



*Introduction to the Global Space-based
InterCalibration System*

NOAA Satellite and Information Service

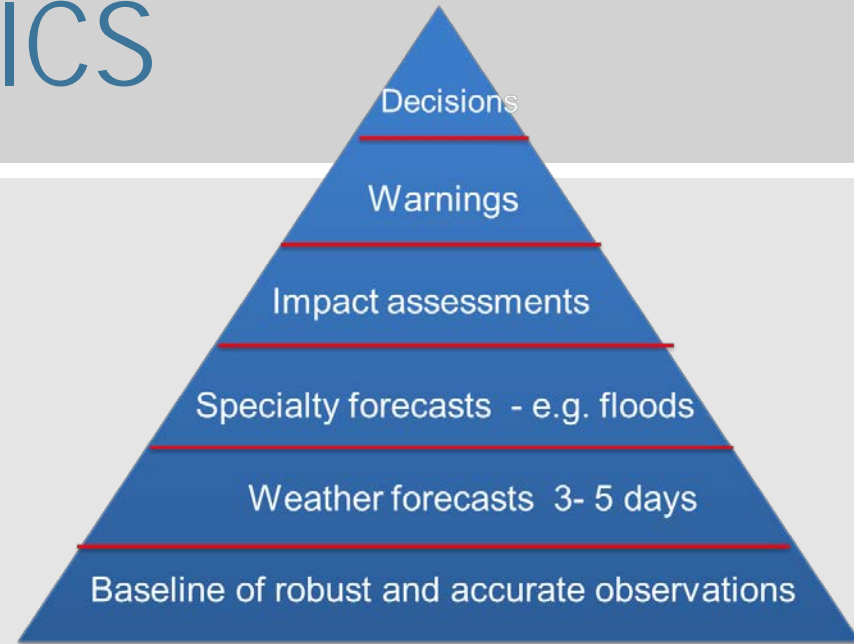
Dr. Mitch Goldberg, JPSS Program Scientist and first GSICS EP Chair

2016 GSICS User Workshop



The aim of GSICS

- To organize the production of satellite inter-calibration information to enable improved and consistent accuracy among space-based observations worldwide for climate monitoring, weather forecasting, and environmental applications.
- Why? Foundation for all applications are the fundamental measurements



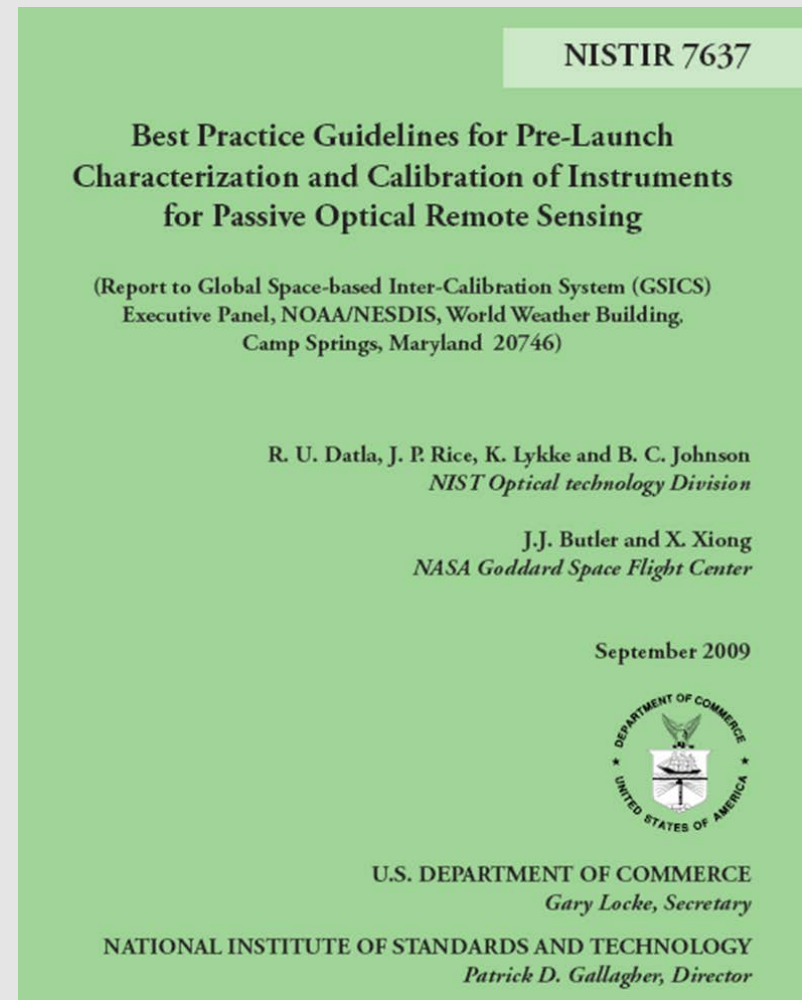


The Beginning: The Space Programme of WMO initiated a discussion and held several meetings in 2005 to develop the concept of a Global Space-based Inter-Calibration System (GSICS). The following experts participated:

- Mitch Goldberg – NOAA/NESDIS (Chair)
- Gerald Frazer – NIST
- Donald Hinsman – WMO (Space Program Director)
- John LeMarshall - JC Sat. Data Assimilation
- Paul Menzel –NOAA/NESDIS
- Toshi Kurino - JMA
- Tillmann Mohr – WMO
- Hank Revercomb – Univ. of Wisconsin
- Johannes Schmetz – Eumetsat
- Jörg Schulz – DWD, CM SAF
- William Smith – Hampton University
- Steve Ungar – CEOS, Chairman WG Cal/Val

Critical building blocks for accurate measurements and intercalibration

- Extensive pre-launch characterization of all instruments traceable to SI standards
- Benchmark instruments in space with appropriate accuracy, spectral coverage and resolution to act as a standard for inter-calibration
- Independent observations
 - Calibration/validation sites, ground based, aircraft





