involved in each research field (e.g. the SECAO network for West Africa, which should combine climate / hydrology measurements with society-oriented products on resources) and through the national thematic poles (particularly ETHER, ICARE in which IPSL is strongly involved). Another promising issue will concern the Earth-sun relationship with, as the core mission PICARD. Database documentation and organisation will benefit from our partnerships within the GIS climate members coming from different communities.

TWP-3) Assessment of uncertainty in climate diagnostics and projections

The analysis of climate evolution, the detection and attribution of observed changes and the characterization of projected future changes are required for a rapidly growing number of applications. Some are associated with new scientific needs, at the interface between climatology and research

areas such as ecology, economy, epidemiology; some others correspond to more applied needs for expertise, from private or public actors going from citizens to large companies, concerning primarily mitigation and adaptation policies at the international, national and regional levels. This increase of climate information use gives to climate science a new responsibility and therefore necessitates **strengthened strategies and methodologies for assessing the uncertainties associated to diagnostics and projections**. However, despite recent advances, this issue still requires specific research activity to properly discuss the different level of uncertainties and how they affect the results for different applications. Progresses in this direction are therefore needed to provide user relevant climate information and the associated expertise (see also section 5.2.2 below).

The aim of TWP-3 is:

- **To develop research on assessing uncertainties of climate information for impact studies,**
- **To build up the expertise required for an effective use of modelled or observed meteorological and climate products and their uncertainties for various applications**.

In the first case, research will benefit from the development of ensemble approaches and of statistical methods, such as the one promoted in the EU-ENSEMBLES project, to analyse the cascade of uncertainties from the large scale to the more regional of local scale of interest for the impact studies, In the second case, the expertise will be based on interdisciplinary projects, and the questions will be identified and addressed in a very tight discussion with the “user side” community. This will benefit in particular from the “Paris Consortium on Climate – Environment and Society”, as well as form other projects such as the RExHySS, the GICC-DRIAS, ANR-SECIF or IS-ENES projects., where periodical workshops involved scientists and a wide array of concerned stake-holders.

This is a transverse activity in many ways. First the uncertainties arise from a sequence of processes treated in different WPs of this proposal: evolution of the atmospheric composition (WP-1), climate response to this forcing (WP-2 and WP-5), regional signature of global changes (WP-3) impact on resources (WP-4). Assessing uncertainties of climate projections also involves comparisons of the full Earth System Model results (TWP-1) with observations of the real world (TWP-2).

Develop methodologies to assess the uncertainties of climate diagnostics and projections

A first objective is to make use of scientific expertise developed in the different WP to improve the characterisation of model skill and the understanding of model uncertainties. This need to be grounded on model evaluation and requires making use of a wide range of observations and a diversity of methods: process-oriented multi-parameter verification, simulators of observing systems from model results. It also often requires an ensemble approach and comparisons of statistics such as mean, variability, PDFs etc.. usually requiring a ensemble simulations, where the climate model is run with a set of different initial conditions. In the L-IPSL project, observations will be systematically compared to a hierarchy of configurations of the IPSL climate model. Sensitivity experiments with different model configurations will be uses to understand the impact of model biases on the simulations of climate variability and trends. One may use for example climate reconstructions using the atmospheric model forced by observed sea surface temperature (which may be de-trended, or reduced to their trends) and by different specifications of atmospheric composition (constant or evolving), with or without nudging of the atmospheric large scale dynamics by “reanalyses”; coupled atmosphere-ocean models with or without modification of the atmospheric composition, etc. The same approach may be used for other components of the climate system **and the comparison of these ensembles of results with observations of the last decades will be used to asses the representation of both climate change trends and natural decadal variability, and to identify the main elements of confidence and sources of uncertainties in this complex system.** Simulations of past climate conditions and comparisons with paleoclimatic data will also be carried out to test the robustness of the climate model skill to large changes in forcing. Evaluation will also involve the development and use of complex statistical methods to establish for instance the geographical patterns of natural variability and long-term changes, or the occurrence of rare events. Uncertainties in our knowledge will also be assessed using model ensemble approaches, within the framework ofl European and international projects to which L-IPSL will be associated. As an output of these researches, a wide range of diagnostics concerning model performance and model relevance will be produced and distributed. This will be based both on qualitative expertise (based on the level of

understanding of the different processes, as emphasized by the recent inter-academic report on the IPCC) and on more quantitative approaches using a basket of different metrics, with specific process-oriented analyses of model performances.

Impact-oriented climate model assessments

Depending on the nature of the impact studies, the importance of spatial scales and temporal variability can be completely different (seasonality, extremes, inter-annual or inter-decadal variations). In most cases, it is not clear to know a priori which will be the most constraining factor in the future evolution, or which is the particular combination of climate indicators or variables which will have an impact. In TWP3, we will promote the **development of integrated evaluation approaches, in which impact models (crop, water resources,...) interfaced with climate model outputs (either directly, or through *ad hoc* filtering or index computation) will be used to assess the climate model results**. The methodology will also be verified using reconstructions of the climate of the last decades from historical data, Exploring these questions and defining and assessing the best way to interface climate outputs with impact models in turn brings new insight and questioning on what climate numerical models can provide, new orientations for model improvements, new need for dedicated observation or observational strategy. For instance, the description of subgrid scale variability, which is often at the basis of climate model so-called “parameterizations”, is often lost in (global or regional) climate scenarios outputs, whereas it could be of great interest for some impact studies. This is for instance the case of the subgrid scale cloud or rainfall distribution, which is currently used for model evaluation and comparison with satellite data but not for impact studies. Such approaches will be developped in the context of international projects (CMIP, CORDEX), and the corresponding expertise will be transferred to users

The bibliography of Chapter 5.2.1 is given in Chapter 7.1

5.2.2 EXPLOITATION OF RESULTS, TRANSFER AND EXPERTISE

Innovation and transfer of knowledge from the L-IPSL project

Strategic positioning

With the growing concern about climate evolution, a considerable interest for climate science has developed during the last decade. Climate research teams – and in particular IPSL – have built scientific knowledge and technical tools that give them the capacity to address some of these issues. This knowledge is at the cutting edge of science, and is progressing rapidly. It also carries major uncertainties, reflecting still inadequate knowledge of the earth system. A stronger and more integrated link between climate science and society is therefore required. This situation stirs a large demand for transfer and innovation. For example, climate change and air pollution issues are strongly connected, with European directives bringing new regulations, such as the National Emission Ceiling directive, and requiring adequate monitoring. At the national scale, the recent definition of regional and territorial plans in the French “Grenelle 2” are effective and require an anticipation of their integrated effects in the long term.

This interaction between science and society constitutes a new mission of institutes such as the L-IPSL, and at the level of the Paris or French levels, the LabEx synergy is absolutely necessary to address these challenges. Nothing can be done without the expertise of the major research laboratories in the field, but the task is enormous and even a research institute of the L-IPSL scale cannot handle it alone. The L-IPSL will need to design an adequate strategy to spread climate knowledge, and the associated tools and services, in which (1) it makes sure that its evolving expertise and the associated uncertainties and limitations, are fully taken into account, but also that (2) dedicated new structures are set up to provide the necessary help to confront a huge demand which is well beyond the capacity of L-IPSL alone.

In what follows we first give general indications on the L-IPSL potential (e.g. the areas in which it has the capacity to transfer knowledge and technology) and on the structural means and association

through which it can act (also described in B.5 and B.6). A set of more specific examples is then reviewed.

L-IPSL potential for innovation; main partners

The capacity of L-IPSL to transfer knowledge and innovation concerns several domains:

- innovative instrumentation for environment observation and monitoring;
- innovative modelling for environment prediction;
- distribution of climate information and associated uncertainties;
- advanced mathematical (for example statistical) methods to combine observations and model results for monitoring, forecasting; downscaling or uncertainty assessment.

In each case, a specific strategy for innovation and the creation a value is needed.

The IPSL has exploited this potential for more than a decade by actively participating to major international monitoring programs such as the European GMES (Global Monitoring for Environment and Security) where it has transferred codes with operational capacity. The OPA/NEMO model is used at European level as a reference operational model for oceanography. The air quality prediction code CHIMERE has been transferred to INERIS, an operator, which uses it in the context of the French PREV'AIR prediction system.

To go further, L-IPSL will rely on strong existing links with industrial partners, a network of SMEs and public agencies. It can also benefit from the framework of the new European "Climate Knowledge and Innovation Community (KiC)" designed to link research, training and innovation at European scale to foster climate change adaptation and mitigation. At the national level, it will also lean on the new project of "Institut d'Excellence sur les Energies Décarbonées" (IEED) named Climate – AIR – Energy (CLAIRE), if funded, a major goal of which is to develop a center for climate and air services.

This strategy is detailed for different areas.

General expertise and transfer of knowledge

Climate-change economic actors need an increased knowledge in climate science, but also an acute understanding of the associated uncertainties. For example, the probabilities of exceeding thresholds in the occurrence of extreme events is necessary to determine the regional impact of emission abatement strategy taking into account climate change, or the regional carbon cycle monitoring. Yet, when addressing such climate change consequences, one has to deal with a large cascade of uncertainties (*Katz, 2002*), attached to emission scenarios, climate projections, and impact models. For the L-IPSL strategy will act simultaneous as a provider of basic knowledge, tools and data and to accompany these services by an uncertainty estimated specifically for each case study.

The strategy of the L-IPSL will be two-fold:

- (i) to develop autonomous initiatives, relying on its strengths, or those of its sponsors to develop training programs with the universities or communication actions toward the public
- (ii) to develop a stronger partnership with industries and SMEs and use them as vectors of knowledge transfer, in particular through non-academic partners. The IEED CLAIRE and the climate KiC are tools to develop this second approach.

Innovative observation technologies

L-IPSL scientific priorities concerning the monitoring of climate require the development of instrumentation for all possible platforms: ground based, airborne, within the ocean, from balloons or ships, from space missions. The observational strategy implies to monitor key parameters on the long term, with multiple parameters being observed and analyzed at collocated instrumental sites. The continuous development of innovative instruments and analyses is absolutely necessary to calibrate the measurement networks, increase their reliability. It naturally leads to a transfer toward SMEs or larger companies. Indeed, this transfer is necessary for long-term climate monitoring, which require development and operations of series of identical instruments. Based on developments of one or two prototypes by research laboratories, transfer of knowledge is necessary to ensure this long-term

observing strategy. L-IPSL will strengthen collaborations, which have already been developed (particularly space projects), during their R&D phase and up to the definition of phase A.

Modeling and innovative methods

For modelling applications, the general strategy of L-IPSL will be to favour the use of its codes through open access, and help develop specific applications with SMEs, agencies and other industrial partners, through specific pilot projects whose products could be spread or commercialized, in particular through the partners of the IEED CLAIRE and the Climate KiC where pilot applicative projects and demonstrators can be developed. These specific applications will then be spread in a commercial mode for users via the SMEs and industrial partners.

The IPSL has developed an integrated global earth system model (ESM), which couples models of the various climate components, and off-line models, which can either be some versions of the ESM components, or autonomous systems (for air quality, continental surfaces, …). All models have been designed to address specific applications. Models are not necessarily based on deterministic equations. Innovative statistical methods - such as advanced time series analysis, downscaling techniques, inversion or data assimilation techniques - also carry a large potential for applications.

The offer of service concerning model studies should not concern the codes and the data bases only, but also the transfer of information and expertise for an optimized use. This will be favored by the organization of a user community (involving other academic laboratories, industries, SME or public decision makers), that will also use by themselves some of the offline components or impact models, thus providing incentive for an easier access to simulations, more explicit documentation.

Distributing the results of climate research and their uncertainties

Distributing the results of climate research constitutes a new mission for institutes such as IPSL. This distribution is now an international task. Data amounts are huge (1 Petabyte for the sole IPSL model in preparation of the next IPCC AR5 report). The complexity of the task should grow by one order of magnitude every 5 years. Distribution uses standardized international technologies, because the international community is evolving from the use of a central facility to the development of an international distributed database, for which IPSL will be a distribution node.

Over the next 5 years, **L-IPSL will develop a perennial dedicated facility** (based on the PRODIGUER and DRIAS projects, with the ability to constantly adapt to growing requirements), and to maintain an active participation in the definition of international standards (such as metadata, format and security). This is essential to the credibility and international positioning of L-IPSL. It will constitute a trans-collaboration across the different L-IPSL laboratories and services. Its target will be to improve the quality of the data distribution to users, and reversely, to improve the quality of the models by organizing a continuous “return of expertise” from the users.

The uncertainty attached to climate information requires a dedicated scientific approach, and tailored analyses (see work proposed in TWP-3). **The diffusion of model and observational results, the communication of the associated uncertainties, in close collaboration with other institutions at the national and international level, will be a priority of L-IPSL**. **A major effort will be made to offer a wide range of diagnostics concerning model performance and model relevance**. This will be based both on qualitative expertise (based on the level of understanding of the different processes, as emphasized by the recent inter-academic report on the IPCC) and on more quantitative approaches using a basket of different metrics, with specific process-oriented analyses of model performances. A prototype for such an approach is under development in the FP7 IS-ENES project to prepare an e-knowledge service at the European level, designed to bridge climate research data and the needs of the various communities requiring climate information. L-IPSL will produce a greatly increased amount of information over the next ten years, and one of its main tasks will be to develop an **“interface research team”** able to customize and transfer this expertise.

Monitoring the earth system

The future development of our societies and its crucial implications for the next generations will strongly depend on environmental policies The information provided by a careful monitoring of climate

parameters is essential for decision makers or citizens who design or vote for those policies. This transfer of information is already taking place. For example, the information provided by the European Earth observation program GMES will increasingly be used by policymakers and public authorities, to prepare environmental legislation and policies, monitor their implementation and assess their effects, with a particular focus on Climate Change. This monitoring is a necessary complement to prediction systems and most GMES services associate both.

The IPSL laboratories participate to this monitoring through the respective “Observatoire des Sciences de l’Univers” set up in the Paris area, and the “labelled “ observation services that they take in charge recurrent measurements, in the ocean or over the continents. Some of the EquipEx projects in which IPSL is actively involved (SOFRA-EX for Lidar networks, including the SIRTA supersite run by the IPSL; GHG-Scope concerning Greenhouse gases) contribute to this monitoring

In addition to these EquipEx proposals, other monitoring activities should be favoured by the L-IPSL and offer new services. For example, IPSL laboratories (as mentioned above) are already involved in the GMES Atmospheric service, which distributes past and present records of atmospheric composition, together with forecasts and reanalyzes of air quality over Europe. This service also provides support to climate change studies by providing a long-term monitoring of the atmospheric concentration in carbon dioxide, methane, aerosols and some estimate of their surface fluxes. These atmospheric GMES services will be enhanced by the L-IPSL project (see WP-1), with a special effort to produce analyses of atmospheric CO_2 and CH_4 and their surface fluxes, for running periods of 6 months behind real time.

Links to new structures for innovation

Research, observations, models and simulations produced at IPSL will feed the development of end-user climate services at a rather national level, with long-term partnership with Meteo-France that will be in particular used for pilot projects with industry and SMEs through the IEED CLAIRE. The IEED CLAIRE project, if funded, aims at developing innovation for climate adaptation and mitigation using in particular the IPSL tools for climate and air pollution monitoring and anticipation. Through the development of targeted pilot projects with industry within CLAIRE, the IPSL will contribute to develop applications such as

- the energy sector, with the evolution of heat/cold extremes and energy resources (see Sections A3 and A4),
- air quality and the emissions abatement regulation, with an effort being put on evaluating co-beneficial (climate – air quality) emission scenarios
- the carbon market and the development of sensors, with the development of regional carbon cycle accounting services using both observations of greenhouse gases from the ICOS infrastructure.

At European level, the Climate KiC will also help develop projects linking research, innovation and training, with the aim of fostering climate adaptation and mitigation. The KiC will help to develop application projects together with European partners and industry.

Finally, in several areas, direct collaborations with agencies or industries are present and will be strengthened. Such is the case of climate change impact on hydrology. For water resource management, the primary indicator will be the change in mean river discharge, which can be combined to demographic data to construct the widely used water scarcity index (*Vorosmarty et al*., *2000*). Other useful indicators relate to extremes flows (exceed thresholds and probabilities), whether high flows regarding flooding vulnerability or low flows for water resource sustainability, but they carry much larger uncertainties. The challenge be to devise the appropriate transfer to end-users, which routinely use the corresponding present time indicators for very specific dimensioning.

Over the last decade, Sisyphe, one of the new partners of L-IPSL, has for instance pioneered multivariate analyses of climate change impacts on river systems (river regimes, ground water, water temperature and water quality). Care has been taken to regularly communicate the results to the involved stake-holders, whether public (Ministry of Environment, ONEMA, water agencies, planning and navigation agencies, local actors) or industrial (water delivery, water treatment, consulting and engineering firms, innovative SMEs). This communication, mainly based on workshops and meetings giving voice to stake holders, has proved very fruitful to progressively broaden their audience and

highlight new applied research questions (such as the consequences of climate change on hydraulic management, or air conditioning activities, from needs in large cities to the cooling potential of rivers).

5.2.3 HIGHER EDUCATION, INTEGRATION INTO THE WORKPLACE

The present involvement of L-IPSL laboratories into Higher Education

The partners of L-IPSL occupy a prominent position for higher education in environmental sciences in *Ile de France*, with more than 130 teachers-researchers, 170 researchers, and 220 engineers and technicians. This unique human potential, associated with the large experimental and modelling capacities of the L-IPSL partners, allows, each year, tens of thousands of hours of teaching to be given and hundreds of PhD and master students to be trained in the high level masters and doctoral schools driven by the universities and graduate schools (Grandes Ecoles) supporting L-IPSL, 5 of which being listed in the Shanghai academic ranking of world universities.

Masters (and equivalent) under the responsability of L-IPSL people	Accrediting organisms	L-IPSL implication	Research / Pro
AIR : Atmosphère et Qualité de l'Air	UPD, UPE-C, ENPC	LISA	R & P
Arctic Studies *	UVSQ	LSCE, LATMOS	P
ECH : Environnements continentaux et hydrosciences (5 parcours)	UPMC, UPD, Mines ParisTech, Agro ParisTech, UPE-MV	SISYPHE, LSCE, IDES, LMD, LATMOS	R & P
Ecole d'ingénieur Polytech'Paris, spécialité Sciences de la Terre	UPMC	SISYPHE, LOCEAN	P
Environnement sédimentaires et volcaniques	UPSXI	LSCE	R
Génie Géologique	UPSXI	IDES	P
Géosciences (5 parcours)	UPMC, MinesParistech, CNAM, ENS	SISYPHE, LMD, LATMOS	R & P
H2S: Hydrologie, Hydrogéologie et Sols	UPSXI	IDES, LSCE ??	R & P
ICE : Interations Climat Environnement	UVSQ, INSTN	LSCE, LATMOS	R
MAPE : Matériaux du Patrimoine dans l'Environnement	UPD, UPE-C, ENPC	LISA	R & P
MECE : Management de l'Environnement pour les Collectivités et les Entreprises	UPD, UPE-C, ENPC	LISA	P
MPE Mécanique et Physique pour l'Environnement.	Ecole Polytechnique	LMD	R & P
OACOS : Océans, Atmosphère, Climat, et Observations Spatiales (4 parcours)	UPMC, ENS, Ecole Polytechnique, ENSTA, Ponts ParisTech	LMD, LOCEAN, LATMOS, LPMAA	R
OEM : Océanographie et Environnement marin	UPMC	LOCEAN	R
QUALUB : Qualité de l'air et lutte contre le bruit	UVSQ, CNAM	LSCE, LATMOS	P
Parcours régional en Planétologie	UPMC, UPSXI, UPE-C, UPD, UVSQ, MNHN, OP, IPGP	LATMOS, LMD, LISA	R
SPE : Sciences et Politiques de l'Environnement	UPMC, SciencesPo	LATMOS, LMD	P
TRIED : Traitement de l'information et exploitation des données	UVSQ, CNAM, Telecom-sud Paris	LATMOS, LOCEAN	P
Masters with a significant participation of L-IPSL people	**Accrediting organisms**	**L-IPSL implication**	**Research / Pro**
AEGR : Analyse économique et gouvernance des risques	UVSQ, INSTN	LSCE, LATMOS	P
CDEQ : Construction Durable et Eco-Quartiers	UVSQ	LSCE, LATMOS	P
ECONOVING *	PRES Universud Paris	LSCE, LATMOS, IDES	P
EMBS (Erasmus Mundus Marine Biodiversity and Conservation) *	UPMC, Universities of Ghent, Bremen, Algarve, Oviedo, Klaipèda	LOCEAN	R&P
Double Diplôme master environnement UPS - Université polytechnique de TOMSK (Russie) *	UPSXI	IDES	R & P
MCE : Médiations des connaissances environnementales	UVSQ	LSCE, LATMOS	R & P
RSE : Stratégies de Développement Durable et Responsabilité sociétale des entreprises	UVSQ	LSCE, LATMOS	P
SAGE : Système Aquatique et Gestion de l'Eau	UPD, UPE-C, ENPC	LISA	R & P
SSENTS : Sciences de santé environnement territoires et santé	UVSQ	LSCE, LATMOS	P
TGAE (Télédétection et Géomatique Appliquées à l'Environnement)& TAPE (Télédétection Appliquée aux Problèmes d'Environnement)	UPMC, UPD, UVSQ,	LMD,	R & P

Table 1: Masters associated to L-IPSL

L-IPSL partners promote and teach a comprehensive and quantitative approach of the climate system, concerning all its components, at all time and space scales. This involves many disciplines (physics, chemistry, mathematics, biology, geosciences, engineering sciences), which cover a large continuum from theory to experiment, and increasingly extend to the human dimensions of the environmental problem. This large variety of approaches permits the coexistence of disciplinary and multidisciplinary masters, concerning the study of the Earth and other planets, the physics and chemistry of the climate system, the global and local aspects of air or water pollutions, the impacts of anthropogenic and climate forcing on the natural resources, the links between climate, economy, and society, … Besides the involvement of its academics and staffs in teaching, IPSL also provides a financial support for innovative teaching in environmental sciences through a yearly call for proposals.

The master studies are distributed over the different universities and Grandes Ecoles to which the L-IPSL laboratories are affiliated (Table 1). The doctoral studies are distributed over a few Ecoles Doctorales, with ED129 (*Sciences de l'Environnement en Ile-de-France*) playing a central and unifying role. Other doctoral schools associated to L-IPSL provide a deeper insight into geosciences, hydrology, natural resources, energy, urban territories, instrumental physics, and space sciences. (Table 2). L-IPSL partners also support international summer schools for young scientists and provide information to a wider public, through the "Fête de la Science", through dedicated courses for professionals (high-school teachers, private company executives…), through regular seminars, and they participate to the design of on-line sites of information (e.g. climate FAQ on www.ipsl.fr). L-IPSL people are involved at an individual level into the diffusion of scientific information (through book writing, or interviews in different communication media).

Doctoral schools	Accrediting organisms	Associated organisms	L-IPSL implication	Number
Sciences de l'environnement d'Ile de France	UPMC, UVSQ, ENS	UPD	LMD, LATMOS, LSCE, LISA, LPMAA, LOCEAN	ED 129
Modélisation et Instrumentation en Physique, Energies, Géosciences et Environnement	UPSXI	UPMC, UVSQ, ENS	IDES, LSCE	ED 534
Géosciences et ressources naturelles	UPMC, Mines ParisTech, Agro ParisTech	IFP, Ec. Natio. Sup. Pétrole et moteurs	LSCE, SiSYPHE	ED 398
Ecole doctorale de l'Ecole Polytechnique	Ecole Polytechnique		LMD, LSCE	ED X
Astronomie et astrophysique IDF	Obs. Paris, UPMC, UPD, UPXI	Univ. Cergy Pontoise, UVSQ, ENS, INSTN	LATMOS, LISA	ED 127
Sciences, ingéniérie et environnement	PRES Paris Est		LISA	ED 531
Doctoral Programme on Marine Ecosystem Health and Conservation	UPMC	UPMC, Universities of Ghent, Bremen, Algarve Oviedo, Klaipèda,Pavia, Bologna, Plymouth	LOCEAN	ERASMUS MUNDUS
La Physique de la Particule à la Matière Condensée	UPMC	ESPCI	LPMAA	ED 389
Sciences et technologies de Versailles	UVSQ		LATMOS	ED 539

Table 2: Doctoral schools associated to L-IPSL

The added value of the L-IPSL project

The objective of L-IPSL, in this very active education and training ecosystem, is to provide bridges between a continuously evolving science, a multi-actor higher-education system, and the increasing demand of knowledge from various sectors of the society. The fast expansion of the international dimension of research and education, with a constant motion of students and post-docs between the major laboratories around the world, exists in all scientific fields but it is especially strong in the context of climate studies, whose aim is precisely to study the Earth environment. L-IPSL partners are already leading several international masters, taught totally or partially in English (Table 1).

During the next decade, the needs for education and training on environmental changes should increase largely, because political and economical decisions will have to take global changes into account from global to local scales. This will concern all aspects of our socio-economic system, from citizens to governments, from start-up initiatives to international companies. Therefore, the masters involving L-IPSL partners are not restricted to climate sciences, but already include several professional masters opened to students from human sciences (Table 1). Confronting these needs requires a joint and multidisciplinary reflexion between all actors involved in higher education and professional training.

In this very broad context, our ambition is to use the strengths and dynamics of the universities and *Grandes Ecoles* associated L-IPSL to create a leading international actor for the academic and professional formation on climate sciences, with capabilities to develop new links with other disciplines, foreign universities and private partners. **L-IPSL will facilitate in priority a few concrete and original actions, with high leverage capabilities, which will be endorsed and realized in synergy with the involved Universities and Grandes Ecoles**. Such synergies already exist (e.g. ENSTA/Ecole Polytechnique/UPMC/ENS/PontsParisTech for master OACOS, UVSQ/ENSTA for

master ICE, UPMC/AgroParisTech/MinesParisTech for master ECH, UPEC/UPD/PontsParisTech for masters AIR-MECE-SAGE-MAPE, see table 1) but need to be further developed and coordinated.

In full consistency with the five axes of the research project (§5.2.1), education actions promoted by L-IPSL will be focused on the specific questions of climate change for the next decades, at global and regional scales, addressing the issues of natural resources (availability, impacts, and feedbacks), and of emerging risks. The triptych Climate-Resources-Risks is the red wire of our proposition. These three notions are associated in all processes of environmental decision-making. They are also linked by the same concept of uncertainty which underlies the L-IPSL project: how can we separate what is known with certainty, from what is so far unpredictable? Recent debates have shown to which extend an education to these issues must be based on a solid scientific culture, and how much it is needed.

L-IPSL proposes to develop sustainable actions in higher education (over the 10 years of the LabEx), complemented by a few fast-track actions delivered after two years.

- Development of the international dimension of graduate level education.

The first initiative will be to help **developing the international dimension of existing masters, and to favour an increased educational offer to non-French speaking students**, in synergy with associated establishments (see §5.2.5: Attraction section). The second initiative will be to **train PhD students and young scientists** more actively on emerging topics related to climate-resources-risks. This will be achieved through **regular international thematic schools**, with lectures by the best international specialists from research institutes and innovative companies. These schools will also be opened to international participants and to scientists at the interface of the climates sciences.

These two initiatives will be developed consistently with other national and international projects in which IPSL is already involved, such as the European Climate KIC or IEED French initiative, the current Erasmus Mundus actions, or the existing industrial chairs (e.g. Econoving at UVSQ or Sustainable development at Ecole Polytechnique). They will include innovative teaching approaches such as e-learning modules for higher education. They will be presented more systematically for funding at European or international levels (EU call on formations, Erasmus Mundus, …), or at a national level from industrial chairs and foundations, in order to de-multiply the L-IPSL human and financial support.

- Asserting a discipline through the diffusion of teaching and communication material

During the last decade, the L-IPSL partners and researchers have developed a large amount of teaching and communication material on all the facets of the Earth Environment system – this is associated with the development of a discipline we may call Climatology or “Earth System Sciences”. This includes courses, lab works, field works and internships, documents for students, books for a wider audience, essays, discussion with journalists. These elements have now reached a high degree of maturity and deserve improved visibility and recognition.

L-IPSL will **gather and synthesize the existing teaching in a series of published reference textbooks and of online books on Climate-Resources-Risks**, visible and accessible worldwide. The publics targeted in priority are higher education students, scientists, and multipliers of the society (trainers, teachers, policy makers, team leaders, …). This ambitious effort is compulsory and can be done efficiently in a coordinated way only. Editing such books (by opposition to publishing them) can come only from a concerted action from a scientific collaborative project such as L-IPSL.

- Professional insertion and training

Recent enquiries about the professional insertion of graduate students 30 months after completion of a master in sciences associated to L-IPSL show excellent results with more than 75% occupying a permanent position, mostly in services (30-35%), in the public sector (15-30%) and in industries (7-25%). Another enquiry concerning PhD students from the doctoral school “Sciences de l’environnement d’Ile de France” has shown in 2007 that, 76% had a permanent position (private sector, higher education and research, administration and secondary education), 21% were carrying out a post-doc mostly in foreign countries, and only 3% were still looking out for an employment.

From these figures, but also from the prominent place of environmental problems in our society, symbolized by the two “Grenelle de l’environnement”, it is doubtless that the environmental sciences will constitute a growing source of employment opportunities for students, but also for the working professionals. Indeed, higher education and professional training should now be considered as a

continuum during one's life. This fact will constitute a major concern for L-IPSL, its researches will constitute a central foundation of this process.

A co-ordonated offer of doctoral modules and professional trainings will be developed in collaboration with the universities and Grandes Ecoles of L-IPSL and their private or public partners. **L-IPSL will coordinate and accompany multiday sessions for key influencers** with significant reach and impact in educational and technical institutions, associations, regional and national agencies or companies. These attendants should in turn act as multipliers by further diffusing the knowledge and skills learned in L-IPSL within and through their own organisations. Experimental and modelling capacities of L-IPSL will be associated to the sessions whenever it is possible. **Dedicated sessions for PhD students will also be proposed** to illustrate the variety of existing and potential opportunities inside and outside L-IPSL.

Expected results, fast-track products, and means

The success of these three educational objectives - International visibility at graduate and doctoral levels, edition and communication, PhD and professional training - will be assessed through a set of visible deliverables. Within 10 years L-IPSL intends to have:

- improved the international visibility of L-IPSL universities and Grandes Ecoles with more international students in the masters and renewed contents, completed by regular attractive international thematic schools;
- edited a textbook & ebook collection dedicated to a quantitative description of the "Earth system sciences";
- developed a regular offer for PhD education and professional training built on the skills of L-IPSL and in synergy with its public and private partners.

Within 2 years, L-IPSL will deliver, as fast-track products favouring the development of the long-term objectives:

- the identification of an international education path on Climate-Resources-Risks in existing masters of L-IPSL, and its promotion at an international level.
- a homogeneous set of 50 laptop easily deployable for education actions promoted by L-IPSL.
- e-communication rooms: an internal network will be created between L-IPSL partners, with rooms equipped using pioneering technologies allowing multisite videoconferencing, virtual and e-learning classes, document exchanges, shared digital whiteboards, …

The success of both short-term and long-term objectives depends critically on adequate resources, both on human side (three full-time persons seems is an absolute minimum to coordinate and develop the proposed actions), and financial side (see §6.1.2).

5.2.4 GOVERNANCE

Management of the L-IPSL and its governing structures

The L-IPSL is an ambitious project, which emanates from the IPSL federation. This federation has shown over the past 15 years its capacity to manage successfully complex projects, in terms of observation (campaign, space missions, archival) and modelling (such as the development and use of an Earth System Model). The IPSL has attracted a strong international recognition. It has developed a high-quality support team of more than 20 people which take directly in charge a growing number of projects, summer schools, events, common to its participating laboratories. The continuity of IPSL action over a long period of time is a tribute to the quality of its management structures.

The L-IPSL project will assert its own scientific dynamics through a dedicated Board (Comité de Pilotage) and will also take the full benefit of previous IPSL successes, making a full use of the IPSL structures, described in Section 4.

General framework

The highest authority of IPSL is the "Conseil des Tutelles" (Council of the supporting institutions). This Council will be extended to become also the highest authority supervising the L-IPSL, gathering representatives from (by alphabetic order) CEA, CNES, CNRS, IRD, ENS, EP, UPD, UMPC, UPEC, UPS-11, UVSQ and that should meet twice a year.

The Council appoints the Director of the L-IPSL, who is also the director of the IPSL federation, and, upon decision of the Council may also be assisted by an executive director. All decisions concerning the management of the LabEx ultimately require its approval.

The director manages the L-IPSL with the assistance of the executive director and of a "Comité de Pilotage" (Board), which is an extension of the current "Conseil de Direction de l'IPSL). This Board gathers the director of the LabEx, the directors of the participating scientific units, and (once appointed) the leaders of the different Work package or Transverse Work Packages. This Board meets at a monthly rate, to follow closely the development of the L-IPSL action. As its membership will be large (a minimum of 17 members) the Board may chose to elect a Bureau to deal with given priorities, and in particular the management of innovation and educational activities.

The Board deliberates upon the choice of WP leaders, upon the allocation of resources to the WP, and elaborates the national and international strategy of L-IPSL. All those decisions have to be approved by the Council. This management of collective resources and strategy at the level of the whole LabEx ensures the consistency and synergy between the WPs.

Each WP has its own management, and its leader will be assisted by a committee whose composition has to be approved by the Board). WP leaders propose a yearly plan to the director and the Board. When appropriate this WP committee is merged with existing IPSL "Poles".

A specific attention to Innovation and Education

As mentioned above the L-IPSL Board may organize some of its action through dedicated Bureaus. There is a specific need to enlarge the membership of such Bureaus, concerning Innovation and Education.

Concerning Education, the L-IPSL project is acting as a tool provider for the supporting Universities and Grandes Ecoles, which need to be adequately represented in any decision process.

Concerning innovation and transfer activities, the L-IPSL activities will be developed in conjunction with outside partners: SMEs, companies, public administrations, the IEED CLAIRE and the Climate KiC, for which an adequate representation should be sought.

In addition, the L-IPSL will also use external services to develop its strategy. A part of the actions concerning the innovation and education will be taken in charge by SMEs – which help attracting additional funding (from the European Commission, from private partners, …) in more efficient manner. These actions will of course have to be closely supervised by the Director, the Board and the relevant Bureaus.

5.2.5 ATTRACTION

The L-IPSL will constitute a highly visible focal point for climate studies in the Paris area. One of the major expected benefits of this increased visibility is to reinforce the capacity of the L-IPSL laboratories to attract international students, post-docs and high-level researchers. Another expected benefits is to use this increased visibility to raise the IPSL Earth System Model at the best international level, which means to be part of the group of the best five ESM worldwide.

Attracting foreign students

Even though current master programs organized by the Universities and Grandes Ecoles of the Paris area in the field of Climatology do attract foreign students, only few of them are taught in English, and their attractiveness for non-French speaking students is therefore necessarily limited.

To develop the international visibility of L-IPSL Universities and "Grandes Ecoles", formal links will be established with prestigious foreign universities, and an international master of science will be set up with a focus on three connected issues: Climate Change, Resources, and Risks. It will be created by pooling up the existing educational resources in the L-IPSL consortium. Indeed, the difficulty of such a

project is that it requires to articulate disciplinary approaches of the climate system and its sub-systems (with a complex science background in physics, applied mathematics, chemistry, ecology), and to open them to a wider social and professional context, requiring the participation of other disciplines (such as economy, politics, and social sciences). An international master should therefore offer an open range of courses, which could fit the expectations of students with different aims (enter a doctoral program or various professional careers). Organizing such a diversity of courses can only be possible because of the exceptionally large area covered by the L-IPSL and its partners within the participating Universities and “Grandes Ecoles”. Sharing resources and skills with existing masters will constitute a necessary requirement to establish an international master, a sufficient number of courses being given or repeated in English.

The international visibility of the research proposed by L-IPSL will also be an important element of attraction for high-level students, post-docs, or researchers. Summer schools constitute a privileged manner to establish the connexion between research and education. This is why the L-IPSL will establish a yearly well-identified and promoted thematic school, which will serve to disseminate the results of its research to young scientist of various origins.

Longer visits of post-docs and researchers

The L-IPSL project is structured in 5 Work Packages and 3 Transverse Work Packages, all of which have been set up because they correspond to scientific domains of key importance in which the L-IPSL laboratories occupy a prominent position at the international level. This prominence is always the result of a very strong insertion within the international programmes of the WCRP or IGBP, where the L-IPSL is coordinating important and highly visible projects.

The careful definition of our project therefore ensures that joining the L-IPSL will be regarded as a high-level opportunity for any researcher, whether junior or senior. The L-IPSL will offer a number of temporary positions of different types: post-docs, visits of different durations for confirmed high-level international researchers. Each WP or TWP will submit proposals of temporary positions to the Board (“Comité de Pilotage”) of L-IPSL, which make final decisions on a yearly basis. This will ensure that, over the years, each WP will have a diversified policy of hiring external researches at different levels.

Attracting foreign scientists, developers and users

The international recognition of the excellence of the IPSL ESM will be reinforced through the organisation of international conferences. This emblematic action aims at opening our activities to the worldwide community and at amplifying the French international exposure on climate studies. Once every two years, this conference will be dedicated to the IPSL climate model and will gather international scientists, developers and users (including those from private companies) to present the major evolutions of the model and to federate an international community around it. Alternately to this biennial conference, an international conference on more specific scientific topics of the L-IPSL will be organized.This ambitious strategy is necessary to reach the level of recognition of major institutions, such as the Hadley Center (UK), the NCAR (USA) or the MPI-Climate (Germany).

5.3. STRATEGY OF THE SUPERVISING INSTITUTIONS

The supervising institutions are listed by alphabetic order

Commissariat à l’Energie Atomique (CEA)

The CNRS is leading the L-IPSL LABEX project as described in document B. The objective of this project is to amplify IPSL actions in climate and environmental sciences toward the international community, societal demand, private companies and education. The development of these activities implies that the resources (financial, human and instrumental) allocated to the LABEX complement, and not replace, those that were available at IPSL before the project.

The L-IPSL LABEX project is fully part of the CEA strategy on climate and environmental sciences at the higher level of excellence. It is also in line with the IPSL strategy to which the CEA fully subscribes. This support will lead to an involvement in terms of human and financial resources at least equal to the current level for the research teams of the LSCE (Laboratoire des Sciences du Climat et de l’Environnement) involved in the L-IPSL project for the next four years (January 2011 – January 2015), provided that the global budget of CEA does not decrease

significantly. Human resources, permanent research positions as well as PhD and postdoctoral fellowship, will thus be at least maintain during this period.

This protocol is renewed tacitly every four years except in case of denouncement by CEA in the two months following the deposit of the quadrennial evaluation report.

Centre National d'Etudes Spatiales (CNES)

Founded in 1961, the Centre National d'Etudes Spatiales (CNES) is the government agency responsible for shaping and implementing France's space policy in Europe. Its task is to invent the space systems of the future, bring space technologies to bring to maturity and guarantee France's independent access to space. CNES is a pivotal player in Europe's space program, and a major source of initiatives and proposals that aim to maintain France and Europe's competitive edge.

It conceives and executes space programs with its partners in the scientific community and industry, and is closely involved in many international cooperation programs—the key to any far-reaching space policy. The agency's more-than 2,400-strong workforce constitutes an exceptional pool of talent, with some 1,800 engineers and executives. Through its ability to innovate and its forward-looking vision, CNES is helping to foster new technologies that will benefit society as a whole, focusing on access to space, civil applications of space, Earth Science and Climate, science and technology research, security and defense.

Space resources are vital for learning more about the Earth and its evolution. Earth observation and measurements offer ways to ensure sustainable stewardship of our planet. CNES and its partners in Europe—through the Global Monitoring for Environment and Security initiative (GMES)—and around the world have put in place satellites dedicated to observing the land, oceans and atmosphere, as well as to hazard and crisis management. The best-known are the Spot satellites flying the Vegetation instrument, the Topex/Poseidon and Jason-series oceanography satellites, the Argos system, Envisat and the Pleiades constellation. Recent satellites such as Demeter (earthquakes), Parasol and Calipso (radiation budget) and Megha-Tropiques (water cycle) are profoundly altering our understanding of the processes at work in the Earth. CNES support also the French Science preparation for the mission and fund the analysis and exploitation of the scientific.

In this framework, CNES is supporting from the beginning the IPSL activities and these laboratories which are involved in different ways in space projects to have a better understanding of the Planetray and Earth Environments. In particular trough the L-IPSL project a lot of teams will contribute through development or exploitation of space missions or airborne observations. The L-IPSL project will study and anticipate the climate change, which is a major axis of the CNES scientific programmes. The L8IPSL project will be an important partner for CNES to studying new space missions with innovative instrumentation. If selected, CNES will support L-IPSL (Financial support, Excellence chairs, doctoral and postdoctoral positions.) depending to the space missions involved in the project.

Centre National de la Recherche Scientifique (CNRS)

The Centre National de la Recherche Scientifique (CNRS) is coordinating the L-IPSL LABEX. The objective of this project is to amplify the actions of the IPSL federation in the field of climate and environmental sciences with a more focused activity on societal demands, and a stronger emphasis on international co-operations, and linkage with private companies and education.

The CNRS develops a large multi-disciplinary strategy to diagnose and predict climate changes and its impacts, through its institutes, in particular the INSU and the INEE, through its national programmes and, through the Obervatoires des Sciences de l'Univers (OSUs). The CNRS already strongly supports the IPSL federation through 19 engineers and technicians permanent positions. If selected, the L-IPSL will significantly increase the efficiency and high-level profile of the work carried out by IPSL, and will strongly contribute to the overall CNRS capacity to react to environmental urgencies.

Ecole Normale Supérieure (ENS)

ENS is able to have an important contribution to research and formation in environment and sustainable development because it a pluri-disciplinary school with excellent laboratories not only in mathematics, physics, chemistry, science of the earth, but also sciences of life, sciences of man and society.

ENS have developed strongly its "Centre d'enseignement et de recherches sur l'environnement et la société" (CERES). LMD (Partner 8) is involved in this transverse structure, and ENS plans to develop an Environment Institute in the following years to favourite synergies and coordinate activities of different laboratories and department working on environmental questions. In the context of the Geoscience Department, LMD leads studies and forecasts of extreme events, aleas and risks, and also studies of climate evolution and anthropic effects. ENS commits, at least, on maintaining his support to LMD, in terms of recurrent budget, human resources

and hosting conditions. In the case of an increase of the financial means attributed to the university, this commitment could be revised upwards, if the L-IPSL LabEx project is selected.

Ecole Polytechnique ParisTech (EP)

Ecole Polytechnique is one of the major actors of the "Pôle Climat Energie Environnement" (PCEE) currently under constitution on the Paris Saclay campus. Environment and sustainable development is one of the strategic axes selected to structure around Ecole Polytechnique the so-called “quartier Palaiseau Jouy” of ParisTech. LMD (partner 8) with Ladhyx participate to the Mechanic department initiative that has initiated the Coriolis Institute for Environment of École Polytechnique to promote pluri-disciplinary research on environment from local to planetary scales. The Coriolis Institut will be a contribution of Ecole Polytechnique in the proposal for the IEED CLAIRE on Climat, Air and Energy. The IEED CLAIRE will be in strong connection with Kic Climat French collocation centre.

Ecole Polytechnique is providing infrastructure to SIRTA, which is involved in the proposed equipex: Sofraex. Ecole Polytechnique sustains at LMD: satellite analysis (it is a part of its strategy to develop a spatial axe), lidar development (in synergy with laser knowledge and use in many others labs) and chemical atmospheric modelling with its impacts on human health.