Space-based Instrument Characterization Elements

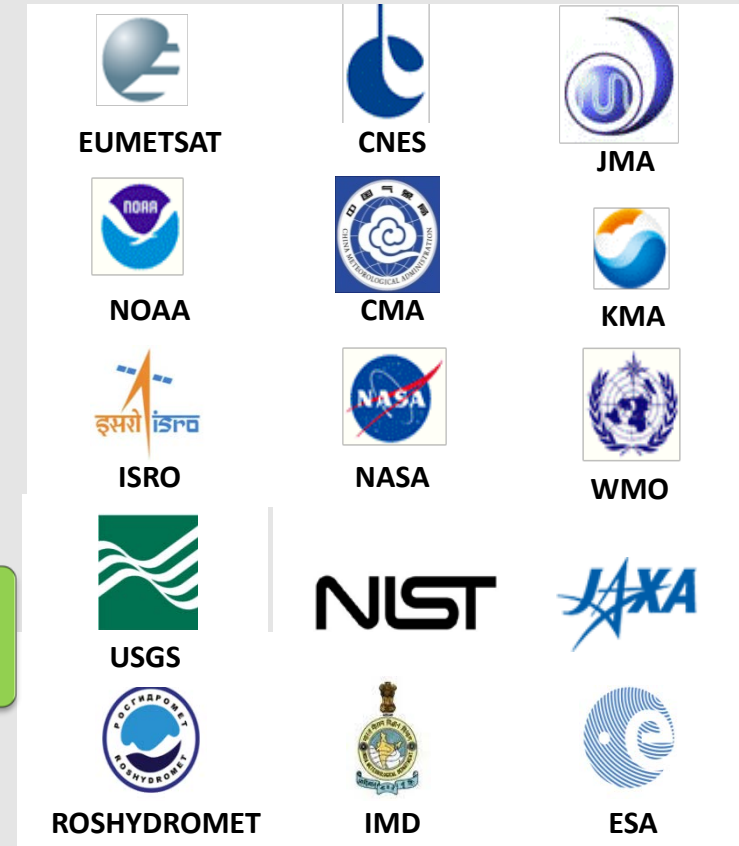
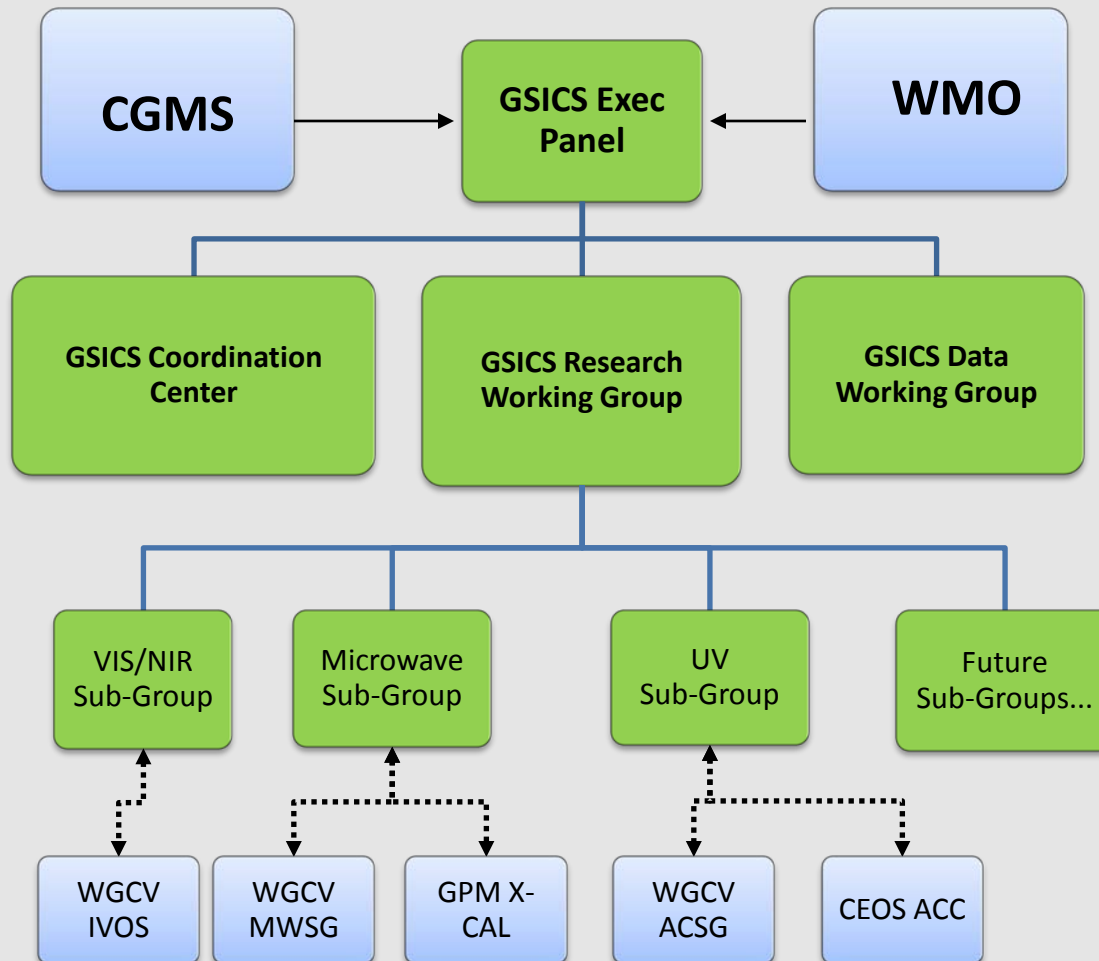
- Fully characterized sensor components
 - Traceability standard
 - Full instrument cycle test to ensure every component is traceable to SI standard
 - Pre-launch tests
 - Sustained post-launch characterization
 - Satellite to Satellite comparisons
 - Collocated in-situ observations
 - Radiative transfer models
 - Data assimilation models



Building Blocks for Satellite Intercalibration

- Collocation
 - Determination and distribution of locations for simultaneous observations by different sensors (space-based and in-situ)
 - Collocation with benchmark measurements
- Data collection
 - Archive, metadata - easily accessible
- Coordinated operational data analyses
 - Processing centers for assembling collocated data
 - Expert teams
- Assessments
 - communication including recommendations
 - Vicarious coefficient updates for “drifting” sensors

GSICS Structure & Partnerships



GCC – GSICS Quarterly Newsletter



Volume 7 Number 3
2013
Fall Issue

Global Space-based Inter-Calibration System

Newsletter

Mark Ball, Editor

CMA • CNES • EUMETSAT • IMD • ISRO • JAXA • JMA • KMA • NASA • NIST • NOAA • ROSSHYDROMET • USGS • WMO

This Issue:
Lunar Calibration

In This Issue

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by Tom Stone

Assessment Calibration of Lunar Spectral Irradiance
by Oliver Cremer

Lunar Calibration of MODIS/VIIRS Solar Bands
by Barthomeu Vilard, Alexander Weger, Tim Hawton and Tom Stone

Physics of Orbital Lunar Observations (POLO) - Radiance Study of the Moon
by Sophie Leckebusch

On the Phase-Dependent Dependence of the Moon Calibration Results
by Sophie Leckebusch, Barthomeu Vilard, Tom Stone, Laurent Colot, Alexander Weger, and Tim Hawton

Calibration/Validation of Suomi-NPP/VIIRS Day-Night Band using Moon Light
by Yi Zhou, Changyong Cao, and Shou Zheng

Angular Variation of MODIS Ingoer Area Mirror Radiance Reflectivity
by Fengping Yu, Jingping Wu, Jun Stone, and Gordon (David) Hunt



News in This Quarter

A Note from the Executive Panel Chair
by Mark Ball

Biennial Meeting of the NOAA/ES/OS Calibration Project Oversight Panel (COPOP)
by Jingping Wu, NOAA

2013 First Campaign of Radiometric Calibration for FY Sensors Held at CRDS Dohaang Site
by Tom Stone

Improved Accessibility to EUMETSAT GSICS Data
by Tim Hawton, EUMETSAT

PI-AC Satellite Receptivity Launches
by Tom Stone

EUMETSAT Begins Providing Alternative Calibration Coefficients for Sentinel-3/OSIRIS
by Tim Hawton, EUMETSAT

ANNOUNCEMENTS

Mark Ball Takes Over as Deputy Director of CRDS Coordination Center

CRDS Forms UV Workshop
by Tom Stone

Upcoming GSICS-related Meetings
by Tom Stone

GSICS-related Publications
by Tom Stone

Special Thanks to Fengping Yu and George Oring



Volume 8 Number 2
2014
Summer Issue

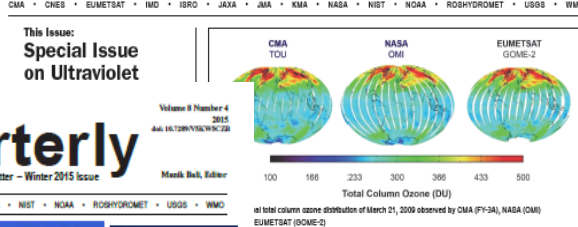
Global Space-based Inter-Calibration System

Newsletter - Summer 2014 Issue

Mark Ball, Editor

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This Issue:
Special Issue on Ultraviolet




Volume 9 Number 4
2015
Fall Issue

Global Space-based Inter-Calibration System

Newsletter - Winter 2015 Issue

Mark Ball, Editor

CMA • CNES • EUMETSAT • IMD • ISRO • JAXA • JMA • KMA • NASA • NIST • NOAA • ROSSHYDROMET • USGS • WMO

This Issue:

In This Issue

Articles

The Conundrum of SI Traceability at L_{min} for the VIIRS Day/Night Band
by Changyong Cao, NOAA

SNPP VIIRS Thermal Emittance Bands On-Orbit Performance
by Barbara Ehrenove and Jack Wang, NOAA

Updates on the International Calibration of NOAA HRSD CO₂ Channels for Climate Studies
by Zhou Wang, Changyong Cao and Shi Zheng, NOAA

CLASSIFIED: Climate Change Observations and Calibration Standards
by C. Lubbe, S.A. Mielke, R.F. Stone and the CLASSIFIED Science Team, NOAA

Inter-comparison of OHS Full Resolution Radiance with ASD
by Ewan Wang, Jingping, Yong Chen, Yu Ju and Alexander Weger and David Tomblid, NOAA

The status of long term data processing in NSIC
by Shi Liu, Peng, Qiu, Zhongqiang and Shi Yu, CNR

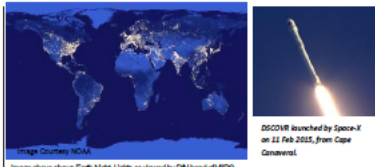
News in This Quarter

Outcome of the Joint GSICS-OSIRIS/NOG Lunar Calibration Workshop
by Alexander Weger, EUMETSAT

OSIRIS/NOG Workshop to be held 21-26 September, 2015, in Toulouse, France
by Tim Hawton, EUMETSAT

Annual OSIRIS/NOG meeting to be held 21-26 March, 2015, in New Delhi, India
by Mark Ball, NOAA

GSICS-Related Publications



The Conundrum of SI traceability at L_{min} for the VIIRS Day/Night Band

by Changyong Cao, NOAA

It is commonly accepted that all good measurements, including those from satellites, should ideally be made SI traceable, which is defined as the “property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty” (VIM). For the VIIRS onboard calibration, the pre-launch “reference” would be the irradiance sources used and maintained at the metrology institute. After the satellite is launched into orbit, the reference becomes the solar irradiance which has been extensively studied with well known uncertainties. After taking into account all the uncertainties in the error budget analysis, it is concluded that the VIIRS onboard solar diffuser calibration can achieve a calibration with ±2% (1-sigma) uncertainty. In the case of the VIIRS Day/Night Band (DNB), the nominal value for this solar diffuser in-band radiance is on the order of 1 000 000 nW/cm²-sr (nW=nanowatts, or 0.001 W/cm²-sr) which is in the low gain stage (LGS). However, at night, the radiances are

Higher Energy Photons Arrive at GSICS

by Flynn, NOAA

Issue of *GSICS Quarterly* features a new area of the focus for GSICS work, the *ultraviolet*. Unlike some other regions, the primary products for the *backscatter/let* (BUV) measurements are the ratios of earth to solar irradiances. These ratios provide information on atmospheric absorption and scattering, and on cloud surface reflectivity for product retrieval algorithms.

radiations have inherent cancellation through the responses and photo track the varying instrument is differ among the instruments, the Ozone Mapping instrument (OMPS) instruments use reference diffuser the diffuser changes and a changes in the rest of the sensor characteristics over a parameter called Calibration Coefficient (CFC). A simplistic item of the adjusted ratios top-of-atmosphere reflectance form

$$\left[\frac{\text{Earth_radiance}(t) * 1 / \text{CFC}(t)}{\text{Day_Solar_irradiance} * \text{AD}(t)} \right]$$

where AD(t) adjusts for the changes in the Earth-Sun distance, while the GOME-2 series of instruments use onboard sources to monitor the solar diffuser changes over time, SDC(t), independent of the rest of the optical and sensor changes, and make daily solar measurements. The simplistic representation of the adjusted ratios has the form

$$\text{Earth_radiance}(t) / [\text{Solar_irradiance}(t) * 1 / \text{SDC}(t)]$$

GSICS Quarterly Newsletter Features

- Since Fall 2013, brand new format .
- Since Winter 2014, the Newsletter has a doi.
- Accepts articles on topics related to calibration (Pre and Post launch).
- New Landing page on the GCC website.
- Rate and Comment section: readers and authors can interact.
- Articles are reviewed by subject experts
- Help available to non native English speaking contributors.
- Since Fall 2014, new navigation features added to the Cover Letter.

Special Thanks to Aleksander Jezek
GSICS-Related Publications

differences between instruments are clearly understood. Measurements widely separated in time and space can be compared if they

the measurement of Top of Atmosphere (TOA) Total Solar Irradiance (TSI) provides an example of this work. The Earth Radiation Budget (ERB)



Satellite Cal/Val Programs Supports GSICS

- **JPSS and GOES-R and other CGMS satellite agency requirements for on-going validation of instrument performance and stability ties into GSICS functional areas.**
- **These include intercalibration, instrument monitoring and campaigns, assessments, routine cause analysis, etc.**
- **Following are excellent examples of assessments that GSICS depends on to establish traceability and next steps**

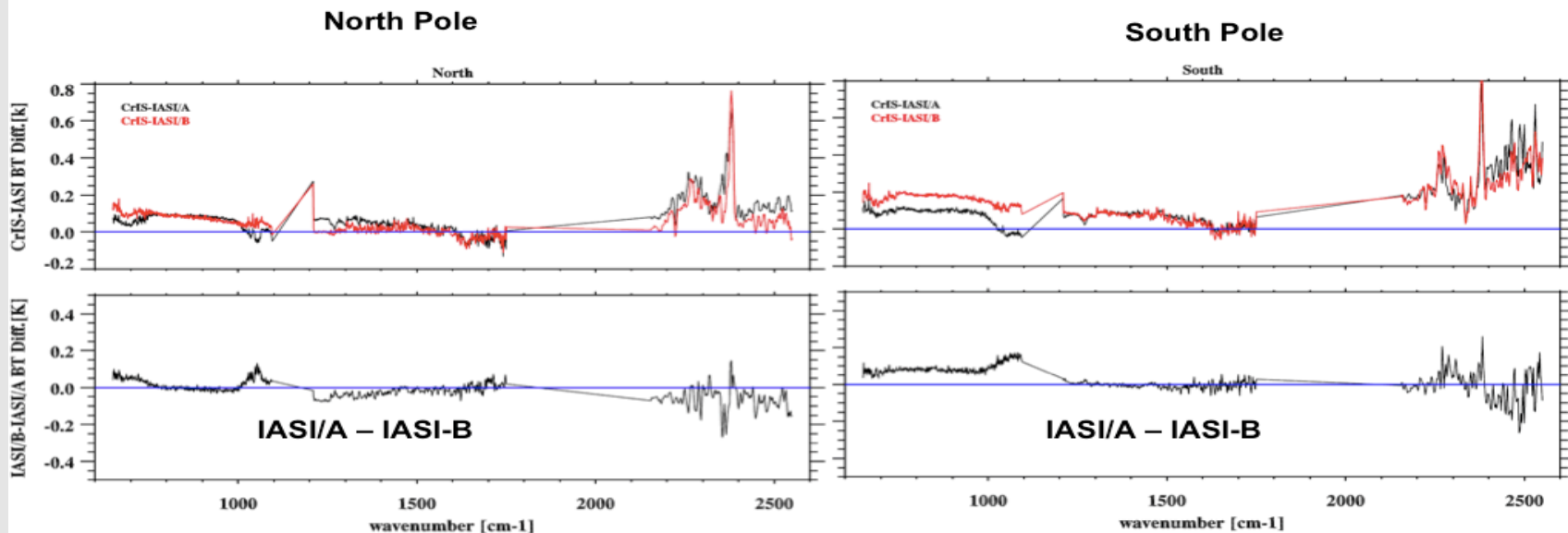
March 2015 Greenland SNPP campaign

SNPP-2 Calibration Validation

- Mission Goals:
 - radiometric calibration validation over cold clear scenes
 - Resolve CrIS and IASI differences
 - assess satellite T/q profile retrievals for cold scenes
- Flights out of Keflavik from March 7-29, 2015
 - ~4.8 hours per flight lag time over Greenland Ice Sheet
- Primary Target – SNPP
- Secondary Targets – METOP A and B, Aqua, Terra