Ecole Polytechnique commits, at least, on maintaining his support to LMD, in terms of recurrent budget, human resources and hosting conditions. In the case of an increase of the financial means attributed to the university, this commitment could be revised upwards, if the L-IPSL LabEx project is selected.

Ecole Pratique des Hautes Etudes (EPHE)

The *Life and Earth Section* of the EPHE, through its laboratories belonging to the network *Global changes, climates and impacts upon human societies* and its partnership with the UMR 7619 *Sisyphe,* is involved in the research field of semi volatile micropollutant atmospheric transfers in relation with the hydrologic and climatic cycles and anthropogenic activity evolution.

In that context, the plan for L-IPSL Labex creation is a major opportunity namely for the teachers-researchers in the Biogeomistry group at *Sisyphe*, that are listed among international leaders recognized for their works upon environmental impacts of atmospheric contamination by xenobiotic organic compounds. A collaboration of the EPHE environmental chemists inside L-IPSL will allow to develop an exhaustive scientific approach of the anthropogenic interactivity and its consequences. The complementarity between specialities of these research teams will lead to an expansion of the research fields and to international innovations, considering new chemical data, extending fieldwork magnitude and larger experimental scale. A general Research and Teaching convention already started between the EPHE and the UMPC, pooling staff and materials of the teams. Their collaboration and scientific potential should be strengthened by a common adhesion to L-IPSL Labex which will favour their international visibility and justify the maintenance or development of their means.

Institut de Recherche pour le Développement (IRD)

Support letter from IRD for the Labex L-IPSL (translation from the letter by B. Dreyfus)

I, Bernard Dreyfus, Delegate Director for Science of Institut de Recherche pour le Développement (IRD), supports, on behalf of IRD, the LABEX project « L-IPSL » coordonated by Dr Hervé Le Treut, Director of IPSL, under CNRS / INSU responsability.

The Labex project L-IPSL gathers the six UMR participating in the IPSL, among which one UMR of excellence under IRD co-responsability (LOCEAN). IRD is moreover a direct sponsor of IPSL. Within LOCEAN and IPSL, IRD scientists work in full collaboration with their colleagues depending from other organisms and universities. They also have a close partnership with colleagues and students from South Country universities and organisms, particularly in Sub-Saharian Africa and Gulf of Guinea (AMMA), the Metiterranean Basin, the South-East and South-West Pacific, the Indian Ocean, and India, following the IRD specific research missions for developments, formation and innovations, as Research Operator and agency.

Issues concerning the climate variability and change and their consequences, and its predictability are among the very first priorities of IRD. For IRD an dits scientific partners in South Countries, as well as for stakeholders and the various socio-economic sectors in the Mediterranean Basin and the various tropical regions, climate process understanding, improved forecasts of the climate variability at intra-seasonal to inter-annual scales, and better scenarii of the climatic change at decadal to multi-decadal scales are major scientific and politic challenges for the next decades. The objectives are in particular to better predict and quantify the possible consequences of the climate variability and evolution on biochemical cycles, resources (water first), continental and marine ecosystems, biodiversity, health… The L-IPSL is an ambitious project, but based on a basis of scientific excellence, internationnally recognized. It clearly meets the IRD (an dits South partners) priorities.

The L-IPSL project includes an important formation axis, based on several Doctorate Schools, and in particular the ED129 (Sciences de l'Environnement en Ile-de-France). The international opening of the formation project is very clear, and corresponds to IRD priorities.

Finally, the L-IPSL project appears as federative, not only for the implied Ile-de-France laboratories, but also for IRD South partners. Its realisation,will undoubtly contribute to enhance the IPSL attractivity and international influence, as in research as in formation ane valorisation.

For all these reasons, IRD supports the Labex project L-IPSL.

Marseille, November 18, 2010-11-21

Bernard Dreyfus

Université Paris-Est Créteil (UPEC)

According to the agreement signed with the Ministry of Research and Education, environmental sciences are one of the strategic domains of research and teaching for UPEC. Thus, in that context, it is obvious that LISA is one of the most strategic laboratories for the University Paris-Est Creteil (UPEC). /

To support these activities, in the framework of the CPER (contract between the Region Ile de France and the state government), UPEC is constructing a 15 M€ new building called "Maison de l'Environnement". This 4000 m2, achieved in 2013, will provide to LISA new laboratory spaces, well instrumented and totally adapted to modern experimental research. The strategy of development of environmental research at UPEC is also based on the OSU (Observatory of Universe Sciences) in which 4 laboratories working on environmental sciences (LISA, LEESU, CEREA and CERTES). This OSU is organized to account for the role of the different partners acting on the PRES Paris-Est (as UPEC, UPMLV and ENPC) but also to associate the University Paris Diderot, one the partners of LISA.

Thus, it is obvious that UPEC wants to be associated to the organization and development of environmental sciences in the Ile de France region, especially to reinforce a well recognized position inside the European and international communities. For these reasons, UPEC strongly supports the involment in L-iPSL of the LISA scientific teams working on the dust cycle, the spectroscopy of species of high atmospheric interest and the exo-astrobiology.

Université Paris-Sud 11 (UPSUD)

The University of Paris-Sud Orsay is one of the major actors of the Pôle Climat Energie Environnement (PCEE) currently under constitution on the Paris Saclay campus. The IDES laboratory (Partner 10), member of the GEREPS (Groupe d'Enseignement et de Recherche en Environnement de l'Université de Paris-Sud), is one of the components of the University most involved in the study of environment and climate, more particularly in their connexions with surface envelops.

The strong links established in the frame of the PCEE with the LSCE (Partner 7) have led to the implementation of a geochemical analytical platform, whose reinforcement and extension is the goal of the proposal of EquipEx PACEC, led by UPSUD. The opportunity provided by the constitution of the L-IPSL LabEx, inside which the laboratories specialized in the study of the ocean and the atmosphere will work together with geologists and hydrologists studying the impact of global climate change on regional climates and water resources, will make UPSUD a stakeholder of one of the most important ensemble of research and teaching at worlwide level on the study of climate and of its evolution. UPSUD commits, at least, on maintaining his support to IDES, in terms of recurrent budget, human resources and hosting conditions and costs. In the case of an increase of the financial means attributed to the university, this commitment could be revised upwards, if the L-IPSL LabEx project is selected. In particular, the additional attribution, beyond recurrent attributions intended for maintaining the number of agents at a constant level, of one position of engineer and one position of teacher-researcher for the L-IPSL LabEx could be envisaged in this case.

Université Pierre et Marie Curie (UPMC)

Sponsored by the CNRS, the L-IPSL project is at the heart of the UPMC and Sorbonne Universities' strategy. Five mixed research units with a large number of teams involved in this LABEX are in fact under co-supervision at UPMC: LOCEAN, LMD, LPMAA, LATMOS and SISYPHE, with the first two evaluated at A+ by the AERES and the others at A. These teams have a major role to play in the development of synergies that this LABEX that will establish its leading role of Ile de France in the study of climate science. As a highly visible contributor to understanding all the different aspects of climate change, L-IPSL will lead the way in climate "services". This LABEX is a perfect complement to the LABEX ODYSSEE, which is sponsored by UPMC through the Sorbonne Universities' PRES. In fact, L-IPSL's first challenge is to break through the current barriers to the development of climate evolution prediction, on a decade and regional scale.

With Sorbonne University sponsorship, UPMC will support this strategic LABEX and will increase its commitment of personnel and finances to the concerned laboratories and their associated departments of research and education. This project will be included in the University's project strategy and integrated into the five-year contract with the State and the corresponding agreement with the CNRS.

To the extent that the University's global budget will allow, UPMC and Sorbonne Universits will commit, for the next four years (January 2011 - January 2015), to increasing significantly its support in terms of personnel (including specialists) for the LABEX partners under their supervision. During this period, the funding for teaching research professors, master's scholarships and the doctoral and post-doctoral contracts will be maintained, as will the annual budget allocations to departmental laboratories and the availability of each laboratory's premises and equipment.

Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)

Created in 1991, the "Université Versailles Saint-Quentin-en-Yvelines (UVSQ)" is active in a wide spectrum of domains. Research at UVSQ is conducted by 35 laboratories, 12 associated to research agencies (CEA, CNRS, INSERM), which contribute to the training of 700 PhD students. Research is developed with six strategic axes among which "environment and sustainable development". 18000 students benefit from a large choice of university courses.

Based on the interaction between sciences and technology, UVSQ strongly supports high-quality scientific production and innovation through a policy of resources, partnerships with the regional public authorities, research agencies (CEA, CNRS, INSERM), competitive clusters (Pôles de compétitivité, Mov'eo, System@TIC), eduction and research clusters *UniverSud Paris,* campus Paris Saclay, industrial groups, in particular car resign industry, offering a unique regional concentration of competences. UVSQ initiated the new cooperative fundations Fondaterra et Mov'éoTEC in 2009 2010. UVSQ is also firmly anchored in the Yvelines, part of the Ile de France region, participating to numerous collaborative projects (Domaines d'Intérêt Majeur) (DIM) with public authorities and the socio-economic environment.

UVSQ also implements an internationally oriented policy in numerous countries around the world, and in particular with the EU and the KIC Climate project (Knowledge and Innovation Community dedicated to climate).

Science concerned with the LabEx L-IPSL is one of the strategic axes UVSQ. The recently created "Observatoire des Sciences de l'Univers" of UVSQ called OVSQ reflects this choice. The OVSQ has a threefold mission: observation, research and training. In research, it brings together two major laboratories in physical sciences applied to the environment and climate studies (LSCE, LATMOS, partners of this proposal), a laboratory in humanities and social sciences (Research Laboratory in economics, ecology, eco-innovation and sustainable development engineering - REEDS, and European Center for Arctic Resaerch CEARC) and a medical research team in the field of epidemiology and relationships between environment and health. OVSQ plays a coordination role in 15 master's degrees in these fields. It is also responsible for 4 observation services, 4 databases of national interest, 8 instrumented platforms or modeling. Finally OVSQ is responsible for a technical platform located in Guyancourt, dedicated to testing and integration of sensors designed for space missions and observations under research balloons.

5.4. CONNECTIONS TO THE SOCIO-ECONOMIC WORLD

Responding to the growing demand for knowledge and innovation transfer constitutes one of the important missions of the L-IPSL, and the may source of connections with the socio-economic world.

These transfer activities are subject to opposite constraints, which give a very specific character to these connections:

- (1) The scientific information concerning climate and climate projections is quickly evolving with time. It is also subject to uncertainties, whose assessment requires a constant analysis effort. Without the direct participation of research institutes such as the L-IPSL, the transfer of knowledge to the economic world may be subject to bias, errors or misunderstanding
- (2) The solicitation of the L-IPSL laboratories by public or private actors is increasing very quickly and is far beyond what academic laboratories can manage themselves. There is a need for mediators, which can be the Universities or Grandes Ecoles supporting the L-IPSL (directly or through fundations), SMEs, dedicated structures such as the Climate KIC of the EIT, or the projected IEED CLAIRE.

In many cases, a triangular relation is required for these transfer applications to be successful, involving (i) the L-IPSL, (ii) a mediator, and (iii) the public or economic actors requesting information or expertise.

These economic actors are very numerous. The request for climate information may concern *inter alia*:

- the energy sector, with the evolution of heat/cold extremes and energy resources
- air quality and the emission abatement regulation, to evaluate co-beneficial (climate – air quality) emission scenarios
- water resource management: the primary required indicator is the change in mean river discharge, which can be combined with demographic data to construct the widely used water scarcity index. Other useful indicators relate to extreme flows (whether high flows which pose a problem of flooding vulnerability or low flows for water resource sustainability), but they carry much larger uncertainties.
- the carbon market and the development of sensors, with the development of regional carbon cycle accounting services using both observations of greenhouse gases from the ICOS infrastructure.

The L-IPSL laboratories have also established links with public actors involved in the planning of economic activities: ministries, regional councils, ADEME, coastal management board.

The L-IPSL will be actively implementing this triangular relation between economic actors, mediators, and research laboratories. Part of the funding required by the LabEx will serve to hire the services of one or several SMEs, which will be in charged of facilitating those exchanges. At the European level, the Climate KiC will also help developing projects that link research, innovation and training, with the ultimate aim of fostering climate adaptation and mitigation. The KiC will help to develop application projects together with European partners and industry.

In several well-focused cases, direct collaborations with agencies or industries are also possible. For example, the L-IPSL dynamics will enhance activities concerning climate change impact on hydrology. Over the last decade, Sisyphe, one of the new partners of L-IPSL, has pioneered multivariate analyses of climate change impacts on river systems (river regimes, ground water, water temperature and water quality). Specific care has been taken to regularly communicate the results to the stake holders involved, whether public (Ministry of Environment, ONEMA, water agencies, planning and navigation agencies, local actors) or industrial (water delivery, water treatment, consulting and engineering firms, innovative SMEs). This has been achieved through workshops and meetings which have progressively broadened their audience and highlighted new applied research questions, for which the L-IPSL project also offers new perspectives (such as the consequences of climate change on hydraulic management, or air conditioning activities, which require to make use of the cooling potential of rivers in large cities).

5.5. PULL EFFECT

The L-IPSL project is susceptible to attract additional funding and to create new opportunities in terms of innovative activities due to the large variety and complementarity of its partners.

(i) The L-IPSL project is first of all at the centre of a large array of academic partners and projects, and it will therefore be a major actor in submitting projects at the national, European and more widely international level.

At the national level, the L-IPSL is by construction organizing a work programme, which serves the interests of its 11 Institutes, Grandes Ecoles or Universities. The L-IPSL will also work in close collaboration with the OSUs (Observatoires des Sciences de l'Univers) of the Paris area (and elsewhere in France, in particular Toulouse, Grenoble and Brest), and it has a scientific proximity with the GAME/CNRM in Meteo-France, which implies a specific and reinforced collaboration. L-IPSL wishes to be a partner of various Idex in the Paris area, and in particular the ones presented by the Fondation pour le Plateau de Saclay and by Paris Sorbonne. The L-IPSL will contribute to the "Programmes Nationaux", managed by INSU, to space projects managed by CNES, to ANR projects, and will also develop new programs.

At the European level L-IPSL laboratories have contributed to numerous FP7 projects (several of them directly administrated by the IPSL). The IPSL is a participant of the Climate KIC of the EIT, and it is contributing to GMES.

At a more widely international level, the L-IPSL laboratories are leading projects within WCRP and IGBP, a situation which will be reinforced by the LabEx. The L-IPSL will in particular be a key actor of the Coupled Model Intercomparison Programme of the WCRP, which constitutes one of the bases for IPCC Assessment Reports. One of its main strengths is to be able to associate modelling and observational studies, in the domain of field campaigns or space missions.

(ii) **At all levels (national or international), the L-IPSL is also developing important academic interdisciplinary collaborations.** Climate Impact Studies very often involve other scientific disciplines than the ones represented within the L-IPSL consortium: ecology and biodiversity, epidemiology, social sciences, economy, … The laboratories of the L-IPSL have already a long tradition of cooperation with these different disciplines, which is presently taken in charge by the GIS (Consortium) "Climat Environment and Societies" and by the OSU. L-IPSL Laboratories are also leading projects from the ANR program "Changement Environnement et Planétaires", from the program "Gestion et Impact des Changements Climatiques") of the Ministry of Ecology, from the IDDRI (Institut pour le Développement Durable et les Relations Internationales) in relation with the EPE consortium (Entreprises pour l'Environnement).

It will collaborate with other Labex within the framework of the various Idex to which it is associated.

(iii) **The L-IPSL will develop a large partnership with economic actors, described in the corresponding section, and also a programme to develop innovative activities.** This interface between L-IPSL and economic actors concerns the transfer of knowledge and expertise, the technical capacities developed in terms of modelling and instrumentation, and education. The scientific uncertainties, which accompany the prediction of future climate change, create a large solicitation for scientific development, transfer of knowledge and expertise, and the L-IPSL will be a major contributor in these areas.

6. FINANCIAL AND SCIENTIFIC JUSTIFICATION FOR THE MOBILISATION OF THE RESOURCES

6.1. JUSTIFICATION FOR THE MOBILISATION OF THE RESOURCES

The specific funding of the LabEx is not expected to meet all the expenses generated by the L-IPSL project, in view of its size and ambition. It will necessarily serve as leverage money to provide scientific momentum and attract more resources. The proponents have therefore identified, for each type of action (research, training and education, valorisation) the key actions, which could bring new entrainment, by comparison to what the laboratories and the IPSL federation are able to realize with the current funding.

In terms of science, the priority is to develop a much stronger capacity to attract high level scientists – including trained engineers for instrumental and modelling "technical" issues. This action will concern a range of different profiles, from promising post-docs to experienced leaders. It is a necessary action to meet the objectives described in section 5.2.1 and the L-IPSL ambition to establish its teams at the best international level. It will constitute a tool to develop fluent and continuous relations with other similar reference institutions. The funding required for this matter will concern salaries and travel.

Increasing the international recognition of the L-IPSL is also one of the main priorities **in the area of education and communication**. This requires a range of different actions, and in particular dedicated funding to establish contacts with foreign universities. A strong priority will also be given to the organisation of *international thematic schools*. Part of the required budget will also be dedicated to professional training. Finally the international recognition of the L-IPSL excellence in research, education and valorisation should be reinforced through *the organisation of international conferences*. Such an emblematic action is required to amplify the French international exposure on climate studies. Organized every two years, this conference will be dedicated to the IPSL climate model and will gather international scientists, developers and users (including from private companies) to present the major evolutions of the model and federate a larger community around it. Alternating with this biennial conference, more focused international events will also be organized by L-IPSL.

Developing activities in the area of education and communication requires both human and technical resources As a *specific initial action* the L-IPSL will develop its capacity of teaching courses or organizing meetings with students/participants located on different sites. This is a key necessity to propose ambitious projects at the scale of L-IPSL, and it will motivate an initial spending of 500 k€ in equipment.

The valorisation of L-IPSL research and educational activities requires links with numerous national actors (SMEs, public and private partners in many different economic areas) and the finding of new funding sources (for example at the European level). These activities need to be developed at a higher level than is presently possible through the current support of the L-IPSL laboratories. The L-IPSL needs to develop an autonomous capacity in this area, and will develop it with the input of several SMEs, which will be contracted through the LabEx funding.

6.1.1 RESEARCH PROJECT

Research project: 400 k€/year

- *Equipement (coût unitaire supérieur à 4000 euros HT)*

No such equipment is required

- *Personnel cost*

L-IPSL will invest an estimated 320 k€ per year on hiring high level collaborators, in order to achieve the scientific goals described in the 5 WP and 3 TWP (see section 5.2.1). This will concern different profiles, with different salaries (to be modulated according to experience), and different duration. Reference costs are estimated as follows:

- High level scientist: 100 k€ / year
- Post-doc: 50 k€ / year
- Engineer: 55 k€ / year

Over a period of 10 years, each WP or TWP will be able to hire people from the different levels, but this will not be possible for each single year. The L-IPSL board will have to ensure the long-term equilibrium of the resource allocations between all WPs and TWPs, on the basis of their demands. The Board will establish tentatively a multi-annual plan, but will adjust it annually.

- *Subcontracting*

No subcontracting is planned.

- *Travel*

An estimated travel budget of 40k€ per year is necessary to support the hiring of high-level scientists, as mentioned above, but also to invite foreign scientists for shorter visits, a necessity to reinforce international collaborations, and to favour the participation of L-IPSL scientists to conferences and international meetings that have a strategic importance.

The attribution of those dedicated funds will also be managed by the L-IPSL Board, on the basis of the demands of the WPs and TWPs.

6.1.2 EDUCATIONAL PROJECT

Teaching and training project (200 k€/year + 500 k€ at the beginning)

A total sum of 200 k€ per year will be allocated to the education objectives described in §5.2.3, with a particular emphasis on the events specifically described in this financial demand: thematic schools and international conferences. This budget will therefore be spread on the following actions (the share corresponds to an average over several years)

- 50 k€ for the organization and the promotion of one international thematic school (“summer school”) per year

- 50 k€ for the development and the promotion of courses for PhD students and dedicated sessions for professional training
- 50 k€ for setting up a higher education program on Climate-Resources-Risks issues, open to English-speaking students and to collaborations with foreign universities: the use of the funding will evolve throughout the project, from the establishment of formal contacts with foreign universities, to the promotion of existing masters, the creation of new courses, and the management of their operating costs.
- 25 k€ to contribute to the organisation of the annual international conference alternatively on the IPSL climate model or on a more specific scientific topic. This spending is included here in the educational budget, but should also draw from the innovation component.
- 25 k€ to issue an internal call for innovative educational projects.

As for Research activities, the L-IPSL Board will ensure that the long-term equilibrium between those activities is well respected, by setting up a multi-annual plan with yearly revision.

At the beginning of the project, the implementation of the fast-track products will require a distributed and dedicated facility to teach courses and organise meetings with participants distributed in different locations.

A total initial sum of 500 k€ is required, with the following distribution:

- 100 k€ for 50 high-performance laptops configured as a deployable network for educational purposes and workshops
- 200 k€ to upgrade and equip one e-communication room in each L-IPSL partner
- 100 k€ to identify and promote an international path within existing masters associated to L-IPSL (meetings, high quality flyer creation and edition, contacts with target foreign universities)

In summary, the 200 k€/year will be distributed as follow:

- *Personnel cost*

The actions listed above require the hiring of two dedicated support persons:

- A communication engineer to organize and promote L-IPSL educational actions and coordinate the associated fund raising, necessary to develop new projects at an international level
- A scientific manager and editor to stimulate and coordinate projects of teaching manuals and teaching sessions for PhD students and professionals.

These persons need to be experienced and a tentative sum of 120 k€ should be allocated

- *Travel*

A 20 k€ budget will be used for missions dedicated to the increased internationalisation dimension of masters, travel expenses for the thematic schools, PhD courses, Professional training, preparation of proposals to answer EU or international calls on education, …

- *Other working costs*

- 10 k€ will be for editorial costs associated with the creation of teaching of e-teaching material
- 25 k€ will be allocated to the organization of an international conference
- 25 k€ will be allocated to an Internal call to fund innovative higher education projects issued from L-IPSL partners and consistent with L-IPSL objectives.

6.1.3 EXPLOITATION OF RESULTS

Valorisation (200 k€)

The specific section on valorisation describes the large spectrum of activities, which are expected from the L-IPSL in this area. A yearly budget of 200 k€ will be dedicated to it from the Labex funding. It will serve different needs (with approximate share indicated):

- Increase the efficiency of fund rising (**60 k€** to get the help of a dedicated “Chargé d’affaires”)

- Assist the development of educational projects, which are oriented toward the economic world (including part of the international conferences mentioned above) and find an association with communication professionals**. (40 k€)**
- Set up projects with SMEs or industries to develop pilot applications in complement to those in IEED CLAIRE. This may concern in particular regional climate applications and a data distribution facility, as emphasized in the proposals **(60 k€)**
- Support and promote the development of spin-off activities – possibly through the set up of Cifre thesis contracts. **(40 k€)**

As explained above, the LabEx funding can only be a part of what it ultimately required to develop those projects. The L-IPSL will have to rely both on its internal capacities, and on external funding. The LabEx funding, for each of the activities listed above, will be used to find the help of subcontractors, and develop skills (in particular human skills), which are not currently present within the L-IPSL.

6.1.4 GOVERNANCE

- *Missions/ Travel (30 k€)*

The L-IPSL activities will be regularly examined by a Scientific Advisory Council, in which external personalities will participate An annual budget of 30 k€ will be used to take in charge their travel expenses.

7. APPENDICES

7.1. STATE OF THE ART AND SCIENTIFIC PROGRAMME REFERENCES

References:

1. **Bony S**., et al. (2006) How well do we understand and evaluate climate change feedback processes ? *J. Climate*, 19 (15) :3445-3482.
2. **Coll, I., Lasry F.,** Fayet S., Armengaud A., **Vautard R**. (2009) Simulation and evaluation of 2010 emission control scenarios in a Mediterranean area, *Atmos. Environ*., 43(27), 4194-4204
3. deMenocal, P. B., Ortiz, J., Guilderson, T., Adkins, J., Sarnthein, M., Baker, L., and Yarusinsky, M. (2000) Abrupt Onset and Termination of the African Humid Period: Rapid Climate Response to Gradual Insolation Forcing, *Quat. Sci. Rev.*19, 347–361.
4. **Ducharne A**, Baubion C, Beaudoin N, Benoit M, **Billen G**, Brisson N, **Garnier J**, Kieken H, Lebonvallet S, Ledoux E, Mary B, Mignolet C, Poux X, Sauboua E, Schott C, **Théry S**, Viennot P (2007). Long term prospective of the Seine river system: Confronting climatic and direct anthropogenic changes. *Science of the Total Environmen*t, 375, 292-31.
5. Forster, P., et al. (2007) Changes in atmospheric constituents and in radiative forcing. Climate Change 2007: The Scientific Basis, S. Solomon et al., Eds., Cambridge University Press, 129234.
6. Francis, J. A., Chan, W., Leathers, D. J., Miller J., R., and Veron, D. E., 2009. Winter Northern Hemisphere weather patterns remember summer Arctic sea-ice extent. Geophys. Res. Lett., 36, doi:10.1029/2009GL037274.
7. **Garnier J.**, Beusen A., **Thieu V.**, **Billen G.**, Bouwman L. (2010). N:P:Si nutrient export ratios and ecological consequences in coastal seas evaluated by the ICEP approach. Special issue “Past and Future Trends in Nutrient Export from Global Watersheds and Impacts on Water Quality and Eutrophication”, *Global Biogeochem. Cycles*, 24, GB0A05, doi:10.1029/2009GB003583.
8. **Grandpeix, J.-Y**., and Lafore J.-L. (2010) A Density Current Parameterization Coupled with Emanuel’s Convection Scheme. Part I: The Models. *J. Atmos. Sci*., 67, 881–897.
9. **Haeffelin, M.,** et al., 2005: SIRTA: A ground-based atmospheric observatory for cloud and aerosol research. Annales Geophysicae, 23, 253-275.
10. Hawkins and Sutton (2009) The potential to narrow uncertainty in regional climate predictions', *BAMS*, 90, p1095, doi: 10.1175/2009BAMS2607.1
11. **Hourdin, F., I. Musat, F.** Guichard, P. M. Ruti, F. Favot, M.-A. Filiberti,* M. Pham, **J.-Y. Grandpeix, J. Polcher,** P. Marquet, A. Boone, J.-P. Lafore, J.-L. Redelsperger, A. Dell’aquila, T. Losada Doval, A. K. Traore, and H. Gallée (2010) AMMA-Model Intercomparison Project ,BAMS, 91 : 95-+

12. **Houssais, M-N**, et al (2007), Arctic salinity anomalies and their link to the North Atlantic during a positive phase of the Arctic Oscillation. Progress in Oceanography, 73, 160-189.
13. **Janicot. S**., J.P. Lafore and C.D. Thorncroft (2010) The West African monsoon. In The Global Monsoon System : Research and Forecast, 2nd Edition, World Scientific Publication Company, WMO, 27pp, In press.
14. Jones, P.D., and M.E. Mann (2004) Climate over past millennia, *Rev. Geophys*. 42(2), RG2002, doi:10.1029/2003RG000143.
15. Katz, 2002
16. **Lenton, T.M**., Held, H., Kriegler, E., Hall, J.W., Lucht, W., Rahmstorf, S., and Schellnhuber, H.J. (2008) Tipping elements in the Earth's climate system, *Proc. Nat. Am. Soc*. 105, 1786-1793, doi 10.1073 pnas.0705414105.
17. **Marti O., P. Braconnot, J.-L. Dufresne, J. Bellier, R. Benshila, S. Bony, P. Brockmann, P. Cadule, A. Caubel and F. Codron, et al., (2009)** Key features of the IPSL ocean atmosphere model and its sensitivity to atmospheric resolution. *Climate Dynamics*, Volume 34, 1-26.
18. Muscheler, R., et al. (2007) Solar activity during the last 1000 years inferred from radionuclide records, *Quat. Sci. Rev*., 26, 82-97.
19. **Piao S.**, **Friedlingstein P.**, **Ciais P.**, **de Noblet, N.**, Labat, D. and **Zaehle S.** (2007). Changes in climate and land use have a larger direct impact than rising CO2 on global river runoff trends, *PNAS*, 104, 15242.
20. Rahmstorf, S (2000) The Thermohaline Ocean Circulation: A system with dangerous thresholds?, *Clim. Change* 46, 247–256.
21. Rial, J.A., Pielke, R.A., Beniston, M., Claussen, M., Canadell, J., Cox, P. Held, H., **De Noblet-Ducoudré, N.**, Prinn, R., Reynolds, J.F., and Salas, J.D. (2004). Nonlinearities, feedbacks and critical thresholds within the Earth's climate system, *Clim. Change* 65, 11-38.
22. **Rio, C., F. Hourdin, J.-Y. Grandpeix**, and J.-P. Lafore, (2009,) Shifting the diurnal cycle of parameterized deep convection over land, *Geophys. Res. Lett*., 36, 7809
23. Rohling, E. and Palike, H. (2005) Centennial-scale climate cooling with a sudden cold event around 8,200 years ago, Nature 434, 975-979.
24. Roudier P., **Sultan B., Quirion P., Berg A**. (2010) The impact of future climate change on West African agriculture: what does the recent literature say? *Global Environmental Change*, accepted with minor revisions.
25. Seneviratne et al 2006, Land-atmosphere coupling and climate change in Europe, Nature, 443, 295-209.
26. Swingedouw D., **Braconnot P**., Delecluse P., Guilyardi E. and Marti O. (2007) Quantifying the AMOC feedbacks during a 2xCO2 stabilization experiment with land-ice melting. *Climate Dynamics* 29: 521-534
27. **Vautard R.**, **Cattiaux J.**, **Yiou P.**, Thépaut J.-N., **Ciais P.** (2010). Northern Hemisphere atmospheric stilling partly attributed to an increase in surface roughness, *Nature Geoscience*, 3, 756-761.

7.2. PARTNERS' REFERENCES AND LIST OF ACRONYMS

List of references

As indicated in the ANR document, references are given for each laboratory. We intentionally retained a particular year (2009) and only retained the Peer reviewed papers for which at least one author is both in this laboratory and a contributor of the L-IPSL proposal. Because of the numerous collaborations inside IPSL, this of course implies a significant degree of redundancy.

Peer-reviewed papers for 2009

Partner 3: LPMAA – UMR 7092

1. Butz A., H. Bösch, **C. Camy-Peyret,** M. P. Chipperfield, M. Dorf, S. Kreycy, L. Kritten, C. Prados-Roman, J. Schwärzle, K. Pfeilsticker (2009) Constraints on inorganic gaseous iodine in the stratosphere inferred from balloon-borne solar occultation observations. Atmos. *Chem. Phys. Discussions*, 9, 14645–14681
2. Butz, A., H. Bosch, **C. Camy-Peyret,** M. P. Chipperfield, M. Dorf, S. Kreycy, L. Kritten, C. Prados-Roman, J. Schwarzle, K. Pfeilsticker (2009) Constraints on inorganic gaseous iodine in the tropical upper troposphere and stratosphere inferred from balloon-borne solar occultation observations. *Atmos. Chem. Phys*., 18, 7229–7242

3. **Claveau, C.,** A. Valentin, (2009) Narrowing and broadening parameters for H2O lines perturbed by helium, argon and xenon in the 1170-1440 cm-1 spectral range. *J. Mol. Phys*. 107: 14 1417-1422, doi:10.1080/00268970902911404
4. Clerbaux C., Wespes C., Clarisse L., Hurtmans D., **Payan S., Camy-Peyret C.,** Coheur P.F., Razavi A. et al, (2009) Characterization of methane retrievals from the IASI space-borne sounder. *Atmos. Chem. and Phys*., 9, 20, 7889-7899
5. **Deng, W.P., D. Mondelain,** F. Thibault, **C. Camy-Peyret,** A.W. Mantz (2009) Experimental He-pressure broadening for the R(10) and P(2) lines in the nu(3) band of (CO2)-C-13, and experimental pressure shifts for R(10) measured at several temperatures between 300 K and 100 K. *J. Mol. Spect*., 256, 1 102-108, doi: 10.1016/j.jms.2009.02.021
6. Gomez, L., D. Jacquemart, N. Lacome, **J.-Y. Mandin** (2009) Line intensities of 12C2H2 in the 7.7 μm spectral region. J. *Quant. Spectrosc. Radiat. Transfer*, 110-18 2102-2114, doi:10.1016/j.jqsrt.2009.05.018,
7. Jacquemart, D., N. Lacome, **J.-Y. Mandin** (2009) Line intensities of 12C2H2 in the 1.3, 1.2, and 1 μm spectral regions. *J. Quant. Spectrosc. Radiat. Tranfer* (special issue HITRAN), 110 733-742, doi: 10.1016/j.jqsrt.2008.11.009
8. Jacquemart, D., N. Lacome, **J.-Y. Mandin, V. Dana,** H. Tran, F.K. Gueye, O.M. Lyulin, V.I. Perevalov, L. Régalia-Jarlot (2009) The IR spectrum of 12C2H2: line intensity measurements in the 1.4 μm region and update of the databases. *J. Quant. Spectrosc. Radiat. Transfer* (special issue HITRAN), 110 717-732 doi:10.1016/j.jqsrt.2008.10.002,
9. Keim C., Eremenko M., Orphal J., Dufour G., Flaud J.-M., Höpfner M., Boynard A., Clerbaux C., **Payan S**., Coheur P.-F., Hurtmans D., Claude H., Dier H., Johnson B., Kelder H., Kivi R., Koide T., López Bartolomé M., Lambkin K., Moore D., J. Schmidlin F., Stübi R., (2009) Tropospheric ozone from IASI: comparison of different inversion algorithms and validation with ozone sondes in the northern middle latitudes. *Atmos. Chem. Phys*., 9, 24 9329-9347
10. Lyulin, O.M., V.I. Perevalov, H. Tran **J.-Y. Mandin, V. Dana**, L. Régalia-Jarlot, X. Thomas et D. Décatoire, (2009) Line intensities of acetylene: New measurements in the 1.5-μm spectral region and global modelling in the $\Delta P = 10$ series. *J. Quant. Spectrosc. Radiat. Transfer,* 110 1815-1824 http://dx.doi.org/10.1016/j.jqsrt.2009.04.012.
11. **Payan, S., C. Camy-Peyret**, H. Oelhaf, G. Wetzel, G. Maucher, C. Keim, M. Pirre[3], N. Huret, A. Engel, M. C. Volk, H. Kuellmann, J. Kuttippurath, U. Cortesi, G. Bianchini, F. Mencaraglia, P. Raspollini, G. Redaelli, C. Vigouroux, M. De Mazière, S. Mikuteit, T. Blumenstock, V. Velazco, J. Notholt, E. Mahieu, P. Duchatelet, D. Smale, S. Wood, N. Jones, C. Piccolo, V. Payne, A. Bracher, N. Glatthor, G. Stiller, K. Grunow, **P. Jeseck**, **Y. Te**, and A. Butz (2009) Validation of version-4.61 methane and nitrous oxide observed by MIPAS. *Atmos. Chem. Phys*., 9, 413-442
12. Rothman, L.S., I.E. Gordon, A. Barbe, D. Chris Benner, P.F. Bernath, M. Birk, L.R. Brown, V. Boudon, J.P. Champion, K. Chance, L.H. Coudert, V. Dana, S. Fally, J.M. Flaud, R.R. Gamache, A. Goldman, D. Jacquemart, N. Lacome, **J.Y. Mandin**, S.T. Massie, S. Mikhailenko, A. Nikitin, et al, (2009) The HITRAN 2008 Molecular Spectroscopic database. *J. Quant. Spectrosc. Radiat. Transfer* (special issue HITRAN), 110 533-572 – DOI: 10.1016/j.jqsrt.2009.02.013
13. Sussmann, R., T. Borsdorff, M. Rettinger, **C. Camy-Peyret**, P. Demoulin, P. Duchatelet, E. Mahieu, C. Servais (2009) Technical Note: Harmonized retrieval of column-integrated atmospheric water vapor from the FTIR network – first examples for long-term records and station trends. *Atmos. Chem. Phys*., 9, 8987-8999
14. **Té, Y., P. Jeseck, I.Pépin C.Camy-Peyret** (2009) A method to retrieve blackbody temperature errors in the two points radiometric calibration. *Infrared Physics & Technology*, 2009 52, 187-192

Partner 4: LOCEAN (UMR 7159)

15. Alencar, J.; Rodriguez-Fernández, J.; **Dégallier, N.**; Marcondes, C. B.; Costa, J. M. & Érico Guimarães, A. (2009), 'Multivariate Discrimination Between Two Cryptic Haemagogus Species Associated with the Transmission of Yellow Fever Virus in the Americas', *Journal of the American Mosquito Control Association* **25**(1), 18-24.
16. Álvarez, M.; **Lo Monaco, C.**; Tanhua, T.; Yool, A.; Oschlies, A.; Bullister, J. L.; Goyet, C.; **Metzl, N.**; Touratier, F.; McDonagh, E. & Bryden, H. L. (2009), 'Estimating the storage of anthropogenic carbon in the subtropical Indian Ocean: a comparison of five different approaches', *Biogeosciences* **6**, 681-703.
17. Alves, J. M. B.; **Servain, J.** & Campos, J. N. B. (2009), 'Relationship between ocean climatic variability and rain-fed agriculture in northeast Brazil', *Climate Research* **38**(3), 225-236.

18. Amorim, M.; Moreira-Turcq, P.; **Turcq, B.** & Cordeiro, R. (2009), 'Source and deposition dynamics of surficial sediments in the floodplain Várzea do Lago Grande de Curuai, Pará, Brazil', *Acta Amazônica* **39**(1), 155-162.
19. Andréfouët, S.; **Cabioch, G.;** Flamand, B. & Pelletier, B. (2009), 'A reappraisal of the diversity of geomorphological and genetic processes of New Caledonian coral reefs : a synthesis from optical remote sensing, coring and acoustic multibeam observations', *Coral Reefs* **28**, 691-707.
20. Araújo, M.; Limongi, C.; **Servain, J.**; Silva, M. & Lentini, C. A. D. (2009), 'Salinity-induced mixed and barrier layers in the southwestern tropical Atlantic Ocean off the northeast of Brazil', *Ocean Science Discussions* **6**, 557-579.
21. **Atmadipoera, A.**; **Molcard, R.**; **Madec, G**.; Wijffels, S.; Sprintall, J.; Koch-Larrouy, A.; Jaya, I. & Supangat, A. (2009), 'Characteristics and variability of the Indonesian throughflow water at the outflow straits', *Deep Sea Research Part I: Oceanographic Research Papers* **56**(11), 1942-1954.
22. Aubert, A.; **Lazareth, C. E.**; **Cabioch, G.**; Boucher, H.; Yamada, T.; Iryu, Y. & Farman, R. (2009), 'The tropical giant clam Hippopus hippopus shell, a new archive of environmental conditions as revealed by sclerochronological and ∂18O profiles', *Coral Reefs* **18**(4), 989-998.
23. Bach, P.; Gaertner, D.; **Menkès, C. E**.; Romanova, E. & Travassos, P. (2009), 'Effects of the gear deployment strategy and current shear on pelagic longline shoaling', *Fisheries Research* **95**, 55-64.
24. Bayon, G.; Loncke, L.; Dupré, S.; Caprais, J.-C.; Ducassou, E.; Duperron, S.; Etoubleau, J.; Foucher, J.-P.; Fouquet, Y.; Gontharet, S.; Henderson, G.; Huguen, C.; Klaucke, I.; Mascle, J.; Migeon, S.; Roy, K. O.-L.; Ondréas, H.; **Pierre, C.**; Sibuet, M.; Stadnitskaia, A. & Woodside, J. (2009), 'Multi-disciplinary investigation of fluid seepage on an unstable margin: The case of the Central Nile deep sea fan', *Marine Geology* **261**(1-4), 92-104.
25. Bellenger, H.; Duvel, J.-P.; **Lengaigne, M.** & Van, P. L. (2009), 'Impact of organized intraseasonal convective perturbations on the tropical circulation', *Geophysical Research Letters* **36**(16703).
26. Born, A.; Levermann, A. & **Mignot, J.** (2009), 'Sensitivity of the Atlantic Ocean circulation to a hydraulic overflow parameterisation in a coarse resolution model', *Ocean Modelling* **27**(3-4), 130-142.
27. **Bouloubassi, I.**; Nabais, E.; Pancost, R. D.; **Lorre, A.** & **Taphanel, M.-H.** (2009), 'First biomarker evidence for methane oxidation at cold seeps in the Southeast Atlantic (REGAB pockmark)', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(23), 2239-2247.
28. Bourguet, N.; Goutx, M.; Ghiglione, J.-F.; Pujo-Pay, M.; Mével, G.; **Momzikoff, A.**; Mousseau, L.; Guigue, C.; Garcia, N.; Raimbault, P.; Pete, R.; Oriol, L. & Lefèvre, D. (2009), 'Lipid biomarkers and bacterial lipase activities as indicators of organic matter and bacterial dynamics in contrasted regimes at the DYFAMED site, NW Mediterranean', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(18), 1454-1469.
29. Bourras, D.; Weill, A.; Caniaux, G.; **Eymard, L.**; Bourlès, B.; Letourneur, S.; Legain, D.; Key, E.; Baudin, F.; Piguet, B.; Traullé, O.; Bouhours, G.; Sinardet, B.; Barrié, J.; Vinson, J. P.; Boutet, F.; Berthod, C. & Clémençon, A. (2009), 'Turbulent air-sea fluxes in the Gulf of Guinea during the AMMA experimentation', *Journal of Geophysical Research* **114**, C04014.
30. **Boutin, J.** & **Merlivat, L.** (2009), 'New in situ estimates of carbon biological production rates in the Southern Ocean from CARIOCA drifter measurements', *Geophysical Research Letters* **36**, L13608.
31. **Boutin, J.**; Quilfen, Y.; **Merlivat, L.** & Piolle, J. F. (2009), 'Global average of air-sea CO2 transfer velocity from QuikSCAT scatterometer wind speeds', *Journal of Geophysical Research* **114**, C04007.
32. **Brochier, T.**; **Colas, F.**; Lett, C.; **Echevin, V.**; Cubillos, L.; Tam, J.; Chlaida, M.; Mullon, C. & Fréon, P. (2009), 'Small pelagic fish reproductive strategies in upwelling systems: A natal homing evolutionary model to study environmental constraints', *Progress in Oceanography* **83**(1-4), 216-269.
33. Burr, G.; Beck, J.; Corrège, T.; **Cabioch, G.**; Taylor, F. & Donahue, D. (2009), 'Modern and Pleistocene reservoir ages inferred from South Pacific corals', *Radiocarbon* **51**, 319-335.
34. **Chaigneau, A.**; Eldin, G. & Dewitte, B. (2009), 'Eddy activity in the four major upwelling systems from satellite altimetry (1992-2007)', *Progress in Oceanography* **83**(1-4), 117-123.
35. Chazottes, V.; **Cabioch, G.**; Golubic, S. & Radtke, G. (2009), 'Bathymetric zonation of modern microborers in dead coral substrates from New Caledonia–Implications for paleodepth reconstructions in Holocene corals', *Palaeogeography, Palaeoclimatology, Palaeoecology* **280**(3-4), 456-468.
36. Claud, C.; Carleton, A. M.; Duchiron, B. & **Terray, P.** (2009), 'Atmospheric and upper ocean environments of Southern Ocean polar mesocyclones in the transition seasons, and associations with teleconnections', *Journal of Geophysical Research* **114**, D23104.
37. Claud, C.; Carleton, A. M.; Duchiron, B. & **Terray, P.** (2009), 'Southern Hemisphere winter cold-air mesocyclones: climatic environments and associations with teleconnections', *Climate Dynamics* **33**, 383-408.

38. Cravatte, S. & **Menkès, C. E.** (2009), 'Sensitivity of mixed layer heat budgets to wind forcing: A case study for the equatorial Pacific cold tongue', *Ocean Modelling* **23**(3), 198-212.

39. Debenay, J.-P. & Fernandez, J.-M. (2009), 'Benthic foraminifera records of complex anthropogenic environmental changes combined with geochemical data in a tropical bay of New Caledonia (SW Pacific)', *Marine Pollution Bulletin* **59**(8-12), 311-322.

40. Debenay, J.-P.; Patrona, L. D.; Herbland, A. & Goguenheim, H. (2009), 'Colonization of coastal environments by Foraminifera: Insight from shrimp ponds in New Caledonia', *Journal of Foraminiferal Research* **39**, 249-266.

41. Debenay, J.-P.; Patrona, L. D.; Herbland, A. & Goguenheim, H. (2009), 'The impact of Easily Oxidized Material (EOM) on the meiobenthos: Foraminifera abnormalities in Shrimp ponds of New Caledonia; implications for environment and paleoenvironment survey', *Marine Pollution Bulletin* **59**(8-12), 323-335.

42. Doney, S. C.; Tilbrook, B.; Roy, S.; **Metzl, N.**; Quéré, C. L.; Hood, M.; Feely, R. A. & Bakker, D. (2009), 'Surface-ocean CO2 variability and vulnerability', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(8-10), 504-511.

43. Drobinski, P.; Bastin, S.; **Janicot, S.**; Bock, O.; Dabas, A.; Delville, P.; Reitebuch, O. & **Sultan, B.** (2009), 'On the late northward propagation of the West African monsoon in summer 2006 in the region of Niger/Mali,', *Journal of Geophysical Research D: Atmospheres* **114**, D09108.

44. **Duteil, O.**; **Lazar, A.**; **Dandonneau, Y.**; Wainer, I. & **Menkès, C. E.** (2009), 'Deep chlorophyll maximum and upper ocean structure interactions: Case of the Guinea Thermal Dome', *Journal of Marine Research* **67**(2), 239-271(33).

45. Duvel, J.-P.; Basdevant, C.; Bellenger, H.; **Reverdin, G.**; Vargas, A. & **Vialard, J.** (2009), 'The Aeroclipper: : A New Device to Explore Convective Systems and Cyclones', *Bulletin of the American Meteorological Society* **90**(1), 63-71.

46. Emile-Geay, J. & **Madec, G.** (2009), 'Geothermal heating, diapycnal mixing and the abyssal circulation', *Ocean Science* **5**(2), 203-217.

47. Er-Raioui, H.; Bouzid, S.; Marhraoui, M. & **Saliot, A.** (2009), 'Hydrocarbon pollution of the Mediterranean coastline of Morocco', *Ocean & Coastal Management* **52**(2), 124-129.

48. **Éric Guilyardi**; Braconnot, P.; Jin, F.-F.; Kim, S. T.; **Kolasinski, M.**; Li, T. & Musat, I. (2009), 'Atmosphere feedbacks during ENSO in a coupled GCM with a modified atm ospheric convection scheme', *Journal of Climate* **22**(21), 5698-5718.

49. **Éric Guilyardi**; Wittenberg, A.; Fedorov, A.; Collins, M.; Wang, C.; Capotondi, A.; van Oldenborgh, G. J. & Stockdale, T. (2009), 'Understanding El Niño in Ocean-Atmosphere General Circulation Models: Progress and Challenges', *Bulletin of the American Meteorological Society* **90**(3), 325-340.

50. Fontaine, B.; Garcia-Serrano, J.; Roucou, P.; Rodriguez-Fonseca, B.; Losada, T.; Chauvin, F.; Gervois, S.; Sijikumar, S.; Ruti, P. & **Janicot, S.** (2009), 'Impacts of Warm and Cold situations in the Mediterranean Basins on the West African monsoon: observed connection patterns (1979-2006) and climate simulations', *Climate Dynamics*, 0930-7575 (Print) 1432-0894 (Online).

51. Foucher, J.-P.; Westbrook, G.; Boetius, A.; Ceramicola, S.; Dupré, S.; Mascle, J.; Mienert, J.; Pfannkuche, O.; Pierre, C. & Praeg, D. (2009), 'Structure and Drivers of Cold Seep Ecosystems', *Oceanography* **22**(1), 92-109.

52. **Frankignoul, C.**; Deshayes, J. & Curry, R. (2009), 'The role of salinity in the decadal variability of the North Atlantic meridional overturning circulation', *Climate Dynamics* **33**(6), 777-793.

53. Gontharet, S.; Stadnitskaia, A.; **Bouloubassi, I.**; **Pierre, C.** & Damsté, J. S. S. (2009), 'Palaeo methane-seepage history traced by biomarker patterns in a carbonate crust, Nile deep-sea fan (Eastern Mediterranean Sea)', *Marine Geology* **261**(1-4), 105-113.

54. Griffies, S. M.; Biastoch, A.; Böning, C.; Bryan, F.; Danabasoglu, G.; Chassignet, E. P.; England., M. H.; Gerdes, R.; Haak, H.; Hallberg, R. W.; Hazeleger, W.; Jungclaus, J.; Large, W. G.; **Madec, G.**; Pirani, A.; Samuels, B. L.; Scheinert, M.; Gupta, A. S.; Severijns, C. A.; Simmons, H. L.; Tréguier, A.-M.; Winton, M.; Yeager, S. & Yin, J. (2009), 'Coordinated Ocean-ice Reference Experiments (COREs)', *Ocean Modelling* **26**, 1-46.

55. Gutiérrez, D.; Sifeddine, A.; Field, D. B.; **Ortlieb, L.**; Vargas, G.; Chavez, F.; Velazco, F.; Ferreira, V.; Tapia, P.; Salvatteci, R.; Morales, M.; Valdes, J.; Reyss, J.; Campusano, A.; Boussafir, M.; Yogo, M. M.; García, M. & Baumgartner, T. (2009), 'Rapid reorganization in ocean biogeochemistry off Peru towards the end of the Little Ice Age', *Biogeosciences* **6**, 835-848.

56. Guzman, N.; Dauphin, Y.; Cuif, J.; Denis, A. & **Ortlieb, L.** (2009), 'Diagenetic changes in Concholepas concholepas shells (Gastropoda, Muricidae) in the hyper-arid conditions of Northern Chile - implications for palaeoenvironmental reconstructions', *Biogeosciences* **6**(2), 197-207.

57. **Hannart, A.**; Dufresne, J.-L. & Naveau, P. (2009), 'Why climate sensitivity may not be so unpredictable', *Geophysical Research Letters* **36**, L16707.

58. Hoppema, M. A.; Velo, A.; van Heuven, S.; Tanhua, T.; Key, R. M.; Lin, X.; Bakker, D. C. E.; Perez, F. F.; Ríos, A. F.; **Lo Monaco, C.**; Sabine, C. L.; Álvarez, M. & Bellerby, R. (2009), 'Consistency of cruise data of the CARINA database in the Atlantic sector of the Southern Ocean', *Earth System Science Data* **2**, 331-365.

59. Huguen, C.; Foucher, J.-P.; Mascle, J.; Ondréas, H.; Thouement, M.; Gontharet, S.; Stadnitskaia, A.; **Pierre, C.**; Bayon, G.; Loncke, L.; Boetius, A.; **Bouloubassi, I.**; de Lange, G.; Caprais, J.; Fouquet, Y.; Woodside, J.; Dupré, S. & the NAUTINIL Scientific Party (2009), 'Menes caldera, a highly active site of brine seepage in the Eastern Mediterranean sea: "In situ" observations from the NAUTINIL expedition (2003)', *Marine Geology* **261**(1-4), 138-152.

60. Iryu, Y.; **Cabioch, G.**; Chen, D.; Matsuda, H. & Piller, W. E. (2009), 'Special Issue: Preface', *Sedimentary Geology* **214**(1-4), 1-2.

61. Ishii, M.; Inoue, H. Y.; Midorikawa, T.; Saito, S.; Tokieda, T.; Sasano, D.; Nakadate, A.; Nemoto, K.; **Metzl, N.**; Wong, C. & Feely, R. A. (2009), 'Spatial variability and decadal trend of the oceanic CO2 in the western equatorial Pacific warm/fresh water', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(8-10), 591-606.

62. **Janicot, S.** (2009), 'A comparison of Indian and African monsoon variability at different time scales', *Comptes Rendus Geoscience* **341**(8-9), 575-590.

63. **Janicot, S.**; **Sultan, B.**; **Mounier, F.**; Hall, N. M. J.; Leroux, S. & Kiladis, G. N. (2009), 'Dynamics of the West African Monsoon. Part IV: Analysis of 25-90-Day Variability of Convection and the Role of the Indian Monsoon', *Journal of Climate* **22**(6), 1541-1565.

64. Kageyama, M.; **Mignot, J.**; Swingedouw, D.; Marzin, C.; Alkama, R. & Marti, O. (2009), 'Glacial climate sensitivity to different states of the Atlantic Meridional Overturning Circulation : results from the IPSL model Climate of the past', *Climate Past Discuss.* **5**, 551-570.

65. **Krémeur, A.-S.**; **Lévy, M.;** Aumont, O. & **Reverdin, G.** (2009), 'Impact of the subtropical mode water biogeochemical properties on primary production in the North Atlantic: New insight from an idealized model study', *Journal of Geophysical Research* **114**, C07019.

66. **Laurian, A.**; **Lazar, A.** & **Reverdin, G.** (2009), 'Generation mechanism of spiciness anomalies: an OGCM analysis in the North Atlantic subtropical gyre', *Journal of Physical Oceanography* **39**(4), 1003-1018.

67. Lavaysse, C.; Flamant, C.; **Janicot, S.**; Parker, D.; Lafore, J.-P.; **Sultan, B.** & Pelon, J. (2009), 'Seasonal evolution of the West African heat low: a climatological perspective', *Climate Dynamics* **33**, 313-330.

68. **Leclair, M.** & **Madec, G.** (2009), 'A conservative leapfrog time stepping method', *Ocean Modelling* **30**(2-3), 88-94.

69. **Lefèvre, N.** (2009), 'Low CO2 concentrations in the Gulf of Guinea during the upwelling season in 2006', *Marine Chemistry* **113**(1-2), 93-101.

70. **Lengaigne, M.**; **Madec, G.**; Bopp, L.; **Menkès, C. E.**; Aumont, O. & Cadule, P. (2009), 'Bio-physical feedbacks in the Arctic Ocean using an Earth system model', *Geophysical Research Letters* **36**, L21602.

71. **Lenton, A.**; Bopp, L. & Matear, R. J. (2009), 'Strategies for high-latitude northern hemisphere CO2 sampling now and in the future', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(8-10), 523-532.

72. **Lenton, A.**; Codron, F.; Bopp, L.; **Metzl, N.**; Cadule, P.; Tagliabue, A. & Sommer, J. L. (2009), 'Stratospheric ozone depletion reduces ocean carbon uptake and enhances ocean acidification', *Geophysical Research Letters* **36**, L12606.

73. **Lévy, M.**; Klein, P. & Jelloul, M. B. (2009), 'New production stimulated by high-frequency winds in a turbulent mesoscale eddy field', *Geophysical Research Letters* **36**(16), L16603.

74. Lietard, C. & **Pierre, C.** (2009), 'Isotopic signatures (*∂*18O and *∂*13C) of bivalve shells from cold seeps and hydrothermal vents', *Geobios* **42**(2), 209-219.

75. Lloyd, J.; **Éric Guilyardi**; Weller, H. & Slingo, J. (2009), 'The role of atmosphere feedbacks during ENSO in the CMIP3 models', *Atmospheric Science Letters* **10**(3), 170-176.

76. **Lo Monaco, C.**; Álvarez, M.; Key, R. M.; Lin, X.; Tanhua, T.; Tilbrook, B.; Bakker, D. C. E.; van Heuven, S.; Hoppema, M.; **Metzl, N.**; Ríos, A. F.; Sabine, C. L. & Velo, A. (2009), 'Assessing the internal consistency of the CARINA database in the Indian sector of the Southern Ocean', *Earth System Science Data Discussions* **2**(1), 367-419.

77. Losada, T.; Rodriguez-Fonseca, B.; **Janicot, S.**; **Gervois, S.**; Chauvin, F. & Ruti, P. (2009), 'A multi-model approach to the Atlantic equatorial mode. Impact on the West African monsoon', *Climate Dynamics*.

78. Marengo, J.; Baez, J. & **Ronchail, J.** (2009), 'Chapter 7 Regional Climate, d. South America, 2) Tropical South America East of the Andes in "State of the Climate in 2008"', *Bulletin of the American Meteorological Society* **90**, S1-S196.

79. Marzeion, B.; Levermann, A. & **Mignot, J.** (2009), 'Sensitivity of North Atlantic subpolar gyre and overturning to stratification-dependent mixing: response to global warming', *Climate Dynamics* **34**(5), 661-668.

80. McPhaden, M. J.; Meyers, G.; Ando, K.; Masumoto, Y.; Murty, V. S. N.; Ravichandran, M.; Syamsudin, F.; **Vialard, J.**; Yu, W. & Wu, L. (2009), 'RAMA: Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction', *Bulletin of the American Meteorological Society* **90**(4), 459-480.

81. McPhaden, M. J.; Meyers, G.; Ando, K.; Masumoto, Y.; Murty, V. S. N.; Ravichandran, M.; Syamsudin, F.; **Vialard, J.;** Yu, W. & Wu, L. (2009), 'Supplement to "RAMA: Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction"', *Bulletin of the American Meteorological Society* **90**(4), ES5.

82. **Merlivat, L.**; González-Dávila, M.; Caniaux, G.; **Boutin, J.** & **Reverdin, G.** (2009), 'Mesoscale and diel to monthly variability of CO2 and carbon fluxes at the ocean surface in the northeastern Atlantic', *Journal of Geophysical Research* **114**, C03010.

83. **Metzl, N.** (2009), 'Decadal increase of oceanic carbon dioxide in Southern Indian Ocean surface waters (1991-2007)', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(8-10), 607-619.

84. **Mignot, J.** & **Frankignoul, C.** (2009, online), 'Local and remote impacts of a tropical Atlantic salinity anomaly', *Climate Dynamics*.

85. **Mignot, J.**; de Boyer Montégut, C. & Tomczak, M. (2009), 'On the porosity of barrier layers', *Ocean Science Discussions* **5**, 379-387.

86. Molinier, M.; **Ronchail, J.**; Guyot, J.-L.; Cochonneau, G.; Guimarães, V. & de Oliveira, E. (2009), 'Hydrological variability in the Amazon drainage basin and African tropical basins', *Hydrological Processes* **23**(22), 3245-3252.

87. Moreira, L.; Moreira-Turcq, P.; Cordeiro, R. & **Turcq, B.** (2009), 'Paleoenvironmental reconstruction of an Amazon floodplain lake, Lago Santa Ninha, Varzea do Lago Grande de Curuai, Pará, Brasil', *Acta Amazônica* **39**(3), 609-616.

88. Msadek, R. & **Frankignoul, C.** (2009), 'Atlantic multidecadal oceanic variability and its influence on the atmosphere in a climate model', *Climate Dynamics* **33**(1), 45-62.

89. Murray, J. W.; Slemons, L.; Gorgues, T.; Aumont, O. & **Menkès, C. E.** (2009), 'Biogeochemical impacts of a western iron source in the Pacific equatorial undercurrent', *Geochimica et Cosmochimica Acta* **73**(13 supplement1), A922.

90. Obligis, E., A. Rahamni and **L. Eymard,** An improved retrieval algorithm for the wet tropospheric correction: application to the ENVISAT microwave radiometer. IEEE Trans. on Geosci. Rem. Sens., *IEEE Transactions on Geoscience and Remote Sensing*, vol. 47, n°9, pp 3057-3064.2009.

91. Obligis, E.; Rahamni, A.; **Eymard, L.**; Labroue, S. & Bronner, E. (2009), 'An Improved Retrieval Algorithm for Water Vapor Retrieval : Application to Envisat Microwave Radiometer', *IEEE Transactions on Geoscience and Remote Sensing* **47**(9), 3057-3064.

92. Ourmières, Y.; Brasseur, P.; **Lévy, M.**; Brankart, J.-M. & Verron, J. (2009), 'On the key role of nutrient data to constrain a coupled physical-biogeochemical assimilative model of the North Atlantic Ocean', *Journal of Marine Systems* **75**, 100-115.

93. Park, W.; Keenlyside, N.; Latif, M.; Ströh, A.; Redler, R.; Roeckner, E. & **Madec, G.** (2009), 'Tropical Pacific Climate and Its Response to Global Warming in the Kiel Climate Model', *Journal of Climate* **22**(1), 71-92.

94. **Park, Y.-H.**; **Vivier, F.**; **Roquet, F.** & Kestenare, E. (2009), 'Direct observations of the ACC transport across the Kerguelen Plateau', *Journal of Geophysical Research C: Oceans* **36**, L18603.

95. Peings, Y.; Douville, H. & **Terray, P.** (2009), 'Extended winter Pacific North America oscillation as a precursor of the Indian summer monsoon rainfall', *Geophysical Research Letters* **36**, L11710.

96. Philippon, S.; Broutin, H.; de Magny, G. C.; Toure, K.; Diakite, C. H.; Fourquet, N.; Courel, M.-F.; **Sultan, B.** & Guégan, J.-F. (2009), 'Meningococcal meningitis in Mali: a long-term study of persistence and spread', *International Journal of Infectious Diseases* **13**(1), 103-109.

97. Pohl, B.; **Janicot, S.;** Fontaine, B. & Marteau, R. (2009), 'Implication of the Madden-Julian Oscillation in the 40-day variability of the West African Monsoon', *Journal of Climate* **22**(13), 3769-3785.

98. Quéré, C. L.; Raupach, M. R.; Canadell, J. G.; Marland, G.; Bopp, L.; Ciais, P.; Conway, T. J.; Doney, S. C.; Feely, R.; Foster, P.; Friedlingstein, P.; Gurney, K.; Houghton, R. A.; House, J. I.; Huntingford, C.; Levy, P.; Lomas, M. R.; Majkut, J.; **Metzl, N.**; Ometto, J.; Peters, G. P.; Prentice, I. C.; Randerson, J. T.; Running, S. W.; Schuster, J. L. S. U.; Sitch, S.; Takahashi, T.; Viovy, N.; van der Werf, G. R. &

Woodward, F. I. (2009), 'Trends in the sources and sinks of carbon dioxide', *Nature Geoscience* **2**, 831-836.

99. Quirion, P.; Berg, A. & **Sultan, B.** (2009), 'Weather-Index Drought Insurance in Burkina-Faso: Assessment of Its Potential Interest to Farmers', *Weather, Climate, and Society* **1**(1), 71-84.
100. Renault, L.; Dewitte, B.; Falvey, M.; Garreaud, R.; **Echevin, V.** & Bonjean, F. (2009), 'Impact of atmospheric coastal jet off central Chile on sea surface temperature from satellite observations (2000-2007)', *Journal of Geophysical Research* **114**, C08006.
101. **Resplandy, L.**; **Lévy, M.**; **d'Ovidio, F.** & **Merlivat, L.** (2009), 'Impact of sub-mesoscale variability in estimating the air-sea CO2 exchange: results from a model study of the POMME experiment', *Global Biogeochemical Cycles* **23**, GB1017.
102. **Resplandy, L.**; **Vialard, J.**; **Lévy, M.**; Aumont, O. & **Dandonneau, Y.** (2009), 'Seasonal and intraseasonal biogeochemical variability in the thermocline ridge of the southern tropical Indian Ocean', *Journal of Geophysical Research* **114**, C07024.
103. **Reverdin, G.**; **Gascard, J.-C.**; Cann, B. L.; Prieur, L.; Assenbaum, M. & L'Herminier, P. (2009), 'A long-lasting mode water vortex in the Northeast Atlantic Ocean', *Journal of Physical Oceanography* **39**(3), 536-558.
104. **Reverdin, G.**; **Lévy, M.**; Raimbault, P. & Lefèvre, D. (2009), 'Nutrients in mode waters of the North-east Atlantic', *Journal of Geophysical Research* **114**, C10004.
105. **Reverdin, G.**; Marin, F.; Bourlès, B. & L'Herminier, P. (2009), 'XBT Temperature Errors during French Research Cruises (1999-2007)', *Journal of Atmospheric and Oceanic Technology* **26**, 2462-2473.
106. Riascos, J. M.; Guzmán, N.; Laudien, J.; Oliva, M. E.; Heilmayer, O. & **Ortlieb, L.** (2009), 'A long-term association between Mesodesma donacium and the boring polychaete Polydora bioccipitalis on the Chilean coast', *Diseases of Aquatic Organisms* **85**(3), 209-215.
107. Rodgers, K. B.; Key, R. M.; Gnanadesikan, A.; Sarmiento, J. L.; Aumont, O.; Bopp, L.; Doney, S. C.; Dunne, J. P.; Glover, D. M.; Ishida, A.; Ishii, M.; Jacobson, A. R.; **Lo Monaco, C.**; Maier-Reimer, E.; Mercier, H.; Metzl, N.; Pérez, F. F.; Rios, A. F.; Wanninkhof, R.; Wetzel, P.; Winn, C. D. & Yamanaka, Y. (2009), 'Using altimetry to help explain patchy changes in hydrographic carbon measurements', *Journal of Geophysical Research* **114**, C09013.
108. **Roquet, F.**; **Park, Y.-H.**; Guinet, C.; Bailleul, F. & **Charrassin, J.-B.** (2009), 'Observations of the Fawn Trough Current over the Kerguelen Plateau from instrumented elephant seals', *Journal of Marine Systems* **78**(3), 377-393.
109. Rouault, M.; **Servain, J.**; Reason, C.; Bourles, B.; Rouault, M. & Fauchereau, N. (2009), 'Extension of PIRATA in the tropical South-East Atlantic: an initial one-year experiment', *African Journal of Marine Science* **31**(1), 63-71.
110. **Rousset, C.**; **Houssais, M.-N.** & Chassignet, E. P. (2009), 'A multi-model study of the restratification phase in an idealized convection basin', *Ocean Modelling* **26**(3-4), 115-133.
111. Russon, T.; Elliot, M.; Kissel, C.; **Cabioch, G.**; Deckker, P. D. & Corrège, T. (2009), 'Mid-late Pleistocene deep-water circulation in the Southwestern Subtropical Pacific', *Geochimica et Cosmochimica Acta* **73**(13 supplement1), A1136.
112. Russon, T.; Elliot, M.; Kissel, C.; **Cabioch, G.**; Deckker, P. D. & Corrège, T. (2009), 'Middle-Late Pleistocene Deep-Water Circulation in the Southwest Subtropical Pacific', *Paleoceanography* **24**, PA4205.
113. Schuster, U.; Watson, A.; Bates, N.; **Corbière, A.**; Gonzalez-Davila, M.; **Metzl, N.**; Pierrot, D. & Santana-Casiano, M. (2009), 'Trends in North Atlantic sea-surface fCO2 from 1990 to 2006', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(8-10), 620-629.
114. **Sémah, A.-M.;** Sémah, F.; Djubiantono, T. & Brasseur, B. (2009, in press), 'Landscapes and Hominids' environments: Changes between the Lower and the Early Middle Pleistocene in Java (Indonesia)', *Quaternary International*.
115. Sévellec, F.; Huck, T.; Jelloul, M. B. & **Vialard, J.** (2009), 'Nonnormal Multidecadal Response of the Thermohaline Circulation Induced by Optimal Surface Salinity Perturbations', *Journal of Physical Oceanography* **39**(4), 852-872.
116. Shen, Z.; **Caquineau, S.**; Cao, J.; Zhang, X.; Han, Y.; Gaudichet, A. & Gomes, L. (2009), 'Mineralogical characteristics of soil dust from source regions in northern China', *Particuology* **7**(6), 507-512.
117. Silva, M.; Araujo, M.; **Servain, J.**; Penven, P. & Lentini, C. A. (2009), 'High-resolution regional ocean dynamics simulation in the southwestern tropical Atlantic', *Ocean Modelling* **30**(4), 256-269.

118. Slemons, L.; **Gorgues, T.**; Aumont, O.; **Menkès, C. E.** & Murray, J. W. (2009), 'Biogeochemical impact of a model western iron source in the Pacific Equatorial Undercurrent', *Deep Sea Research Part I: Oceanographic Research Papers* **56**(12), 2115-2128.

119. Sommer, J. L.; Penduff, T.; Theetten, S.; **Madec, G.** & Barnier, B. (2009), 'How momentum advection schemes influence current-topography interactions at eddy permitting resolution', *Ocean Modelling* **29**(1), 1-14.

120. Sprintall, J.; Wijffels, S. E.; **Molcard, R.** & Jaya, I. (2009), 'Direct estimates of the Indonesian Throughflow entering the Indian Ocean: 2004-2006', *Journal of Geophysical Research* **114**, C07001.

121. **Sultan, B.**; **Janicot, S.** & Correia, C. (2009), 'Medium Lead-Time Predictability of Intraseasonal Variability of Rainfall in West Africa', *Weather and Forecasting* **24**(3), 767-784.

122. Swingedouw, D.; **Mignot, J.**; Braconnot, P.; Mosquet, E.; Kageyama, M. & Alkama, R. (2009), 'Impact of freshwater release in the North Atlantic under different climate conditions in an OAGCM', *Journal of Climate* **22**(23), 6377-6403.

123. Taillandier, V.; **Echevin, V.**; **Mortier, L.** & Devenon, J.-L. (2009), 'Controlling the open ocean forcing of baroclinic coastal jets with a 4D-var method', *Dynamics of Atmospheres and Oceans* **48**(2-3), 155-174.

124. Takahashi, T.; Sutherland, S. C.; Wanninkhof, R.; Sweeney, C.; Feely, R. A.; Chipman, D. W.; Hales, B.; Friederich, G.; Chavez, F.; Sabine, C.; Watson, A.; Bakker, D. C.; Schuster, U.; **Metzl, N.**; Yoshikawa-Inoue, H.; Ishii, M.; Midorikawa, T.; Nojiri, Y.; Körtzinger, A.; Steinhoff, T.; Hoppema, M.; Olafsson, J.; Arnarson, T. S.; Tilbrook, B.; Johannessen, T.; Olsen, A.; Bellerby, R.; Wong, C.; Delille, B.; Bates, N. & de Baar, H. J. (2009), 'Climatological mean and decadal change in surface ocean pCO2, and net sea-air CO2 flux over the global oceans', *Deep Sea Research Part II: Topical Studies in Oceanography* **56**(8-10), 554-577.

125. Takahashi, T.; Sutherland, S. C.; Wanninkhof, R.; Sweeney, C.; Feely, R. A.; Chipman, D. W.; Hales, B.; Friederich, G.; Chavez, F.; Sabine, C.; Watson, A.; Bakker, D. C.; Schuster, U.; **Metzl, N.**; Yoshikawa-Inoue, H.; Ishii, M.; Midorikawa, T.; Nojiri, Y.; Körtzinger, A.; Steinhoff, T.; Hoppema, M.; Olafsson, J.; Arnarson, T. S.; Tilbrook, B.; Johannessen, T.; Olsen, A.; Bellerby, R.; Wong, C.; Delille, B.; Bates, N. & de Baar, H. J. (2009), 'Corrigendum to "Climatological mean and decadal change in surface ocean pCO2, and net sea-air CO2 flux over the global oceans" [Deep Sea Research II 56 (2009) 554-577]', *Deep Sea Research Part I: Oceanographic Research Papers*.

126. **Terray, P.** (2009), 'Southern Hemisphere extra-tropical forcing: A new paradigm for El Niño-Southern Oscillation', *Climate Dynamics*.

127. Théry, T.; Gomy, Y. & **Dégallier, N.** (2009), 'Revision of Saprinus (Saprinus) splendens (Paykull 1811) with description of Saprinus (Saprinus) secchii n. sp. (Coleoptera : Histeridae)', *Zootaxa*, 35-48.

128. Triantaphyllou, M.; Ziveri, P.; Gogou, A.; Marino, G.; Lykousis, V.; **Bouloubassi, I.**; Emeis, K.-C.; Kouli, K.; Dimiza, M.; Rosell-Melé, A.; Papanikolaou, M.; Katsouras, G. & Nunez, N. (2009), 'Late Glacial-Holocene climate variability at the south-eastern margin of the Aegean Sea', *Marine Geology* **266**(1-4), 182-197.

129. Våge, K.; Pickart, R. S.; Thierry, V.; **Reverdin, G.**; Lee, C. M.; Petrie, B.; Agnew, T. A.; Wong, A. & Ribergaard, M. H. (2009), 'Surprising return of deep convection to the subpolar North Atlantic Ocean in winter 2007-2008', *Nature Geoscience* **2**(1), 67-72.

130. Valdés, J.; **Sifeddine, A.**; **Ortlieb, L.** & **Pierre, C.** (2009), 'Interplay between sedimentary organic matter and dissolved oxygen availability in a coastal zone of the Humboldt Current System; Mejillones Bay, northern Chile', *Marine Geology* **265**(3-4), 157-166.

131. Vallet, C.; Koubbi, P.; **Sultan, E.**; Goffart, A.; Swadling, K. M. & Wright, S. W. (2009), 'Distribution of Euphausiid larvae along the coast of east Antarctica in the Dumont d'Urville Sea (139 °E - 145 °E) during summer 2004', *Antarctic Science / ANTARCTICA ANTARCTIC SCIENCE* **21**(3), 197-207.

132. Vancoppenolle, M.; Fichefet, T.; Goosse, H.; Bouillon, S.; **Madec, G.** & Maqueda, M. A. M. (2009), 'Simulating the mass balance and salinity of Arctic and Antarctic sea ice. 1. Model description and validation', *Ocean Modelling* **27**(1-2), 33-53.

133. Vangriesheim, A.; **Pierre, C.**; Aminot, A.; **Metzl, N.**; Baurand, F. & Caprais, J.-C. (2009), 'The influence of Congo River discharges in the surface and deep layers of the Gulf of Guinea', *Deep Sea Research Part II: Topical Studies in Oceanography* **53**(23), 2183-2196.

134. Vázquez-Rodríguez, M.; Touratier, F.; **Lo Monaco, C.** ; Waugh, D. W.; Padin, X. A.; Bellerby, R. G. J.; Goyet, C.; **Metzl, N.**; Ríos, A. F. & Pérez, F. F. (2009), 'Anthropogenic carbon distributions in the Atlantic Ocean: data-based estimates from the Arctic to the Antarctic', *Biogeosciences* **6**(3), 439-451.

135. **Vialard, J.**; Duvel, J.-P.; McPhaden, M. J.; **Bouruet-Aubertot, P.**; Ward, B.; Key, E.; Bourras, D.; Weller, R.; Minnett, P.; Weill, A.; Cassou, C.; **Eymard, L.**; Fristedt, T.; Basdevant, C.; **Dandonneau, Y.**; **Duteil, O.**; Izumo, T.; de Boyer Montégut, C.; **Masson, S.**; Marsac, F.; **Menkès, C. E.** & Kennan, S. C. (2009),

'CIRENE: Air-sea interactions in the Seychelles-Chagos thermocline ridge region', *Bulletin of the American Meteorological Society* **90**(1), 45-61.

136. **Vialard, J.**; Duvel, J.-P.; McPhaden, M. J.; **Bouruet-Aubertot, P.**; Ward, B.; Key, E.; Bourras, D.; Weller, R.; Minnett, P.; Weill, A.; Cassou, C.; **Eymard, L.**; Fristedt, T.; Basdevant, C.; **Dandonneau, Y.**; **Duteil, O.**; Izumo, T.; de Boyer Montégut, C.; **Masson, S.**; Marsac, F.; **Menkès, C. E.** & Kennan, S. C. (2009), 'Supplement to CIRENE: Air-sea interactions in the Seychelles-Chagos thermocline ridge region', *Bulletin of the American Meteorological Society* **90**(1), ES1-ES4.
137. **Vialard, J.;** Shenoi, S. S. C.; McCreary, J.; Shankar, D.; Durand, F.; Fernando, V. & Shetye, S. R. (2009), 'Intraseasonal response of Northern Indian Ocean coastal waveguide to the Madden-Julian Oscillation', *Geophysical Research Letters* **36**, L14606.
138. **Villar, J. C. E.**; Guyot, J.-L.; **Ronchail, J.**; Cochonneau, G.; Filizola, N.; Fraizy, P.; Labat, D.; de Oliveira, E.; Ordoñez, J. J. & Vauchel, P. (2009), 'Contrasting regional discharge evolutions in the Amazon basin (1974-2004)', *Journal of Hydrology* **375**(3-4), 297-311.
139. **Villar, J. C. E.**; **Ronchail, J.**; Guyot, J.-L.; Cochonneau, G.; Naziano, F.; Lavado, W.; de Oliveira, E.; Pombosa, R. & Vauchel, P. (2009), 'Spatio-temporal rainfall variability in the Amazon basin countries (Brazil, Peru, Bolivia, Colombia, and Ecuador)', *International Journal of Climatology* **29**(11), 1574-1594.
140. **Vincent, E**.; **Lengaigne, M.**; **Menkès, C. E.**; Jourdain, N. C.; Marchesiello, P. & **Madec, G.** (2009, online), 'Interannual variability of the South Pacific Convergence Zone and implications for tropical cyclone genesis', *Climate Dynamics*.
141. Watson, A. J.; Schuster, U.; Bakker, D. C. E.; Bates, N. R.; **Corbière, A.**; González-Dávila, M.; Freidrich, T.; Hauck, J.; Heinze, C.; Johannessen, T.; Körtzinger, A.; **Metzl, N.**; Olafsson, J.; Olsen, A.; Oschlies, A.; Padin, X. A.; Pfeil, B.; Santana-Casiano, J. M.; Steinhoff, T.; Telszewski, M.; Rios, A. F.; Wallace, D. W. R. & Wanninkhof, R. (2009), 'Tracking the Variable North Atlantic Sink for Atmospheric CO2', *Science* **326**(5958), 1391-1393.
142. Zazzo, A.; **Saliège, J.-F.**; Person, A. & Boucher, H. (2009), 'Radiocarbon dating of calcined bones: where does the carbon come from ?', *Radiocarbon* **51**(2), 601-611.

Partner 5: LISA – UMR 7583

143. Aroui H., Laribi H., **Orphal J., Chelin P.** (2009) Self-broadening, self-shift, and self-mixing in the ν_2, $2\nu_2-\nu_2$, and ν_4 bands of NH_3, *J. Quant. Spectrosc. Rad. Trans,* 110, 2037–2059.
144. Brizzi G., Arnone E., Carlotti M., Dinelli B.M.**, Flaud J.-M.**, Papandrea E., **Perrin A.** and Ridolfi M. (2009), Retrieval of atmospheric $H^{15}NO_3$/ $H^{14}NO_3$ isotope ratio profile from MIPAS/ENVISAT limb measurements, *J. Geophys. Res.*, 114, doi:10.1029/2008JD011504.
145. Buch A., **Sternberg R.**, Szopa C., **Freissinet C.**, Garnier C., Bekri E. J., Rodier C., Navarro-Gonzalez R., **Raulin F.,** Cabane M., Stambouli A., Glavin D.P. and Mahaffy P.R. (2009), Development of a gas chromatography compatible sample processing system (SPS) for the in-situ analysis of refractory organic matter in Martian soil: preliminary results**,** *Adv. Space Res.***, 43,** 143-151**.**
146. Carvajal M., Margulès L., Demyk K., **Kleiner I.**, Guillemin J.-C., Lattanzi V., Walters A., Demaison J., Wlodarczak G. and Huet T.R., Møllendal H., Tercero B., Ilyushin V. V. and Cernicharo J. (2009), Rotational spectrum of $^{13}C_2$- methyl formate ($HCOO^{13}CH_3$) and detection of the two ^{13}C- methyl formate in Orion, *Astron. Astrophys*., 500, 1109-1118.
147. **Chabas A., Lombardo T., Ausset P.**, Cachier H., Pertuisot M. H., Oikonomou K., Falcone R., Verità M., Geotti-Bianchini F. (2009), Self-cleaning versus float glass in urban atmosphere, *Eur. J. Glass Sci. Technol.*, 50**,** 139-142.
148. Che H.Z., Zhang X.Y.**, Alfaro S.**, **Chatenet B.**, Gomes L. and Zhao J.Q. (2009) Aerosol optical properties and its radiative forcing over Yulin, China in 2001 and 2002, *Adv. Atmos. Sci.,* **26**, 564-576.
149. Cockell C. S., Herbst T. *et al.* including **Cottin H.** (more than 40 authors) (2009) Darwin-an experimental astronomy mission to search for extrasolar planets**,** *Exp. Astronomy*, 23, 435-461**.**
150. Cockell C. S., Leger A. *et al.* including **Cottin H.** (more than 50 authors) (2009) Darwin-a mission to detect and search for life on extrasolar planets**,** *Astrobiology***,** 9**,** 1-22**.**
151. **Coudert L**. H., Belov S. P., **Willaert F**., McElmurry B. A., Bevan J. W. and Hougen J. T. (2009), Submillimeter spectrum and analysis of vibrational and hyperfine coupling effects in (HI)2, *Chem. Phys. Lett.*, 482, 180-188.
152. Coustenis A., Atreya S. *et al.* including **Raulin F., Benilan Y., Coll P.** (more than 100 authors) (2009), Tandem: Titan and Enceladus mission**,** *Exp. Astronomy*, 23, 893-946.

153. Coustenis A., Atreya, S., Castillo, J. and **Coll, P.** (2009) Preface to the special issue of PSS on "Surfaces and atmospheres of the outer planets, their satellites and ring systems: Part V", *Planet. Space Sci.*, 57, 1523-1524**.**

154. Darmenova K., Sokolik I. N., Shao Y., **Marticorena B., Bergametti G.** (2009) Development of a physically-based dust emission module within the Weather Research and Forecasting (WRF) model: Assessment of dust emission parameterizations and input parameters for source regions in Central and East Asia, *J. Geophys. Res.,* **114**, doi:10.1029/2008JD011236.

155. Dixneuf S., Ruth A. A., Vaughan S., Varma R., **Orphal J. (**2009) The time dependence of molecular iodine emission from Laminaria Digitata, *Atmos. Chem. Phys.,* 9, 823-829.

156. **Dufour G.,** Wittrock F., Camredon M., Beekmann M., Richter A., Aumont B., Burrows J. (2009) SCIAMACHY formaldehyde observations: constraint for isoprene emission estimates over Europe?, *Atmos. Chem. Phys***., 9**, 1647-1664.

157. **Dufour G.,** Szopa S., Barkley M., Boone C., **Perrin A.**, Palmer P. and Bernath P. (2009) Global upper-tropospheric formaldehyde: seasonal cycle investigated through ACE-FTS space borne observations, *Atmos. Chem. Phys.,* 9, 3893-3910.

158. **Es-Sebbar E.**, **Benilan Y.**, **Jolly A.** and **Gazeau M.C.** (2009) Characterization of an N_2 flowing microwave post-discharge by OES spectroscopy and determination of absolute ground-state nitrogen atom densities by TALIF**,** *J. Phys. D-Applied Phys.*, 42, 11**.**

159. Favez O., **Alfaro S. C.**, Sciare J., Cachier H., Abdelwahab M.M. (2009) Ambient measurements of light-absorption by agricultural waste burning organic aerosols, *J. Aerosol Science*, doi:10.1016/j.jaerosci.2009.04.002.

160. **Ferradaz T., Benilan Y., Fray N., Jolly A., Schwell M., Gazeau M.C.,** Jochims H.W. (2009) Temperature-dependent photoabsorption cross-sections of cyanoacetylene and diacetylene in the mid- and vacuum-UV: Application to Titan's atmosphere**,** *Planet. Space Sci.*, 57, 10-22**.**

161. **Flaud J-M.**, Lafferty W.J., Sams R. L. (2009) Line Intensities for the ν_1, ν_3 and $\nu_1 + \nu_3$ bands of $^{34}SO_2$, *J. Quant. Spectrosc. Radiat. Transf.*, 110, 669–674.

162. Forêt G.**, Hamaoui L.,** Schmechtig C.**, Eremenko M.,** Keim C**., Dufour G.,** Boynard A., Coman A., Ung A., Beekmann M. (2009), Evaluating the potential of IASI ozone observations to constrain simulated surface ozone concentrations, *Atmos. Chem. Phys*., 9, 8479-8491.

163. Foucher P. Y., Chédin A., **Dufour G.**, Capelle V., Boone C. D., Bernath P. (2009) Technical Note: Feasibility of CO_2 profile retrieval from limb viewing solar occultation made by the ACE-FTS instrument, *Atmos. Chem. Phys.*, 9, 2873-2890.

164. **Fray N.,** Schmitt, B. (2009) Sublimation of ices of astrophysical interest: a bibliographic review**,** *Planet. Space Sci.*, 57, 2053-2080**.**

165. Geffroy-Rodier C., Grasset L., **Sternberg R.,** Buch A., Ambles A. (2009), Thermochemolysis in search for organics in extraterrestrial environments**,** *J. Anal. Applied Pyrolysis*, 85, 454-459**.**

166. **Gerin N.**, Marcelino N., Biver N., Roueff E., **Coudert L. H., Elkeurti M.,** Lis D. C., Bockelée-Morvan D. (2009) Detection of $^{15}NH_2D$ in dense cores: a new tool for measuring the $^{14}N/^{15}N$ ratio in the cold ISM, *Astron. Astrophys.,* 498, L9-L12.

167. **Gomez-Martin L.**, **Tran H.,** Jacquemart D. (2009) Line-mixing in the ν_6 Q branches of nitrogen-broadened methyl bromide at low temperatures, *J. Mol. Spectrosc.*, 256, 35-40.

168. **Gomez-Martin L.**, **Perrin A.**, Mellau G. (2009) New analysis of the □□ fundamental band of HDCO: positions and intensities. *J. Mol. Spectrosc.*, 256, 28-34.

169. **Gomez-Martin L.**, **Tran H., Perrin A.**, Gamache R. R., Laraia A., **Orphal J., Chelin P.**, Fellows C. E., **Hartmann J.M.** (2009) Some improvements of the HNO_3 spectroscopic parameters in the spectral region from 600 to 950 cm^{-1}, *J. Quant. Spectrosc. Radiat. Transf.,* 110, 675–686.

170. Gratien A., Lefort M., Picquet-Varrault B., **Orphal J.**, Doussin J.-F., Flaud J.M. (2009) Experimental intercomparison of the absorption cross-sections of nitrous acid (HONO) in the ultraviolet and mid-infrared spectral regions, *J. Quant. Spectrosc. Radiat. Transf*., 110, 256–263.

171. Gutlé, C., Demaison J., Rudolph H. D. (2009) Anharmonic force field and equilibrium structure of nitric acid, *J. Mol. Spectrosc.*, 254, 99-107**.**

172. **Hartmann J-M., Coudert L. H.,** Doizi D., Dauvois V., Roujou J.-L., Lorin V., Larousse B., Fauvet P., Carles P. (2009) Speciation of the gaseous phase of the HI section of the iodine sulphur thermochemical cycle by modeling and inversion of FTIR spectra, *Int. J. Hydrogen Energy,* 34, 162-168.

173. **Hartmann J-M.**, **Tran H.,** Toon G. C. (2009) Influence of line mixing of the retrievals of atmospheric CO_2 from spectra in the 1.6 and 2.1 µm regions, *Atmos. Chem. Phys.*, 9, 7303-7312.

174. Höpfner M., **Orphal J.**, von Clarmann T., Stiller G., Fischer H. (2009) Stratospheric $BrONO_2$ observed by MIPAS, *Atmos. Chem. Phys.* 9, 1735-1746.