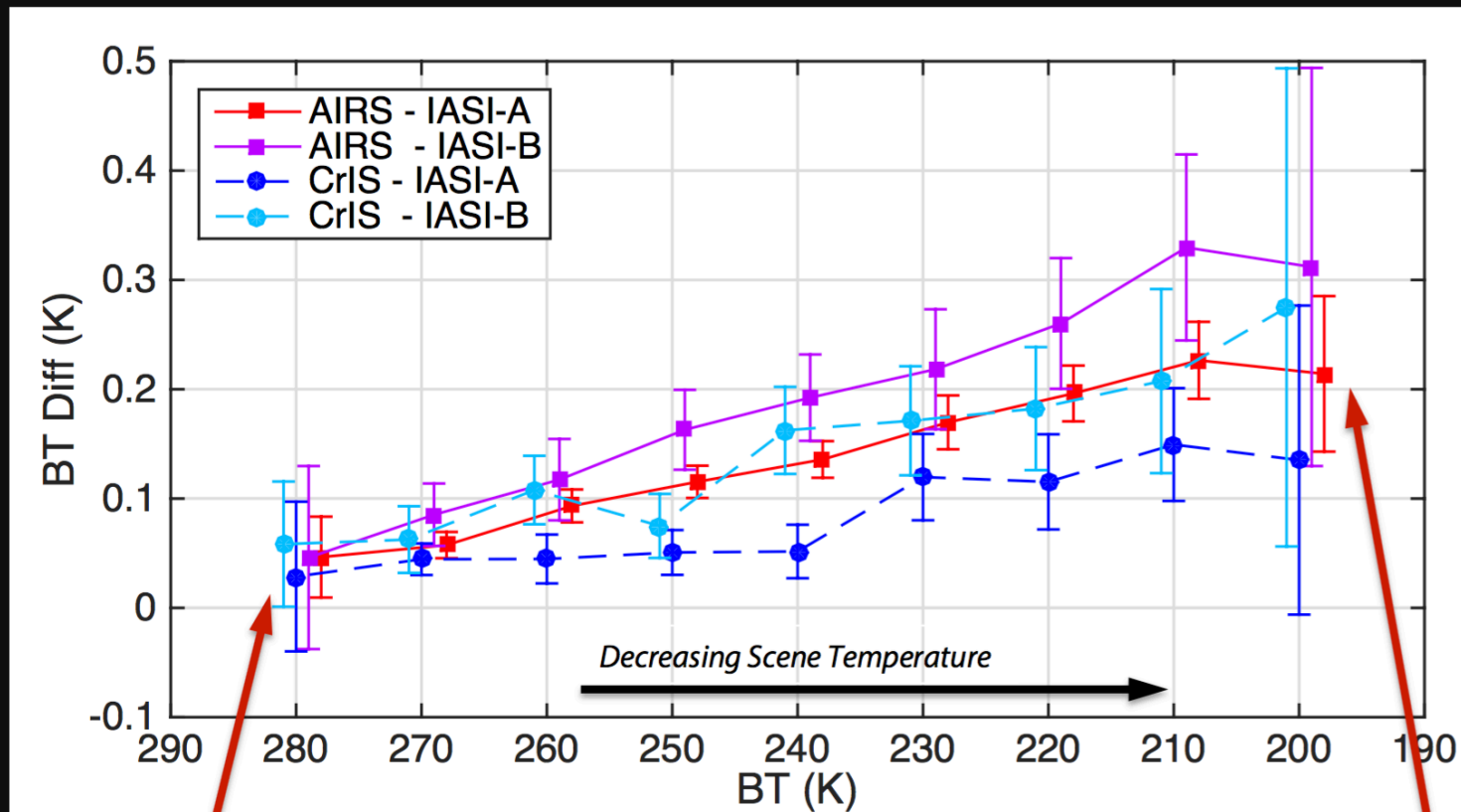
SNPP – 2 CalVal Payload

- S-HIS (Scanning High-resolution Interferometer Sounder)
 - cross-track scanning interferometer sounder which measures emitted thermal radiation at high spectral resolution between 3.3 and 18 microns
 - <https://shis.ssec.wisc.edu>
- NAST-I (NPOESS Airborne Sounding Testbed-Interferometer)
 - high spectral resolution (0.25cm⁻¹) and high spatial resolution (0.13 km linear resolution per km of aircraft flight altitude, at nadir) scanning
- NAST-M (NPOESS Airborne Sounding Testbed-Microwave)
 - passive microwave spectrometers
- MASTER (MODIS Airborne Simulator)
 - visible, shortwave infrared, and thermal infrared channels
 - <http://masterweb.jpl.nasa.gov>