175. **Iniguez E.,** Navarro-Gonzalez R., de la Rosa J., Urena-Nunez F., **Coll P., Raulin F.,** McKay C.P. (2009) On the oxidation ability of the Nasa Mars-1 soil simulant during the thermal volatilization step: Implications for the search of organics on Mars**,** *Geophys. Res. Lett.*, 36, 5**.**

176. Jelisavac D., Cortés Gómez D., Nguyen H.V.L., Sutikdja L.W., Stahl W., **Kleiner I.** (2009), The microwave spectrum of the *trans* conformer of ethyl acetate, *J. Mol. Spectrosc.*, 257, 111-115.

177. Journet E. (2009) Ocean chemistry: A matter of mineralogy, *Nature Geosciences*, 2, 317-318.

178. **Keim C., Eremenko M., Orphal J., Dufour G., Flaud J.-M.**, Höpfner M., Boynard A., Clerbaux C., Payan S., Coheur P.-F., Hurtmans D., Claude H., Dier H., Johnson B., Kelder H., Kivi R., Koide T., Lopez Bartolome M., Lambkin K., Moore D., Schmidlin F. J., Stubi R. (2009) Tropospheric ozone from IASI: comparison of different inversion algorithms and validation with ozone sondes in the northern middle latitudes, *Atmos. Chem. Phys*., 9, 9329–9347.

179. Kuppers M., Keller H.U. et al. including **Cottin H.** (more than 100 authors) (2009) Triple F-a comet nucleus sample return mission**,** *Exp. Astronomy*, 23, 809-847**.**

180. Lafferty W. J., **Flaud J.-M.**, El Hadji Abib Ngom, Sams R. L. (2009) $^{34}S^{16}O_2$ High Resolution analysis of the (030), (101), (111), (002) and (201) vibrational states; Determination of equilibrium rotational constants for sulfur dioxide and anharmonic vibrational constants, *J. Mol. Spectrosc.*, 253, 51–54.

181. Lammer H., Bredehoft J.H., Coustenis A., Khodachenko M.L., Kaltenegger L., Grasset O., Prieur D., **Raulin F.,** Ehrenfreund P., Yamauchi M., Wahlund J.E. ,, Griessmeier J.M., Stangl G., Cockell C.S., Kulikov Y.N., Grenfell J.L., Rauer J. L. (2009) What makes a planet habitable?, *Astron. Astrophys. Rev.*, 17, 181-249**.**

182. Laraia A., Gamache R.R., **Hartmann J.M.**, **Perrin A., Gomez-Martin L.** (2009) Theoretical calculations of N_2-broadened half-widths of ν_5 transitions of HNO_3, *J. Quant. Spectrosc. Radiat. Transf*., 110, 687-699.

183. Lauvergnat D., **Coudert L. H.,** Klee S., **Smirnov M.** (2009) New assignments in the torsional spectrum of CH_2DOH, *J. Mol. Spectrosc.,* 256, 204-215.

184. Lauzin C., Ditriche K., Liévin J., Herman M., **Perrin A.** (2009) Investigation of the C_2H_2–CO_2 van der Waals complex in the overtone range using cw cavity ring-down spectroscopy. *J. Chem. Phys***.,** 130**,** 204306, 2009; DOI:10.1063/1.3137069.

185. Lebreton J. P., Coustenis A., Lunine J., **Raulin F.,** Owen T., Strobel D. (2009) Results from the Huygens probe on Titan**,** *Astron. Astrophys. Rev.*, 17, 149-179**.**

186. Leon J.-F., Derimian Y., Chiapello I., Tanré D., Podvin T., **Chatenet B.**, Diallo A., Deroo C. (2009) Aerosol vertical distribution and optical properties over M'Bour (16.96 W; 14.39 N), Senegal from 2006 to 2008, *Atmos. Chem. Phys.,* 9, 23, 9249-9261.

187. Margules L., **Coudert L. H.,** Mollendal H., Guillemin J.-C., Huet T. R., Janeckova R. (2009) The microwave spectrum of the mono deuterated species of methyl formate $HCOOCH_2D$, *J. Mol. Spectrosc.*, 254, 55-68.

188. Margulés L., **Perrin A.**, Janeckovà R., Bailleux S., Endres C.P., Giesen T.F., S. Schlemmer (2009) Rotational transitions within the ν_2, ν_3, ν_4 and ν_6 bands of formaldehyde $H_2\,^{12}C\,^{16}O$, *Can. J. Phys.,* 87, 425-435.

189. Margulès L., **Perrin A.**, Demaison J., Merke I., Willner H., Rotger M., Boudon V. (2009) Breakdown of the reduction of the rovibrational Hamiltonian: The case of $S^{18}O_2F_2$, *J. Mol. Spectrosc.,* 256, 232-237.

190. Martet, M., Peuch V.-H., Laurent B., Marticorena B., Bergametti G. (2009) Evaluation of long-range transport and deposition of desert dust with the CTM MOCAGE, *Tellus,* 61, 449-463.

191. Myhre G., Berglen. T.F, Hoyle C.R., Christopher S.A., Coe H., Crosier J., **Formenti P.**, Haywood J.M., Johnsrud M., Jones T.A., Loeb N., Osborne S., Remer L.A. (2009) Modelling of chemical and physical aerosol properties during the ADRIEX aerosol campaign, *Quart. J. Roy. Meteorol. Soc.,* 135, 638, 53-66, Part A..

192. Nikitin A. V., Champion J.-P., Butler R.A.H., Brown L.R., **Kleiner I.** (2009) Global modelling of the lower three polyads of PH_3: Preliminary results, *J. Mol. Spectrosc.*, 256, 4-16.

193. Nixon C. A., Jennings D.E., **Flaud J.-M.**, Bezard B., Teanby N.A., Irwin P.G.J., Ansty T.M., Coustenis A., Flasar F.M. (2009) Titan's prolific propane: The Cassini CIRS perspective, *Planet. Space. Sci*., 57, 1573–1585.

194. Nouri S., Ben Mabrouk K., **Chelin P.**, Aroui H., **Orphal J. (2009)** Pressure-induced line mixing in the ν_4 band of NH_3 perturbed by O_2 and self-perturbed, *J. Mol. Spectrosc.,* 258, 75–87.

195. **Perrin A**., Vander Auwera J., Zelinger Z. (2009) High resolution study of the ν_3 fundamental band of *trans*-formic acid. *J. Quant. Spectrosc. Radiat. Transf*., 110, 743-755.

196. **Perrin A.**, Jacquemart D., **Kwabia Tchana F.,** Lacome N. (2009) Absolute line intensities measurements and calculations for the 5.7 and 3.6 µm bands of formaldehyde, *J. Quant. Spectrosc. Radiat. Transf.,* 110, 700-716.

197. Rothman L. S., Gordon I. E., Barbe A., Benner D .C., Bernath P. F., Birk M., Boudon V., Brown L. R., Campargue A., Champion J.-P., Chance K., **Coudert L. H.**, Dana V., Devi V. M., Fally S., **Flaud J.-M.**, Gamache R.R., Goldmanm A., Jacquemart D., **Kleiner I.**, Lacome N., Lafferty W.J., Mandin J.-Y., Massie S.T., Mikhailenko S.N., Miller C.E., Moazzen-Ahmadi N., Naumenko O.V., Nikitin A.V., **Orphal J.**, Perevalov V.I., **Perrin A.**, Predoi-Cross A., Rinsland C.P., Rotge M., Imeckova M.S, Smith M.A.H., Sung K., Tashkun S.A., Tennyson J., Toth R.A., Vandaele A.C., Vander Auwera J. (2009) The HITRAN 2008 molecular spectroscopic database, *J. Quant. Spectrosc. Radiat. Transf.,* 110, 533–572.

198. Rouil L., Honore C., Vautard R., Beekmann M., Bessagnet B., Malherbe L., Meleux F., Dufour A., Elichegaray C., **Flaud J-M.**, Menut L., Martin D., Peuch A., Peuch V-H., Poisson N. (2009) PREV'AIR: an operational forecasting and mapping system for air quality in Europe, *Bull. Am. Meteorol. Soc.,* 90, 73-83.

199. Sow M., Alfaro S. C., Rajot J. L., Marticorena B. (2009) Size resolved dust emission fluxes measured in Niger during 3 dust storms of the AMMA experiment, *Atmos. Chem. Phys.,* 9, 12, 3881-3891.

200. **Stalport F., Coll P.,** Szopa C., **Cottin H., Raulin F.** (2009) Investigating the photostability of carboxylic acids exposed to Mars surface ultraviolet radiation conditions**,** *Astrobiology*, 9, 543-549**.**

201. Teanby N. A., Irwin P.G.J., de Kok R., **Jolly A.,** Bezard B., Nixon C.A., Calcutt S.B. (2009) Titan's stratospheric C_2N_2, C_3H_4, and C_4H_2 abundances from Cassini/CIRS far-infrared spectra**,** *Icarus*, 202, 620-631**.**

202. **Tran H.**, **Hartmann J.-M. (2009)** An isolated line-shape model based on the Keilson and Storer velocity-memory function. I. Theoretical approaches, *J. Chem. Phys*., **130**, 094301.

203. Tran H., Hartmann J.-M., **Chaussard F., Gupta M. (2009) An isolated line-shape model based on the Keilson-Storer function for velocity changes. II. Molecular Dynamics Simulations and the Q(1) lines for pure H_2, *J. Chem. Phys*., 131, 154303.**

204. **Tran H.**, Chaussard F., Le Cong N., Lavorel B., Faucher O., Joubert P. (2009) Femtosecond time resolved coherent anti-Stokes Raman spectroscopy of H_2-N_2 mixtures in the Dicke regime: Experiments and modelling of velocity effects, *J. Chem. Phys*., 131, 174310.

205. **Tran H.**, Brizzi G., **Gomez-Martin L.**, **Perrin A.**, Hase F., Ridolfi M., **Hartmann J.M.** (2009) Validation of HNO_3 spectroscopic parameters using atmospheric absorption and emission measurements. *J. Quant. Spectrosc. Radiat*. *Transf.,* 110, 109-117.

206. Vangvichith M., **Tran H., Hartmann J. M.** (2009) Line-mixing and collisions induced absorption for O_2-CO_2 mixtures in the oxygen A band region, *J. Quant. Spectrosc. Radiat. Transf.*, **110**, 2212-2216.

Partner 6: LATMOS (UMR 8190) (OA Part)

207. **Al-Sakka H., Weill A., Le Gac C., Ney R., Chardenal L., Vinson J.-P., Barthès L.,** Dupont E., (2009) CURIE: a low power X-band, low atmospheric Boundary Layer Doppler radar. *Meteorologische Zeitschrift*, 18, doi:10.1127/0941-2948/2009/0377

208. **Ancellet G., Leclair De Bellevue J.,** Mari C., Nedelec P., **Kukui A.,** Borbon A., Perros P., (2009) Effects of regional-scale and convective transports on tropospheric ozone chemistry revealed by aircraft observations during the wet season of the AMMA campaign. *Atmos. Chem. and Phys*., 9, 383-411

209. Austin J., Wilson R.J., Akiyoshi H., **Bekki S.,** Butchart N., Claud C., Fomichev V.I., Forster P., Garcia R.R., Gillett N.P., Keckhut P., Langematz U., Manzini E., Nagashima T., Randel W.J., Rozanov E., Shibata K., Shine K.P., Struthers H., Thompson D.W.J., Wu F., Yoden S. (2009) Coupled chemistry climate model simulations of stratospheric temperatures and their trends for the recent past. *Geophys. Res. Lett.*, 36, doi:10.1029/2009GL038462

210. Blumenstock T., Hase F., Kramer I., Mikuteit S., Fischer H., **Goutail F.,** Raffalski U., (2009) Winter to winter variability of chlorine activation and ozone loss as observed by ground-based FTIR measurements at Kiruna since winter 1993/94. *International Journal of Remote Sensing*, 30 15-16, doi:10.1080/01431160902821916

211. **Bou Karam D., Flamant C.,** Tulet P., Chaboureau J.-P., Dabas A., Todd M.C. (2009) Estimate of Sahelian dust emissions in the intertropical discontinuity region of the West African Monsoon. *J. Geophys D: Atmospheres*, 114 doi:10.1029/2008JD011444

212. **Bou Karam D., Flamant C.,** Tulet P., Todd M. C., **Pelon J.,** Williams E. (2009) Dry cyclogenesis and dust lofting in the intertropical discontinuity region of the West African Monsoon: A representative case study. *J. Geophys. Res.*, 114, doi:10.1029/2008JD010952

213. **Bourras D., Weill A.,** Caniaux G., Eymard L., Bourlès B., Letourneur S., Legain D., **Key E.,** Baudin F., Piguet B., Traullé O., Bouhours G., Sinardet B., Barrié J., **Vinson J.-P., Boutet F.,** Berthod C., Clémençon A. (2009) Turbulent air-sea fluxes in the Gulf of Guinea during the AMMA experiment. *J. of Geophys. Res. C: Oceans*, 114, doi:10.1029/2008JC004951

214. **Boynard A., Clerbaux C.,** Coheur P.-F., Hurtmans D., **Turquety S., George M., Hadji-Lazaro J.**, Keim C., Meyer-Arnek J. (2009) Measurements of total and tropospheric ozone from IASI: comparison with correlative satellite, ground-based and ozonesonde observations. *Atmos. Chem. and Phys*., 9 16, 6255-6271

215. **Brogniez H.,** Roca R., Picon L. (2009) A study of the free tropospheric humidity interannual variability using Meteosat data and an advection-condensation transport model. *J. Climate*, 22 24, doi:0.1175/2009JCLI2963.1

216. Butkovskaya N., Rayez M.-T., Rayez J.-C., **Kukui A.,** Le Bras G. (2009) Water vapor effect on the HNO3 yield in the HO2 + NO reaction: Experimental and theoretical evidence, *J. Phys. Chem.* A , 113 42, doi:10.1021/jp811428p

217. Cagnazzo C., Manzini E., Calvo N., Douglass A., Akiyoshi H., **Bekki S.,** Chipperfield M., Dameris M., Deushi M., Fischer A.M., Garny H., Gettelman A., Giorgetta M.A., Plummer D., Rozanov E., Shepherd T.G., Shibata K., Stenke A., Struthers H., Tian W. (2009) Northern winter stratospheric temperature and ozone responses to ENSO inferred from an ensemble of Chemistry Climate Models. *Atmos. Chem. and Phys.,* 9 22, 8935-8948

218. Champollion C., **Flamant C.,** Bock O., Masson F., Turner D.D., Weckwerth T. (2009) Mesoscale GPS tomography applied to the 12 June 2002 convective initiation event of IHOP_2002. *Quarterly Journal of the Royal Meteorological Society*, 135 640, doi: 10.1002/ qj.386

219. Clain G., Baray J.-L., Delmas R., Diab R., Leclair De Bellevue J., **Keckhut P.,** Posny F., Metzger J.M., Cammas J.-P. (2009) Tropospheric ozone climatology at two Southern Hemisphere tropical/subtropical sites, (Reunion Island and Irene, South Africa) from ozonesondes, LIDAR, and in situ aircraft measurements. *Atmos. Chem. Phys.,* 9 5, 1723-1734

220. Clain G., Baray J.-L., Delmas R., **Keckhut P**., Cammas J.-P. (2009) A lagrangian approach to analyse the tropospheric ozone climatology in the tropics: Climatology of stratosphere–troposphere exchange at Reunion Island. *Atmospheric Environment*, 44 7, doi: 10.1016/ j.atmosenv.2009.08.048

221. Clarisse L., **Clerbaux C**., Dentener F., Hurtmans D., Coheur P.-F. (2009) Global ammonia distribution derived from infrared satellite observations. *Nature geoscience*, 2, 10.1038/ ngeo551

222. **Clerbaux C., Boynard A.,** Clarisse L., **George M., Hadji-Lazaro J**., Herbin H., Hurtmans D., **Pommier M.,** Razavi A., **Turquety S**., Wespes C., Coheur P.-F. (2009) Monitoring of atmospheric composition using the thermal infrared IASI/MetOp sounder. *Atmos. Chem. Phys.,* 9 16

223. Coheur P.-F., Clarisse L., **Turquety S.,** Hurtmans D., **Clerbaux C.** (2009) IASI measurements of reactive trace species in biomass burning plumes. *Atmos. Chem. Phys.*, 9 15

224. **Cuesta J. E.,** Marsham J.H., Parker D.J., **Flamant C.,** (2009) Dynamical mechanisms controlling the vertical redistribution of dust and the thermodynamic structure of the West Saharan atmospheric boundary layer during summer. *Atmos. Science Letters*, 10 1: 10.1002/asl.207

225. **De Montera L., Barthès L., Mallet C.,** Golé P. (2009) The Effect of Rain-No Rain Intermittency on the Estimation of the Universal Multifractals Model Parameters, *J. Hydrometeorology*, 10 2, 10.1175/2008JHM1040.1

226. Decharme B., Ottle C., Saux-Picart S., Boulain N., Cappelaere B., Ramier D., **Zribi M**., (2009) A New Land Surface Hydrology within the Noah-WRF Land-Atmosphere Mesoscale Model Applied to Semiarid Environment: Evaluation over the Dantiandou Kori (Niger), *Advances in Meteorology*, 10.1155/2009/731874

227. Dou X., Li T., Xu J., Liu H.-L., Xue X., Wang S., Leblanc T., Mcdermid I.S**., Hauchecorne A., Keckhut P.**, Bencherif H., Heinselman C., Steinbrecht W., Mlynczak M.G., Russell Iii J.M. (2009) Seasonal oscillations of middle atmosphere temperature observed by Rayleigh lidars and their comparisons with TIMED/SABER observations. *J. Geophys. Res. D: Atmospheres,* 114,10.1029/2008JD011654

228. Drobinski P., **Bastin S.,** Janicot S., Bock O., Dabas A., Delville P., Reitebuch O., Sultan B. (2009) On the late northward propagation of the West African monsoon in summer 2006 in the region of Niger/Mali. *J. Geophys. Res. D: Atmospheres,* 114 (2009) 10.1029/2008JD011159

229. Dupuy E., Walker K.A., Kar J., Boone C.D., Mcelroy C.T., Bernath P.F., Drummond J.R., Skelton R., Mcleod S.D., Hughes R.C., Nowlan C.R., Dufour D.G., Zou J., Nichitiu F., Strong K., Baron P., Bevilacqua R.M., Blumenstock T., Bodeker G.E., Borsdorff T., Bourassa A.E., Bovensmann H., Boyd I.S., Bracher A., Brogniez C., Burrows J.P., Catoire V., Ceccherini S., Chabrillat S., Christensen T., Coffey M.T., Cortesi U., Davies J., De Clercq C., Degenstein D.A., De MaziËre M., Demoulin P., Dodion

J., Firanski B., Fischer H., Forbes G., Froidevaux L., Fussen D., Gerard P., **Godin-Beekmann S., Goutail F.,** Granville J., Griffith D., Haley C.S., Hannigan J.W., Hˆpfner M., Jin J.J., Jones A., Jones N.B., Jucks K., Kagawa A., Kasai Y., Kerzenmacher T.E., Kleinbˆhl A., Klekociuk A.R., Kramer I., K¸llmann H., **Kuttippurath J.**, Kyrölä E., Lambert J.-C., Livesey N.J., Llewellyn E.J., Lloyd N.D., Mahieu E., Manney G.L., Marshall B.T., Mcconnell J.C., Mccormick M.P., Mcdermid I.S., Mchugh M., Mclinden C.A., Mellqvist J., Mizutani K., Murayama Y., Murtagh D.P., Oelhaf H., Parrish A., Petelina S.V., Piccolo C., **Pommereau J.-P.,** Randall C.E., Robert C., Roth C., Schneider M., Senten C., Steck T., Strandberg A., Strawbridge K.B., Sussmann R., Swart D.P.J., Tarasick D.W., Taylor J.R., TÈtard C., Thomason L.W., Thompson A.M., Tully M.B., Urban J., Vanhellemont F., Vigouroux C., Von Clarmann T., Von Der Gathen P., Von Savigny C., Waters J.W., Witte J.C., Wolff M., Zawodny J.M. (2009) Validation of ozone measurements from the Atmospheric Chemistry Experiment (ACE). *Atmos. Chem. Phys*., 9 287-343

230. **Dusséaux R., Aït Braham K.,** Emad N. (2009) Eigenvalue system for the scattering from rough surfaces – Saving in computation time by a physical approachª. *Optics Communications*, 282 18, 10.1016/j.optcom.2009.06.010
231. **Flamant C.,** Knippertz P., Parker D.J., Chaboureau J.-P., **Lavaysse C.,** Agusti-Panareda A., Kergoat L. (2009) The impact of a mesoscale convective system cold pool on the northward propagation of the intertropical discontinuity over West Africa. *Quarterly Journal of the Royal Meteorological Society*, 135 638, 10.1002/qj.357
232. **Flamant C., Lavaysse C.,** Todd M.C., Chaboureau J.-P., **Pelon J.** (2009) Multi-platform observations of a springtime case of BodÈlÈ and Sudan dust emission, transport and scavenging over West Africa. *Quarterly Journal of the Royal Meteorological Society*, 135 639, 10.1002/qj.376
233. Foret G., Hamaoui L., Schmechtig C., Eremenko M., Keim C., Dufour G., **Boynard A.,** Coman A., Ung A., Beekmann M. (2009) Evaluating the potential of IASI ozone observations to constrain simulated surface ozone concentrations. *Atmo. Chem. Phys.*, 9 21, 8479-8491
234. Fortems-Cheiney A., Chevallier F., Pison I., Bousquet P., Carouge C., **Clerbaux C.,** Coheur P.-F., George M., Hurtmans D., Szopa S. (2009) On the capability of IASI measurements to inform about CO surface emissions. *Atmos. Chem. Phys.,* 9 22, 8735-8743
235. Fowler D., Pilegaard K., Sutton M.A., Ambus P., Raivonen M., Duyzer J., Simpson D., Fagerli H., Fuzzi S., Schjoerring J.K., **Granier C.,** Neftel A., Isaksen I.S.A., Laj P., Maione M., Monks P.S., Burkhardt J., Daemmgen U., Neirynck J., Personne E., Wichink-Kruit R., Butterbach-Bahl K., Flechard C., Tuovinen J.P., Coyle M., Gerosa G., Loubet B., Altimir N., Gruenhage L., Ammann C., Cieslik S., Paoletti E., Mikkelsen T.N., Ro-Poulsen H., Cellier P., Cape J.N., Horv·th L., Loreto F., Niinemets U., Palmer P.I., Rinne J., Misztal P., Nemitz E., Nilsson D., Pryor S., Gallagher M.W., Vesala T., Skiba U., Br¸ggemann N., Zechmeister-Boltenstern S., Williams J., O'Dowd C., Facchini M.C., De Leeuw G., Flossman A., Chaumerliac N., Erisman J.W. (2009) Atmospheric composition change: Ecosystems–Atmosphere interactions. *Atmos. Environment*, 43 33, 10.1016/ j.atmosenv.2009.07.068
236. Fraser A., Adams C., Drummond J.R., **Goutail F.,** Manney G., Strong K. (2009) The polar environment atmospheric research laboratory UV-visible ground-based spectrometer: First measurements of O3, NO2, BrO, and OClO columns, *J. of Quantitative Spectroscopy and Radiative Transfer*. 110 12 doi:10.1016/j.jqsrt.2009.02.034
237. **George M., Clerbaux C.,** Hurtmans D., Turquety S., Coheur P.-F., **Pommier M., Hadji-Lazaro J.,** Edwards D.P., Worden H., Luo M., Rinsland C., Mcmillan W. (2009) Carbon monoxide distributions from the IASI/METOP mission: evaluation with other space-borne remote sensors. *Atmos. Chem. Phys.,* 9 21, 8317-8330
238. Gettelman A., Birner T., Eyring V., Akiyoshi H., **Bekki S.,** Br¸hl C., Dameris M., Kinnison D.E., Lefèvre F., Lott F., Mancini E., Pitari G., Plummer D.A., Rozanov E., Shibata K., Stenke A., Struthers H., Tian W. (2009) The Tropical Tropopause Layer 1960–2100. *Atmos. Chem. Phys.,* 9 5, 1621-1637
239. Hˆller H., Betz H.-D., Schmidt K., Calheiros R.V., May P., Houngninou E., **Scialom G.** (2009) Lightning characteristics observed by a VLF/LF lightning detection network (LINET) in Brazil, Australia, Africa and Germany. *Atmos. Chem. Phys.,* 9 20, 7795-7824
240. **Hauser D., Caudal G.,** Guimbard S., Mouche A. (2009) Reply to comment by Paul A. Hwang on 'A study of the slope probablity density function of the ocean waves from radar observations' by D. Hauser, G. Caudal, S. Guimbard, and A. Mouche [2007JC004264RR], *J. of Geophys. Res. C: Oceans*, 114, 10.1029/2008JC005117
241. Herbin H., Hurtmans D., Clarisse L., **Turquety S., Clerbaux C.,** Rinsland C.P., Boone C., Bernath P.F., Coheur P.-F. (2009) Distributions and seasonal variations of tropospheric ethene (C2H4) from Atmospheric Chemistry Experiment (ACE-FTS) solar occultation spectra, *Geophys. Res. Letters*, 36, 10.1029/2008GL036338

242. Herbin H., Hurtmans D., **Clerbaux C.,** Clarisse L., Coheur P.-F. (2009) $H_2{}^{16}O$ and HDO measurements with IASI/MetOp. *Atmos. Chem. Phys.,* 9 24, 9433-9447

243. **Hoareau C., Keckhut P., Sarkissian A.,** Baray J.-L., Durry G. (2009) Methodology for water monitoring in the upper troposphere with Raman lidar at the Haute-Provence Observatory. *Journal of Atmospheric and Oceanic Technology*, 26 10 10.1175/ 2009JTECHA1287.1

244. Isaksen I.S.A., **Granier C.,** Myhre G., Berntsen T.K., Dals¯ren S.B., Gauss M., Klimont Z., Benestad R., Bousquet P., Collins W., Cox T., Eyring V., Fowler D., Fuzzi S., Jˆckel P., Laj P., Lohmann U., Maione M., Monks P., Prevot A.S.H., Raes F., Richter A., Rognerud B., Schulz M., Shindell D., Stevenson D.S., Storelvmo T., Wang W.-C., Van Weele M., Wild M., Wuebbles D. (2009) Atmospheric composition change: Climate–Chemistry interactions. Atmospheric Environment, 43 33, 10.1016/j.atmosenv.2009.08.003

245. Joly L., Marnas F., Gibert F., **Bruneau D.,** Grouiez B., Flamant P.-H., Durry G., Dumelie N., Parvitte B., Zéninari V. (2009) Laser diode absorption spectroscopy for accurate CO2 line parameters at 2 μm: consequences for space-based DIAL measurements and potential biases. *Applied Optics,* 48 29,10.1364/AO.48.005475

246. **Jumelet J., Bekki S., David C., Keckhut P.,** Baumgarten G. (2009) Size distribution time series of a polar stratospheric cloud observed above Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR) (69∞N) and analyzed from multiwavelength lidar measurements during winter 2005. *J. Geophys. Res. D: Atmospheres*, 114,10.1029/ 2008JD010119

247. **Jumelet J., Bekki S.,** Seifert P., **Montoux N., Vernier J.-P., Pelon J.** (2009) Microphysical modelling of a midlatitude "polar stratospheric cloud" event: Comparisons against multiwavelength ground-based and spaceborne lidar data. *J. Geophys. Res. D: Atmospheres*, 114 10.1029/2009JD011776

248. **Jumelet J., David C., Bekki S., Keckhut P.** (2009) Uniwavelength lidar sensitivity to spherical aerosol microphysical properties for the interpretation of Lagrangian stratospheric observations, *J. of Atmos. and Solar-Terrestrial Physics*, 71 1 10.1016/ j.jastp.2008.09.038

249. Keim C., Eremenko M., Orphal J., Dufour G., Flaud J.-M., Hˆpfner M., **Boynard A., Clerbaux C.,** Payan S., Coheur P.-F., Hurtmans D., Claude H., Dier H., Johnson B., Kelder H., Kivi R., Koide T., Lopez Bartolomé M., Lambkin K., Moore D., J. Schmidlin F., Stübi R. (2009) Tropospheric ozone from IASI: comparison of different inversion algorithms and validation with ozone sondes in the northern middle latitudes. *Atmos. Chem. Phys.*, 9 24 9329-9347

250. Khaykin S., **Pommereau J.-P.,** Korshunov L., Yushkov V., Nielsen J., Larsen N., Christensen T., Garnier A., Lukyanov A., Williams E. (2009) Hydration of the lower stratosphere by ice crystal geysers over land convective systems, *Atmos. Chem. Phys*, 9 6 (2009)

251. Kim S.-W., Heckel A., Frost G.J., Richter A., Gleason J., Burrows J.P., Mckeen S., Hsie E.-Y., **Granier C.,** Trainer M. (2009) NO2 columns in the western United States observed from space and simulated by a regional chemistry model and their implications for NOx emissions. *J. Geophys. Res. D: Atmospheres* 114, 10.1029/2008JD011343

252. **Kuttippurath J., Godin-Beekmann S., Lefèvre F., Pazmino A.** (2009) Ozone depletion in the Arctic winter 2007-2008. *International Journal of Remote Sensing*, 30 15-16, 10.1080/01431160902821965

253. Laj P., Klausen J., Bilde M., Plafl-Duelmer C., Pappalardo G., **Clerbaux C.,** Baltensperger U., Hjorth J., Simpson D., Reimann S., Coheur P.-F., Richter A., De MaziËre M., Rudich Y., Mcfiggans G., Torseth K., Wiedensohler A., Morin S., Schulz M., Allan J.D., AttiÈ J.-L., Barnes I., Birmili W., Cammas J.P., Dommen J., Dorn H.-P., Fowler D., Fuzzi S., Glasius M., **Granier C.,** Hermann M., Isaksen I.S.A., Kinne S., Koren I., Madonna F., Maione M., Massling A., Moehler O., Mona L., Monks P.S., M¸ller D., M¸ller T., Orphal J., Peuch V.-H., Stratmann F., TanrÈ D., Tyndall G., Abo Riziq A., Van Roozendael M., Villani P., Wehner B., Wex H., Zardini A.A. (2009) Measuring atmospheric composition change. *Atmospheric Environment*, 43 33, 10.1016/j.atmosenv.2009.08.020

254. Lavaysse C., **Flamant C.,** Janicot S., Parker D.J., Lafore J.-P., Sultan B., **Pelon J.,** (2009) Seasonal evolution of the West African heat low: a climatological perspective. Climate Dynamics, 33, 10.1007/s00382-009-0553-4

255. Legrand M., Preunkert S., Jourdain B., Gallée H., **Goutail F**., Weller R., Savarino J. (2009) Year-round record of surface ozone at coastal (Dumont d'Urville) and inland (Concordia) sites in East Antarctica. *J. Geophys. Res. D: Atmospheres*, 114 10.1029/ 2008JD011667

256. **Mallet C., Barthes L**. (2009) Estimation of gamma raindrop size distribution parameters: Statistical fluctuations and estimation errors, *J. Atmos. and Oceanic Technology*, 26 8: 10.1175/2009JTECHA1199.1

257. Mallet M., Tulet P., SerÁa D., Solmon F., Dubovik O., **Pelon J.,** Pont V., Thouron O. (2009) Impact of dust aerosols on the radiative budget, surface heat fluxes, heating rate profiles and convective activity over West Africa during March 2006. *Atmos. Chem. Phys.*, 9 18, 7143-7160

258. Massart S., **Clerbaux C.,** Cariolle D., Piacentini A., **Turquety S., Hadji-Lazaro J.** (2009) First steps towards the assimilation of IASI ozone data into the MOCAGE-PALM system. *Atmos. Chem. Phys.*, 9 14, 5073-5091

259. Monks P.S., Granier C., Fuzzi S., Stohl A., Williams M.L., Akimoto H., Amann M., Baklanov A., Baltensperger U., Bey I., Blake N., Blake R.S., Carslaw K., Cooper O.R., Dentener F., Fowler D., Fragkou E., Frost G.J., Generoso S., Ginoux P., Grewe V., Guenther A., Hansson H.C., Henne S., Hjorth J., Hofzumahaus A., Huntrieser H., Isaksen I.S.A., Jenkin M.E., Kaiser J., Kanakidou M., Klimont Z., Kulmala M., Laj P., Lawrence M.G., Lee J.D., Liousse C., Maione M., Mcfiggans G., Metzger A., Mieville A., Moussiopoulos N., Orlando J.J., O'Dowd C.D., Palmer P.I., Parrish D.D., Petzold A., Platt U., PˆschI U., PrÈvÙt A.S.H., Reeves C.E., Reimann S., Rudich Y., Sellegri K., Steinbrecher R., Simpson D., Ten Brink H., Theloke J., Van Der Werf G.R., Vautard R., Vestreng V., Vlachokostas C., Von Glasow R. (2009) Atmospheric composition change – global and regional air quality. *Atmospheric Environment,* 43 33, 10.1016/j.atmosenv.2009.08.021

260. **Montoux N., Hauchecorne A., Pommereau J.-P., Lefèvre F.,** Durry G., Jones R.L., Rozanov A., Dhomse S., P. Burrows J., Morel B., Bencherif H. (2009) Evaluation of balloon and satellite water vapour measurements in the Southern tropical and subtropical UTLS during the HIBISCUS campaign. *Atmos. Chem. Phys*, 9 14, 5299-5319

261. Nielsen J.K., Larsen N., Christensen T., Khaykin S., **Pommereau J.-P.** (2009) Convective origin of stratospheric water vapor? *IOP Conference Series: Earth and Environmental Science,* 6 9, 10.1088/1755-1307/6/9/092021

262. Nisbet E.G., Jones S.M., Maclennan J., Eagles G., Moed J., Warwick N., **Bekki S.,** Braesicke P., Pyle J.A., Fowler C.M.R. (2009) Kick-starting ancient warming. *Nature geoscience*, 2 3, 10.1038/ngeo454

263. Pappalardo G., Papayannis A., BˆsenberG J., Ansmann A., Apituley A., Alados Arboledas L., Balis D., Beckmann C., Chaikovsky A., Comeron A., Gustafsson O., Hansen G., Mitev V., Mona L., Nicolae D., Rita Perrone M., Pietruczuk A., Pujadas M., Putaud J.-P., **Ravetta F.,** Rizi V., Simeonov V., Spinelli N., Stoyanov D., Trickl And M. Wiegner T., Trickl T., Wiegner M. (2009) EARLINET coordinated lidar observations of Saharan dust events on continental scale, IOP Conference Series: Earth and Environmental Science, 7, 10.1088/1755-1307/7/1/012002

264. Paris J.-D., Stohl A., Nédélec P., Arshinov M., Panchenko M.V., Shmargunov V.P., **Law K.** S., Belan B.D., Ciais P. (2009) Wildfire smoke in the Siberian Arctic in summer: source characterization and plume evolution from airborne measurements. *Atmos. Chem. Phys*, 9 23, 9315-9327

265. Pisso I., Real E., **Law K. S.,** Legras B., Bousserez N., Attié J.L., Schlager H. (2009) Estimation of mixing in the troposphere from Lagrangian trace gas reconstructions during long-range pollution plume transport. *J. Geophys. Res. D: Atmospheres*, 114, 10.1029/2008JD011289

266. **Plana-Fattori A.,** Brogniez G., Chervet P., Haeffelin M., Lado-Bordowsky O., Morille Y., Parol F., **Pelon J.,** Roblin A., SËze G., Stubenrauch C. (2009) Comparison of high cloud characteristics as estimated by selected spaceborne observations and ground-based lidar datasets[a]. *J. Applied Meteorology and Climatology*, 48, 10.1175/2009JAMC1964.1

267. **Protat A.,** Bouniol D., **Delanoë J.,** May P.T., **Plana-Fattori A.,** Hasson A., O'connor E., Görsdorf U., Heymsfield A.J. (2009) Assessment of Cloudsat Reflectivity Measurements and Ice Cloud Properties Using Ground-Based and Airborne Cloud Radar Observations. *J. Atmos. and Oceanic Technology*, 26 9, 10.1175/2009JTECHA1246.1

268. Randel W.J., Shine K.P., Austin J., Barnett J., Claud C., Gillett N.P., **Keckhut P.,** Langematz U., Lin R., Long C., Mears C., Miller A., Nash J., Seidel D.J., Thompson D.W.J., Wu F., Yoden S. (2009) An update of observed stratospheric temperature trends. *J. Geophys. Res. D: Atmospheres,* 114, doi:10.1029/2008JD010421

269. **Raut J.-C.,** Chazette P. (2009) Assessment of vertically-resolved PM10 from mobile lidar observations. *Atmos. Chem. Phys.*, 9 21, 8617-8638

270. Razavi A., **Clerbaux C.,** Wespes C., Clarisse L., Hurtmans D., Payan S., Camy-Peyret C., Coheur P.F. (2009) Characterization of methane retrievals from the IASI space-borne sounder, *Atmos. Chemis. Phys.*, 9 20, 7889-7899

271. Renard J.-B., **Bekki S.,** Blelly P.-L., Bourgeois Q., Berthet G., **Hauchecorne A.** (2009) Analysis of the spatial distribution of the unusual NO2 enhancements in the Arctic polar upper stratosphere and mesosphere observed by GOMOS-Envisat on January-March 2004. *J. of Geophys. Res. A: Space Physics*, 114, doi:10.1029/2009JA014174

272. Ricaud P., **Pommereau J.-P**., Attié J.-L., Le Flochmoën E., El Amraoui L., Teyssèdre H., Peuch V.-H., Feng W., P. Chipperfield M. (2009) Equatorial transport as diagnosed from nitrous oxide variability. *Atmos. Chem. Phys.*, 9 21, 4899-4930

273. Rix M., Valks P., Hao N., Loyola D., Zimmer W., Emmadi S., Erbertseder T., Van Geffen J., Clarisse L., **Clerbaux C**., Coheur P.-F. (2009) Satellite Monitoring of Volcanic Sulfur Dioxide Emissions for Early Warning of Volcanic Hazards. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing,* 2 3, doi:10.1109/JSTARS.2009.2031120

274. **Sarkissian A.,** Slusser J. (2009) Water vapor total column measurements using the Elodie Archive at Observatoire de Haute Provence from 1994 to 2004. *Atmospheric Measurement Techniques* , 2 2

275. Saux-Picart S., Ottlé C., Decharme B., André C., **Zribi M.,** Perrier A., Coudert B., Boulain N., Cappelaere B., Descroix L., Ramier D. (2009) Water and energy budgets simulation over the AMMA-Niger super-site spatially constrained with remote sensing data. *J. Hydrology*, 375 1-2, doi:10.1016/j.jhydrol.2008.12.023

276. Saux-Picart S., Ottlé C., Perrier A., Decharme B., Coudert B., **Zribi M.,** Boulain N., Cappelaere B., Ramier D. (2009) SEtHyS_Savannah: A multiple source land surface model applied to Sahelian landscapes. *Agricultural and Forest Meteorology* , 149 9, doi:10.1016/ j.agrformet.2009.03.013

277. **Scialom G., Faroux J., Giraud M., Ney R., Evaristo R., Lemaitre Y., Viltard N.** (2009) RONSARD Radar: Implementation of Dual Polarization on a C-Band Doppler Weather Radar, *IEEE Geoscience and Remote Sensing Letters*, 6 1, doi:10.1109/LGRS.2008.2008318

278. Sofieva V. F., **Dalaudier F.,** Kan V., Gurvich A. S. (2009) Technical note: Scintillations of the double star α Cru observed by GOMOS/Envisat. *Atmos. Chem. & Phys.*, 9 22, 8967-8973

279. Sofieva V.F., Gurvich A.S., **Dalaudier F**. (2009) Gravity wave spectra parameters in 2003 retrieved from stellar scintillation measurements by GOMOS. *Geophysical Research Letters*, 36, doi:10.1029/2008GL036726

280. Sofieva V.F., Kan V., **Dalaudier F.,** Kyrölä E., Tamminen J., **Bertaux J.-L., Hauchecorne A.**, Fussen D., Vanhellemont F. (2009) Influence of scintillation on quality of ozone monitoring by GOMOS. *Atmos. Chem. Phys*, 9 23, 9197-9207

281. Sofieva V.F., Kyrölä E., Verronen P.T., Seppälä A., Tamminen J., Marsh D.R., Smith A.K., **Bertaux J.-L., Hauchecorne A., Dalaudier F.,** Fussen D., Vanhellemont F., Fanton D'Andon O., Barrot G., Guirlet M., Fehr T., Saavedra L. (2009) Spatio-temporal observations of the tertiary ozone maximum. *Atmos. Chem. Phys*, 9 17, 6597-6615

282. Steinbrecht W., Claude H., Schönenborn F., Mcdermid I.S., Leblanc T., **Godin-Beekmann S., Keckhut P., Hauchecorne A.,** Van Gijsel J.A.E., Swart D.P.J., Bodeker G.E., Parrish A., Boyd I.S., K‰mpfer N., Hocke K., Stolarski R.S., Frith S.M., Thomason L.W., Remsberg E.E., Von Savigny C., Rozanov A., Burrows J.P. (2009) Ozone and temperature trends in the upper stratosphere at five stations of the Network for the Detection of Atmospheric Composition Change. *International Journal of Remote Sensing*, 30, doi:10.1080/ 01431160902821841

283. Struthers H., Bodeker G.E., Austin J., **Bekki S**., Cionni I., Dameris M., Giorgetta M.A., Grewe V., **Lefèvre F.,** Lott F., Manzini E., Peter T., Rozanov E., Schraner M. (2009) The simulation of the Antarctic ozone hole by chemistry-climate models. *Atmos. Chem. Phys*, 9 17 6363-6376

284. Tétard C., Fussen D., Bingen C., Capouillez N., Dekemper E., Loodts N., Mateshvili N., Vanhellemont F., Kyrölä E., Tamminen J., Sofieva V., **Hauchecorne A., Dalaudier F., Bertaux J.-L.,** Fanton D'Andon O., Barrot G., Guirlet M., Fehr T., Saavedra L. (2009) Simultaneous measurements of OClO, NO2 and O3 in the Arctic polar vortex by the GOMOS instrument. *Atmos. Chem. Phys*, 9 20

285. Theys N., Van Roozendael M., Errera Q., Hendrick F., Daerden F., Chabrillat S., Dorf M., Pfeilsticker K., Rozanov A., Lotz W., Burrows J.P., Lambert J.-C., **Goutail F**., Roscoe H.K., De Mazière M. (2009) A global stratospheric bromine monoxide climatology based on the BASCOE chemical transport mode. *Atmos. Chem. Phys*, 9 3

286. Thornton H.E., Jackson D.R., **Bekki S.,** Bormann N., Errera Q., Geer A.J., Lahoz W.A., Rharmili S. (2009) The ASSET intercomparison of stratosphere and lower mesosphere humidity analyses. *Atmos. Chem. Phys*, 9 3 (2009)

287. **Turquety S.,** Hurtmans D., **Hadji-Lazaro J.,** Coheur P.-F., **Clerbaux C., Josset D., Tsamalis C.** (2009) Tracking the emission and transport of pollution from wildfires using the IASI CO retrievals: analysis of the summer 2007 Greek fires. *Atmos. Chem. Phys*, 9 14, 995-1016

288. Van Gijsel J.A.E., Swart D.P.J., Baray J.-L., Claude H., Fehr T., Von Der Gathen P., **Godin-Beekmann S**., Hansen G.H., Leblanc T., Mcdermid I.S., Meijer Y.J., Nakane H., Quel E.J., Steinbrecht W., Strawbridge K.B., Tatarov B., Wolfram E.A. (2009) Global validation of ENVISAT ozone profiles using lidar measurements. *International Journal of Remote Sensing*, 30 15-16, doi:10.1080/01431160902821825

289. **Vannier E., Ciarletti V.,** Darboux F. (2009) Wavelet-based detection of clods on a soil surface. Computers and Geosciences, 35 11, doi:10.1016/j.cageo.2009.03.007

290. **Vernier J.-P., Pommereau J.-P., Garnier A., Pelon J.,** Larsen N., Nielsen J., Christensen T., Cairo F., Thomason L.W., Leblanc T., Mcdermid I.S. (2009) Tropical stratospheric aerosol layer from CALIPSO lidar observations, J. Geophys. Res. D: Atmospheres, 114, doi:10.1029/2009JD011946

291. Vialard J., Duvel J.-P., Mcphaden M.J., Bouruet-Aubertot P., Ward B., Key E., **Bourras D.,** Weller R., Minnett P., Weill A., Cassou C., Eymard L., Fristedt T., Basdevant C., Dandonneau Y., Duteil O., Izumo T., De Boyer MontÈgut C., Masson S., Marsac F., Menkes C., Kennan S. (2009) Supplement to Cirene: Air—Sea Interactions in the Seychelles—Chagos Thermocline Ridge Region. *Bulletin of the American Meteorological Society*, 90 1, doi:10.1175/2008BAMS2499.2

292. Vialard J., Duvel J.-P., Mcphaden M.J., Bouruet-Aubertot P., Ward B., Key E., **Bourras D.,** Weller R., Minnett P., Weill A., Cassou C., Eymard L., Fristedt T., Basdevant C., Dandonneau Y., Duteil O., Izumo T., De Boyer MontÈgut C., Masson S., Marsac F., Menkes C., Kennan S. (2009) Cirene: Air—Sea Interactions in the Seychelles—Chagos Thermocline Ridge Region. *Bulletin of the American Meteorological Society*, 90 1, doi:10.1175/2008BAMS2499.1

293. Wespes C., Hurtmans D., **Clerbaux C**., Santee M.L., Martin R.V., Coheur P.F. (2009) Global distributions of nitric acid from IASI/MetOP measurements. *Atmos. Chem. Phys.*, 9 20, 8035-8069

294. Yan X., Ducrocq V., Jaubert G., Brousseau P., Poli P., Champollion C., **Flamant C.,** Boniface K. (2009) The benefit of GPS zenith delay assimilation to high-resolution quantitative precipitation forecasts: a case-study from COPS IOP 9. *Quarterly Journal of the Royal Meteorological Society*, 135 644, doi:10.1002/qj.508

295. **Zribi M., Parde M.,** De Rosnay P., Baup F., Boulain N., Descroix L., Pellarin T., Mougin E., Ottle C., Decharme B. (2009) ERS scatterometer surface soil moisture analysis of two sites in the south and north of the Sahel region of West Africa. *J. Hydrology***,** 375 1-2 (2009) 10.1016/j.jhydrol.2008.11.046

Partner 7 - LSCE (UMR 8212)

296. Ahmadov R., Gerbig C., Kretschmer R., Korner S., Rodenbeck C., **Bousquet P.**, **Ramonet M.** (2009) Comparing high resolution WRF-VPRM simulations and two global CO2 transport models with coastal tower measurements of CO2. *Biogeosci*. 6, 807-817.

297. Almogi-Labin A., Bar-Matthews M., Shriki D., Kolosovsky E., **Paterne M.**, Schilman B., Ayalon A., Aizenshtat Z., Matthews A. (2009) Climatic variability during the last ~90 ka of the southern and northern Levantine Basin as evident from marine records and speleothems. *Quat. Sci. Rev.* 28, 2882-2896.

298. Anenberg S.C., West J.J., Fiore A.M., Jaffe D.A., Prather M.J., Bergmann D., Cuvelier K., Dentener F.J., Duncan B.N., Gauss M., Hess P., Jonson J.E., Lupu A., MacKenzie I.A., Marmer E., Park R.J., Sanderson M.G., Schultz M., Shindell D.T., **Szopa S.**, Vivanco M.G., Wild O., Zeng G. (2009) Intercontinental impacts of ozone pollution on human mortality. *Environ. Sci. Tech.* 43, 6482-6487.

299. Antoine P., Rousseau D.D., Fuchs M., **Hatté C.**, **Gauthier C.**, Markovic S., Jovanovic M., Gaudenyi T., Moine O., Rossignol J. (2009) High resolution record of the last climatic cycle in the Southern Carpathian basin (Surduk, Vojvodina, Serbia). *Quat. Int.* 198, 19-36.

300. Argyriades J., Arnold R., Augier C., Baker J., Barabash A.S., Basharina-Freshwille A., Bongrand M., Broudin G., Brudanin V., Caffrey A.J., Chauveau E., Daraktchieva Z., Durand D., Egorov V., Fatemi-Ghomi N., Flack R., Hubert P., Jerie J., Jullian S., Kauer M., King S., Klimenko A., Kochetov O., Konovalov S.I., Kovalenko V., Lalanne D., Lamhamdi T., Lang K., Lamière Y., Longuemare C., Lutter G., Marquet C., Martin-Albo J., Manger F., Nachab A., Nasteva I., Nemchenok I., Nova F., Novella P., Ohsumi H., Pahlka R.B., Perrot F., Piquemal F., **Reyss J.L.**, Ricol J.S., Saakyan R., Sarazin X., Simard L., Simkovic F., Shitov Y., Smolnikov A., Snow S., Soldner-Rembold S., Stekl I., Suhonen J., Sutton C.S., Szklarz G., Thomas J., Timkin V., Tretyak V., Umatov V., Vala L., Vanyushin I., Vasiliev V., Vorobel V., Vylov T. (NEMO Collaboration) (2009) Measurement of the double-beta decay half-life of 150Nd and search for neutrinoless decay modes with the NEMO-3 detector. *Phys. Rev. C* 80, 032501.

301. Argyriades J., Arnold R., Augier C., Baker J., Barabash A.S., Bongrand M., Broudin-Bay G., Brudanin V.B., Caffrey n A., Chauveau E., Daraktchieva Z., Durand D., Egorov V.G., Fatemi-Ghomi N., Flack R., Freshville A., Guillon B., Hubert P., Jullian S., Kauer M., King S., Kchetov O.I., Konovalov S.I., Kovalenko V.E., Lalanne D., Lang K., Lemière Y., Lutter G., Mamedov F., Marquet C., Martin-Albo J., Mauger F., Nachab A., Nasteva I., Nemchenok I.B., Nova F., Novella P., Ohsumi H., Pahlka R.B., Perrot F., Piquemal F., **Reyss J.L.**, Ricol J.S., Saakyan R., sarazin X., Simard L., Shitov Y.A., Smolnikov A.A., Snow S., Soldner-Rembold S., Stekl I., Sutton C.S., Szklarz G., Thomas J., Timkin V.V., Tretyak V.I., Tretyak V.I.I., Umatov V.I., Vala L., Vanyushin I.A., Vasiliev V.A., Vorobel V., Vylov T., NEMO Coll. (2009) Measurement of the backgroundin the NEMO 3 double beta decay experiment. *Nucl. Instrum. Meth. Phys. Res.* A 606, 449-465.

302. Arnold L., **Bréon F.M.**, Brewer S. (2009) The Earth as an extrasolar planet: the vegetation spectral signature today and during the last Quaternary climatic extrema. *Int. J. Astrobiol*. 8, 81-94.

303. Arnold S.R., Spracklen D.V., Williams J., Yassaa N., **Sciare J.**, **Bonsang B.**, **Gros V.**, Peeken I., Lewis A.C., **Alvain S.**, **Moulin C.** (2009) Evaluation of the global oceanic isoprene source and its impacts on marine organic carbon aerosol. *Atmos. Chem. Phys.* 9, 1253-1262.

304. **Arsouze T.**, **Dutay J.C.**, Lacan F., Jeandel C. (2009) Reconstructing the Nd oceanic cycle using a coupled dynamical - biogeochemical model. *Biogeosci.* 6, 2829-2846.

305. Banks W.E., Zilhao J., D'Errico F., **Kageyama M.**, Sima A., Ronchiteli A. (2009) Investigating links between ecology and bifacial tool types in Western Europe during the Last Glacial Maximum. *J. Archaeol. Sci.* 36, 2853-2867.

306. **Barras C.**, Geslin E., **Duplessy J.C.**, Jorissen F.J. (2009) Reproduction and growth of the deep-sea benthic foraminifer Bulimina Marginata under different laboratory conditions. *J. Foram. Res.* 39, 155-165.

307. Beer C., **Ciais P.**, Reichstein M., Baldocchi D., Law B.E., Papale D., Soussana J.F., Ammann C., Buchmann N., Frank D., Gianelle D., Janssens I.A., Knohl A., Kostner B., Moors E., Roupsard O., Verbeeck H., Vesala T., Williams C.A., Wohlfahrt G. (2009) Temporal and among-site variability of inherent water use efficiency at the ecosystem level. *Global Biogeochem. Cycles* 23B2018, 10.1029/2008GB003233.

308. **Belmecheri S.**, Namiotko T., Robert C., **Von Grafenstein U.**, Danielopol D.L. (2009) Climate controlled ostracod preservation in Lake Ohrid (Albania, Macedonia). *Palaeogeogr. Palaeoclim. Palaeoecol.* 277, 236-245.

309. **Belviso S.**, Caniaux G. (2009) A new assessment in North-Atlantic waters of the relationship between DMS concentration and the upper mixed layer solar radiation dose. *Global Biogeochem. Cycles* 23, GB1014, 10.1029/ 2008GB003382.

310. Bernard A., **Daux V.**, Lécuyer C., Brugal J.P., **Genty D.**, **Wainer K.**, Gardien V., Fourel F., Jaubert J. (2009) Pleistocene seasonal temperature variations recorded in the d18O of Bison priscus teeth. *Earth Planet. Sci. Lett.* 283, 133-143.

311. **Bonelli S.**, **Charbit S.**, **Kageyama M.**, **Woillez M.N.**, **Ramstein G.**, **Dumas C.**, Quiquet A. (2009) Investigating the evolution of major Northern Hemisphere ice sheets during the last glacial-interglacial cycle. *Clim. Past* 5, 329-345.

312. Boomer I., Wunnemann B., Mackay A.W., Austin P., Sorrel P., Reinhardt C., Keyser D., **Guichard F.**, **Fontugne M.** (2009) Advances in understanding the late Holocene history of the Aral Sea region. *Quat. Int.* 194, 79-90.

313. Boone A., De Rosnay P., Balsamo G., Beljaars A., Chopin F., Decharme B., Delire C., Ducharne A., Gascoin S., Grippa M., Guichard F., Gusev Y., Harris P., Jarlan L., Kergoat L., Mougin E., Nasonova O., Norgaard A., Orgeval T., **Ottlé C.**, Poccard-Leclercq I., Polcher J., Saldholt I., Saux-Picart S., Taylor C., Xue Y.K. (2009) The AMMA land surface model intercomparison project (ALMIP). *Bull. Amer. Meteorol. Soc.* 90, 1865-1880.

314. **Bordon A.**, Peyron O., **Lézine A.M.**, Brewer S., Fouache E. (2009) Pollen-inferred Late-Glacial and Holocene climate in southern Balkans (Lake Maliq).. *Quat. Int.* 200, 19-30.

315. Boucher O., **Friedlingstein P.**, Collins B., Shine K.P. (2009) The indirect global warming potential and global temperature change potential due to methane oxidation. *Environ. Res. Lett.* 4, 044007.

316. **Bouttes N.**, **Roche D.M.**, **Paillard D.** (2009) Impact of strong deep ocean stratification on the glacial carbon cycle. *Paleoceanography* 24, PA3203, 10.1029/2008PA001707.

317. Brasseur P., Gruber N., Barciela R., Brander K., Doron M., El Moussaoui A., Hobday A.J., Huret M., Kremeur A.S., Lehodey P., Matear R., **Moulin C.**, Murtugudde R., Senina I., Svendsen E. (2009) Integrating biogeochemistry and ecology into ocean data assimilation systems. *Oceanography* 22 (GODAE), 206-215.

318. Briais A., Ondréas H., Klingelhoefer F., Dosso L., Hamelin C., **Guillou H.** (2009) Origin of volcanism on the flanks of the Pacific-Antarctic ridge between 41°30'S and 52°S. *Geochem. Geophys. Geosyst.* 10, Q09001, 10.1029/2008GC002350.

319. **Cadule P.**, **Bopp L.**, **Friedlingstein P.** (2009) A revised estimated of the processes contributing to global warming due to climate-carbon feedback. *Geophys. Res. Lett.* 36, L14705, 10.1029/2009GL038681.

320. Cao L., Eby M., Ridgwell A., Caldeira K., Archer D., Ishida A., Joos F., Matsumoto K., Mikolajewicz U., Mouchet A., **Orr J.C.**, Plattner G.K., Schlitzer R., Tokos K., Totterdell I., Tschumi T., Yamanaka Y., Yool A. (2009) The role of ocean transport in the uptake of anthropogenic CO2. *Biogeosci.* 6, 375-390.

321. Cappelaere B., Descroix L., Lebel T., Boulain N., Ramier D., Laurent J.P., Favreau G., Boubkraoui S., Boucher M., Bouzou Moussa I., Chaffard V., Hiernaux P., Issoufou H.B.A., Le Breton E., Mamadou I.,

Nazoumou Y., Oi M., **Ottlé C.**, Quantin G. (2009) The AMMA-CATCH experiment in the cultivated Sahelian area of south-west Niger - Investigating water cycle response to a fluctuating climate and changing environment. J. Hydrol. 375, 34-51.

322. Cariolle D., **Caro D.**, Paoli R., **Hauglustaine D.A.**, Cuenot B., **Cozic A.**, Paugam R. (2009) Parameterization of plume chemistry into large-scale atmospheric models: Application to aircraft NOx emissions [NO_x]. *J. Geophys. Res*. 114, D19302, 10.1029/2009JD011873.
323. Carré M., Klaric L., Lavallée D., Julien M., Bentaleb I., **Fontugne M.**, Kawka O. (2009) Insights into Early Holocene hunter-gatherer mobility on the Peruvian Southern coast from mollusk gathering seasonality. *J. Archaeol. Sci.* 36, 1173-1178.
324. Carton H., Singh S.C., Tapponnier P., Elias A., Briais A., Sursock A., Jomaa R., King G.C.P., **Daeron M.**, Jacques E., Barrier L. (2009) Seismic evidence for Neogee and active shortening offshore of Lebanon (Shalimar cruise). *J. Geophys. Res.* 114, B07407, 10.1029/2007JB005391.
325. Catinon M., **Ayrault S.**, Boudouma O., Asta J., Tissut M., Ravanel P. (2009) The inclusion of atmospheric particles into the bark suber of ash trees. *Chemosphere* 77, 1313-1320.
326. Catinon M., **Ayrault S.**, Clocchiatti R., Budouma O., Asta J., Tissut M., Ravanel P. (2009) The anthropogenic atmospheric elements fraction: A new interpretation of elemental deposits on tree barks. *Atmos. Environ.* 43, 1124-1130.
327. Cattiaux J., **Vautard R.**, **Yiou P.** (2009) Origins of the extremely warm European fall of 2006. *Geophys. Res. Lett.* 36, L06713, 10.1029/2009GL037339.
328. **Chaduteau C.**, **Jean-Baptiste P.**, **Fourré E.**, Charlou J.L., Donval J.P. (2009) Helium transport in sediment pore fluids on the Congo-Angola margin. *Geochem. Geophys. Geosyst.* 10, Q01002, 10.1029/2007GC001897.
329. Champollion C., Drobinski P., Haeffelin M., Bock O., **Tarniewicz J.**, Bouin M.N., **Vautard R.** (2009) Water vapor variability induced by urban/rural surface heterogeneities during convective conditions. *Quat. J. Royal Meteorol. Soc*. 135, 1266-1276.
330. **Chevallier F.**, Engelen R.J., **Carouge C.**, Conway T.J., **Peylin P.**, **Pickett-Heaps C.**, **Ramonet M.**, **Rayner P.**, **Xueref-Remy I.** (2009) AIRS-based vs. flask-based estimation of carbon surface fluxes. *J. Geophys. Res.* 114, D20303, 10.1029/2009JD012311.
331. **Chevallier F.**, Fortems A., **Bousquet P.**, Pison I., Szopa S., Devaux M., Hauglustaine D. (2009) African CO emissions between years 2000 and 2006 as estimated from MOPITT observations. *Biogeosci.* 6, 103-111.
332. **Chevallier F.**, Maksuytov S., **Bousquet P.**, **Bréon F.M.**, Saito R., Yoshida Y., Yokota T. (2009) On the accuracy of the CO2 surface fluxes to be estimated from the GOSAT observations. *Geophys. Res. Lett.* 36, L19807, 10.1029/2009GL040108.
333. **Ciais P.**, Piao S.L., **Cadule P.**, **Friedlingstein P.**, Chédin A. (2009) Variability and recent trands in the African carbon balance. *Biogeosci*. 6, 1935-1948.
334. **Cleroux C.**, Lynch-Stieglitz J., Schmidt M.W., **Cortijo E.**, **Duplessy J.C.** (2009) Evidence for calcification depth change of G. truncatulinoides between Deglaciation and Holocene in the western Atlantic Ocean. Mar. Micropal. 73, 57-61.
335. Coll I., Lasry F., Fayet S., Armengaud A., **Vautard R**. (2009) Simulation and evaluation of 2010 emission control scenarios in a Mediterranean area. *Atmos. Environ*. 43, 4194-4204.
336. Colomb A., **Gros V.**, Alvain S., **Sarda-Esteve R.**, **Bonsang B.**, **Moulin C.**, Klupfel T., Williams J. (2009) Variation of atmospheric volatile organic compounds over the Southern Indian (30-49°S). *Environ. Chem.* 6, 70-82.
337. **Combourieu-Nebout N.**, Peyron O., Dormoy I. (2009) Rapid climatic variability in the west Mediterranean during the last 25.000 years from high resolution pollen data. *Clim. Past* 5, 503-521.
338. Couchoud I., **Genty D.**, Hoffmann D., Drysdale R., **Blamart D.** (2009) Millenial-scale climate variability during the Last Interglacial recorded in a speleothem from south-western France. *Quat. Sci. Rev.* 28, 3263-3274.
339. Curci G., Beekmann M., **Vautard R.**, Smiatek G., Steinbrecher R., Theloke J., Friedrich R. (2009) Modelling study of the impact of isoprene and terpene biogenic emissions on European ozone levels. *Atmos. Environ.* 43, 1444-1455.
340. De Haas H., Mienis F., **Frank N.**, Richter T.O., Steinacher R., De Stigter H., Van der Land C., Van Weering T.C.E. (2009) Morphology and sedimentology of (clustered) cold-water coral mounds at the south Rockall Trough margins, NE Atlantic Ocean. *Facies* 55, 1-26.

341. Demir T., Seyrek A., **Guillou H.**, **Scaillet S.**, Westaway R., Bridgland D. (2009) Preservation by basalt of a staircase of latest Pliocene terraces of the River Murat in eastern Turkey: Evidece for rapid uplift of the eastern Anatolian Plateau. *Global Planet. Change* 68, 254-269.

342. Desprat S., Sanchez-Goni M.F., Duprat J., **Cortijo E.**, McManus J.F. (2009) Millenial-scale climatic variability between 340.000 and 270.000 years ago in SW Europe: evidence from a NW Iberian margin pollen sequence. *Clim. Past 5, 53-72.*

343. Dillon M., **Franke C.** (2009) Diagenetic alteration of natural Fe-Ti oxides identified by energy dispersive spectroscopy and low-temperature magnetic remanence and hysteresis measurements. *Phys. Earth Planet. Int.* 172, 141-156.

344. **Donnadieu Y.**, Goddéris Y., Bouttes N. (2009) Exploring the climatic impact of the continental vegetation on the Mezosoic atmospheric CO2 and climate history. *Clim. Past* 5, 86-96.

345. Dormoy I., Peyron O., **Combourieu-Nebout N.**, Goring S., Kotthoff U., Magny M., Pross J. (2009) Terrestrial climate variability and seasonality changes in the Mediterranean region between 15.000 and 4000 years BP deduced from marine pollen records. *Clim. Past* 5, 615-632.

346. Dufour G., **Szopa S.**, Barkley M.P., Boone C.D., Perrin A., Palmer P.I., Bernath P.F. (2009) Global upper(tropospheric formaldehyde: seasonal cycles observed by the ACE-FTS satellite instrument. *Atmos. Chem. Phys*. 9, 3893-3910.

347. Durant A.J., Harrison S.P., Watson I.M., **Balkanski Y.** (2009) Sensitivity of direct radiative forcing by mineral dust to particle characteristics. *Progr. Phys. Geogr.* 33, 80-102.

348. **Dutay J.C.**, Lacan F., **Roy-Barman M.**, **Bopp L.** (2009) The influence of particle size and type on 231Pa and 230Th simulation with a global coupled biogeochemical-ocean general circulation model: a first approach. *Geochem. Geophys. Geosyst*. 10, Q01011, 10.1029/2008GC002291.

349. **Dutreuil S.**, **Bopp L.**, **Tagliabue A.** (2009) Impact of enhanced vertical mixing on marine biogeochemistry: lessons for geo-engineering and natural variability. *Biogeosci*. 6, 901-912.

350. Elias T., Haeffelin M., Drobinski P., Gomes L., Rangognio J., Bergot T., **Chazette P.**, **Raut J.C.**, Colomb M. (2009) Particulate contribution to extinction of visible radiation: Pollution, haze, and fog. *Atmos. Res.* 92, 443-454.

351. Engelen R.J., Serrar S., **Chevallier F.** (2009) Four-dimensional data assimilation of atmospheric CO2 using AIRS observations. *J. Geophys. Res.* 114, D03303, 10.1029/2008JD010739.

352. **Etien N.**, **Daux V.**, **Masson-Delmotte V.**, Mestre O., **Stiévenard M.**, **Guillemin M.T.**, Boettger T., Bréda N., Haupt M., Perraud P.P. (2009) Summer maximum temperature in Northern France over the past century: instrumental data versus multiple proxies (tree-ring isotopes, grape harvest dates and forest fires). *Clim. Change* 94, 429-456.

353. Fautin D.G., Guinotte J.M., **Orr J.C.**, 2010. Comparative depth distribution corallimorpharians and scleractinians (Cnidaria: Anthozoa). *Mar. Ecol. Progr. Ser.* 397, 63-70.

354. **Favez O.**, Alfaro S.C., **Sciare J.**, **Cachier H.**, Abdelwahab M.M. (2009) Ambient measurements of light-absorption by agricultural waste burning organic aerosols. *J. Aerosol Sci.* 40, 613-620.

355. **Favez O.**, **Cachier H.**, **Sciare J.**, **Sarda-Estève R.**, Martinon L. (2009) Evidences for a significant contribution of wood burning aerosols to PM2.5 during the winter season in Paris, France. *Atmos. Environ*. 43, 3640-3644.

356. Fiore A.M., Dentener F.J., Wild O., Cuvelier C., Schultz M.G., Hess P., **Textor C.**, **Schulz M.**, Doherty R.M., Horowitz L.W., MacKenzie I.A., Sanderson M.G., Shindell D.T., Stevenson D.S., **Szopa S.**, Dingenen R.V., Zeng G., Atherton C., Bergmann D., Bey I., Carmichael G., Collins W.J., Duncan B.N., Faluvegi G., Folberth G., Gauss M., Gong S., **Hauglustaine D.**, Holloway T., Isaksen I.S.A., Jacob D.J., Jonson J.E., Kaminski J.W., Keating T.J., Lupu A., Marmer E., Montanaro V., Park R.J., Pitari G., Pringle K.J., Pyle J.A., Schroeder S., Vivanco M.G., Wind P., Wojcik G., Wu S., Zuber A. (2009) Multi-model estimates of intercontinental source-receptor relationships for ozone pollution. *J. Geophys. Res.* 114, D04301, 10.1029/2008JD010816.

357. Follain S., Walter C., **Bonté P.**, Marguerie D., **Lefèvre I.** (2009) A-horizon dynamics in a historical hedged landscape. *Geoderma* 150, 334-343.

358. **Fontugne M.**, **Guichard F.**, Bentaleb I., Strechie C., Lericolais G. (2009) Vriations in 14C reservoir ages of Black Sea waters and sedimentary organic carbon during anoxic periods: Influence of photosynthetic versus chemoautotrophic production. *Radiocarbon* 51, 969-976.

359. **Fortems-Cheiney A.**, **Chevallier F.**, **Pison I.**, **Bousquet P.**, **Carouge C.**, Clerbaux C., Coheur P.F., George M., Hurtmans D., **Szopa S.** (2009) On the capability of IASI measurements to inform about CO surface emissions. *Atmos. Chem. Phys.* 9, 8735-8743.

360. **Frank N.**, Ricard E., **Lutringer-Paquet A.**, Van der Land C., Colin C., **Blamart D.**, Foubert A., Van Rooij D., Henriet J.P., De Haas H., Van Weering T. (2009) The Holocene occurrence of cold water corals in the NE Atlantic: implications for coral carbonate mound evolution. *Mar. Geol.* 266, 129-142.

361. **Franke C.**, **Kissel C.**, **Robin E.**, **Bonté P.**, Lagroix F. (2009) Magnetic particle characterization in the Seine river system: Implications for the determination of natural versus anthropogenic input. *Geochem. Geophys. Geosyst.* 10, Q08Z05, 10.1029/2009GC002544.

362. Ganopolski A., **Roche D.M.** (2009) On the nature of lead-lag relationships during glacial-interglacial climate transitions. *Quat. Sci. Rev*. 28, 3361-3378.

363. **Gherardi J.M.**, **Labeyrie L.**, Nave S., Francois R., McManus J.F., **Cortijo E.** (2009) Glacial-Interglacial circulation changes inferred from 231Pa/230Th sedimentary record in the North Atlantic region. *Paleoceanography* 24, PA2204, 10.1029/2008PA001696.

364. Gibert F., Joly L., **Xueref-Rémy I.**, **Schmidt I.**, **Royer A.**, Flamant P.H., **Ramonet M.**, Parvitte B., Durry G., Zéninari V. (2009) Inter-comparison of 2 mu-m Heterodyne differential absorption Lidar, laser diode spectrometer, LICOR NDIR analyzer and flasks measurements of near-ground atmospheric CO2 mixing ratio. *Spectrochim. Acta A* 71, 1914-1921.

365. Glen J.M.G., **Nomade S.**, Lyons J.J., Metcalfe I., Mundil R., Renne P.R. (2009) Magnetostratigraphic correlations of Permian-Triassic marine-to-terrestrial sections from China. *J. Asian Earth Sci.* 36, 521-540.

366. Goddéris Y., **Donnadieu Y.** (2009) Biogeochemistry: Climatic plant power. *Nature* 460, 40-41 (news and views).

367. **Govin A.**, **Michel E.**, **Labeyrie L.**, **Waelbroeck C.**, **Dewilde F.**, Jansen E. (2009) Evidence for northward expansion of Antarctic Bottom Water mass in the Southern Ocean during the last glacial inception. *Paleoceanography* 24, PA1202, 10.1029/2008PA001603.

368. Gregory J.M., Jones C.D., **Cadule P.**, **Friedlingstein P.** (2009) Quantifying carbon cycle feedbacks. *J. Clim.* 22, 5232-5250.

369. **Grenier C.**, Bernard-Michel G., Benabderrahmane H. (2009) Evaluation of retention properties of a semi-synthetic fractured block from modelling at performance assessment time scales (Aspo Hard Rock Laboratory, Sweden). *Hydrogeol. J.* 17, 1051-1066.

370. **Gros V.**, Peeken I., Bluhm K., Zollner E., **Sarda-Esteve R.**, **Bonsang B.** (2009) Carbon monoxide emissions by phytoplankton: evidence from laboratory experiments. *Environ. Chem*. 6, 369-379.

371. **Guemas V.**, Salas-Melia D., **Kageyama M.**, Giordani H., Voldoire A., Sanchez-Gomez E. (2009) Winter interactions between weather regimes and marine surface in the North Atlantic European region. *Geophys. Res. Lett.* 36, L09816, 10.1029/2009GL037551.

372. Guilyardi E., **Braconnot P.**, Jin F.F., Kim S.T., Kolasinski M., Li T., Musat I. (2009) Atmosphere feedbacks during ENSO in a coupled GCM with a modified atmospheric convection scheme. *J. Clim.* 22, 5698-5718.

373. Gutierrez D., Sifeddine A., Field D.B., Ortlieb L., Vargas G., Chavez F., Velazco F., Ferreira V., Tapia P., Salvatteci R., Boucher H., Morales M.C., Valdes J., **Reyss J.L.**, Campusano A., Boussafir M., Mandeng-Yogo M., Garcia M., Baumgartner T. (2009) Rapid reorganization in ocean biogeochemistry off Peru towards the end of the Little Ice Age. *Biogeosci.* 6, 835-848.

374. **Hayek M.**, **Mouche E.**, **Mugler C.** (2009) Modeling vertical stratification of CO2 injected into a deep layered aquifer. *Adv. Water Res.* 32, 450-462.

375. Hoor P., Borken-Kleefeld J., **Caro D.**, Dessens O., Endresen O., Gauss M., Grewe V., **Hauglustaine D.**, Isaksen I.S.A., Jockel P., Lelieveld J., Meijer E., Olivie D., Prather M., Schnadt Poberaj C., Staehelin J., Tang Q., Van Aardenne J., Van Velthoven P., Sausen R. (2009) The impact of traffic emissions on atmospheric ozone and OH: results from QUANTIFY. *Atmos. Chem. Phys.* 9, 3113-3136.

376. **Huneeus N.**, Boucher O., **Chevallier F.** (2009) Simplified aerosol modeling for variational data assimilation. *Geosci. Model Dev*. 2, 213-229.

377. Huntington K.W., Eiler J.M., Affek H.P., Guo W., Bonifacie M., Yeung L.Y., Thiagarajan N., Passey B., Tripati A., **Daeron M.**, Came R. (2009) Methods and limitations of "clumped" CO2 isotope (Δ47) analysis by gas-source isotope ratio mass spectrometry. *J. Mass Spectrom.* 44, 1318-1329.

378. Isaksen I.S.A., Myhre G., Gauss M., Berntsen T.K., Benestad R., **Bousquet P.**, Collins W., Cox T., Dalsoren S.B., Eyring V., Fowler D., Fuzzi S., Granier C., Jockel P., Klimont Z., Laj P., Lohmann U., Maione M., Monks P., Prevot A.S.H., Raes F., Richter A., Rognerud B., **Schulz M.**, Shindell D., Stevenson D.S., Storelvmo T., Wang W.C., Van Weele M., Wild M., Wuebbles D. (2009) Atmospheric composition change: Climate-chemistry interactions. *Atmos. Environ.* 43, 5138-5192.

379. Jacquemoud S., Verhoef W., Baret F., **Bacour C.**, Zarco-Tejada P.J., Asner G.P., François C., Ustin S.L. (2009) PROSPECT + SAIL models: A review of use for vegetation characterization. *Remote Sensing Environ.* 113, S56-S66.

380. Jalut G., Dedoubat J.J., **Fontugne M.**, Otto T. (2009) Holocene circum mediterranean vegetation changes: climate forcing and human impact. *Quat. Int.* 200, 4-18.

381. **Jean-Baptiste P.**, Allard P., Coutinho R., Ferreira T., **Fourré E.**, Queiroz G., Gaspar J.L. (2009) Helium isotopes in hydrothermal volcanic fluids of the Azores archipelago. *Earth Planet. Sci. Lett.* 281, 70-80.

382. **Jean-Baptiste P.**, **Fourré E.**, Charlou J.L., Donval J.P., Corrège T. (2009) Gaining insight into Clipperton's lagoon hydrology using tritium. *Estuar. Coastal Shelf Sci.* 80, 39-46.

383. Jomelli V., Favier V., Rabatel A., Brunstein D., **Hoffmann G.**, Francou B. (2009) Fluctuations of glaciers in the tropical Andes over the last millennium and palaeoclimatic implications: A review. *Palaeogeogr. Palaeoclim. Palaeoecol.* 281, 269-282.

384. Jost A., Fauquette S., **Kageyama M.**, Krinner G., **Ramstein G.**, Suc J.P., Violette S. (2009) High resolution climate and vegetation simulations of the Late Pliocene, a model-data comparison over western Europe and the Mediterranean region. *Clim. Past* 5, 585-606.

385. **Juillet-Leclerc A.**, Reynaud S., Rollion-Bard C., Cuif J.P., Dauphin Y., **Blamart D.**, Ferrier-Pagès C., Allemand D. (2009) Oxygen isotopic signature of the skeletal microstructures in cultured corals: identification of vital effects. *Geochim. Cosmochim. Acta* 73, 5320-5332.

386. **Kageyama M.**, Mignot J., Swingedouw D., **Marzin C.**, **Alkama R.**, **Marti O.** (2009) Glacial climate sensitivity to different states of the Atlantic Meridional overturning circulation: results from the IPSL model. *Clim. Past* 5, 551-570.

387. Keenan T., **Garcia R.**, Friend A.D., **Zaehle S.**, Gracia C., Sabate S. (2009) Improved understanding of drought controls on seasonal variation in Mediterranean forest canopy CO2 and water fluxes through combined in situ measurements and ecosystem modelling. *Biogeosci.* 6, 1423-1444.

388. Kim J.H., Crosta X., **Michel E.**, Schouten S., Duprat J., Damsté J.S.S. (2009) Impact of lateral transport on organic proxies in the Southern Ocean. *Quat. Res.* 71, 246-250.

389. **Kim S.W.**, **Chazette P.**, **Dulac F.**, **Sanak J.**, Johnson B., Yoon S.C. (2009) Transport and vertical structure of aerosols and water vapor over West Africa during the African monsoon dry season. *Atmos. Chem. Phys.* 9, 8017-8038.

390. **Kissel C.**, **Laj C.**, Mulder T., **Wandres C.**, Cremer M. (2009) The magnetic fraction: a tracer of deep water circulation in the North Atlantic. *Earth Planet. Sci. Lett.* 288, 444-454.

391. Koch D., **Schulz M.**, Kinne S., Bond T.C., **Balkanski Y.**, Bauer S., Berntsen T., Boucher O., Chin M., Clarke A., Dee Luca N., Dentener F., Diehl T., Dubovik O., Easter R., Fahey D.W., Feichter J., Fillmore D., Freitag S., Ghan S., Ginoux P., Gong S., Horowitz L., Iversen T., Kirkevag A., Klimont Z., Kondo Y., Krol M., Liu X., McNaughton C., Miller R., Montanaro V., Moteki N., Myhre G., Penner J.E., Perlwitz J., Pitari G., Reddy S., Sahu L., Sakamoto H., Schuster G., Schwarz J.P., Seland O., Spackman J.R., Stier P., Takagawa N., Takemura T., **Textor C.**, Van Aardenne J.A., Zhao Y. (2009) Evaluation of black carbon estimations in global aerosol models. *Atmos. Chem. Phys.* 9, 9001-9026.

392. Kohler M., Degering D., Laubenstein M., Quirin P., Lampert M.O., Hult M., Arnold D., Neumaier S., **Reyss J.L.** (2009) A new low-level gamma-ray spectrometry system for environmental radioactivity at the underground laboratory Felsenkeller. *Appl. Rad. Isotop.* 67, 736-740.

393. **Koven C.**, **Friedlingstein P.**, **Ciais P.**, Khvorostyanov D., Krinner G., Tarnocai C. (2009) On the formation of high-latitude soil carbon stocks: The effects of cryoturbation and insulation by organic matter in a land surface model. *Geophys. Res. Lett.* 36, L21501, 10.1029/2009GL040150.

394. **Lachkar Z.**, **Orr J.C.**, **Dutay J.C.** (2009) Seasonal and mesoscale variability of oceanic transport of anthropogenic CO2. *Biogeosci*. 6, 2509-2523.

395. **Lachkar Z.**, **Orr J.**, **Dutay J.C.**, Delecluse P. (2009) On the role of mesoscale eddies in the ventilation of Antarctic intermediate water. *Deep-Sea Res. I* 56, 909-925.

396. Lagabrielle Y., Goddéris Y., **Donnadieu Y.**, Malavieille J., Suarez M. (2009) The tectonic history of Drake Passage and its possible impacts on global climate. *Earth Planet. Sci. Lett*. 279, 197-211.

397. **Lainé A.**, **Kageyama M.**, **Braconnot P.**, **Alkama R.** (2009) Impact of greenhouse gas concentration changes on the surface energetics in the IPSL-CM4 model: regional warming patterns, land/sea warming ratios, glacial/interglacial differences. *J. Clim*. 22, 4621-4635.

398. **Lainé A.**, **Kageyama M.**, Salas-Mélia D., **Ramstein G.**, Planton S., Denvil S., Tyteca S. (2009) An energetics study of winter-time northern hemisphere storm tracks under 4xCO2 conditions in two ocean-atmosphere coupled models. *J. Clim.* 22, 819-839.

399. **Lainé A.**, **Kageyama M.**, Salas-Mélia D., Voldoire A., Rivière G., **Ramstein G.**, Planton S., Tyteca S., **Peterschmitt J.Y.** (2009) Northern hemisphere storm tracks during the last glacial maximum in the PMIP2 ocean-atmosphere coupled models: energetic study, seasonal cycle, precipitation. *Clim. Dyn*. 32, 593-614.

400. Laj P., Klausen J., Bilde M., Plass-Duelmer C., Pappalardo G., Clerbaux C., Baltensperger U., Hjorth J., Simpson D., Reimann S., Coheur P.F., Richter A., De Mazière M., Rudich Y., McFiggans G., Torseth K., Wiedensohler A., Morin S., **Schulz M.**, Allan J., Attié J.L., Barnes I., Birmilli W., Cammas P., Dommen J., Dorn H.P., Fowler D., Fuzzi J.S., Glasius M., Granier C., Hermann M., Isaksen I., Kinne S., Koren I., Madonna F., Maione M., Massling A., Moehler O., Mona L., Monks P., Muller D., Muller T., Orphal J., Peuch V.H., Stratmann F., Tanré D., Tyndall G., Riziq A.A., Van Roozendael M., Villani P., Wehner B., Wex H., Zardini A.A. (2009) Measuring atmospheric composition change. *Atmos. Environ.* 43, 5351-5414.

401. Langmann B., Duncan B., **Textor C.**, Trentmann J., Van der Werf G.R. (2009) Vegetation fire emissions and their impact on air pollution and climate. *Atmos. Environ.* 43, 107-116.

402. **Lansard B.**, **Rabouille C.**, Denis L., Grenz C. (2009) Benthic remineralization at the land-ocean interface: A case study of the Rhone River (NW Mediterranean Sea). *Estuar. Coastal Shelf Sci.* 81, 544-554.

403. **Lauvaux T.**, Gioli B., Sarrat C., **Rayner P.**, **Ciais P.**, **Chevallier F.**, Noilhan J., Miglietta F., Brunet Y., Ceschia E., Elbers J., Dolman A.J., Gerbig C., Hutjes R., Jarosz N., Legain D., Uliasz M. (2009) Bridging the gap between atmospheric concentrations and local ecosystem measurements. *Geophys. Res. Lett*. 36, L19809, 10.1029/2009GL039574.

404. **Lauvaux T.**, Pannekoucke O., Sarrat C., **Chevallier F.**, **Ciais P.**, Noilhan J., **Rayner P.J.** (2009) Sturcture of the transport uncertainty in mesoscale inversions of CO2 sources and sinks using ensemble model simulations. *Biogeosci*. 6, 1089-1102.

405. **Le Hir G.**, **Donnadieu Y.**, Goddéris Y., Pierrehumbert R.T., Halverson G.P., Macouin M., Nédélec A., **Ramstein G.** (2009) The snowball Earth aftermath: Exploring the limits of contiental waethering processes. *Earth Planet. Sci. Lett.* 277, 453-463.

406. Le Quéré C., Raupach M.R., Canadell J.G., Marland G., **Bopp L.**, **Ciais P.**, Conway T.J., Doney S.C., Feely R.A., Foster P., **Friedlingstein P.**, Gurney K., Houghton R.A., House J.I., Huntingford C., Levy P.E., Lomas M.R., Majkut J., Metz l N., Ormetto J.P., Peters G.P., Prentice I.C., Randerson J.T., Running S.W., Sarmiento J.L., Schuster U., Sitch S., Takahashi T., **Viovy N.**, Van der Werf G.R., Woodward F.I. (2009) Trends in the sources and sinks of carbon dioxide. *Nature Geosci.* 2, 831-836.

407. Lebamba J., Ngomanda A., Vincens A., Jolly D., Favier C., Elenga H., **Bentaleb I.** (2009) A reconstruction of Atlantic Central African biomes and forest succession stages derived from modern pollen data and plant functional types. *Clim. Past* 5, 403-429.

408. Lebamba J., Vincens A., Jolly D., Ngomanda A., Schevin P., Maley J., **Bentaleb I.**, and REGAB members (Favier C., **Fontugne M.**, Nguetsop F., Oslisly R.) (2009) Modern pollen rain in savanna and forest ecosystems of Gabon and Cameron, Central Atlantic Africa. *Rev. Palaeobot. Palynol*. 153, 34-45.

409. Lengaigne M., Madec G., **Bopp L.**, Menkes C., Aumont O., **Cadule P.** (2009) Bio-physical feedbacks in the Arctic Ocean using an Earth System model. *Geophys. Res. Lett.* 36, L21602, 10.1029/2009GL040145.

410. Lenton A., **Bopp L.**, Matear R.J. (2009) Strategies for high-latitude northern hemisphere CO2 sampling now and in the future. *Deep-Sea Res. II* 56, 523-532.

411. Lenton A., Codron F., **Bopp L.**, Metzl N., **Cadule P.**, **Tagliabue A.**, Le Sommer J. (2009) Stratospheric ozone depletion reduces ocean carbon uptake and enhances ocean acidification. *Geophys. Res. Lett.* 36, L12606, 10.1029/2009GL038227.

412. Leonhardt R., Fabian K., Winklhofer M., Ferk A., **Laj C.**, **Kissel C.** (2009) Geomagnetic field evolution during the Lascamps excursion. *Earth Planet. Sci. Lett*. 278, 87-95.

413. Lericolais G., Bulois C., Gillet H., **Guichard F.** (2009) High frenquency sea level fluctuations recorded in the Black Sea since the LGM. *Global Planet. Change* 66. 65-75.

414. **Lézine A.M.**, **Watrin J.**, Vincens A., Hély C., and contributors (Agwu C.O.C., Bengo M.D., Edorh T., El Ghazali G., Elenga H., Frédoux A., Jolly D., Maley J., Ritchie J.C., Salzmann U., Sculz E., Tossou M.G., Ybert J.P.) (2009) Are modern pollen data representative of West African vegetation? *Rev. Palaeobot. Palynol.* 156, 265-276.

415. **Liakakou E.**, **Bonsang B.**, Williams J., Kanakidou M., Mihalopoulos N. (2009) C2-C8 NMHCs over the Eastern Mediterranean: Seasonal variation and impact on regional oxidation chemistry. *Atmos. Environ.* 43, 5611-5621.

416. **Lombard F.**, Erez J., **Michel E.**, **Labeyrie L.** (2009) Temperature effect on respiration and photosynthesis of the symbiont-bearing planktonic foraminifera Globigerinoides ruber, Orbulina universa, and Globigerinella siphonifera. *Limnol. Oceanogr*. 54. 210-218.