Assessment of the calibration accuracy for cold Earth scenes

Mean SNO differences for 910-930 cm^{-1}



Error-bars represent statistical matchup uncertainty, not sensor uncertainty

0.050 K Agreement

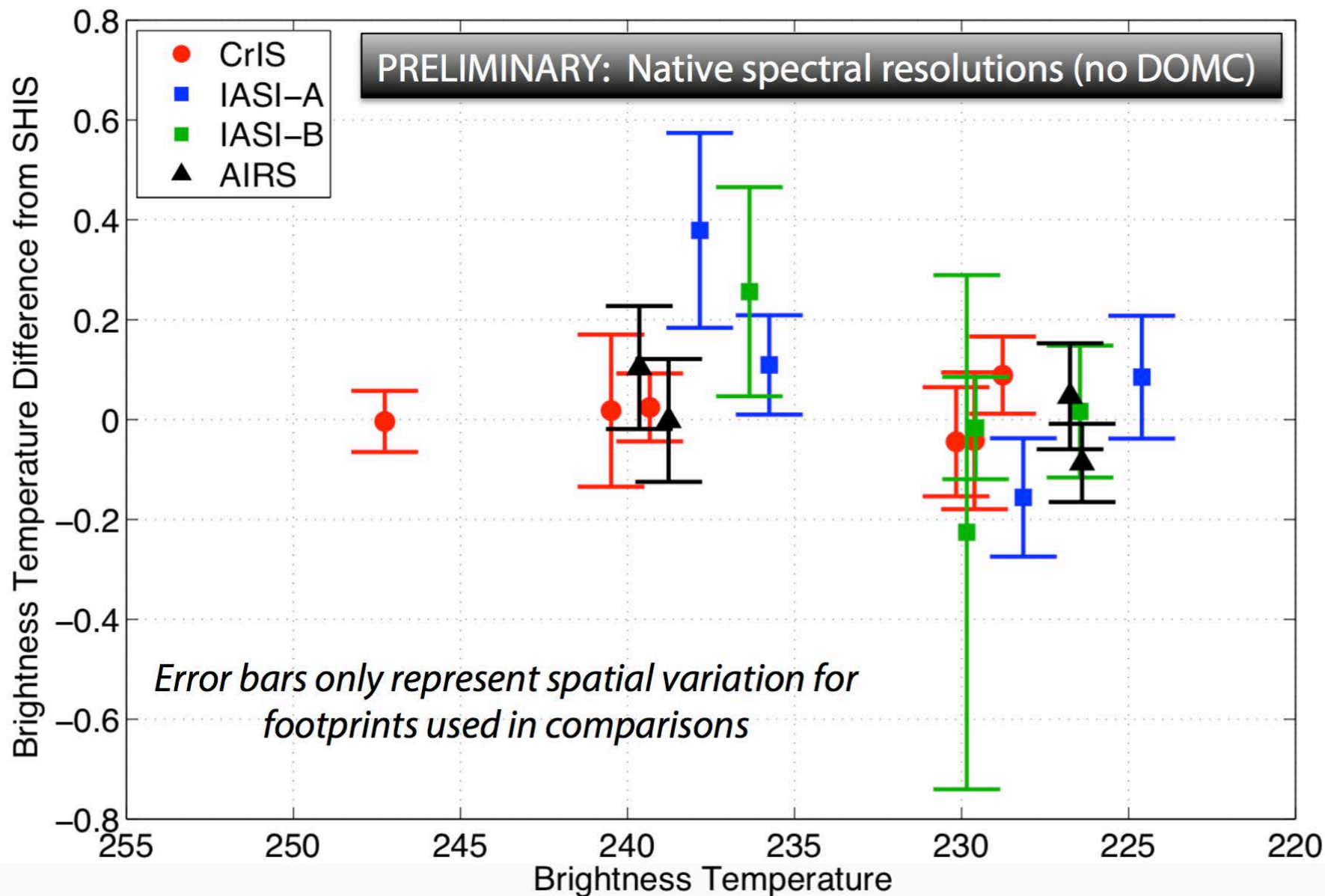
> 0.3 K relative differences

Preliminary Analysis and Results:

Credit: Tobin

SNPP Calibration Validation Campaign 2015

SNAP2015, 850–900 cm^{-1}



GSICS correction is negligible for AHI

MTSAT-2 Infrared Channel

- IR1 (10.8 μm)
- IR2 (12.0 μm)
- IR3 (6.8 μm)
- IR4 (3.8 μm)

LEO Data

- AIRS & IASI-A (asc & Des)
- AIRS (asc, 1:30pm)
- IASI-A (des, 9:30am)
- IASI-B (des, 9:30am)
- AIRS (des, 1:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (asc, 9:30pm)
- AIRS (des & asc)
- IASI-A (des & asc)
- IASI-B (des & asc)

Time Sequence

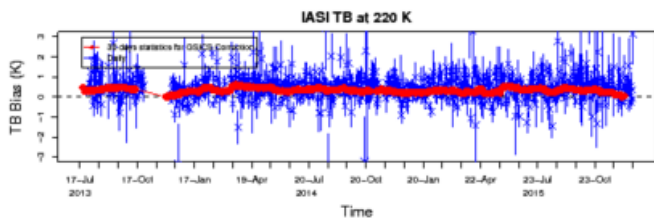
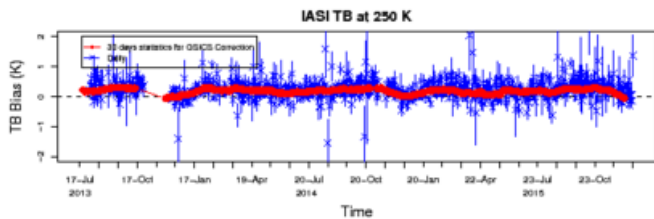
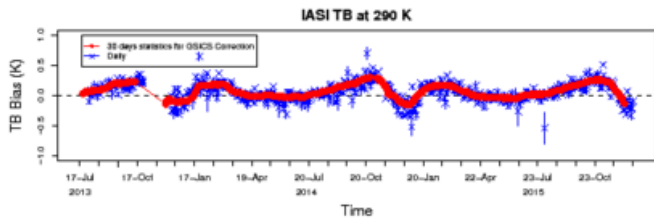
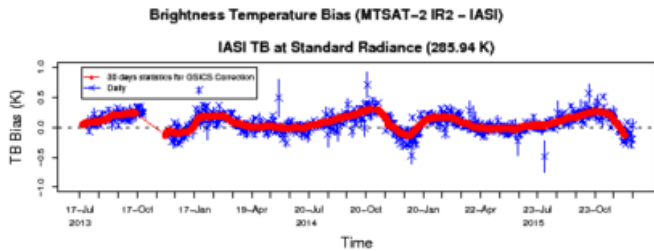
- TB difference
- Regression coef.

Statistics for GSICS Correction

- Scatter plot (DN)
- Scatter plot (Rad)

(Month Day Year) ▲

- Sep12, 2015
- Sep13, 2015
- Sep14, 2015
- Sep15, 2015
- Sep16, 2015
- Sep17, 2015
- Sep18, 2015
- Sep19, 2015
- Sep20, 2015
- Sep21, 2015
- Sep22, 2015
- Sep23, 2015 ▼



AHI Infrared Bands

- Band07 (3.9 μm)
- Band08 (6.2 μm)
- Band09 (6.9 μm)
- Band10 (7.3 μm)
- Band11 (8.6 μm)
- Band12 (9.6 μm)
- Band13 (10.4 μm)
- Band14 (11.2 μm)
- Band15 (12.4 μm)
- Band16 (13.3 μm)

LEO Data

- AIRS (all)
- IASI-A (all)
- IASI-B (all)
- CrIS (all)
- AIRS (asc, 1:30pm)
- AIRS (des, 1:30am)
- IASI-A (des, 9:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (des, 9:30am)
- IASI-B (asc, 9:30pm)
- CrIS (asc, 1:30pm)
- CrIS (des, 1:30am)

Time Series

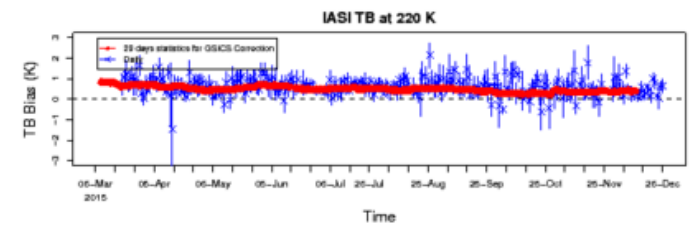
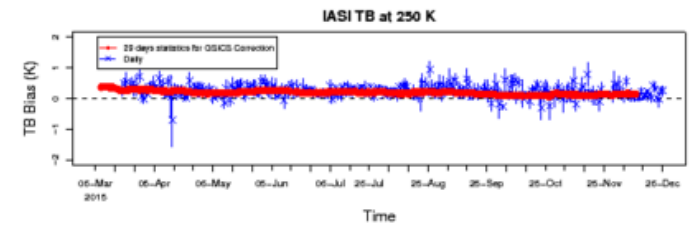
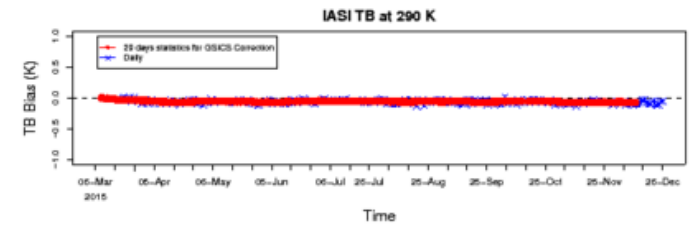
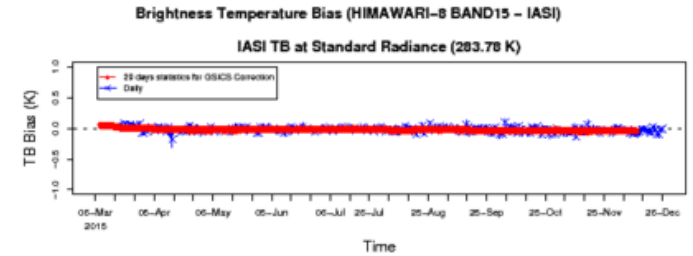
- TB difference
- Regression coef.