417. **Lombard F.**, **Labeyrie L.**, **Michel E.**, Spero H.J., Lea D.W. (2009) Modelling the temperature dependent growth rates of planktic foraminifera. *Mar. Micropal.* 70, 1-7.

418. **Maignan F.**, **Bréon F.M.**, **Fédèle E.**, **Bouvier M.** (2009) Polarized reflectances of natural surfaces: Spaceborne measurements and analytical modeling. *Remote Sensing Environ.* 113, 2642-2650.

419. Malaizé B., Vénec-Peyré M.T., Joly C., **Bassinot F.**, **Caillon N.**, Charlier K. (2009) Imprints of high-salinity water plumes originating from the red sea during termination II. *Palaeogeogr. Palaeoclim. Palaeoecol.* 276, 69-79.

420. MARGO project members (**Waelbroeck C.**, Paul A., Kucera M., Rosell-Mele A., Weinelt M., Schneider R., Mix A.C., Abelmann A., Armand L., Bard E., Barker S., Barrows T.T., Benway H., Cacho I., Chen M.T., **Cortijo E.**, Crosta X., De Vernal A., Dokken T., Duprat J., Elderfield H., Eynaud F., Gersonde R., Hayes A., Henry M., Hillaire-Marcel C., Huang C.C., Jansen E., Juggins S., Kallel N., Kiefer T., Kienast M., **Labeyrie L.**, **Leclaire H.**, Londeix L., Mangin S., Matthiessen J., Marret F., Meland M., Morey A.E., Mulitza S., Pflaumann U., Pisias N.G., Radi T., Rochon A., Rohling E.J., Sbaffi L., Schafer-Neth C., Solignac S., Spero H., Tachikawa K., Turon J.L.) (2009) Constraints on the magnitude and patterns of ocean cooling at the Last Glacial Maximum. *Nature Geosci.* 2, 127-132.

421. Marz C., Beckmann B., **Franke C.**, Vogt C., Wagner Y., Kasten S. (2009) Geochemical environment of the Coniacian-Santonian western tropical Atlantic at Demerara Rise. *Palaeogeogr. Palaeoclim. Palaeoecol.* 273, 286-301.

422. **Marzin C.**, **Braconnot P.** (2009) Variations of Indian and African monsoons induced by insolation changes at 6 and 9.5 kyr BP. *Clim. Dyn.* 33, 215-231.

423. **Mathien-Blard E.**, **Bassinot F.** (2009) Salinity bias on the foraminifera Mg/Ca thermometry: correction procedure and implications for past ocean hydrographic reconstructions. *Geochem. Geophys. Geosyst.* 10, Q12011, 10.1029/2008GC002353.

424. Matteo Z., **D'Andrea F.**, **Vautard R.**, **Ciais P.**, **De Noblet-Ducoudré N.**, **Yiou P.** (2009) Hot European summers and the role of soil moisture in the propagation of Mediterranean drought. *J. Clim.* 22, 4747-4758.

425. **Mazaud A.**, Channell J.E.T., Xuan C., Stoner J.S. (2009) Upper and lower Jaramillo polarity transitions recorded in IODP Expedition 303 North Atlantic sediments: Implications for transitional field geometry. *Phys. Earth Planet. Int.* 172, 131-140.

426. Melki T., Kallel N., Jorissen F.J., **Guichard F.**, Dennielou B., Berné S., **Labeyrie L.**, **Fontugne M.** (2009) Abrupt climate change, sea surface salinity and paleoproductivity in the Western Mediterranean Sea (Gulf of Lion) during the last 28 kyr. *Palaeogeogr. Palaeoclim. Palaeoecol. 279, 96-113.*

427. Menut L., Chiapello I., **Moulin C.** (2009) Predictability of mineral dust concentrations: The African Monsoon Multidisciplinary Analysis first short observation period forecasted with CHIMERE-DUST. *J. Geophys. Res*. 114, D07202, 10.1029/2008JD010523.

428. **Mercier N.**, **Hatté C.**, **Fontugne M.**, **Reyss J.L.**, **Valladas H.**, Wengler L., Brugal J.P., Ouammou A., Weisrock A. (2009) Chronology of Uper Pleistocene sequences at Sidi Messaoud (wadi Noun, sothwestern Morocco) based on 14C, optical and U-series dating. *Quat. Geochronol*. 4, 326-334.

429. Mertens K.N., Ribeiro S., Bouimetarhan I., Caner H, **Combourieu-Nebout N.**, Dale B., De Vernal A., Ellegaard M., Filipova M., Godhe A., Goubert E., Grosfjeld K., Holzwarth U., Kotthoff U., Leroy S.A.G., Londeix L., Marret F., Matsuoka K., Mudie P.J., Naudts L., Pena-Manjarrez J.L., Persson A., Popescu S.M., Pospelova V., Sangiorgi F., Van der Meer M.J.T., Vink A., Zonneveld K.A.F., Vercauteren D., Vlassenbroeck J., Louwye S. (2009) Process longth variation in csts of a dinoflagellate, Lingulodinium machaerophorum, in surface sediments: Investigating its potential as salinity proxy. Mar. Micropal. 70, 54-69.

430. Michelangeli P.A., **Vrac M.**, Loukos H. (2009) Probablistic downscaling approaches: Application to wind cumulative distribution functions. *Geophys. Res. Lett.* 36, L11708, 10.1029/2009GL038401.

431. Ming J., Xiao C., **Cachier H.**, Qin D., Qin X., Li Z., Pu J. (2009) Black Carbon (BC) in the snw of glaciers in west China and its potential effects on albedos. *Atmos. Res.* 92, 114-123.

432. Mojtahid M., Jorissen F., **Lansard B.**, Fontanier C., **Bombled B.**, **Rabouille C.** (2009) Spatial distribution of live benthic foraminifera in the Rhône prodelta: Faunal response to a continental-marine organic matter gradient. *Mar. Micropal.* 70, 177-200.

433. Monks P.S., Granier C., Fuzzi S., Stohl A., Williams M., Akimoto H., Amman M., Baklanov A., Baltensperger U., Bey I., Blake N., Blake R.S., Carslaw K., Cooper O.R., Dentener F., Fowler D., Fragkou E., Frost G., Generoso S., Ginoux P., Grewe V., Guenther A., Hansson H.C., Henne S., Hjorth J., Hofzumahaus A., Huntrieser H., Isaksen I.S.A., Jenkin M.E., Kaiser J., Kanakidou M., Klimont Z., Kulmala M., Laj P., Lawrence M.G., Lee J.D., Liousse C., Maione M., McFiggans G., Metzger A., Mieville A., Moussiopoulos N., Orlando J.J., O'Dowd C., Palmer P.I., Parrish D.D., Petzold A., Platt U., Poeschl

U., Prévôt A.S.H., Reeves C.E., Reimann S., Rudich Y., Sellegri K., Steinbrecher R., Simpson D., Ten Brink H., Theloke J., Van der Werf G.R., **Vautard R.**, Vestreng V., Vlachokostas C., VonGlasow R. (2009) Atmospheric composition change - Global and regional air quality. *Atmos. Environ.* 43, 5268-5350.

434. Morcrette J.J., Boucher O., Jones L., Salmond D., Bechtold P., Beljaards A., Benedetti A., Bonet A., Kaiser J.W., Razinger M., **Schulz M.**, Serrar S., Simmons A.J., Sofiev M., Suttie M., Tompkins A.M., Untch A. (2009) Aerosol analysis and forecast &in the ECMWF integrated forecast system. Part I: forward modelling. *J. Geophys. Res.* 114, D06206, 10.1029/2008JD011235.
435. Munoz A., Sen A.K., Sancho C., **Genty D.** (2009) Wavelet analysis of Late Holocene stalagmite records from Ortigosa caves in Northern Spain. *J. Cave Karst Studies* 71, 63-72.
436. Myhre G., Kvalevag M., Radel G., Cook J., Shine K.P., Clark H., Karcher F., Markowicz K., Kardas A., Wolkenberg P., **Balkanski Y.**, Ponater M., Forster P., Rap A., Rodriguez De Leon R. (2009) Intercomparison of radiative forcing calculations of stratospheric water vapour and contrails. *Meteorol. Zeit.* 18, 585-596.
437. Naughton F., Sanchez-Goni M.F., **Kageyama M.**, Bard E., Duprat J., **Cortijo E.**, Despart S., Malaizé B., Joly C., Rostek F., Turon J.L. (2009) Wet to dry climatic trend in north-western Iberia within Heinrich events. *Earth Planet. Sci. Lett.* 284, 329-342.
438. Ngomanda A., Chepstow-Lusty A., Makaya M., Favier C., Schevin P., Maley J., **Fontugne M.**, Oslisly R., Jolly D. (2009) Western equatorial African forest-savanna mosaics: a legacy of late Holocene climatic change ? *Clim. Past* 5, 647-659.
439. Ott L.E., Pawson S., Suarez M., Bacmeister J., Pickering K., Stenchikov G., Huntrieser H., Loewenstein M., Lopez J., **Xueref-Remy I.** (2009) Analysis of convective transport and parameter sensitivity in a single column versio of the Goddard Earth observation system, version 5, generation circulation model. *J. Atmos. Sci.* 66, 627-646.
440. Otto-Bliesner B., Schneider R., Brady E.C., Kucera M., Abe-Ouchi A., Bard E., **Braconnot P.**, Crucifix M., Hewitt C., **Kageyama M.**, **Marti O.**, Paul A., Rosell-Mele A., **Waelbroeck C.**, Weber S.L., Weinelt M., Yu Y. (2009) A comparison of PMIP2 model simulations and the MARGO proxy reconstruction for tropical sea surgace temperatures at last glacial maximum. *Clim. Dyn.* 32, 799-815.
441. Ovadnevaite J., Ceburnis D., Plauskaite-Sukiene K., Modini R., Dupuy R., Rimselyte I., **Ramonet M.**, Kvietkus K., Ristovski Z., Berresheim H., O'Dowd C.D. (2009) Volcanic sulphate and arctic dust plumes over the North Atlantic Ocean. *Atmos. Environ.* 43, 4968-4974.
442. Palmer P.I., **Rayner P.** (2009) Atmospheric science: failure to launch. *Nature Geosci.* 2, 245 (news and views).
443. **Paris J.D.**, Arshinov M.Y., **Ciais P.**, Belan B.D., Nédélec P. (2009) Large-scale aircraft observations of ultra-fine and fine particle concentrations in the remote Siberian troposphere: New particle formation studies. *Atmos. Environ.* 43, 1302-1309.
444. **Paris J.D.**, Stohl A., Nédélec P., Arshinov M.Y., Panchenko M.V., Shmargunov V.P., Law K.S., Belan B.D., **Ciais P.** (2009) Wildfire smoke in the Siberian Arctic in summer: source characterization and plume evolution from airborne measurements. *Atmos. Chem. Phys.* 9, 9315-9327.
445. Piao S., **Ciais P.**, **Friedlingstein P.**, **De Noblet-Ducoudré N.**, **Cadule P.**, **Viovy N.**, Wang T. (2009) Spatio-temporal patterns of terrestrial carbon cycle during the 20th century. *Global Biogeochem. Cycles 23,* GB4026, 10.1029/2008GB003339.
446. Piao S., Fang J., **Ciais P.**, **Peylin P.**, Huang Y., Sitch S., Wang T. (2009) The carbon balance of terrestrial ecosystems in China. *Nature* 458, 1009-1013.
447. Piao S., **Friedlingstein P.**, **Ciais P.**, **Peylin P.**, Zhu B., Reichstein M. (2009) Footprint of temperature changes in the temperate and boreal forest carbon balance. *Geophys. Res. Lett. 36,* L07404, 10.1029/2009GL037381.
448. Piao S., Yin L., Wang X., **Ciais P.**, Peng S., Shen Z., Seneviratne S.I. (2009) Summer soil moisture regulated by precipitation frequency in China. *Environ. Res. Lett*. 4, 044012.
449. **Pison I.**, **Bousquet P.**, **Chevallier F.**, **Szopa S.**, **Hauglustaine D.** (2009) Multi-species inversion of CH4, CO and H2 emissions from surface measurements. *Atmos. Chem. Phys.* 9, 5281-5297.
450. Quaas J., Ming Y., Menon S., Takemura T., Wang M., Penner J.E., Gettelman A., Lohmann U., Bellouin N., Boucher O., Sayer A.M., Thomas G.E., McComiskey A., Feingold G., Hoose C., Kristjansson J.E., Liu X., **Balkanski Y.**, Donner L.J., Ginoux P.A., Stier P., Grandey B., Feichter J., Sednev I., Bauer S.E., Koch D., Grainger R.G., Kirkevag A., Iversen T., Seland O., Easter R., Ghan S.J., Rasch P.J., Morrison H., Lamarque J.F., Iacono M.J., Kinne S., **Schulz M.** (2009) Aerosol indirect effects - general circulation model intercomparison and evaluation ith satellite data. *Atmos. Chem. Phys.* 9, 8697-8717.

451. **Rabouille C.**, Caprais J.C., **Lansard B.**, Crassous P., Dedieu K., **Reyss J.L.**, Khripounoff A. (2009) Organic matter budget in the Southeast Atlantic continental margin close to the Congo Canyon : In situ measurements of sediment oxygen consumption. *Deep-Sea Res II* 56, 2223-2238.

452. **Raut J.C.**, **Chazette P.** (2009) Assessment of vertically-resolved PM10 from mobile lidar observations. *Atmos. Chem. Phys.* 9, 8617-8638.

453. **Raut J.C.**, **Chazette P.**, Fortain A. (2009) Link between aerosol optical, microphysical and chemical measurements in an underground railway station in Paris. *Atmos. Environ.* 43, 860-868.

454. **Raut J.C.**, **Chazette P.**, Fortain A. (2009) New approach using lidar measurements to characterize spatiotemporal aerosol mass distribution in an underground railway station in Paris. *Atmos. Environ.* 43, 575-583.

455. Reidmiller D.R., Fiore A.M., Jaffe D.A., Bergmann D., Cuvelier C., Dentener F.J., Duncan B.N., Folberth G., Gauss M., Gong S., Hess P., Jonson J.E., Keating T., Lupu A., Mermer E., Park R., Schultz M.G., Shindell D.T., **Szopa S.**, Vivanco M.G., Wild O., Zuber A. (2009) The influence of foreign vs. North American emissions on surface ozone in the US. *Atmos. Chem. Phys.* 9, 5027-5042.

456. Renssen H., Seppa H., Heiri O., **Roche D.M.**, Goosse H., Fichefet T. (2009) The spatial and temporal complexity of the Holocene thermal maximum. *Nature Geosci.* 2, 411-414.

457. Retailleau S., Howa H., Schiebel R., **Lombard F.**, Eynaud F., Schmidt S., Jorissen F., **Labeyrie L.** (2009) Planktic foraminiferal production along an offshore-onshore transect in the south-eastern Bay of Biscay. *Cont. Shelf Res.* 29, 1123-1135.

458. Rodgers K.B., Key R.M., Gnanadesikan A., Sarmiento J.L., Aumont O., **Bopp L.**, Doney S.C., Dunne J.P., Glover D.M., Ishida A., Ishii M., Jacobson A.R., Lo Monaco C., Maier-Reimer E., Mercier H., Metzl N., Pérez F.F., Rios A.F., Wanninkhof R., Wetzel P., Winn C.D., Yamanaka Y. (2009) Using altimetry to help explain patchy changes in hydrographic carbon measurements. *J. Geophys. Res. 114,* C09013, 10.1029//2008JC005183.

459. Rodriguez-Gonzalez A., Fernandez-Turiel J.L., Perez-Torrado F.J., Hansen A., Aulinas M., Carracedo J.C., Gimeno D., **Guillou H.**, Paris R., **Paterne M.** (2009) The Holocene volcanic history of Gran Canaria island: implications for volcanic hazards. *J. Quat. Sci.* 24, 697-709.

460. Roger J.C., Guinot B., **Cachier H.**, Mallet M., Dubovik O., Yu T. (2009) Aerosol complexity in megacities: From size-resolved chemical composition to optical properties of the Beijing atmospheric particles. *Geophys. Res. Lett.* 36, L18806, 10.1029/2009GL039238.

461. Rojas M., Moreno P., **Kageyama M.**, Crucifix M., Hewitt C., Abe-Ouchi A., Ohgaito R., Brady E.C., Hope P. (2009) The Southern Westerlies during the last glacial maximum in PMIP2 simulations. *Clim. Dyn.* 32, 525-548.

462. Rollion-Bard C., Vigier N., Meibom A., **Blamart D.**, Reynaud S., Rodolfo-Metalpa R., Martin S., Gattuso J.P. (2009) Effect of environmental conditions and skeletal ultrastructure on the Li isotopic composition of scleractinian corals. *Earth Planet. Sci. Lett*. 286, 63-70.

463. Rouil L., Honoré C., **Vautard R.**, Beekmann M., Bessagnet B., Malherbe L., Meleux F., Dufour A., Elichegaray C., Flaud J.M., Menut L., Martin D., Peuch A., Peuch V.H., Poisson N. (2009) PREV'AIR: an operational forecasting and mapping system for air quality in Europe. *Bull. Amer. Meteorol. Soc.* 90, 73-83.

464. **Roy-Barman M.** (2009) Modelling the effect of boundary scavenging on Thorium and Protactinium profiles in the ocean. *Biogeosci*. 6, 3091-3107.

465. **Roy-Barman M.**, Lemaître C., **Ayrault S.**, Jeandel C., Souhaut M., Miquel J.C. (2009) The influence of particle composition on Thorium scavenging in the Mediterranean Sea. *Earth Planet. Sci. Lett. 286, 526-534.*

466. Russon T., **Elliot M.**, **Kissel C.**, Cabioch G., De Dekker P., Corrège T. (2009) Mid-Late Pleistocene deep water circulation in the Southwest subtropical Pacific. *Paleoceanography,* 24, PA4205, 10.1029/ 2009PA001755.

467. Sadekov A.Y., Eggins S.M., De Deckker P., Ninneman U., Kuhnt W., **Bassinot F.** (2009) Surface and sub-surface seawater temperature reconstructio using Mg/Ca microanalysis of planktonic foraminifera Globigerinoides ruber, Globigerinoides sacculifer and Pulleniatina obliquiloculata. *Paleoceanography* 24, PA3201, 10.1029/2008PA001664.

468. Sanchez-Goni M.F., **Landais A.**, Cacho I., Duprat J., Rossignol L. (2009) Contrasting intrainterstadial climatic evolution between high and middle North Atlantic latitudes: A close-up of Greenland interstadials 8 and 12. *Geochem. Geophys. Geosyst.* 10, Q04U04, 10.1029/2008GC002369.

469. Sarrat C., Noilhan J., Lacarrère P., Dolman A.J., Gerbig C., Elbers J.A., Vellinga O.S., Gioli B., Miglietta F., Neininger B., **Lauvaux T.**, **Ciais P.**, **Ramonet M.**, Ceschia E., Bonnefond J.M. (2009) Mesoscale

modeling of the CO2 interactions between the surface and the atmosphere applied to the April 2007 CERES field experiment. *Biogeosci. 6, 633-646.*

470. Sarrat C., Noilhan J., Lacarrère P., Masson V., Ceshia E., **Ciais P.**, Dolman A., Elbers J., Gerbig C., Jarosz N. (2009) CO2 budgeting at the regional scale using a Lagrangian experimental strategy and meso-scale modeling. *Biogeosci.* 6, 113-127.
471. Saux-Picart S., **Ottlé C.**, **Decharme B.**, André C., Zribi M., Perrier A., Coudert B., Boulain N., Cappelaere B., Descroix L., Ramier D. (2009) Water and energy budgets simulation over the AMMA-Niger suer site spatially constrained with remote sensing data. *J. Hydrol.* 375, 287-295.
472. Saux-Picart S., **Ottlé C.**, Perrier A., **Decharme B.**, Coudert B., Zribi M., Boulain N., Cappelaere B., Ramier D. (2009) SEtHyS_Savannah: A multiple source land surface model applied to Sahelian landscapes. *Agricult. Forest Meteorol.* 149, 1421-1432.
473. Schmidt S., Howa H., Mouret A., **Lombard F.**, Anschutz P., **Labeyrie L.** (2009) Particle fluxes and recent sediment accumulation on the Aquitanian margin of Bay of Biscay. *Cont. Shelf Res.* 29, 1044-1052.
474. Schulze E.D., Luyssaert S., **Ciais P.**, Freibauer A., Janssens I.A., Soussana I.F., Smith P., Grace J., Levin I., Thiruchittampalam B., Heimann M., Dolman A.J., Valentini R., **Bousquet P.**, **Peylin P.**, Peters W., Rodenbeck C., Etiope G., **Vuichard N.**, Wattenbach M., Nabuurs G.J., Poussi Z., Nieschulze J., Gash J.H., and the CarboEurope Team (2009) Importance of methane and nitrous oxide for Europe's terrestrial greenhouse-gas balance. *Nature Geosci.* 2, 842-850.
475. **Sciare J.**, **Favez O.**, **Sarda-Esteve R.**, **Oikonomou K.**, **Cachier H.**, **Kazan V.** (2009) Long-term observations of carbonaceous aerosols in the Austral Ocean atmosphere: Evidence of a biogenic marine organic source. *J. Geophys. Res.* 114, D15302, 10.1029/2009JD011998.
476. **Sepulchre P**., Sloan L.C., Snyder M., Fiechter J. (2009) Impacts of Andean uplift on the Humboldt current system: A climate model sensitivity study. *Paleoceanography* 24, PA4215, 10.1029/2008PA001668.
477. Sima A., Rousseau D.D., **Kageyama M.**, **Ramstein G.**, **Schulz M.**, **Balkanski Y.**, Antoine P., **Dulac F.**, **Hatté C.** (2009) Imprint of North-Atlantic abrupt climate changes on western European loess deposits as viewed in a dust emission model. *Quat. Sci. Rev.* 28, 2851-2866.
478. Singer B.S., **Guillou H.**, Jicha B.R., **Laj C.**, **Kissel C.**, Beard B.L., Johnson C.M. (2009) 40Ar/39Ar, K-Ar and 230Th-238U dating of the Laschamp excursion: A radioisotopic tie-point for ice core and climate chronologies. *Earth Planet. Sci. Lett.* 286, 80-88.
479. Smirnov A., Holben B.N., Slutsker I., Giles D.M., McClain C.R., Eck T.F., Sakerin S.M., Macke A., Croot P., Zibordi G., Quinn P.K., **Sciare J.**, Kinne S., Harvey M., Smyth T.J., Piketh S., Zielinski T., Proshutinsky A., Goes J.I., Nelson N.B., Larouche P., Radionov V.F., Goloub P., Krishna Moorthy K., Matarrese R., Robertson E.J., Jourdin F. (2009) Maritime aerosol network as a component of aerosol robotic network. *J. Geophys. Res.* 114, D06204, 10.1029/2008JD011257.
480. Solomon S., Plattner G.K., Knutti R., **Friedlingstein P.** (2009) Irreversible climate change due to carbon dioxide emissions. *Proc. Nat. Acad. Sci.* 106, 1704-1709.
481. Steinbrecher R., Smiatek G., Koble R., Seufert G., Theloke J., Hauff K., Ciccioli P., **Vautard R.**, Curci G. (2009) Intra- and inter-annual variability of VOC emissions from natural and semi-natural vegetation in Europe and neighbouring countries. *Atmos. Environ.* 43, 1380-1391.
482. Stiros S.C., Pirazzoli P.A., **Fontugne M.** (2009) New evidence of Holocene coastal uplift in the Strophades Islets (W Hellenic Arc, Greece). *Mar. Geol.* 267, 207-211.
483. **Swingedouw D.**, Mignot J., **Braconnot P.**, Mosquet E., **Kageyama M.**, **Alkama R.** (2009) Impact of freshwater release in the North Atlantic under different climate conditions in an OAGCM. *J. Clim.* 22, 6377-6403.
484. Szegvary T., Conen F., **Ciais P.** (2009) European 222Rn inventory for applied atmospheric studies. *Atmos. Environ.* 43, 1536-1539.
485. **Szopa S.**, Foret G., Menut L., **Cozic A.** (2009) Impact of large scale circulation on European summer surface ozone and consequences for modelling forecast. *Atmos. Environ.* 43, 1189-1195.
486. **Tagliabue A.**, **Bopp L.**, Aumont O. (2009) Evauating the importance of atmospheric and sedimentary iron sources to Southern Ocean biogeochemistry. *Geophys. Res. Lett*. 36, L13601, 10.1029/2009GL038914.
487. **Tagliabue A.**, **Bopp L.**, Aumont O., Arrigo K.R. (2009) Influence of light and temperature on the marine iron cycle: From theoretical to global modeling. *Global Biogeochem. Cycles 23,* GB2017, 10.1029/2008GB003214.
488. **Tagliabue A.**, **Bopp L.**, **Roche D.M.**, **Bouttes N.**, **Dutay J.C.**, **Alkama R.**, **Kageyama M.**, **Michel E.**, **Paillard D.** (2009) Quantifying the roles of ocean circulation and biogeochemistry in governing ocean carbon-13 and atmospheric carbon dioxide at the last glacial maximum. *Clim. Past* 5, 695-706.

489. Telszewski M., Chazottes A., Schuster U., Watson A.J., **Moulin C.**, Bakker D.C.E., Gonzalez-Davila M., Johannessen T., Kortzinger A., Luger H., Olsen A., Omar A., Padin X.A., Rios A.F., Steinhoff T., Santana-Casiano M., Wallace D.W.R., Wanninkhof R. (2009) Estimating the monthly pCO2 distribution in the North Atlantic using a self-organizing neural network. *Biogeosci*. 6, 1405-1421.

490. Teuling A.J., Hirschi M., Ohmura A., Wild M., Reichstein M., **Ciais P.**, Buchmann N., Ammann C., Montagnani L., Richardson A.D., Wohlfahrt G., Seneviratne S.I. (2009) A regional perspective on trends in continental evaporation. *Geophys. Res. Lett.* 36, L02404, 10.1029/2008GL036584.

491. Timmermans R.M.A., Schaap M., Elbern H., Siddans R., Tjemkes S., **Vautard R.**, Builtjes P. (2009) An observing system simulation experiment (OSSE) for aerosol optical depth from satellites. *J. Atmos. Ocean. Technol.* 26, 2673-2682.

492. Toucanne S., Zaragosi S., Bourillet J.F., Cremer M., Eynaud F., Van Vliet-Lanoe B., Penaud A., Fontanier C., Turon J.L., **Cortijo E.**, Gibbard P.L. (2009) Timing of massive "Fleuve Manche" discharges over the last 250 kyr: insights into the European ice-sheet oscillations and the European drainage network from MIS 10 to 2. *Quat. Sci. Rev*. 28, 1238-1256.

493. Toucanne S., Zaragosi S., Bourillet J.F., Cremer M., Eynaud F., Van Vliet-Lanoe B., Penaud A., Fontanier C., Turon J.L., **Cortijo E.**, Gibbard P.L. (2009) Timing of massive "Fleuve Manche" discharges over the last 350 kyr: insights into the European ice-sheet oscillations and the European drainage network from MIS 10 to 2. *Quat. Sci. Rev.* 28, 2974-2981.

494. Tribolo C., Mercier N., **Valladas H.**, Joron J.L., Guibert P., Lefrais Y., Selo M., Texier P.J., Rigaud J.P., Porraz G., Poggenpoel C., Parkington J., Texier J.P., Lenoble A. (2009) Thermoluminescence dating of a Stillbay-Howiesons Poort sequence at Diepkloof Rock Shelter (Western Cape, South Africa). *J. Archaeol. Sci.* 36, 730-739.

495. Turnbull J., **Rayner P.**, Miller J.B., Naegler T., **Ciais P.**, **Cozic A.** (2009) On the use of 14CO2 as a tracer for fossil fuel CO2: quantifying uncertainties using an atmospheric transport model. *J. Geophys. Res.* 114, D22302, 10.1029/2009JD012308.

496. Van Beek P., Sternberg E., **Reyss J.L.**, Souhaut M., **Robin E.**, Jeandel C. (2009) 228Ra/226Ra and 226Ra/Ba ratios in the Western Mediterranean Sea: barite formation and transport in the water column. *Geochim. Cosmochim. Acta* 73, 4720-4737.

497. Van Meerbeeck C.J., Renssen H., **Roche D.** (2009) How did Marine Isotope Stage 3 and Last Glacial Maximum climates differ ? Perspectives from equilibrium simulations. *Clim. Past* 5, 33-51.

498. Van Rooij D., Huvenne V.A.I., **Blamart D.**, Henriet J.P., Wheeler A., De Haas H. (2009) The Enya mounds: a lost mound-drift competition. *Int. J. Earth Sci. (Geol. Rundsch.)* 98, 849-863.

499. **Vautard R.**, Schaap M., Bergstrom R., Bessagnet B., Brandt J., Builtjes P.J.H., Christensen J.H., Cuvelier C., Foltescu V., Graf A., Kerschbaumer A., Krol M., Roberts P., Rouil L., Stern R., Tarrason L., Thunis P., Vignati E., Wind P. (2009) Skill and uncertainty of a regional air quality model ensemble. *Atmos. Environ.* 43, 4822-4832.

500. **Vautard R.**, **Yiou P.** (2009) Control of recent European surface climate change by atmospheric flow. *Geophys. Res. Lett.* 36, L22702, 10.1029/ 2009GL040480.

501. **Vautard R.**, **Yiou P.**, Van Oldenbourgh G.J. (2009) Decline of fog, mist and haze in Europe over the past 30 years. *Nature Geosci.* 2, 115-119.

502. Vermote E., Justice C.O., **Bréon F.M.** (2009) Towards a generalized approach for correction of the BRDF effect in MODIS diretional reflectances. *IEEE Trans. Geosci. Remote Sensing* 47, 898-908.

503. **Vimeux F.**, Ginot P., Schwikowski M., Vuille M., **Hoffmann G.**, Thompson L.G., Schotterer U. (2009) Climate variability during the last 1000 years inferred from Andean ice cores: A revie of methodology and recent results. *Palaeogeogr. Palaeoclim. Palaeoecol.* 281, 229-241.

504. Vivanco M.G., Palomino I., **Vautard R.**, Bessagnet B., Martin F., Menut L., Jimenez S. (2009) Multi-year assessment of photochemical air quality simulation over Spain. *Environ. Model. Softw.* 24, 63-73.

505. **Vuichard N.**, **Ciais P.**, Wolf A. (2009) Soil carbon sequestration or biofuel production: New land-use opportunities for mitigating climate over abandoned Soviet farmlands. *Environ. Sci. Technol.* 43, 8678-8683.

506. **Wainer K.**, **Genty D.**, **Blamart D.**, Hoffmann D., Couchoud I. (2009) A new stage 3 millenial climatic variability record from a SW France speleothem. *Palaeogeogr. Palaeoclim. Palaeoecol*. 271, 130-139.

507. Wandji P., Tsafack J.P.F., Bardintzeff J.M., Nkouathio D.G., Kagou Dongmo A., Bellon H., **Guillou H.** (2009) Xenoliths of dunites, wehrlites and clinopyroxenites in the basanites from Batoke volcanic cone (Mount Cameroon, Central Africa): petrogenetic implications. *Miner. Petrol.* 96, 81-98.

508. Wang Y., Hou S., **Masson-Delmotte V.**, **Jouzel J.** (2009) A new spatial distribution map of d18O in Antarctic surface snow. *Geophys. Res. Lett. 36,* L06501, 10.1029/2008GL036939.

509. Weber U., Jung M., Reichstein M., Beer C., Brakkhekke M., Lehsten V., Ghent D., Kaduk J., **Viovy N.**, **Ciais P.**, Gobron N., Rodenbeck C. (2009) The inter-annual variability of Africa's ecosystem productivity: a multi-model analysis. *Biogeosci*. 6, 285-295.

510. **Weill S.**, **Mouche E.**, Patin J. (2009) A generalized Richards equation for surface/subsurface flow modelling. *J. Hydrol.* 366, 9-20.

511. Westaway R., **Guillou H.**, Seyrek A., Demir T., Bridgland D., **Scaillet S.**, Beck A. (2009) Late Cenozoic surface uplift, basaltic volcanism, and incision by the river Tigris around Diyarbakir, SE Turkey. *Int. J. Earth Sci.* 98, 601-625.

512. Williams M., Richardson A.D., Reichstein M., Stoy P.C., **Peylin P.**, Verbeeck H., Carvalhais N., Jung M., Hollinger D.Y., Kattge J., Leuning R., Luo Y., Tomelleri E., Trudinger C., Wang Y.P. (2009) Improving land surface models with FLUXNET data. *Biogeosci.* 6, 1341-1359.

513. Wingate L., Ogée J., Cuntz M., Genty B., Reiter I., Seibt U., Yakir D., Maseyk K., Pendall E.G., Barbour M.M., Mortazavi B., Burlett R., **Peylin P.**, Miller J., Mencuccini M., Shim J.H., Hunt J., Grace J. (2009) The impact of soil microorganisms on the global budget of δ18O in atmospheric CO2. *Proc. Nat. Acad. Sci.* 106, 22.411-22.415.

514. **Yiou P.**, Dacunha-Castelle D., Parey S., Huong Hoang T.T. (2009) Statistical representation of temperature mean and variability in Europe. *Geophys. Res. Lett*. 36, L04710, 10.1029/2008GL036836.

515. **Yver C.**, **Schmidt M.**, **Bousquet P.**, Zahorowski W., **Ramonet M.** (2009) Estimation of the molecular hydrogen soil utake and traffic emissions at a auburban site near Paris through hydrogen, carbon monoxide, and radon-222 semicontinuous measurements. *J. Geophys. Res.* 114, D18304, 10.1029/2009JD012122.

516. Zampieri M., D'Andrea F., **Vautard R.**, **Ciais P.**, **De Noblet-Ducoudré N.**, **Yiou P.** (2009) Hot European summers and the role of soil moisture in the propagation of Mediterranean drought. *J. Clim.* 22, 4747-4758.

517. Zribi M., Pardé M., De Rosnay P., Baup F., Boulain N., Descroix L., Pellarin T., Mougin E., **Ottlé C.**, **Decharme B.** (2009) ERS scatterometer surface soil moisture aalysis of two sites in the south and north of the Sahel region of West Africa. *J. Hydrol.* 375, 253-261.

Partner 8: LMD (UMR 8539 - Laboratoire de Météorologie Dynamique)

518. Antoine P, **Rousseau D.D.**, Fuchs M., Hatte, C., Gauthier C., Markovic S., Jovanovic M., Gaudenyi T., Moine O. and Rossignol J. (2009) High resolution record of the Last Climatic Cycle in the Southern Carpathian basin (Surduk, Vojvodina, Serbia). *Quat. Int.* 198, 19-36.

519. Antoine P., **Rousseau D.D.**, Moine O., Kunesch S., Hatte C., Lang A., Tissoux H., and Zoller L. (2009) Rapid and cyclic aeolian deposition during the Last Glacial in European loess: a high-resolution record from Nussloch, Germany: *Quat. Sci. Rev*. 28, 2955-2973.

520. Austin J., Wilson J., Akiyoshi H., Bekki S., Butchart N., **Claud C.**, Foster P., Garcia R.R, Gillett N.P., Keckhut P., Langematz U., Manzini E., Nagashima T., Randel, W.J., Rozanov E., Shepherd T.G., Shibata K., Shine K.P., Struthers H., Thompson D., Wu F., Yoden S., (2009) Coupled chemistry climate model simulations of stratospheric temperatures and their trends for the recent past. *Geophys, Res. Let*., 36, L13809, doi :10.1029/2009GL038462.

521. Baudena, M., **F. D'Andrea**, A.Provenzale (2009) An idealized model for tree-grass coexistence in savannas. *J. Ecology*, 98, 74-80, doi: 10.1111/j.1365-2745.2009.01588.x

522. **Bellenger, H., and J.P. Duvel** (2009) An Analysis of Tropical Ocean Diurnal Warm Layers. *J. Climate*, 22, 3629–3646.

523. **Bellenger, H., J.-P. Duvel**, M. Lengaigne, and **P. Levan**, (2009) Impact of organized intraseasonal convective perturbations on the tropical circulation. *Geophys. Res. Lett*., 36, L16703, doi:10.1029/2009GL039584.

524. **Berges, J.C., I. Jobard, and R. Roca** (2009) A new index to estimate precipitation using cloud growing rate. *Geophys. Res. Lett.,* 36, L08808, doi:10.1029/2008GL036665.

525. Bernardin F., Bossy M., C. Chauvin, **Drobinski P.**, Rousseau A., Salameh T., (2009) Stochastic Downscaling Method: Application to Wind Refinement. *Stoch. Env. Res. Ris. Assess*, 23, 851-859

526. Bessagnet B., **L.Menut**, G.Curci, A.Hodzic, B.Guillaume, C.Liousse, S.Moukhtar, B.Pun, C.Seigneur, M. Schulz (2009) Regional modeling of carbonaceous aerosols over Europe - Focus on Secondary Organic Aerosols. *J. Atmos. Chem*., 61, 175-202.

527. **Bielli, S. and R. Roca** (2009) Scale decomposition of atmospheric water budget over West Africa during the monsoon 2006 from NCEP analyses. *Clim Dyn*, doi://10.1007/s00382 -009-0597-5.

528. Boone, A. B. Decharme, F. Guichard, P. de Rosnay, G. Balsamo, A. Beljaars, F. Chopin, **T. Orgeval, J. Polcher**, C. Delire, A. Ducharne, S. Gascoin, M. Grippa, L. Jarlan, L. Kergoat, E. Mougin, Y. Gusev, O. Nasonova, Phil Harris, Christopher Taylor, Anette Norgaard, Inge Sandholt, Catherine Ottlé, Isabelle Poccard-Leclercq, S. Saux-Picart, Y. Xue (2009) The AMMA Land Surface Model Intercomparison Project (ALMIP). *Bulletin of the American Meteorological Society* 2009 90:12, 1865-1880

529. Bordi, I., K. Fraedrich, **M. Ghil**, and A. Sutera (2009) Zonal-flow régime changes in a GCM and in a simple quasi-geostrophic model: The role of stratospheric dynamics, *J. Atmos. Sci.*, 66, 1366–1383.

530. Bou Karam D., C. Flamant, **J. Cuesta**, J. Pelon, E. Williams (2009) Dust emission and transport associated with a Saharan depression: The February 2007 case. *J. Geophys. Res.*, in press.

531. Bouchut F., J. Lambaert, **G. Lapeyre, V. Zeitlin** (2009) Fronts and nonlinear waves in a simplified shallow-water model of the atmosphere with moisture and convection. *Physics of Fluids*, 21, 116604

532. Boynard, A., C. Clerbaux, P.-F. Coheur, D. Hurtmans, **S. Turquety**, M. George, J. Hadji-Lazaro, C. Keim, and J. Meyer-Arnek (2009) Measurements of total and tropospheric ozone from IASI: comparison with correlative satellite and ozonesonde observations, Atmos. Chem. Phys., 9, 6255-6271.

533. Brogniez H., **Roca R. and L.Picon L.** (2009) A Study of the Free Tropospheric Humidity Interannual Variability Using Meteosat Data and an Advection–Condensation Transport Model. *J. Climate* 22:24, 6773-6787

534. Cézard N., A. Dolfi-Bouteyre, J.-P. Huignard, **P. H. Flamant** (2009) Performance evaluation of a dual fringe-imaging Michelson interferometer for air parameter measurements with a 355-nm Rayleigh-Mie lidar. *Appl. Opt.*, 48, 2321-2332

535. Champollion C., **Drobinski P.**, Haeffelin M., Bock O., Tarniewicz J., Bouin M.N., Vautard R. (2009) Water Vapor Variability Induced by Urban/Rural Heterogeneities during Convective Conditions. *Quart. J. Roy. Meteorol. Soc*., 135, 1266-1276

536. **Chédin A., Scott N.A.,** Ciais P.**, Rio C., Hourdin F., Crevoisier C. and Armante R.** (2009) Regional-scale correlation between CO2 fire emissions, burned areas, and mid-tropospheric CO2 daily variations over southern Africa. *Atmos. Chem. Phys, Discuss.*, 9, 18621-18657.

537. **Chepfer H., V. Noel**, (2009) A Tropical NAT-like belt observed from space. *Geophys. Res. Lett*. 36 L03813.

538. **Cheruy, F. and F. Aires** (2009) Cluster Analysis of Cloud Properties over the Southern European Mediterranean Area in Observations and a Model. *Mon. Wea. Rev*., 137 (10), 3161-3176, doi:10.1175/2009MWR2882.1.

539. Ciais P., Piao S.-L., Cadule P., Friedlingstein P. and **Chédin A.** (2009) Variability and recent trends in the African terrestrial carbon balance. *Biogeosciences*, 5, 3497-3532.

540. **Claud C.,** Carleton A.M., Duchiron B., Terray P. (2009) Atmospheric and upper ocean environments of Southern Ocean polar mesocyclones, in the transition-season months, and associations with teleconnections. *J. Geophys. Research*, 114, D23104, doi:10.1029/ 2009JD011995.

541. **Claud C.**, Carleton A.M., Duchiron B., Terray P. (2009) Atmospheric and upper ocean environments of Southern Ocean polar mesocyclones, in the transition-season months, and associations with teleconnections. *J. Geophys. Research*, 114, D23104, doi:10.1029/ 2009JD011995.

542. **Claud C.**, Carleton A.M., Duchiron B., Terray P. (2009) Southern Hemisphere winter cold-air mesocyclones : climatic environments and associations with teleconnections, *Clim. Dyn.,* 2009, 33, 383-408, doi 10.1007/s00382-008-0468-5.

543. **Claud C.**, Funatsu B., Noer G., Chaboureau J.P. (2009) Observation of Polar Lows by the Advanced Microwave Sounding Unit : Potential and limitations, *Tellus*, 2009, 61A, 264-277, DOI :10.1111/j.1600-0870.2008.00384.x

544. Clerbaux, C., A. Boynard, L. Clarisse, M. George, J. Hadji-Lazaro, H. Herbin, D. Hurtmans, M. Pommier, A. Razavi, **S. Turquety**, C. Wespes, and P.-F. Coheur (2009) Monitoring of atmospheric composition using the thermal infrared IASI/MetOp sounder. *Atmos. Chem. Phys*., 9, 6041-6054.

545. Coheur, P.-F. L. Clarisse, **S. Turquety**, D. Hurtmans, and C. Clerbaux (2009) IASI measurements of reactive trace species in biomass burning plumes. *Atmos. Chem. Phys.*, 9, 5655-5667.

546. **Crevoisier C., Chédin A.**, Matsueda H., Machida T., **Armante R. and Scott N. A.** (2009) First year of upper tropospheric integrated content of CO2 from IASI hyperspectral infrared observations. *Atmos. Chem. Phys*., 9, 4797-4810.

547. **Crevoisier C.**, Nobileau D., Fiore A., **Armante R., Chédin A., and Scott N. A.** (2009) Tropospheric methane in the tropics - first year from IASI hyperspectral infrared observations. *Atmos. Chem. Phys*., 9, 6337-6350.

548. **Cuesta, J.**, C. Lavaysse, C. Flamant, M. Mimouni, P. Knippetz (2009) Northward bursts of the West African monsoon leading to rainfall over the Hoggar massif, Algeria. *Q. J. Roy. Met. Soc.*, doi: 10.1002/qj.439

549. **Cuesta, J.**, J. Marsham, D. Parker, C. Flamant (2009) Dynamical mechanisms controlling the vertical redistribution of dust and the thermodynamic structure of the West Saharan Atmospheric Boundary Layer during Summer. *Atmos. Sci. Lett.*, doi: 10.1002/asl.207

550. Daumard, F., Champagne, S., Fournier, A., **Goulas, Y., Ounis, A.,** Hanocq, J.F. and **Moya, I.** (2009) A field platform for continuous measurement of canopy fluorescence. *IEEE Transactions Geosc. Remote Sens.,* in press.