Statistics for GSICS Correction

- Scatter plot

(Month Day Year) ▲

- Sep12, 2015
- Sep13, 2015
- Sep14, 2015
- Sep15, 2015
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- Sep17, 2015
- Sep18, 2015
- Sep19, 2015
- Sep20, 2015
- Sep21, 2015
- Sep22, 2015
- Sep23, 2015 ▼



GSICS Infrared Inter-calibration



Himawari-8/AHI IR Inter-calibration with AIRS, IASI-A/B and CrIS

AHI Infrared Bands

- Band07 (3.9 μm)
- Band08 (6.2 μm)
- Band09 (6.9 μm)
- Band10 (7.3 μm)
- Band11 (8.6 μm)
- Band12 (9.6 μm)
- Band13 (10.4 μm)
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- Band15 (12.4 μm)
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LEO Data

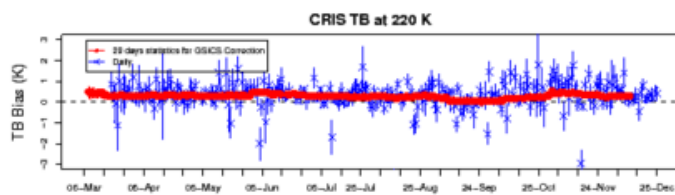
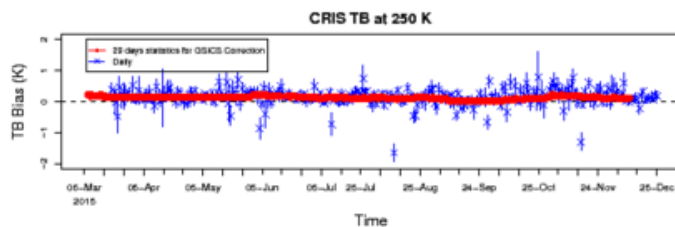
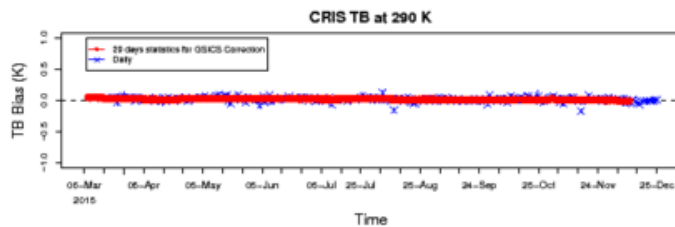
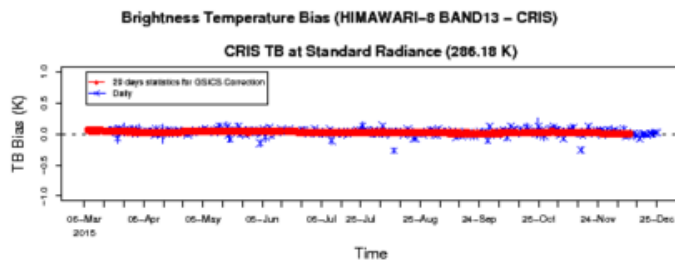
- AIRS (all)
- IASI-A (all)
- IASI-B (all)
- CrIS (all)
- AIRS (asc, 1:30pm)
- AIRS (des, 1:30am)
- IASI-A (des, 9:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (des, 9:30am)
- IASI-B (asc, 9:30pm)
- CrIS (asc, 1:30pm)
- CrIS (des, 1:30am)

Time Series

- TB difference
- Regression coef.

Statistics for GSICS Correction

- Scatter plot
- (Month Day Year) ▲
- Sep11, 2015
- Sep12, 2015
- Sep13, 2015
- Sep14, 2015
- Sep15, 2015



GSICS Infrared Inter-calibration



Himawari-8/AHI IR Inter-calibration with AIRS, IASI-A/B and CrIS

AHI Infrared Bands

- Band07 (3.9 μm)
- Band08 (6.2 μm)
- Band09 (6.9 μm)
- Band10 (7.3 μm)
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- IASI-A (all)
- IASI-B (all)
- CrIS (all)
- AIRS (asc, 1:30pm)
- AIRS (des, 1:30am)
- IASI-A (des, 9:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (des, 9:30am)
- IASI-B (asc, 9:30pm)
- CrIS (asc, 1:30pm)
- CrIS (des, 1:30am)

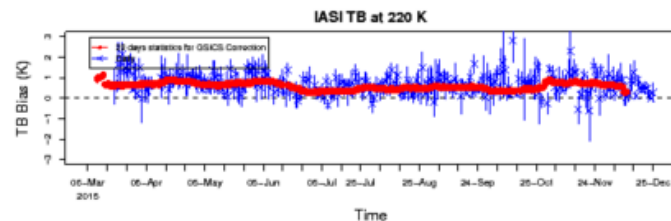
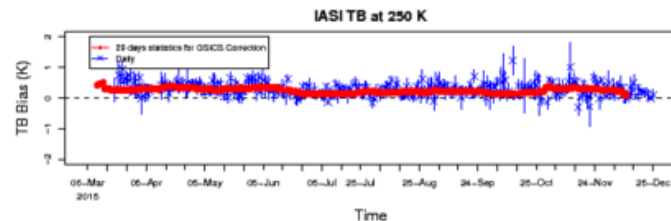
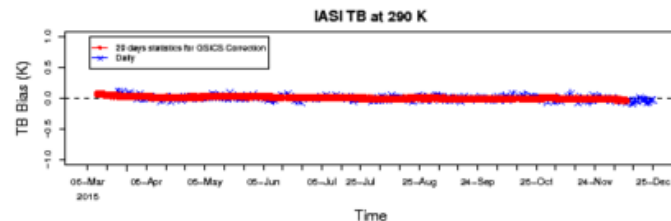
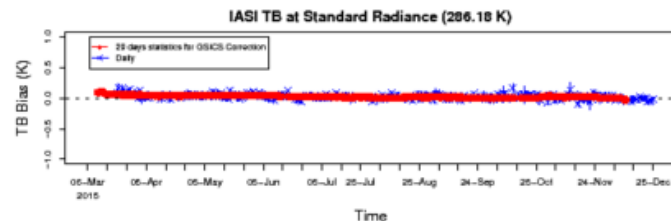
Time Series

- TB difference
- Regression coef.