551. de Meij A., Gzella, A., Cuvelier, C., Thunis, P., Bessagnet, B., Vinuesa, J.F., **Menut, L.,** Kelder H. (2009) The impact of MM5 and WRF meteorology over complex terrain on CHIMERE model calculations. *Atmos. Chem. Phys*., 9, 6611-6632.

552. de Rosnay, P., et al. (2009) AMMA Land Surface Model Intercomparison Experiment coupled to the Community Microwave Emission Model : ALMIP-MEM. *J. Geophys. Res.-Atmos.*, 114, D05108, doi :10.1029/2008JD010724.

553. Deremble, B., **F. D'Andrea, and M. Ghil**, (2009) Fixed points, stable manifolds, weather regimes and their predictability Chaos. 19 (4), 043109, doi: 10.1063/1.3230497

554. d'Ovidio, F., Shuckburgh, E. and **Legras, B.**, (2009) Local mixing events in the upper-troposphere lower-stratosphere: Part 1, detection with the Lyapunov diffusivity, *J. Atmos. Sci*., 66, 3678-3694

555. **Drobinski P.,** Bastin S., Janicot S., Dabas A., Delville P., Reitebuch O., Sultan B. (2009) On the Late Northward Propagation of the West African Monsoon in Summer 2006 in the Region of Niger/Mali. *J. Geophys. Res.,* 114, D09108, doi:10.1029/2008JD011159

556. **Drobinski P., Dubos T.** (2009) Breeze Scaling: From Large-Scale Land/Sea-Breezes to Mesoscale Inland Breezes. *Quart. J. Roy. Meteorol. Soc*., 135, 1766-1775.

557. **Dubos T.,** (2009) A conservative Fourier-finite-element method for solving PDEs on the whole sphere. *Quart. J. Roy. Met. Soc.* 135(644) 1877-1889

558. **Duvel, J.P., C. Basdevant, H. Bellenger**, G. Reverdin, A. Vargas, and J. Vialard, (2009) The Aeroclipper: A New Device to Explore Convective Systems and Cyclones. *Bull. Amer. Meteor. Soc*., 90, 63–71

559. Elias T., Haeffelin M., **Drobinski P.,** Gomes L., Rangognio J., Bergot T., Chazette P., Raut J.C., Colomb M. (2009) Particulate Contribution to Extinction of Visible Radiation: Pollution, Haze, and Fog. *Atmos. Res*., 92, 443-454

560. Eymet, V., R. Fournier, **J. Dufresne**, S. Lebonnois, **F. Hourdin**, and M. A. Bullock, 2009: Net exchange parameterization of thermal infrared radiative transfer in Venus' atmosphere. *J. Geophys. Res. (planets),* 114, E11008, doi :10.1029/2008JE003276.

561. Fesquet C., **Drobinski P.,** Barthlott C., Dubos T. (2009) Impact of Terrain Heterogeneity on Near-Surface Turbulence Structure. *Atmos. Res.,* 94, 254-269

562. Fesquet C., Dupont S., **Drobinski P.,** Dubos T., Barthlott C. (2009) Impact of Terrain Heterogeneity on Coherent Structure Properties: Numerical Approach. *Boundary Layer Meteorol.*, 133, 71-92

563. Foucher P.-Y., **Chédin A.**, Dufour G., Capelle V., Boone C. D. , Bernath P. (2009) Feasibility of CO2 profile retrieval from limb viewing solar occultation made by the ACE-FTS instrument. *Atmos. Chem. Phys., Techn. note*, 9, 2873-2890.

564. Funatsu B., **Claud C.**, Chaboureau J.P. (2009) Comparison between the large-scale environments of moderate and intense precipitating systems in the Mediterranean region, *Mon Wea Rev*, 137, 3933-3959, DOI : 10.1175/2009MWR2922.1.

565. **Gastineau, G., L. Li, and H. Le Treut**, (2009) The Hadley and Walker Circulation Changes in Global Warming Conditions Described by Idealized Atmospheric Simulations. *J. Climate,* 22, 3993-4013, doi :10.1175/2009JCLI2794.1.

566. George, M., C. Clerbaux, D. Hurtmans, **S. Turquety,** P.-F. Coheur, M. Pommier, J. Hadji-Lazaro, D. P. Edwards, H. Worden, M. Luo, C. Rinsland and W. McMillan, (2009) Carbon monoxide distributions from the IASI/METOP mission: evaluation with other space-borne remote sensors. *Atmos. Chem. Phys.,* 9, 8317-8330.

567. **Gibert F.**, L. Joly, I. Xueref-Remy, M. Schmidt, A. Royer, **P. H. Flamant**, D. Filippi, F. Boumard, B. Parvitte, D. Bruneau, V. Zeninari, and G. Durry, (2009) Inter-comparison of 2-µm Heterodyne Differential Absorption Lidar, Laser Diode Spectrometer, LICOR NDIR analyzer and flasks measurements of near-ground atmospheric CO2 mixing ratio, *Spectrochimica Acta Part A,* 71, 1914-1921, doi:10.1016/j.saa.2008.07.010

568. Gula J., **R. Plougonven and V. Zeitlin** (2009) Ageostrophic instabilities of fronts in a channel in the stratified rotating fluid. *J. Fluid Mech*. 627, p485-507.

569. Gula, J., **V. Zeitlin and R. Plougonven** (2009) Instabilities of two-layer shallow-water flows with vertical shear in the rotating annulus. *J. Fluid Mech*. 638, p27-47.

570. Hannart, A., **J.-L. Dufresne**, and P. Naveau (2009) Why climate sensitivity may not be so unpredictable. Geophys. Res. Lett., 36, L15704, doi :10.1029/2009GL039640.

571. Hatte C., **Rouseau D.D.** and Guiot, J. (2009) Climate reconstruction from pollen and d13C using inverse vegetation modeling. Implication for past and future climates. *Clim. Past* 5, 147-156.

572. Herbin, H., D. Hurtmans, L. Clarisse, **S. Turquety**, C. Clerbaux, C. P. Rinsland, C. Boone, P. F. Bernath, and P.-F. Coheur, (2009) Distributions and seasonal variations of tropospheric ethene (C2H4) from Atmospheric Chemistry Experiment (ACE-FTS) solar occultation spectra. *Geophys. Res. Lett.,* 36, L04801, doi:10.1029/2008GL036338.

573. Hoang, H. S., R. Baraille and **O. Talagrand** (2009) On the stability of a reduced-order filter based on dominant singular value decomposition of the system dynamics, Automatica, 45, 2400-2405, DOI:10.1016/j.automatica.2009.06.032, http://dx.doi.org/10.1016/ j.auto matica. 2009.06.032.

574. Hudman, R.C., L T. Murray, D.J. Jacob, **S. Turquety**, S. Wu, D. B. Millet, M. Avery, A. H. Goldstein, J. Holloway, and T. Ryerson, (2009) North American influence on tropospheric ozone and the effects of recent emission reductions: constraints from ICARTT observations. *J. Geophys. Res.,* 114, D07302, doi:10.1029/2008JD010126.

575. Jimenez, C., C. Prigent, and **F. Aires** (2009) Toward an estimation of global land surface heat uxes from multisatellite observations. *J. Geophys. Res. Atm.*, 114, doi: 10.1029/2008 JD011392.

576. Jin, X., T. Wu, **L. Li**, and C. Shi (2009) Cloudiness characteristics over southeast asia from satellite FY-2C and their comparison to three other cloud datasets. *J. Geophys. Res. Atm*., 114, D17207, doi :doi :10.1029/2008JD011422.

577. Joly L., F. Marnas, **F. Gibert**, D. Bruneau, B. Grouiez, P.H. Flamant, G. Durry, B. Parvitte and V. Zéninari, (2009) Laser diode absorption spectroscopy for accurate CO2 line parameters at 2 µm. Consequences for space-based DIAL measurements and potential biases. *Appl. Optics*, 48, 5475-5482.

578. Ke, Z., P. Zhang, W. Dong, and **L. Li** (2009) A new way to improve seasonal prediction by diagnosing and correcting the inter-model systematic errors. *Mon. Wea. Rev*., 137 (6), 1898-1907, doi :10.1175/2008MWR2676.1.

579. **Khvorostyanov D. V.**, G. Krinner, P. Ciais, M. Heimann, S. A. Zimov (2009), Reply to L. Kutzbach, Tellus B, 61, 3, 579-580

580. Klein P. and **G. Lapeyre** (2009) The oceanic vertical pump induced by mesoscale eddies *Annual Review of Marine Science*, 1, 351-375 (2009).

581. Klein, P., J. Isern-Fontanet, **G. Lapeyre**, G. Roullet, E. Danioux, B. Chapron, S. Le Gentil and H. Sasaki (2009) Diagnosis of vertical velocities in the upper ocean from high resolution sea surface height. *Geophys. Res. Lett*., 36, L12603

582. Koven, C., P. Friedlingstein, P. Ciais, **D. Khvorostyanov**, G. Krinner, and C. Tarnocai (2009), On the formation of high-latitude soil carbon stocks: Effects of cryoturbation and insulation by organic matter in a land surface model, *Geophys. Res. Lett*., 36, L21501, doi:10.1029/2009GL040150.

583. Kravtsov, S., D. Kondrashov, and **M. Ghil** (2009) Empirical model reduction and the modeling hierarchy in climate dynamics, in Stochastic Physics and Climate Modelling, Eds. T. N. Palmer and P. Williams, Cambridge Univ. Press, pp. 35–72.

584. Lamquin N., Gierens K., **Stubenrauch C.J.** and Chatterjee R. (2009) Evaluation of Upper Tropospheric Humidity forecasts from ECMWF using AIRS and CALIPSO data. *Atmos. Chem. Phys*, 9, 1779-1793.

585. **Lapeyre G.** (2009) What mesoscale signal does the altimeter reflect? On the decomposition in baroclinic modes and on a surface-trapped mode. Journal of Physical Oceanography., 39, 2857-2874

586. Lebeaupin Brossier C., **Drobinski P**. (2009) Numerical High-Resolution Air-Sea Coupling over the Gulf of Lions during Two Tramontane/Mistral Events. *J. Geophys. Res*., 114, D10110, doi:10.1029/2008JD011601.

587. Lebonnois, S., P. Rannou, and **F. Hourdin** (2009) The coupling of winds, aerosols and chemistry in Titan's atmosphere. *Royal Society of London Philosophical Transactions Series A*, 367, 665-682, doi :10.1098/rsta.2008.0243.

588. Lenton, A., **F. Codron**, L. Bopp, N. Metzl, P. Cadule, A. Tagliabue, and J. L. Sommer (2009) Stratospheric ozone depletion reduces ocean carbon uptake and enhances ocean acidification. *Geophys. Res. Lett.,* 36, L12606, doi :10.1029/2009GL038227.

589. **Lott F.**, J. Kuttippurath, and **F. Vial**, (2009) A Climatology of the Gravest Waves in the Equatorial Lower and Middle Stratosphere: Method and comparison between the ERA-40 re-analysis and the LMDz-GCM, *J. Atmos. Sciences*, 66, 1327-1346, 2009.

590. Mailler, S. and **F. Lott,** (2009) Dynamical influence of the Himalayas on the winter monsoon over southeastern Asia, *Geophys. Res. Lett*., 36, L06708, 2009. doi:10.1029/ 2008GL036952.

591. Massart, S., C. Clerbaux, A. Piacentini, D. Cariolle, **S. Turquety**, and J. Hadji-Lazaro (2009) First steps towards the operational assimilation of IASI ozone data into the MOCAGE-PALM system, *Atmos. Chem. Phys.,* 9, 5073-5091.

592. Menendez, C. G., et al. (2009) Downscaling extreme month-long anomalies in southern South America. *Climatic Change*, 98 (3-4), 379-403, doi :10.1007/s10584-009-9739-3.

593. **Menut L.**, I. Chiapello and C. Moulin (2009) Previsibility of mineral dust concentrations: The CHIMERE-DUST forecast during the first AMMA experiment dry season. *J. Geophys. Res. – Atmos*., 114, D07202, doi:10.1029/2008JD010523

594. **Menut L.,** O.Masson, B.Bessagnet (2009) Contribution of Saharan dust on radionuclides aerosols activity levels in Europe? The 21-22 February 2004 case study. *J. Geophys. Res*., 114, D16202, doi:10.1029/2009JD011767.

595. **Noel V., A. Hertzog, H. Chepfer** (2009) CALIPSO observations of wave-induced PSCs with near-unity optical depth over Antarctica in 2006-2007. *J. Geophys. Res*. 114 D05202.

596. **Noel V., H. Chepfer** (2009) Reply to comment by Poole et al. on a tropical NAT-like belt observed from space. *Geophys. Res. Lett*. 36 L20804.

597. Noël, V. A. Hertzog, and H. Chepfer, (2009) CALIPSO observations of wave-induced PSCs with near-unity optical depth over Antarctica in 2006-2007, *J. Geophys. Res*., 114, D05202, doi:10.1029/2008JD010604.

598. Peyridieu S., **Chédin A.**, Tanré D., Capelle V., Pierangelo C., Lamquin N. and **Armante R.** (2009) Saharan dust infrared optical depth and altitude retrieved from AIRS : a focus over North Atlantic - Comparison to MODIS and CALIPSO. *Atmos. Chem. Phys., Discuss*., 9, 21199-21235.

599. Pisso, I., V. Marécal, **B. Legras** and G. Berthet (2009) Sensitivity of ensemble Lagrangian reconstructions to assimilated wind time step resolution, , *Atmos. Chem. Phys. Discuss*., 9, 8619-8633, 2010.

600. Plana-Fattori A., Brogniez G., Chervet P., **Haeffelin M.**, Lado-Bordowsky O., **Morille Y.**, Parol F., Pelon J., Roblin A., **Sèze G. and Stubenrauch C.** (2009) Comparison of high cloud characteristics as estimated by selected spaceborne observations and ground-based lidar datasets. *J. Appl. Meteorol. Climatol*., 48, 1142-1160 doi:10.1175/ 2009JAMC1964.1.

601. Plana-Fattori, A., et al., 2009: Comparison of High-Cloud Characteristics as Estimated by Selected Spaceborne Observations and Ground-Based Lidar Datasets*. J. Appl. Meteorol. Climat*., 48 (6), 1142-1160, doi :10.1175/2009JAMC1964.1.

602. **Plougonven R. and V. Zeitlin**, (2009) Nonlinear development of inertial instability in a barotropic shear, *Physics of Fluids 21*, 106601, doi:10.1063/1.3242283.

603. **Plougonven, R.**, C. Snyder and F. Zhang, (2009) Comments on 'Application of the Lighthill-Ford Theory of Spontaneous Imbalance to Clear-Air Turbulence Forecasting', *J. Atmos. Sci*. 66, 2506-2510.

604. Quaas, J., et al. (2009) Current understanding and quantication of clouds in the changing climate system and strategies for reducing critical uncertainties. Peer-reviewed book chapter for Clouds in the Perturbed Climate System: Their Relationship to Energy Balance, Atmospheric Dynamics, and Precipitation., J. Heintzenberg and R. J. Charslon, Eds., Cambridge, MA : The MIT Press., Ernst Strungmann Forum Report, Vol. 2, chap. Observational Strategies at Meso and Large Scales to Reduce Critical Uncertainties in Future Changes of Cloud Properties., 557-573.

605. Randel, W., Shine K., Austin J., Barnett, **Claud C.**, Gillett N., Keckhut P., Langematz U., Lin R., Long C., Mears C., Miller A., Nash J., Seidel D.J., Thompson D., Wu F., Yoden S. (2009) An update of observed stratospheric temperature trends, *J. Geophys. Research,* 114, D02107, doi:10.1029/2008JD010421.

606. Rascher, U., Agati, G., Alonso, L., Cecchi, G., Champagne, S., Colombo, R., Damm, A., Daumard, F., de Miguel, E., Fernandez, G., Franch, B., Franke, J., Gerbig, C., Gioli, B., Gomez, J. A., **Goulas, Y**., Guanter, L., Gutierrez-de-la-Camara, O., Hamdi, K., Hostert, P., Jimenez, M., Kosvancova, M., Lognoli, D., Meroni, M., Miglietta, F., Moersch, A., Moreno, J., **Moya, I.**, Neininger, B., Okujeni, A., **Ounis, A.,** Palombi, L., Raimondi, V., Schickling, A., Sobrino, J. A., Stellmes, M., Toci, G., Toscano, P., Udelhoven, T., van der Linden, S., & Zaldei, A., (2009) CEFLES2: the remote sensing component to quantify photosynthetic efficiency from the leaf to the region by measuring sun-induced fluorescence in the oxygen absorption bands. *Biogeosciences*, *6*(*7*), 1181-1198.

607. Raybaut M., T. Schmid, A. Godard, A. K. Mohamed, M. Lefebvre, F. Marnas, **P. Flamant**, A. Bohman, P. Geiser, and P. Kaspersen, (2009) High-energy single-longitudinal-mode nearly-diffraction-limited optical parametric source with 3 MHz frequency stability for CO2 DIAL, *Optics Letters*, 34, 2069-2071.

608. Reznik G. and **V. Zeitlin**, (2009) Resonant excitation of coastal Kelvin waves by inertia-gravity waves. *Phys. Letters A*, 373, 1019 – 1021.

609. **Rio C., Hourdin F. and Chédin A.** (2009) Numerical simulation of tropospheric injection of biomass burning products by pyro-thermal plumes. *Atmos. Chem. Phys*, *Discuss.*, 9, 18659-18704.

610. **Rio, C., F. Hourdin, J. Grandpeix**, and J. Lafore (2009) Shifting the diurnal cycle of parameterized deep convection over land. *Geophys. Res. Lett*., 36, L07809, doi : 10.1029/2008GL036779.

611. **Rivière, O., G. Lapeyre et O. Talagrand**, (2009) A novel technique for nonlinear sensitivity analysis: application to moist predictability, *Q. J. R. Meteorol. Soc.*, 135, 1520-1537, disponible à l'adresse http://www3.interscience.wiley.com/journal/113388514/home, DOI: 10.1002/qj.460.

612. Rouil L., C.Honore, R.Vautard, M.Beekmann, B.Bessagnet, L.Malherbe, F.Meleux, A.Dufour, C.Elichegaray, J-M.Flaud, **L.Menut**, D.Martin, A.Peuch, V-H.Peuch, N.Poisson (2009) PREV'AIR : an operational forecasting and mapping system for air quality in Europe, *BAMS*, DOI: 10.1175/2008BAMS2390.1

613. **Rousseau D.D.**, Wu N., Pei Y.P. and Li F. (2009) Three exceptionally strong East-Asian summer monsoon events during glacial conditions in the past 470 kyr. *Clim. Past*. 5, 157-169.

614. Salameh T., **Drobinski P.**, Vrac M., Naveau P. (2009) Statistical Downscaling of Near-Surface Wind over Complex Terrain in Southern France. Metetorol. *Atmos. Phys*., 103, 243-256

615. Shevliakova E., Pacala S. W., Malyshev S., Hurtt G. C., Milly P. C. D., Caspersen J. P., Sentman L. T., Fisk J. P., Wirth C., and **Crevoisier C.** (2009) Carbon cycling under 300 years of land use change: Importance of the secondary vegetation sink. *Global Biogeochem. Cycles*, 23, GB2022 doi:10.1029/2007GB003176.

616. Shuckburgh, E., Jones, H. Marshall, J. and Hill, C., (2009) Understanding the regional variability of eddy diffusivity in the Pacific sector of the Southern Ocean, *J. Phys. Oceanogr*., 39, 2011-2023.

617. Simonnet, E., H. A. Dijkstra, and **M. Ghil**, (2009) Bifurcation analysis of ocean, atmosphere and climate models, in Computational Methods for the Ocean and the Atmosphere, R. Temam and J. J. Tribbia (eds.), North-Holland, pp. 187–229.

618. Snyder C., **R. Plougonven** and D.J. Muraki (2009) Mechanisms for spontaneous gravity wave generation within a dipole vortex, *J. Atmos. Sci*. 66(11), p3464-3478.

619. Struthers, H., G.E. Bodeker, I. Cionni, J. Austin, S. Bekki, M. Dameris, M.A. Giorgetta, V. Grewe, F. Lefevre, **F. Lott**, E. Manzini, T. Peter, E. Rozanov, and M. Schraner, (2009) The simulation of the Antarctic ozone hole by chemistry-climate models, *Atmos. Chem. Phys* (9), 6363-6376.

620. **Stubenrauch C.** J., Kinne S., and GEWEX Cloud Assessment Team (2009) Evaluation of Global Cloud Data Products. *GEWEX news article*, 19, 1.

621. Sultan, B., M. Bella-Medjo, A. Berg, **P. Quirion**, and S. Janicot (2009) Multi-scales and multisites analysis of the role of rainfall in cotton yields in west africa. *International Journal of Climatology*, 30 (1), 58-71, doi :10.1002/joc.1872.

622. Sutyrin G. G., **A. Stegner**, I. Taupier-Letage and S. Teinturier, (2009) Amplification of a surface-intensified eddy drift along steep shelf in the eastern Mediterranean sea. *Journal of Physical Oceanography*, v.39, 1729-1741 (2009).

623. Szopa S., G.Foret, **L.Menut**, A.Cozic, 2009, Impact of large scale circulation on European summer surface ozone: consequences for modeling, *Atmospheric Environment*, Vol. 43, Issue 6, Pages 1189-1195, doi:10.1016/j.atmosenv.2008.10.039

624. Taricco, C., **M. Ghil**, S. Alessio, and G. Vivaldo, (2009) Two millennia of climate variability in the Central Mediterranean, *Clim. Past*, 5, 171–181, www.clim-past.net/5/171/ 2009/.

625. **Turquety, S**., D. Hurtmans, J. Hadji-Lazaro, P.-F. Coheur, C. Clerbaux, D. Josset, and C. Tsamalis (2009) Tracking the emission and transport of pollution from wildfires using the IASI CO retrievals: analysis of the summer 2007 Greek fires, *Atmos. Chem. Phys.,* 9, 4897-4913.

626. Vialard, J., **J.P. Duvel**, M.J. Mcphaden, P. Bouruet-Aubertot, B. Ward, E. Key, D. Bourras, R. Weller, P. Minnett, A. Weill, C. Cassou, L. Eymard, T. Fristedt, **C. Basdevant**, Y. Dandonneau, O. Duteil, T. Izumo, C. de Boyer Montégut, S. Masson, F. Marsac, C. Menkes, and S. Kennan, (2009) Supplement to Cirene: Air—Sea Interactions in the Seychelles—Chagos Thermocline Ridge Region. *Bull. Amer. Meteor. Soc*., 90, ES1–ES4.

627. Vialard, J., **J.P. Duvel**, M.J. Mcphaden, P. Bouruet-Aubertot, B. Ward, E. Key, D. Bourras, R. Weller, P. Minnett, A. Weill, C. Cassou, L. Eymard, T. Fristedt, C. Basdevant, Y. Dandonneau, O. Duteil, T. Izumo, C. de Boyer Montégut, S. Masson, F. Marsac, C. Menkes, and S. Kennan, 2009: Cirene: Air‹Sea Interactions in the Seychelles‹Chagos Thermocline Ridge Region. Bull. Amer. Meteor. Soc., 90, 45–61.

628. **Viollier, M.**, C. Standfuss, **O. Chomette** and A. Quesney (2009) Top-of-Atmosphere Radiance-to-Flux conversion in the SW domain for the ScaRaB-3 instrument on Megha-Tropiques. *J. Atmos. Oceanic Technol.,* 26, 2161-2171.

629. Vrac M., Diday E., Billard L., Chédin A. (2009) Analysis of mixture models using copulas. *J. Roy. Stat. Soc. B*, in revision.

630. Vuolo M.R., **H.Chepfer, L.Menut** and G.Cesana (2009) Comparison of mineral dust layers vertical structures modelled with CHIMERE-DUST and observed with the CALIOP lidar, *J. Geophys. Res. – Atmos*. , Vol. 114, D09214, doi:10.1029/2008JD011219

631. Vuolo M.R., **L.Menut** and **H.Chepfer** (2009) Impact of transport schemes accuracy on modelled dust concentrations variability, *J. Atmos. and Oceanic Technology*, 26, p.1135-1143, doi:10.1175/2008JTECHA1197.1

632. Xavier, P.K., **J.P. Duvel**, P. Braconnot and F.J. Doblas-Reyes, 2009: An evaluation metric for intraseasonal variability in climate models. In press. J. Climate.

633. **Yano, J.-l. and M. Bonazzola** (2009) Scale Analysis for Large-Scale Tropical Atmospheric Dynamics. *J. Atmos. Sci.,* 66 (1), 159-172, doi:10.1175/2008JAS2687.1.

634. **Yano, J.-l.,** S. Mulet, and **M. Bonazzola** (2009) Tropical large-scale circulations : asymptotically non-divergent ? 61 (3), 417-427, doi:10.1111/j.1600-0870.2009.00397.x.

635. Zampieri, M., **F. D'Andrea**, R. Vautard, Ph. Ciais, N. de Noblet-Ducoudré, P. Yiou, (2009) Hot European Summers and the role of soil moisture in the propagation of Mediterranean drought. *J. Climate*, 22, 4747–4758.

636. Zhang, Y., B. Stevens, B. Medeiros, and **M. Ghil**, (2009) Low-cloud fraction, lower-tropospheric stability and large-scale divergence, *J. Climate*, 22, 4827–4844, doi: 10.1175/2009JCLI2891.1

Partner 09: SISYPHE – UMR 7619

637. Abell J., **Laverman AM**., Van Cappellen P. (2009), Bioavailability of organic matter in a freshwater estuarine sediment: long-term degradation experiments with and without nitrate supply. *Biogeochemistry*; 94 (1): 13-28.

638. **Adler PM.,** Mityushev VM. (2009), Resurgence flows in porous media, *Physical Review E*, 79 (2): 026310.

639. **Adler PM**., Perrier F. (2009), Radon Emanation in Partially Saturated Porous Media, *Transport in Porous Media*, 78 (2): 149-159.

640. Andreassian V., Perrin C., Berthet L., Le Moine N., Lerat J., Loumagne C., **Oudin L**., Mathevet T., Ramos MH., Valery A. (2009), HESS Opinions 'Crash tests for a standardized evaluation of hydrological models', *Hydrology and Earth System Sciences*, 13 (10): 1757-1764.

641. Auken E., **Violette S., Ozouville N.,** Deffontaines B., Sorensen K, Viezzoli A., **de Marsily G**. (2009), SkyTEM contribution to hydrogeology of volcanic Islands of Galapagos Archipelago, *Comptes Rendus Géosciences*, 341 (10-11): 899-907.

642. Auken E., **Guérin R., de Marsily G**., Sailhac P. (2009), Hydrogeophysics Foreword, *Comptes Rendus Géosciences*, 341 (10-11): 795-799.

643. **Billen G.,** Barles S., **Garnier J.,** Rouillard J., Benoit P. (2009), The Food-Print of Paris: Long term Reconstruction of the Nitrogen Flows imported to the City from its Rural Hinterland. *Regional Environmental Change*, 9(1): 13-24.

644. **Billen G., Thieu V., Garnier J., Silvestre M.** (2009), Modelling the N cascade in regional watersheds: The case study of the Seine, Somme and Scheldt rivers, *Agriculture, Ecosystems & Environment*, 133 (3-4): 234-246.

645. Boé J., Terray L., Martin E., **Habets F**. (2009), Changes in component of the hydrological cycle in French river basins during the 21st century, *Water Resources Research*, 45, W08426.

646. Boone A., De Rosnay P., Balsamo G., Beljaars A., Chopin F., Decharme B., Delire C., **Ducharne A**., **Gascoin S**., Guichard F., Gusev Y., Harris P., Jarlan L., Kergoat L., Mougin E., Nasonova O., Norgaard A., Orgeval T., Ottlé C. et Al. (2009), The AMMA Land Surface Model Intercomparison Project (ALMIP), *Bulletin of the American Meteorological Society*, 90 (12): 1865-1880.

647. **Botta F.,** Lavison G., Couturier G., **Alliot F., Moreau-Guigon E**., Fauchon N., Guery B., **Chevreuil M., Blanchoud H**. (2009), Transfer of glyphosate and its degradate AMPA to surface waters through urban sewerage systems, *Chemosphere*, 77 (1): 133-139.

648. Bouilloud L., Martin E., **Habets F**., Boone A., Le Moigne P., Livet J., Marchetti M., Foidart A., Franchistéguy L., Morel S., Noilhan J., Pettré P. (2009), Road surface condition forecasting in France, *Journal of Applied Meteorology and Climatology*, 48 (12): 2513-2527.

649. Bouwman A. F., Beusen A. H. W., **Billen G**. (2009), Human alteration of the global nitrogen and phosphorus soil balances for the period 1970-2050, *Global Biogeochemical Cycles*, 23: GB0A04.

650. Chihi H., **de Marsily G**. (2009), Simulating Non-Stationary Seismic Facies Distribution in a Prograding Shelf Environment, Oil & Gas Science and Technology – *Revue de l'Institut Français du Pétrole*, 64 (4), 451-467.

651. **Cosenza P., Ghorbani A., Camerlynck C., Réjiba F., Guérin R., Tabbagh A**. (2009), Effective medium theories for modeling the relationships between electromagnetic properties and hydrological variables: advantages, limitations and compromises, *Near Surface Geophysics*, 7(5-6) :563-578.

652. **Curie F., Ducharne A**., Sebilo M., **Bendjoudi H.** (2009), Denitrification in a hyporheic riparian zone controlled by river regulation in the Seine River basin (France), *Hydrological Processes*, 23 (5): 655-664.

653. **Dargnat C., Blanchard M., Chevreuil M., Teil MJ**. (2009), Occurrence of phthalate esters in the Seine River estuary (France), *Hydrological Processes*, 23(8): 1192-1201.

654. **Dargnat C., Teil M-J., Chevreuil M., Blanchard M.** (2009), Phthalate removal throughout wastewater treatment plant. Case study of Marne Aval station (France), *Science of the Total Environment*, 407(4): 1235-1244.

655. **Delmas M**., Cerdan O., **Mouchel JM**., **Garcin M.** (2009), A method for developing a large-scale sediment yield index for European river basins. *Journal of Soil and Sediments*, 9 (6): 613-626.

656. **Diss S**., Testud J., Lavabre J., **Ribstein P**., Moreau E., Parent Du Chatelet J. (2009), Ability of dual polarized X-band radar to estimate rainfall, *Advances in Water Resources*, 32 (7): 975-985.

657. **Ducharne A**. (2009), Reducing scale dependance in TOPMODEL using a dimensionless topographic index, *Hydrology and Earth System Sciences*, 13 (12): 2399-2412.

658. Ezersky M., Legchenko A., **Camerlynck C., Al- Zoubi A.** (2009), Identification of sinkhole development mechanism based on a combined geophysical study in Nahal Hever south area (Dead Sea coast of Israel), *Environmental Geology*, 58 (5): 1123-1141.

659. Ferahtia J., Djarfour N., Baddari K**., Guérin R**.,(2009), Application of signal dependent rank-order mean filter to the removal of noise spikes from 2D electrical resistivity imaging data, *Near Surface Geophysics*, 7 (3): 159-169.

660. **Garnier J., Billen G., Vilain G., Martinez A., Mounier E., Silvestre M., Toche F**. (2009), Nitrous oxide (N2O) in the Seine river and basin: observations and budgets, *Agriculture, Ecosystems & Environment*, 133: 223-233.

661. **Gascoin S., Ducharne A., Ribstein P., Carli M., Habets F**. (2009), Adaptation of a catchment-based land surface model to the hydrogeological setting of the Somme River basin (France), *Journal of Hydrology*, 368 (1-4): 105-116.

662. **Gascoin S., Ducharne A., Ribstein P**., Lejeune Y., Wagnon P. (2009), Dependence of bare soil albedo to soil moisture on the moraine of the Zongo glacier (Bolivia): implications for land surface modelling, *Journal of Geophysical Research*, 114: D19102.

663. **Gascoin S., Ducharne A., Ribstein P.,** Perroy E., Wagnon P. (2009), Sensitivity of bare soil albedo to surface soil moisture on the moraine of the Zongo glacier (Bolivia), *Geophysical Research Letters*, 36: L02405.

664. Gaviglio P., Bekri S., Vandycke S**., Adler PM**., Schroeder C., Bergerat F., Darquennes A., Coulon M. (2009), Faulting and deformation in chalk, *Journal of Structural Geology*, 31 (2): 194-207.

665. **Ghorbani A**., **Camerlynck C., Florsch N.** (2009), CR1Dinv: A Matlab program to invert 1D Spectral Induced Polarization data for the Cole-Cole model including electromagnetic effects, *Computers and Geosciences*, 35 (2): 255-266.

666. **Ghorbani A**., Zamora M., **Cosenza P**. (2009), Effects of desiccation on the elastic wave velocities of clay-rocks, International *Journal of Rock Mechanics and Mining Sciences*, 46 (8): 1267-1272.

667. **Ghorbani A**., **Cosenza P**., Revil A., Zamora M., Schmutz M., **Florsch N.,** Jougnot D. (2009), Non-invasive monitoring of water content and textural changes in clay-rocks using spectral induced polarization: A laboratory investigation, *Applied Clay Science*, 43 (3-4): 493-502.

668. Grizzetti B., Bouraoui F., **de Marsily G**. (2009), Assessing nitrogen pressures on European surface water, *Global Biogeochemical Cycles*, 22 (4), GB4023.

669. **Guérin R**., Baltassat JM., Boucher M., Chalikakis K., **Galibert PY**., Girard JF., **Plagnes V**., **Valois R**. (2009), Geophysical characterisation of karstic networks - Application to the Ouysse system (Poumeyssen, France, Comptes Rendus Géosciences, 341 (10-11): 810-817.

670. **Hamzehpour H**., Mourzenko VV., Thovert JF., **Adler PM.** (2009), Percolation and permeability of networks of heterogeneous fractures, *Physical Review E*, 79 (3), 036302.

671. Harcouet-Menou V., Guillou-Frottier L., Bonneville A., **Adler PM**., Mourzenko V. (2009), Hydrothermal convection in and around mineralized fault zones: insights from two- and three-dimensional numerical modeling applied to the Ashanti belt, Ghana, *Geofluids*, 9 (2) : 116-137.

672. Jamwal P., Mittal,a. K., **Mouchel JM.,** (2009), Efficiency evaluation of sewage treatment plants with different technologies in Delhi(India), *Environmental Monitoring and Assessment*, 153(1-4): 293-305.

673. **Jost A**., Fauquette S., Kageyama M., Krinner G., Ramstein G., Suc J.P., Violette S., (2009), High resolution climate and vegetation simulations of the Late Pliocene, a model-data comparison over western Europe and the Mediterranean region, *Climate of the Past*, 5 (4): 585-606.

674. Jougnot D., **Ghorbani A**., Revil A., Leroy P., **Cosenza P**., (2009), Spectral induced polarization of partally satured clay-rocks: a mechanistic approach, *Geophysical Journal International*, 180(1): 210-224.

675. Laruelle G.G., Roubeix V., **Sferratore A**., Brodherr B., Ciuffa D., Conley D. J., Dürr H.H**., Garnier J**., Lancelot C., **Le Thi Phuong Q**., Meunier J.-D., **Meybeck M**., Michalopoulos P., Moriceau B., Longphuirt S., Loucaides S., Papush L., Presti M. , Ragueneau O. ,. Regnier P. A. G, Saccone L., Slomp C. P., Spiteri C., Van Cappellen P.(2009). Anthropogenic perturbations of the silicon cycle at the global scale: the 1 key role of the land-ocean transition. *Global Biogeochemical Cycles*, 23, GB4031, doi:10.1029/2008GB003267.

676. Legchenko A., Ezersky M., **Camerlynck C**., Al-Zoubi A., Chalikakis K. (2009), Joint use of TEM and MRS methods in a complex geological setting, *Comptes Rendus Geoscience*, 341 (10-11): 908-917.

677. Longuevergne L., Boy JP., **Florsch N**., Viville D., Ferhat G., Ulrich P., Luck B., Hinderer J. (2009), Local and global hydrological contributions to gravity variations observed in Strasbourg, *Journal of Geodynamics*, 48 (3-5) : 189-194.

678. Longuevergne L., **Florsch N**., Boudin F., **Oudin L**., **Camerlynck C**. (2009), Tilt and strain deformation induced by hydrologically active natural fractures: application to the tiltmeters installed in Sainte-Croix-aux-Mines observatory (France), *Geophysical Journal International*, 178 (2): 667-677.

679. Ludwig W.; Dumont E., **Meybeck M**., Heussner S. (2009), River discharges of water and nutrients to the Mediterranean and Black Sea: Major drivers for ecosystem changes during past and future decades? *Progress in Oceanography*, 80 (3-4) : 199-217.

680. **Malinouskaya I**., Mourzenko VV., Thovert JF., **Adler PM**. (2009), andom packings of spiky particles: Geometry and transport properties, *Physical Review E*, 80 (1) : 011304.

681. Miège C., Karolak S., Gabet V., Jugan ML., Oziol L., **Chevreuil M**., Levi Y., Coquery M. (2009), Evaluation of estrogenic disrupting potency in aquatic environments and urban wastewaters by combining chemical and biological analysis, TRAC-*Trends in Analytical Chemistry*, 28 (2): 186-195.

682. Monnier S., **Camerlynck C., Rejiba F.** (2009), Ground-penetrating radar surveys on rock glaciers of the Vanoise Massif (Northern French Alps): methodological issues, *Géomorphologie* : Relief, Processus, Environnement, 2: 129-140.

683. Qu X., Mazeas L., Vavilin VA., Epissard J., Lemunier M., **Mouchel JM**., He P. J., Bouchez T. (2009), Combined monitoring of changes in delta(CH4)-C-13 and archaeal community structure during mesophilic methanization of municipal solid waste, *FEMS Microbiology Ecology*, 68 (2): 236-245.

684. **Rousseau-Gueutin P**., de Greef V., **Gonçalvès J., Violette S.,** Chanchole S. (2009), Experimental device for chemical osmosis measurement on natural clay-rock samples maintained at in situ conditions. Implications for formation pressure interpretations, *Journal of Colloid and Interface Science*, 337 (1): 106-116.

685. **Sangare D., Adler PM**. (2009), Continuum percolation of isotropically oriented circular cylinders, *Physical Review E*, 79 (5): 052101.

686. Schmutz M., **Guérin R., Andrieux P.,** Maquaire O. (2009), Determination of the 3D structure of an earthflow by geophysical methods. The case of Super Sauze, in the French Southern Alps, *Journal of Applied Geophysics*, 68 (4): 500-507.

687. Seguí P.Q., Martin E., **Habets F**., Noilhan J. (2009), Improvement, calibration and validation of a distributed hydrological model over France, *Hydrology and Earth System Sciences*, 13 (2): 163-181.

688. Slimani S., Massei N., Mesquita J., **Valdes-Lao D**., Fournier M., Laignel B., Dupont JP. (2009), Combined climatic and geological forcings on the spatio-temporal variability of piezometric levels in the chalk aquifer of Upper Normandy (France) at pluridecennal scale, *Hydrogeology Journal*, 17: 1823–1832.

689. Sorruco A., Vincent C., Francou B., **Ribstein P**., Berger T., Sicart JE., Wagnon P., Arnaud Y., Favier V., Lejeune Y. (2009), Mass balance on Zongo Glacier, Bolivie, between 1956 and 2006, using, glaciological, hydrological and geodetic methods, *Annals of Glaciology*, 50 (50): 1-8.

690. Stälnäcke P., Pengerud A., Bechmann M., **Garnier J**., Humborg Ch., Novotny V. (2009), Driving force and pressure relationships at contrasting scales: implications for catchment management, *International Journal of River Basin Management*, 7 (3): 221-232.

691. **Tabbagh A., Cosenza P., Ghorbani A., Guérin R., Florsch N.** (2009), Modelling of Maxwell-Wagner Induced Polarisation Amplitude for Clayey Materials, *Journal of Applied Geophysics*, 67 (2): 109-113.

692. **Tabbagh A., Guérin R., Bendjoudi H., Cheviron B., Bechkit M.A.** (2009), Pluri-annual recharge assessment using vertical soil temperature profiles: example of the Seine river basin (1984-2001), *Comptes Rendus Geoscience*, 341 (10-11): 949-956.

693. **Tamtam F**., Mercier F., **Eurin J., Chevreuil M., Le Bot B**. (2009), Ultra performance liquid chromatography tandem mass spectrometry performance evaluation for analysis of antibiotics in natural waters, *Analytical And Bioanalytical Chemistry*, 393(6-7): 1709-1718.

694. **Thiesson J.,** Dabas M., **Flageul S.** (2009), Detection of Resistive Features using Towed Slingram Electromagnetic Induction Instruments, *Archaeological Prospection*, 16 (2): 103-109.

695. **Thieu V., Billen G., Garnier J**. (2009), Nutrient transfer in three contrasting NW European watersheds: the Seine, Somme, and Scheldt rivers. A comparative application of the Seneque/Riverstrahler model, *Water Research*, 43 (6): 1740- 1748.

696. **Thouvenot-Korppoo M., Billen G., Garnier J**. (2009), Modelling benthic denitrification processes over a whole drainage network, *Journal of Hydrology*, 379 (3-4): 239-250.

697. Trajkovska S., Mbaye M., Gaye Seye M., Aaron J., **Chevreuil M., Blanchoud H**. (2009), Toxicological study of pesticides in air and precipitations of Paris by means of a bioluminescence method, *Analytical and Bioanalytical Chemistry*, 394(4) :1099-1106.

698. Tyler CR., Filby AL., Bickley LK., Cumming RI., Gibson R., **Labadie P**., Katsu Y., Liney KE., Shears JA., Silva-Castro V., Urushitani H., Lange A., Winter MJ., Iguchi T., Hill EM. (2009), Environmental Health Impacts of Equine Estrogens Derived from Hormone Replacement Therapy, *Environmental Science & Technology*, 43 (10): 3897-3904.

699. **Violette S.,** Boulicot G., Gorelicks M. (2009), Tsunami-induced Groundwater Salinization in Southeastern India, *Comptes Rendus Geoscience*, 341 (4): 339-346.