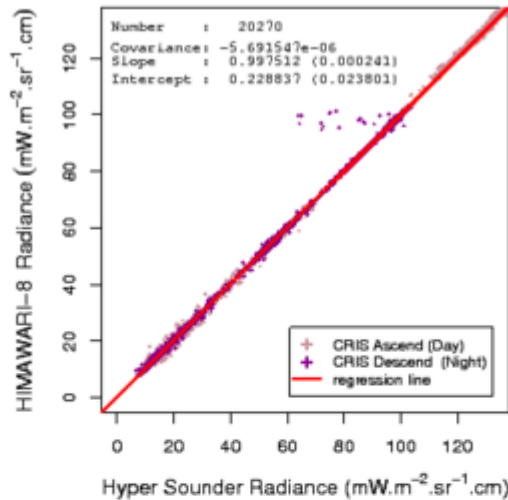
Statistics for GSICS Correction

- Scatter plot
- (Month Day Year) ▲
- Sep11, 2015
- Sep12, 2015
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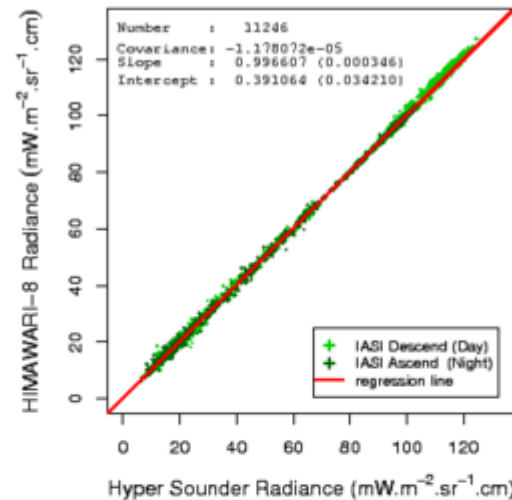
Brightness Temperature Bias (HIMAWARI-8 BAND13 - IASI)



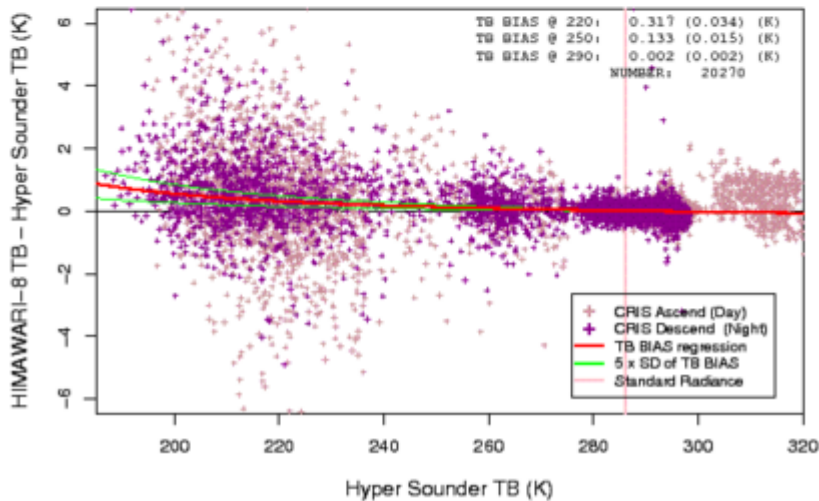
HIMAWARI-8 BAND13 vs. NPP/CRIS
12 Sep 2015 (Period: 29 Aug 2015 to 26 Sep 2015)



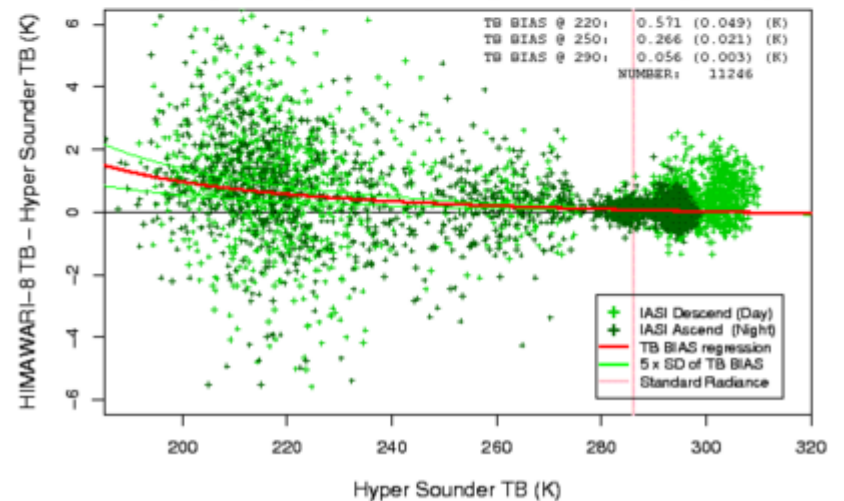
HIMAWARI-8 BAND13 vs. METOP-B/IASI
12 Sep 2015 (Period: 29 Aug 2015 to 26 Sep 2015)



HIMAWARI-8 BAND13 vs. NPP/CRIS
12 Sep 2015 (Period: 29 Aug 2015 to 26 Sep 2015)



HIMAWARI-8 BAND13 vs. METOP-B/IASI
12 Sep 2015 (Period: 29 Aug 2015 to 26 Sep 2015)





GSICS Himawari-8/AHI infrared inter-calibration guide

Inter-calibration between Himawari-8/AHI infrared bands and high-spectral-resolution sounders

The Meteorological Satellite Center (MSC) examines way of improving inter-calibration between Himawari-8/AHI (referred to here as AHI) infrared bands and high-spectral-resolution sounders (hyper sounders). Data from the three hyper sounders detailed below are used for this work.

- The [Atmospheric Infrared Sounder \(AIRS\)](#) is a multi-aperture array grating spectrometer on board the AQUA satellite of the National Aeronautics and Space Administration (NASA, U.S.).
- The [Infrared Atmospheric Sounding Interferometers \(IASIs\)](#) are hosted by the Metop-A and -B satellites of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT, EU).
- The [Cross-track Infrared Sounder \(CrIS\)](#) is a Fourier transform spectrometer hosted by NASA's Suomi NPP satellite.

Inter-calibration is conducted once a day. The hyper-sounder data used in this work are collected via the Internet. Inter-calibration computation may be canceled if network conditions are poor.

As of July 2015, AHI GSICS Corrections are under development. The products will be reviewed within GSICS to enter Demonstration-phase.

Outcome

The results of this inter-calibration work have three statistical parameters. It should be noted that the results contain a certain level of uncertainty caused due to variations in instrument accuracy, differences in observation conditions and spectral compensation residuals.

Coefficients of regression between the radiance of hyper sounders and AHI

Linear regression coefficients (C_0 and C_1) and their standard uncertainties are computed to allow association of Himawari Standard Data (HSD) radiance with hyper sounder radiance. The radiance is in wavenumber space, and its unit is $\text{mW}\cdot\text{m}^{-2}\cdot\text{sr}^{-1}\cdot\text{cm}$.

$$\text{Radiance (AHI)} = C_0 + C_1 \times \text{Radiance (hyper sounder)}$$

GSICS Correction

GSICS Correction is the initial core product of GSICS. It is a dataset that allows users to determine corrected satellite radiances based on the results of inter-calibration, and consists of the above linear regression coefficients (C_0 and C_1). Corrected satellite radiances are calculated using the following equation:

$$\text{Corrected radiance (AHI)} = \text{HSD radiance (AHI)} / C_1 - C_0 / C_1$$

GSICS Correction is computed for every day. To reduce the random component of uncertainty, correction is derived from data over 29- and 15-day time periods for Re-Analysis Correction (RAC) and Near Real Time Correction (NRTC), respectively. The smoothing period for RAC is $t - 14$ days to $t + 14$ days, and that for NRTC is $t - 14$ days to $t + 0$ days (where t is the date of validity).

TB difference between hyper sounders and AHI

The brightness temperature (TB) difference (AHI value minus hyper sounder value) and its standard uncertainties associated with AHI and hyper sounder radiance are computed at reference temperatures of standard radiance, 290 K, 250 K and 220 K. A standard radiance from GSICS is defined to allow comparison and convenient expression of instrument inter-calibration bias in units that are understandable to users.