Partner 10: IDES – UMR 8148

700. **Adiaffi B., Marlin C**., Oga Y., **Massault M., Noret A**., Biemi J. (2009) Palaeoclimatic and deforestation effect on the coastal fresh groundwater resources of SE Ivory Coast from isotopic and chemical evidence. *Journal of Hydrology*, 369 1-2 130-141

701. Batlle-Aguilar J., **Schneider S**., **Pessel M., Tucholka P**., Coquet Y., Vachier P. (2009) Axisymetrical infiltration in soil imaged by non-invasive electrical resistivimetry. *Soil Science Society of America Journal*, 73 2 510-520

702. Bodin S., **Fiet N**., Godet A., Matera V., Westermann S., Clement A., Janssen N.M.M., Stille P., Föllmi K.B. (2009) Early Cretaceous (late Berriasian to early Aptian) palaeoceanographic change along the northwestern Tethyan margin (Vocontian Trough, southeastern France): δ13C, δ18O and Sr-isotope belemnite and whole-rock records. *Cretaceous Research*, 30 5 1247-1262

703. Bouchaou L., **Michelot J.L**., Qurtobi M., Zine N., Gaye C.B., Aggarwal P.K., Marah H., Zerouali A., Taieb H., Vengosh A. (2009) Origin and residence time of groundwater in the Tadla Basin (Morocco) using multiple isotopic and geochemical tools. *Journal of Hydrology*, 379 3-4 323-338

704. **Bouley S., Ansan V., Mangold N., Masson** P., Neukum G. (2009) Fluvial morphology of Naktong Vallis, Mars : a late activity with multiphe processes. *Planetary and Space Science*, 57 (8-9): 982-999

705. Chenet A., Courtillot V., Fluteau F., Gerard M., **Quidelleur X**., Khadri S., Subbarao K., Thordarson T. (2009) Determination of rapid Deccan eruptions across the KTB using paleomagnetic secular variation: (II) Constraints from analysis of 8 new sections and synthesis for a 3500m-thick composite section. *J. Geophys. Res. B: Solid Earth*, 114 B06103

706. Chevrel S.D., Pinet P.C., Daydou Y., Le Mouelic S., Langevin Y., **Costard F**., Erard S. (2009) The Aristarchus Plateau on the Moon: Mineralogical and structural study from integrated Clementine UV-Vis-NIR spectral data. *Icarus*, 199 1 9-24

707. Corcho-Alvarado J.A., **Barbecot F**., Purtschert R., **Gillon M**., Aeschbach-Hertig W., Kipfer R. (2009) European climate variations over the past half-millenium reconstructed from groundwater. *Geophysical Research Letters*, 36 L15703

708. Corcho-Alvarado J.A., **Barbecot F**., Purtschert R. (2009) Ambient vertical flow in long screen wells: a case study in the Fontainebleau sands aquifer (France). *Hydrogeology Journal*, in press

709. Di Muro A., Métrich N., **Mercier M**., Giordano D., Massare D., Montagnac G. (2009) Micro-Raman determination of iron redox state in dry natural glasses : application to peralkaline rhyolites and basalts. *Chemical Geology*, 259 :78-28.

710. Diez W.C., Feldman N., **Mangold N**., Baratoux D., Maurice S., Gasnault O., D'Uston L., **Costard F**. (2009) Contribution of Mars Odyssey GRS at the Central Elysium Planitia. *Icarus*, 200 (1) :19-29

711. Dissard D., Nehrke G., Reichart G.J., **Nouet J**., Bijma J. (2009) Effect of the fluorescence indicator calcein on Mg and Sr incorporation into foraminiferal calcite. *Geochemistry Geophysics Geosystems*, 10 Q11001

712. Dotsika E., Poutoukis D., **Michelot J.L**., Raco B. (2009) Natural tracers for identifying the origin of the thermal fluids emerging along the Aegean Volcanic arc (Greece): Evidence of Arc-Type Magmatic Water (ATMW) participation. *Journal of Volcanology and Geothermal Research*, 179 1-2 19-32

713. **Duchamp-Alphone S., Fiet N., Pagel M**., Remane J. (2009) A chemical method for extracting delicate calcareous microfossils from indurated calcareous rocks exemplified by calpionellids. *Micropaleontology*, 55 1 87-93

714. **Durand V**., Leonardi V., Deffontaines B., Macquar J. (2009) Fluid transfers in a carbonate-gaseous aquifer through the local tectonic and geodynamic history. *Journal of the Geologcal Society*, 166 4 643-654

715. Errami E., **Bonin B**., Laduron D., Lasri L. (2009) Petrology and geodynamic significance of the post-collisional Pan-African magmatism in the Eastern Saghro area (Anti-Atlas, Morocco). *Journal of African Earth Sciences*, 55 1-2 105-124

716. **Farre B., Dauphin Y**. (2009) Lipids from the nacreous and prismatic layers of two Pteriomorpha Mollusc shells. *Comparative Biochemistry and Physiology*, B 152 103–109

717. Frank N., Ricard E., Lutringer-Paquet A., Van Der Land C., **Colin C**., Blamart D., Foubert A., Van Rooij D., Henriet J.P., De Haas H., Van Weering T. (2009) The Holocene occurrence of cold water corals in the NE Atlantic: implications for coral carbonate mound evolution. *Marine Geology*, 266 1-4 129-142

718. Frizon De Lamotte D., Leturmy P., **Missenard Y**., Khomsi S., Ruiz G., Saddiqi O., Guillocheau F., Michard A. (2009) Mesozoïc and Cenozoïc vertical movements in the Atlas system (Algeria, Morroco, Tunisia) : an overview. *Tectonophysics*, 475 (1): 9-28

719. Fullea J., Afonso J., Connolly J., Fernandez M., Garcia-Castellanos D., **Zeyen H**. (2009) «LithMod3D : an interactive 3D software to model the thermal, compositionnal, density, seismological and rheological structure of the lithosphere upper mantle. *Geochemistry Geophysics Geosystems*, 10 doi:10.1029/2009GC002391 Q08019

720. **Garnier J., Quantin C**., Echevarria G., Becquer T. (2009) Assessing chromate availability in tropical ultramafic soils using isotopic exchange kinetics. *Journal of Soils and Sediments*, 9 5 468-475

721. **Garnier J., Quantin C**., Guimaraes E., Garg V., Martins E., Becquer T. (2009) Understanding the genesis of ultramafic soils and catena dynamics in Niquelandia, Brazil. *Geoderma*, 151 3-4 204-214

722. **Gautheron C**., Tassan-Got L., Barbarand J., Pagel M. (2009) Effect of alpha-damage annealing on apatite (U-Th)/He thermochronology. *Chemical Geology*, 266 166-179

723. **Gillon M., Barbecot F., Gibert E**., Corcho-Alvarado J.A., Marlin C., Massault M. (2009) Open to closed system transition traced through the TDIC isotopic signature at the aquifer recharge stage, implications for groundwater 14C dating. *Geochimica et Cosmochimica Acta / Geochemica et Cosmochimica Acta; Geochimica et Cosmochimica Acta (England); Geochimica and Cosmochimica Acta*, 73 21 6488-6501

724. **Gillon M., Barbecot F., Marlin C., Gibert E**. (2009) Groundwater dating : importance of isotopic and geochemical exchanges during the water infiltration. *Actualite Chimique*, 329 25-29

725. Gorin G., **Fiet N**., Pacton M. (2009) Benthic microbial mats: a possible major component of organic matter accumulation in the Lower Aptian oceanic anoxic event. *Terra Nova*, 21 1 21-27

726. Gregoire M., Langlade J.A., **Delpech G**., Dantas C., Ceuleneer G. (2009) Nature and evolution of the lithospheric mantle beneath the passive margin of East Oman: Evidence from mantle xenoliths sampled by Cenozoic alkaline lavas. *Lithos*, 112 3-4 203-216

727. Greswell R., Ellis P., Cuthbert M., White R., **Durand V**. (2009) The design and application of an inexpensive pressure monitoring system for shallow water level measurement, tensiometry and piezometry. *Journal of Hydrology*, 373 4 416-425

728. Gunnel Y., Calvet M., Brichau S., Carter A., Aguilard J.P., **Zeyen H**. (2009) Low long-term erosion rates in high-energy moutain belts : insights from thermo- and biochronology in the Eastern Pyrenees. *Earth and Planetary Science Letters*, 278 doi:10.1016/j.epsl.2008.12.004 208-218

729. Guzman N., **Dauphin Y., Cuif J.P., Denis A**., Ortlieb L. (2009) Diagenetic changes in Concholepas concholepas shells (Gastropoda, Muricidae) in the hyper-arid conditions of Northern Chile – implications for palaeoenvironmental reconstructions. *Biogeosciences*, 6 2 197-207

730. Houlbreque F., Meibom A., **Cuif J.**P., Stolarski J., Marrochi Y., Ferrier-Pages C., Domart-Coulon I., Dunbar R.B. (2009) Strontium-86 labeling experiments show spatially heterogeneous skeletal formation in the scleractinian coral Porites porites. *Geophysical Research Letters*, 36 L 04604

731. Jouniaux L., Maineult A., Naudet V., **Pessel M**., Sailhac P. (2009) Review of Self-potential methods in Hydrogeophysics. *C. R. Geoscience*, 341 10-11 928-936

732. Juillet-Leclerc A., Reynaud S., Rollion-Bard C., **Cuif J.P., Dauphin Y**., Blamart D., Ferrier-Pages C., Allemand D. (2009) Oxygen isotopic signature of the skeletal microstructures in cultured corals: identification of vital effects. *Geochimica et Cosmochimica Acta*, 17 18 5320-5332

733. **Lekmine G**., **Pessel M**., Auradou H. (2009) 2D Electrical Resistivity Tomography surveys optimisation of solutes transports in porous media. *ArchéoSciences*, 33 309-312 309-312

734. Lenat J.F., Boivin P., Deniel C., **Gillot P.Y**., Bachelery P., Cochonat P., Cornaglia B., Labazuy P., Le Drezen E., Lipman P.W., Ollier G., Savoye B., Vincent P., Voisset M. (2009) Age and nature of deposits on the submarine flanks of Piton de la Fournaise (Reunion Islands). *Journal of Volcanology and Geothermal Research*, 184(1-2):199-207

735. Li Y., Becquer T., Dai J., **Quantin C**., Benedetti M. (2009) Ion activity and distribution of heavy metals in acid mine drainage polluted subtropical soils. *Environmental Pollution*, 157 4 1249-1257

736. Liu Z., **Zhao Y., Colin** C., Siringan F.P., Wu Q. (2009) Chemical weathering in Luzon, Philippines from clay mineralogy and major-element geochemistry of river sediments. *Applied Geochemistry*, 24 11 2195-2205

737. Mahemuti A., Meneveau N., Seronde M.F., Schiele F., Descotes-Genon V., Ecarnot F., Blonde M.C., **Mercier M**., Racadot E., Bassand J.P. (2009) Early changes in local hemostasis activation following percutaneous coronary intervention in stable angina patients: a comparison between drug-eluting and bare metal stents. *Journal of Thrombosis and Thrombolysis*, 28 3 333-341

738. **Mangold N., Ansan V., Masson P**., Vincendon C. (2009) Estimate of aeolian dust thickness in Arabia Terra, Mars: Implications of a thick mantle (> 20 m) for hydrogen detection. *Géomorphologie-Relief Processus-Environnement*, 1 23-31

739. Marty B., Guillot T., **Sarda P**., Consortium K. (2009) Kronos : exploring the depths of Saturn with probes and remote sensing through an international mission. *Experimental Astronomy*, 23 3 947-976

740. **Massol** H., Jaupart C. (2009) Dynamics of magma flow near the vent : implications for dome eruptions. *Earth and Planetary Science Letters*, 279 3-4 185-196

741. **Mercier M**., Di Muro A., Giordano D., Métrich N., Lesne P., Pichavant M., Scaillet B., Clocchiatti R., Montagnac G. (2009) Influence of glass polymerisation and oxidation on micro-Raman water analysis in alumino-silicate glasses. *Geochimica et Cosmochimica Acta / Geochemica et Cosmochimica Acta; Geochimica et Cosmochimica Acta (England); Geochimica and Cosmochimica Acta*, 73 1 197-217

742. Nazari H., Ritz J.F., Salamati R., Shafei A., Ghassemi A., **Michelot J.L., Massault M**., Ghorashi M. (2009) Morphological and palaeoseismological analysis along the Taleghan fault (Central Alborz, Iran). *Geophysical Journal International*, 178 2 1028-1041

743. Pinti D.L., Hashizume K., Sugihara A., **Massault M**., Philippot P. (2009) Isotopic fractionation of nitrogen and carbon in Paleoarchean cherts from Pilbara Craton, Western Australia : origin of N-15 depleted nitrogen. *Geochimica et Cosmochimica Acta*, 73 13 3819-3848

744. Poulet F., Mangold N., **Platevoet B., Bardintzeff J.M**., Sautter V., Mustard J.F., Bibring J.P., Pinet P., Langevin Y., Gondet B., Aleon-Toppani A. (2009) Quantitative compositionnal analysis of Martian mafic regions using the Mex/OMEGA reflectance data 2. Petrological implications. *Icarus*, 201 1 84-101

745. Poulet F., Bibring J.P., Langevin Y., Mustard J-F., Mangold N., Vincendon C., Gondet B., Pinet P., **Bardtinzeff J., Platevoet B**. (2009) Quantitative compositional analysis of Martian mafic regions using the Mex/OMEGA reflectance data. *Icarus*, 201 1 69-83

746. **Quidelleur X**., Carlut J., Tchilingurian P., **Germa A., Gillot P.Y**. (2009) Paleomagnetic directions from mid-latitude sites in the southern hemisphere (Argentina): Contribution to Time Averaged Field models. *Physics of The Earth and Planetary Interiors*, 172 3-4 199-209

747. **Rouchon V., Orberger B**., Hofmann A., Pinti D.L. (2009) Diagenetic Fe-carbonates in Paleoarchean felsic sedimentary rocks (Hooggenoeg Formation, Barbeton greenstone belt, South Africa) : implications for CO2 sequestration and the chemical budget of seawter. *Precambrian Research*, 172 3-4 255-278

748. Roulleau E., Pinti D.L., **Rouchon V., Quidelleur X., Gillot P.Y**. (2009) Tephro-chronostratigraphy of the lacustrine interglacial record of Pianico, Italian Southern Alps: Identifying the volcanic sources using radiogenic isotopes and trace elements. *Quaternary International*, 204 (1-2): 31-43

749. Saddiqi O., El Haimer F.Z., Michard A., **Barbarand J**., Ruiz G.M.H., Mansour E.M., Leturmy P., Frizon De Lamotte D. (2009) Apatite fission-track analyses on basement granites from south-western Meseta, Morocco: paleogeographic implications and interpretation of AFT age discrepancies. *Tectonophysics*, 475 1 29-37

750. **Samper A., Quidelleur X**., Komorowski J.C., **Lahitte P**., Boudon G. (2009) Effusive history of the Grande Decouverte volcanic complex, southern Basse-Terre (Guadeloupe, French West Indies) from new K-Ar Cassignol-Gillot ages. *Journal of Volcanology and Geothermal Research*, 187 117-30

751. Selo M., Valladas H., Mercier N., Joron J.L., Bassinot F., Person A., **Nouet J**. (2009) Investigations of uranium distribution in flints. *Radiation measurements*, 44 (5-6): 615-619

752. Servagi-Vernat S., Bosset M., Crehange G., Buffet-Miny J., Puyraveau M., Maingon P., **Mercier M**., Bosset J. F. (2009) Feasibility of chemoradiotherapy for oesophageal cancer in elderly patients aged >or=75 years: a prospective, single-arm phase II study. *Drugs & Aging*, 26 3 255-262

753. Shmulovich K., **Mercury L**., Thiéry R., Ramboz C., El Mekki M. (2009) Experimental superheating of water and aqueous solutions. *Geochimica et Cosmochimica Acta*, 73 2457-2470

754. Supparattanapan S., Sejan P., **Quantin C**., Maeght J., Grunberger O. (2009) Salinity and organic amendment effects on methane production of a rain-fed saline paddy field. *Soil Science & Plant Nutrition*, 55 142-149

List of acronyms

ACCENT: **A**tmospheric **C**omposition **C**hange. The **E**uropean **Net**work of Excellence

ACP: **A**stro**p**article et **C**osmologie – a joint research unit afilliated with CNRS, UPD, Observatoire de Paris and CEA

ACRI: company with expertise in fluids mechanics, environment and natural hazards

ACRI-ST: company with expertise Earth observation, environment and atmospheric modelling

ACTE: LabEx "**A**groEcologie, **C**hangement global, **Te**rritoires"

ADCP: Acoustic **D**oppler **C**urrent **P**rofiler, a device for 3-D flow visualisation in aquatic ecosystems

ADEME: **A**gence **d**e l'**E**nvironnement et de la **M**aitrise de l'**E**nergie

ADM: **A**ir **D**oppler lidar **M**ission

AERES: **A**gence d'**é**valuation de la **r**echerche **e**t de l'**e**nseignement **s**upérieur

AESN: **A**gence de l'**E**au **S**eine-**N**ormandie, the water authority in charge of the river Seine basin

AIH: **A**merican **I**nstitute of **H**ydrology

AISH: **A**ssociation **I**nternationale des **S**ciences **H**ydrologiques, (or IAHS) **I**nternational **A**ssociation for **H**ydrological **S**ciences

ALTIKA: **Alti**mètre océanographique de haute précision en bande **Ka**

AMMA: **A**nalyse **M**ultidisciplinaire de la **M**ousson **A**fricaine

ANDRA: Agence **N**ationale pour la gestion des **D**échets **RA**dioactifs

ANR OPTIMISM:

ANR: Agence **N**ationale de la **R**echerche

AR5: IPCC **5**th **a**ssessment **r**eport

ARGO: name of the ocean float network for global monitoring

ASTEE: **A**ssociation **S**cientifique et **T**echnique pour l'**E**au et l'**E**nvironnent. The major French professional association for water and environmental management

ATER: **A**ttaché **T**emporaire d'**E**nseignement et de **R**echerche

BCST: **B**iologie-**C**himie-**S**ciences de la **T**erre

BESSY: **B**erliner **E**lektronen**s**peicherring-Gesellschaft für **Sy**nchrotronstrahlung mbH, a german synchroton facility in Berlin

BPS: Balloons pressurised

BRGM: Geoscience pour Terre durable (previously **B**ureau de **R**echerches **G**éologiques et **M**inières), French geological survey

C4MIP: Coupled **C**arbon **C**ycle **C**limate **M**odel **I**ntercomparison **P**roject

CAPES: Certificat d'**A**ptitude au **P**rofessorat de l'**E**nseignement du **S**econd degré

CARAUS: **CAR**bone **AUS**tral

CARBOCEAN: European Integrated Project CARBOOCEAN - Marine carbon sources and sinks assessment

CASSINI: is the spacecraft of the international Cassini-Huygens mission, dedicated to explore Saturn, its ring system and its 31 known moons. The spacecraft with the probe Huygens on board was launched in 1997

CD: Comité **D**irecteur

CDD: Contrat à **d**urée **d**éterminée

CEA: **C**ommissariat à l'**E**nergie **A**tomique

CEREA: **C**entre d'**E**nseignement et de **R**echerche en **E**nvironnement **A**tmosphérique (laboratory ENPC-EDF)

CERFACS: **C**entre **E**uropéen de **R**echerche et de **F**ormation **A**vancée en **C**alculs **S**cientifiques

CETP: **C**entre d'Etude des **E**nvironnements **T**errestres et **P**lanétaires

CFMIP: **C**loud **F**eedback **M**odel **I**ntercomparison **P**roject

CFOSAT: **C**hinese-**F**rench **O**ceanic **SAT**ellite, satellite mission devoted to the monitoring of the ocean surface wind and wave, and related ocean and atmospheric science and applications
ChArMex: **Ch**imie-**A**er**o**sols-**M**editerranean **Ex**periment
CHIMERE: Regional atmospheric chemistry model used for tropospheric mesoscale modelling and air pollution forecasting.
CICLAD: Calcul Intensif pour le CLlimat, l'Atmosphère et la Dynamique
CIFRE: **C**onvention **I**ndustrielle de **F**ormation par la **Re**cherche. A system to fund PdD students that employed by industries or other economic actors within collaborative project with universities
CIMEL: CIMEL Electronique is specialized in measurement of lowlevel signals. Since 1965, it produces and commercializes a broad variety of instruments for application such as meteorology, climatology, agricultural meteorology, remote sensing.
CLAIRE: Institut d'Excellence **Cl**imat-**AIR**-**E**nergie
CLIMSERV: Service de données et de calcul de l'IPSL
CLIVAR: **Cli**mate **Var**iability and Predictability, is the WCRP project that addresses Climate Variability and Predictability, with a particular focus on the role of ocean-atmosphere interactions in climate.
CLOUDSAT: Clouds satellite mission (NASA – CSA)
CMIP: **C**oupled **M**odel **I**ntercomparison **P**roject (WCRP-sponsored program)
CNAP: Corps **N**ational des **A**stronomes **et P**hysiciens
CNES: Centre **N**ational d'**E**tudes **S**patiales, government agency responsible for shaping and implementing France's space policy in Europe
CNRM: **C**entre **N**ational de **R**echerche **M**étéorologique, a Météo-France Research Center
CNRS: **C**entre **N**ational de la **R**echerche **S**cientifique, government-funded research organization, under the administrative authority of France's Ministry of Research.
CONCORDIASI: Balloon experiment with BPS at MacMurdo site and Concordia sites dedicated to IASI mission
CORDEX: **CO**ordinated **R**egional climate **D**ownscaling **Ex**periment, is a WCRP-sponsored program to produce regional climate change scenarios globally, contributing to the IPCC AR5 and to the climate community beyond the AR5.
CORIOLIS: Centre de traitement des données de physique des océans pour l'océanographie
CPU: **C**entral **P**rocessing **U**nit
DLR: German Aerospace Center
DRIAS: Projet "**D**onner accès aux scenarios climatiques **R**égionalisés français pour l'**I**mpact et l'**A**daptation de nos **S**ociétés et environnements", an IPSL, Météo-France and CERFACS collaboration
EARLINET:
EARTHCARE: joint European-Japanese mission on the interactions between clouds, radiation and aerosols
ECMWF: **E**uropean **C**entrefor **M**edium-Range **W**eather **F**orecasts
Eco et Sols:
ED129: **E**cole **D**octorale des Sciences de l'Environnement d'Ile de France
ED389: **E**cole **D**octorale de Physique P2MC La Physique de la Particule à la Matière Condensée
ED398: **E**cole **D**octorale Géoscience et Ressources Naturelles
EDF: **E**lectricité **D**e **F**rance, the former French national electrical company, now private
EDS: **E**nergy-**D**ispersive X-ray **S**pectroscopy
EGU: **E**uropean **G**eosceinces **U**nion
EIT: **E**uropean Institute of **I**nnovation and **T**echnology
ENPC: Ecole **N**ationale des **P**onts et **C**haussées-**E**lectricité **d**e **F**rance, an engineering school and insitute, created in 1750
ENS: **E**cole **N**ormale **S**upérieure
ENSEMBLES: FP6 project that aims to develop a prediction system for climate change
ENVISAT: **ENV**Ironment **SAT**ellite, polar-orbiting Earth observation satellite which provides measurements of the atmosphere, ocean, land, and ice
EP: Ecole Polytechnique
EPHE: **E**cole **P**ratique des **H**autes **E**tudes, a French graduate school
EPHYSE:
EQUIP-GOPS:
EquipEX: Equipements d'Excellence
ESA: **E**uropea**n S**pace **A**gency
ESE: **E**cologie **S**ystématique et **E**volution
ESEP: Exploration **S**patiale des **E**nvironnements **P**lanétaires

ESF: European **S**pace **F**undation
ESFRI: European **S**cienti**f**ic **R**esearch **I**nfrastructure
ESM: **E**arth **S**ystem **M**odel, an advanced form of global climate models which includes oceanic and atmospheric dynamics and physics as well as biogeochemical cycles, land use.
ESPRI: **E**nsemble de **S**ervices **P**our la **R**echerche à l'**I**PSL
ETHER: French thematic center dedicated to atmospheric chemistry, in particular active gases
EU: European Union
Eumetsat: European **met**eorological **sat**ellites organization
EUPEN: **Eu**ropean **P**hysics **E**ducation **N**etwork
FAQ: **F**requently **a**sked **q**uestions
FAR: **F**ourth **A**ssessment **R**eport
FAST: Fluides, **A**utomatique et **S**ystèmes **T**hermiques (UMR 7608)
FCS: **F**ondation de **C**oopération **S**cientifique
FEMTO-ST: **F**ranche-Comté **E**lectronique **M**écanique **T**hermique et **O**ptique – **S**ciences et **T**echnologies, a joint research unit which is affiliated with the French National Centre of Scientific Research (CNRS), the University of Franche-Comté, the National School of Mechanical Engineering and Microtechnology, and the Belfort-Montbéliard University of Technology.
FIRE: **F**édération Ile de **F**rance de **R**echerche sur l'**E**nvironnement
FIRST-TF: Facilities for **I**nnovation, **R**esearch, **S**ervices, **T**raining in **T**ime & **F**requency, a french LabEx project to create a coordinated a network of the time/frequency community in France.
FONCE:
FUSE: **F**ar **U**ltraviolet **S**pectroscopic **E**xplorer, a NASA-supported astrophysics mission that was launched on June 24, 1999, to explore the Universe using the technique of high-resolution spectroscopy in the far-ultraviolet spectral region
GC-MS: **G**as **C**hromatography-**M**ass **S**pectrometry, an analytical device mainly devoted to the analysis of organic components
GCOS: **G**lobal **C**oordinated **O**bservation **S**ystem
GDR: **G**roupement **d**e **R**echerche
GDRE/GDRI: **G**roupement de **R**echerche **E**uropéen/**G**roupement de **R**echerche **I**nternational
GEISA: **G**estion et **E**tude des **I**nformations **S**pectroscopiques **A**tmosphériques
GEO: **G**lobal **E**arth **O**bservation
GEOMON: **GEOmon** is a European project contributing to GEOSS. Its mission is to build an integrated pan-European atmospheric observing system of greenhouse gases, reactive gases, aerosols, and stratospheric ozone.
GEREPS: Groupe d'**E**nseignement et de **R**echerche en **E**nvironnement de l'Université de **P**aris-**S**ud
GEWEX: The **G**lobal **E**nergy and **W**ater Cycle **Ex**periment, leads the WCRP studies of the dynamics and thermodynamics of the atmosphere, the atmosphere's interactions with the Earth's surface (especially over land), and the global water cycle.
GHG: **G**reen**H**ouse **G**as
GIP: **G**roupement d'**i**ntérêt **p**ublic
GIS: Climat: **G**roupement d'**I**ntérêt **S**cientifique "Climat-Environnement-Sociétés"
GMES: **G**lobal **M**onitoring for **E**nvironment and **S**ecurity
GOSAT: **G**lobal Greenhouse Gas **O**bservation by **Sat**ellite (managed by JAXA)
GPS: **G**lobal **P**ositioning **S**ystem
HDR: **H**abilitation à **D**iriger des **R**echerches, French certification for senior scientists and professors, enables thesis supervision
HITRAN: **Hi**gh-resolution **tran**smission molecular absorption database, US Spectrospopic data base
HR HPLC/MS/MS: High **R**esolution **H**igh **P**ressure **L**iquid **C**hromatography coupled with tandem **M**ass **S**pectrometers, an analytical device mainly devoted to the analysis of organic components
HST: **H**ubble **S**pace **T**elescope, a large optical space telescope brought to orbit in 1990 and built by NASA with contributions from ESA
HYGEOS:
HyMex: **Hy**drological cycle in the **M**editerranean **Ex**periment
HYPERARCTIC: **HY**drologie et **PER**gélisol en milieu **ARCTIC**
IAEA: International **A**tomic **E**nergy **A**gency
IAOOS: Integrated **A**rctic **O**cean **O**bserving **S**ystem

IASI/METOP: **I**nfrared **A**tmospheric **S**ounding **I**nterferometer instrument on board on the METOP satellite (METOP: **Met**eorological **Op**erational satellite)
IATOS: **I**ngénieurs, **A**dministratifs, **T**echniciens, **O**uvriers et **P**ersonnel de **S**ervice
ICARE: French national thematic center dedicated to aerosols and clouds
ICE: Master Interactions Climat Environnement (UVSQ)
ICOS: **I**ntegrated **C**arbon **O**bserving **S**ystem, a new research infrastructure to decipher the greenhouse gas balance of Europe and adjacent regions
ICP-AES: Inductively **C**oupled **Plasma**- **A**tomic **E**mission **S**pectroscopy
ICP-MS: **I**nductively **C**oupled **P**lasma **M**ass **S**pectroscopy
IDEO: **I**sotopic and **D**ynamic effects in **E**xcited **O**zone: symmetry breaking, high-energy states and dissociation, a french research project funded by ANR
IDES: **I**nteractions et **D**ynamique des **E**nvironnements de **S**urface
IDIL: Fibres Otiques, a french private company specialized on optical fibre technology.
IEED: **I**nstitut d'**E**xcellence sur les **E**nergies **D**écarbonnées
IFP: Institut **F**rançais du **P**étrole
Ifremer: Institut **F**rançais de **R**echerche pour l'**E**xploitation de la **M**er, French institute for marine science
IGBP: **I**nternational **G**eosphere-**B**iosphere **P**rogramme, focused on acquiring basic scientific knowledge about the interactive processes of biology and chemistry of the earth as they relate to Global Change
IMBER: **I**ntegrated **M**arine **B**iogeochemistry and **E**cosystem **R**esearch, an international project on ocean by SCOR (Scientific Committee on Ocean Research) and IGBP.
INEE: **I**nstitut **E**cologie **e**t **E**nvironnement, One of the institutes part of CNRS, in charge of ecology and environmental sciences
INERIS: **I**nstitut **n**ational d'**é**tudes des **ris**ques
INRA: **I**nstitut **N**ational de **R**echerche **A**gronomique
INSU: Institut des **S**ciences de l'**U**nivers (CNRS)
INTRAMIF: **IN**itial **TR**Aining network on **M**ass Independent **F**ractionation, Marie Curie initial training network (FP7) as part of the European people action program dedicated to explore the use of mass independent fractionation effects for investigating the earth and climate system
ITA; **I**ngénieurs, **T**echniciens et **A**dministratifs du CNRS
IPCC: **I**ntergovernmental **P**anel on **C**limate **C**hange
IPEV: **I**nstitut **P**aul **E**mile **V**ictor, French polar institute
IPSL: **I**nstitut **P**ierre **S**imon **L**aplace
IR: **I**nfra **R**ed, wavelength region of the electromagnetic spectrum between 0.7 and 300 μm
IRD: **I**nstitut de **R**echerche pour le **D**éveloppement
IRMS: **I**sotopic **R**atio **M**ass **S**pectrometer
IRSN: **I**nstitut de **R**adioprotection et de **S**ûreté **N**ucléaire
ISMO: **I**nstitut des **S**ciences **Mo**léculaires, a joint research unit affiliated with CNRS and the University of Paris Sud
ISRO: **I**ndian **S**pace **R**esearch **O**rganisation
ISSWG: **I**AS**I** **S**cience **W**orking **G**roup
IUT: **I**nstitut **U**niversitaire de **T**echnologie
JAXA: **J**apan **A**erospace E**x**ploration **A**gency
JPL: Joint **P**lanetary **L**aboratory, space laboratory in USA
KIC Climat: **K**nowledge and **I**nnovation **C**ommunity on Climate
L-IPSL: **L**abEx **IPSL**
LA: **L**aboratoire d'**A**érologie, French laboratory in Toulouse dedicated to aeroly research
LabEX: **Lab**oratoires d'**Ex**cellence
LACY: **L**aboratoire de l'étude de l'**A**tmosphère et des **Cy**clones, French laboratory in the Reunion Island
LA-MC-ICPMS: **L**aser **A**blation- **M**ulti **C**ollection: **I**nductively **C**oupled **P**lasma **M**ass **S**pectroscopy
LAMP: **La**boratoire de **M**étéologie **P**hysique
LATMOS: **L**aboratoire **A**tmosphères, **M**ilieux, **O**bservations **S**patiales
LCAR: **L**aboratoire **C**ollisions **A**grégats **R**éactivité, a joint research unit affiliated with CNRS and Université Paul Sabatier in Toulouse
LCFIO: **L**aboratoire **C**harles **F**abry de l'**I**nstitut d'**O**ptique, a joined research unit affiliated with Institut d'Optique Graduate School, CNRS and Université Paris Sud
LEA/LIA: **L**aboratoire **E**uropéen **A**ssocié / **L**aboratoire **I**nternational **A**ssocié
LEESU: **L**aboratoire **E**au **E**nvironnement et **S**ystèmes **U**rbains

LEOSPHERE: Startup on Lidar environmental Observations
LGGE: **L**aboratoire de **G**laciologie et **G**éophysique de l'**E**nvironnement
LISA: **L**aboratoire **I**nteruniversitaire des **S**ystèmes **A**tmosphériques (UMR 7583)
LKB: **L**aboratoire **K**astler-**B**rossel, a joint research unit affiliated with Ecole National Superieur, UPMC, Collège de France and CNRS.
LMD: **L**aboratoire de **M**étéorologie **D**ynamique
LMDZ: General atmospheric circulation model developed at LMD
LOA: **L**aboratoire d'**O**ptique **A**tmosphérique
LOCEAN: **L**aboratoire d'**O**céanographie et du **C**limat: **E**xpérimentation et **A**pproches **N**umériques
LPL: **L**aboratoire de **P**hysique **L**aser, a joint research unit affiliated with CNRS and University Paris 13
LPMA: **L**imb **P**rofile **M**onitor of the **A**tmosphere
LPMAA: **L**aboratoire de **P**hysique **M**oléculaire pour l'**A**tmosphère et l'**A**strophysique, a joint research unit affiliated with UPMC and CNRS and member of the IPSL foundation
LSCE: **L**aboratoire des **S**ciences du **C**limat et de l'**E**nvironnement
LuMMex: **LU**mière, **M**atière **M**esures **EX**trêmes
MACC: **M**onitoring **A**tmospheric **C**omposition and **C**limate, European project
MAG AEOLUS: ESA mission group for AEOLUS instrument on board ADMspace mission
MAG Earthcare: ESA Mission group for Earthcare mission
MEGHATROPIQUES: French- Indian space mission dedicated to water and energy cycles in the tropics
MarEco: **Mar**ine **Eco**systems
MEMO: **M**ammals **E**cology, **M**easurements in the **O**cean
Mercator-ocean: service de prevision opérationnelle de l'océan en France
MESR: **M**Inistère de l'**E**nseignement **S**upérieur et de la **R**echerche
MiChem: **M**ulti-Scale **I**ntegrative **Chem**istry: from Single Molecule to Nano-edifices, a french LabEx project to foster ground-breaking discoveries in chemistry from the synergistic action of chemists from different sub-disciplines and cultures
MICROCARB: micro-satellite project measuring carbon emissions
MIPAS: Michelson **I**nterferometer for **P**assive **A**tmospheric **S**ounding, instrument on board on the Envisat satellite
MIS 11: **M**arine **I**sotopic **S**tage 11
MNHN: **M**useum **N**ational d'**H**istoire **N**aturelle, both a museum and a scientific institute in the field of earth sciences and ecology
MQDT: **M**ultichannel **Q**uantum **D**efect **T**heory, an ab-initio based method for molecular dynamics and the calculation molecular electronic spectra
NAOS: Novel **A**rgo **O**cean observing **S**ystem
NASA: **N**ational **A**eronautics and **S**pace **A**dministration (USA)
NASDA: **Na**tional **S**pace **D**evelopment **A**gency of Japan
NCEP: **N**ational **C**enters for **E**nvironmental **P**redictions (US agency)
NDACC: **N**etwork for the **D**etection of **A**tmospheric **C**omposition **C**hange
NEMO: **N**ucleus for **E**uropean **M**odelling of the **O**cean
NEMO/OPA: ocean dynamics (**O**céan **PA**rallélisé)
NIRS: **N**ear **I**nfra**R**ed **S**pectroscopy
NOVELTIS: Company with expertise on expertise in geophysical measurement analysis, space technologies, mathematics and computer science
NOVIMET: Société en hydro-météorologie
OA: Océan-**A**tmosphère
OACOS: Master **O**céans, **A**tmosphère, **C**limat, et **O**bservations **S**patiales (UPMC)
OASIS: **O**cean **A**tmosphere **S**ea **I**ce **S**oil coupleur
OBSParis: Observatoire de Paris
OCO: Orbiting Carbon Observatory
ODYSSEE: **O**rganisation et **D**ynamique des **S**ystèmes et **S**ervices **E**cologiques et **E**nvironnementaux, des concepts à la gestion, a LabEx project
OHP: **O**bservatoire de **H**aute **P**rovence
OMP: **O**bservatoire **M**idi-**P**yrénées
OPAR: **O**bservatoire de **P**hysique de l'**A**tmosphère de la **R**éunion
OSU: **O**bservatoire des **S**ciences de l'Univers
OVSQ: Observtoire de Versailles Saint-Quentin-en-Yvelines, OSU of UVSQ and CNRS-INSU
PACEC: Plateforme **A**nalytique **C**ollaborative pour l'**E**tude de l'**E**nvironnement et du **C**limat (EquipEx)

PCEE: **P**ôle **C**limat-**E**nvironnement-**E**nergie du Campus de Saclay
PCRD: Programme **C**adre de **R**echerche **D**éveloppement
PCST: **P**hysique-**C**himie-**S**ciences de la **T**erre
PHLAM: Laboratoire de **Ph**ysique des Lasers, **A**tomes et **M**olécules, a joint research unit at Lille affiliated with the University of Lille and the CNRS
PI: Principal **I**nvestigator
PICARD: French microsatellite dedicated to sun studies
PICS: **P**rojet **I**nternational de **C**oopération **S**cientifique
P2IM: Laboratoire de **P**hysique des **I**nteractions **I**oniques et Moléculaires, a joint research unit which is affiliated with CNRS and the University of Provence (UMR6633)
PIREN-Seine: Programmes **I**nterdisciplinaires de **R**echerche sur l'**E**nvironnement- Seine. For more details http://www.sisyphe.upmc.fr/piren/?q=presentation-piren-seine
PMIP: **P**aleoclimate **M**odel **I**ntercomparison **P**roject
PRES: Pôle de **R**echerche et d'**E**nseignement **S**upérieur
PREV'AIR: Système national de prevision de la qualité de l'air, French regional forecast model
PRG: **P**aris **R**ive **G**auche (name of the UPD campus)
PRODIGUER: IPSL Project for the availability of climate models simulations data and metadata
QUALAIR: plate-forme d'observation de la **QUA**lité de l'**AIR**
RAMCES: **R**éseau **A**tmosphérique de **M**esure de **C**omposés à **E**ffet de **S**erre
REFIMEVE/MEFINEV: Réseau **F**ibré **mé**trologique à **V**ocation **E**uropéenne / **Me**trological **Fi**ber **N**etwork with **E**uropean **V**ocation, a french EquiPex project to realize a unique network of ultra-high performance time-frequency transmission between laboratories and institutions in France and beyond
RENATER: **Ré**seau **Na**tional de télécommunications pour la **T**echnologie, l'**E**nseignement et la Recherche, a french telecommunication network for technology research and education founded in 1990
SAMA: **S**tatistiques pour l'**A**nalyse, la **M**odélisation et l'**A**ssimilation
ScaraB: **Sca**nner for **Ra**diation **B**udget, a space instrument
SO: **S**ervice d'**O**bservation
SOERE: **S**ystèmes d'**O**bservation et d'**E**xpérimentation pour la **R**echerche en **E**nvironnement
S.O. OISO: **S**ervice d'**O**bservation **O**cean **I**norganic carbone in the **S**outhern **O**cean (part of CARAUS)
SCOOP:
SCOUT-03: Stratospheric-Climate Links with Emphasis on the Upper Troposphere and Lower Stratosphere, European (European FP6 project)
SDUEE: **S**ciences de l'**U**nivers, **E**nvironnement et **E**cologie, master programme at UPMC
SECAO: Suivi **E**nvironnement et **C**limatique en **A**frique de l'Ouest
SeineARIO: EquipEx aiming at monitoring the biogeochemical dynamics of the larger streams in the Seine basin
SGE: Master **S**ciences et **G**énie de l'**E**nvironnement
SIMCO: **S**pectrometer for **I**sotope **M**easurement of atmospheric **CO**2, a diode laser based in-situ analyser of the isotopic composition of atmospheric carbon dioxide developed and maintained by LPMAA.
SIRTA: **S**ite **I**nstrumenté de **R**echerche par **T**élédétection **A**tmosphérique, one main instrumental site of the IPSL federation
SISYPHE: Structure et fonctionnement des hydrosytèmes continentaux
SME: **S**mall and **M**edium-sized **E**nterprises
SMILE: **S**pectroscopie **M**oléculaire et **I**nstrumentation **L**aser pour l'**E**nvironnement, a research team of the LPMAA (IPSL/UPMC/CNRS)
SMOS: **S**urface **M**oisture and **O**cean **S**alinity
SNAPO-CO2: **S**ervice **N**ational d'**A**nalyse des **P**aramètres **O**céaniques – CO2
SNOCO: **S**ervice **N**ational d'**O**céanographie **CO**tière
SNRI: **S**tratégie **N**ationale de **R**echerche et d'**I**nnovation
SO SSS: Suivi par les bateaux marchands de la Salinité de Surface de la mer
SO: Service d'**O**bservation
SOERE: Système d'**O**bservation et d'**E**xpérimentation au long terme pour la **R**echerche en **E**nvironnement
SOERE MOOSE: Mediterranean Ocean Observing System on Environment
SOFRAEX: **S**ystème d'**O**bservation **F**rançais pour la **R**echerche **A**tmosphérique et la gestion d'événements **Ex**trêmes : aérosols nuages et précipitations
SOLEIL: **S**ource **O**ptimisée de **L**umière d'**E**nergie **I**ntermédiaire du **L**URE, a synchrotron facility run by a civil corporation held by the CNRS and CEA

SPARC: **S**tratospheric **P**rocesses **a**nd their **R**ole in **C**limate, is a WCRP core project, its principal objective is to help the stratospheric research community focus on significant issues related to climate.
SPECATMO: De la **SPEC**troscopie à l'**ATMO**sphère: Mesures et modèles (doctoral school)
STEPS TWO Academic Network: **S**takeholders **T**une **E**uropean **P**hysics **S**tudies
STU: **S**ciences de la **T**erre et de l'**U**nivers
SVT: **S**ciences de la **V**ie et de la **T**erre
SWIR-balloon: Short wave infrared interferometer instrument on board balloon plateform
SYRTE: **Sy**stèmes de **R**éférence **T**emps et **E**space, a joint research unit affiliated with the Observatoirede Paris, CNRS, UPMC and LNE
TEB: **T**erre, **E**nvironnement, **B**iosphère, (UPMC)
TGIR: très grands instruments de recherche
TIMS: **T**hermal **I**onization **M**ass **S**pectrometry
TOSCA: Terre Ocean Surface continentales atmosphere, CNES scientific advisory committee for Earth observation science
TRIED: Master **TR**aitement de l'**I**nformation et **E**xploitation des **D**onnées (UVSQ)
TWP: **T**ransversal **W**ork **P**ackage
UFR: **U**nité de **F**ormation et de **R**echerche
UMI: **U**nité **M**ixte **I**nternationale, International research Unit
UMR: **U**nité **M**ixte de **R**echerche, Unit number
UNESCO: **U**nited **N**ations **E**ducational, **S**cientific and **C**ultural **O**rganization
UPD: **U**niversité **P**aris-**D**iderot
UPEC: **U**niversité **P**aris-**E**st **C**réteil
UPMC: **U**niversité **P**ierre et **M**arie **C**urie
UPSUD: **U**niversité de **P**aris-**S**ud 11
UTINAM: **U**niverse, **T**ransport, **I**nterfaces, **N**anostructures, **A**tmosphere and environment, **M**olecules, a joint research unit of CNRS and the University of Franche-Comté
UV: Ultra **V**iolet, wavelength region of the electromagnetic spectrum between 10 and 400 nm
UVSQ: Université de Versailles Saint-Quentin-en-Yvelines
VENUS: **V**egetation and **E**nvironment monitoring on a **N**ew Micro-**S**atellite
VORCORE: Campagne de ballons pressurisés pour l'étude du coeur du vortex antarctique
VUV: **V**acuum **U**ltra **V**iolet, wavelength region of the electromagnetic spectrum between 100 and 200 nm
WCRP: World **C**limate **R**esearch **P**rogramme, under the joint sponsorship of the International Council for Science (ICSU), the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, its main objectives are to determine the predictability of climate and to determine the effect of human activities on climate.
WMO: **W**orld Meteorological **O**rganization, Official United Nations' authoritative voice on weather, climate and water, scientific organization.
WMO/UNEP:
WP: Work package