The standard radiance of AHI was calculated for each channel by RTTOV-11.2 in a 1976 US Standard Atmosphere at nadir, at night, in clear sky, and over the sea with an SST of 288.15K and a wind speed of 7m/s.

$$d \text{ Tb} = \text{Tb (AHI)} - \text{Tb (hyper sounder)}$$

AHI band (μm)	Band7 (3.9)	Band8 (6.2)	Band9 (6.9)	Band10 (7.3)	Band11 (8.6)	Band12 (9.6)	Band13 (10.4)	Band14 (11.2)	Band15 (12.4)	Band16 (13.3)
Standard radiance [K]	285.95	234.65	243.85	254.59	283.82	259.45	286.18	286.10	283.78	269.73

Conversion between brightness temperature and radiance

The Planck function and sensor spectral response functions are used to compute brightness temperature [K] from radiance [$\text{mW}\cdot\text{m}^{-2}\cdot\text{sr}^{-1}\cdot\text{cm}$] and vice-versa. In general, approximation equations called *sensor Planck function*, which are generated for AHI infrared bands, are used to facilitate computation.

Brightness temperature to radiance

$$B_i(T_b) = \frac{2hc^2\nu_i^3}{\exp\{hc\nu_i/k(a_{1i} + a_{2i}T_b) - 1\}}$$

where B_i : sensor Planck function of band i
 T_b : brightness temperature
 ν_i : central wavenumber of band i
 a_{1i}, a_{2i} : band correction coefficients of band i
 h : Planck constant
 k : Boltzmann constant
 c : speed of light

Radiance to brightness temperature

$$T_b = b_{1i} + b_{2i}T_e + b_{3i}T_e^2$$

$$T_e(B_i) = \frac{\frac{hc}{k}\nu_i}{\ln\left(\frac{2hc^2\nu_i^3}{B_i} + 1\right)}$$

where T_b : the Planck temperature of band i
 T_e : effective temperature
 B_i : spectral radiance
 b_{1i}, b_{2i}, b_{3i} : band correction coefficients of band i

AHI band	Wavenumber ν (cm^{-1})	Band correction coefficients				
		a1	a2	b1	b2	b3
Band 7 (3.9 μm)	2575.767	0.464673802	0.999341618	-0.479757	1.000766	-1.860569e-07
Band 8 (6.2 μm)	1609.241	1.646844799	0.996401237	-1.662616	1.003694	-1.732716e-07
Band 9 (6.9 μm)	1442.079	0.30813537	0.999259063	-0.3357036	1.000974	-4.847962e-07
Band 10 (7.3 μm)	1361.387	0.057369468	0.999854346	-0.06306013	1.000195	-1.069833e-07
Band 11 (8.6 μm)	1164.443	0.135127541	0.999615566	-0.1605105	1.000589	-4.019762e-07
Band 12 (9.6 μm)						



Wrap up


- Where we are:
 - GSICS has developed a cadre of calibration scientists throughout the world's earth remote sensing satellite agencies
 - Every satellite/instrument operator is now responsible for characterizing their own satellites with community consensus algorithms and tools
- Where we are going:
 - GSICS will continue promote capacity building
 - Contribute significant to the new Climate Architecture.

Learn more about GSICS

THE GLOBAL SPACE-BASED INTER-CALIBRATION SYSTEM

BY M. GOLDBERG, G. OHRING, J. BUTLER, C. CAO, R. DATLA, D. DOELLING, V. GARTNER, T. HEWISON, B. IACOVAZZI, D. KIM, T. KURINO, J. LAFFAILLE, P. MINNIS, D. RENAULT, J. SCHMETZ, D. TOBIN, L. WANG, F. WENG, X. WU, F. YU, P. ZHANG, AND T. ZHU

An international project will tie observations from operational low-earth-orbiting and geostationary environmental satellites to those from in-orbit sensors that serve as calibration standards.



The satellite component of the Global Observing System

Improved calibration of space-based Earth-observing instruments is a fundamental, urgent scientific need. There is an increasing demand for more accurate measurements and intercalibration of observations from different instruments in response to such issues as interoperability within the Global Earth Observation System of Systems (GEOSS), data assimilation in numerical weather prediction (NWP), climate change detection, and near-real-time operational applications. For example, as NWP models become more reliable, their appetite for more accurate data input steadily grows. As the requirements for monitoring global climate become clearer (Ohring et al. 2005)—temperature changes as tiny as a few tenths of a degree per decade—



GSICS-RD002

Global Satellite Inter-Calibration System

VISION OF GSICS IN THE 2020s Shaping GSICS to meet future challenges



World Meteorological Organization
Weather • Climate • Water
Global Access of Information providing/

GSICS-RD002

Global Satellite Inter-Calibration System

VISION OF GSICS IN THE 2020s Shaping GSICS to meet future challenges

Version 1.1

May 2015



Questions?





GSICS Infrared Inter-calibration



Himawari-8/AHI IR Inter-calibration with AIRS, IASI-A/B and CrIS

AHI Infrared Bands

- Band07 (3.9 μm)
- Band08 (6.2 μm)
- Band09 (6.9 μm)
- Band10 (7.3 μm)
- Band11 (8.6 μm)
- Band12 (9.6 μm)
- Band13 (10.4 μm)
- Band14 (11.2 μm)
- Band15 (12.4 μm)
- Band16 (13.3 μm)

LEO Data

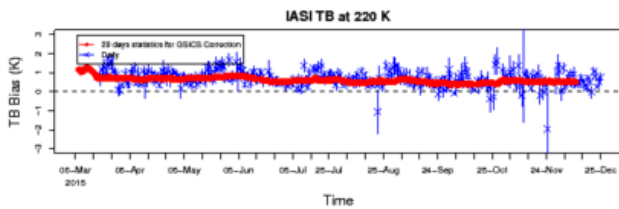
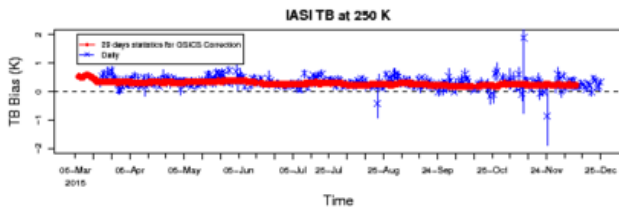
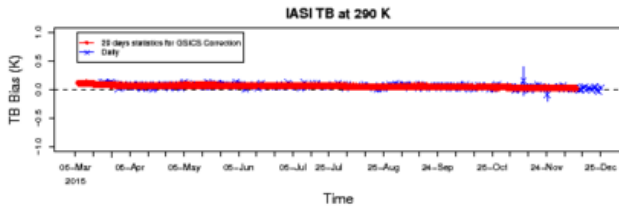
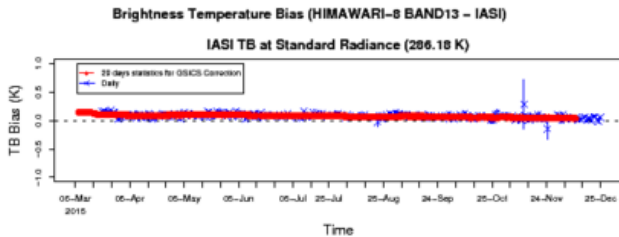
- AIRS (all)
- IASI-A (all)
- IASI-B (all)
- CrIS (all)
- AIRS (asc, 1:30pm)
- AIRS (des, 1:30am)
- IASI-A (des, 9:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (des, 9:30am)
- IASI-B (asc, 9:30pm)
- CrIS(asc, 1:30pm)
- CrIS(des, 1:30am)

Time Series

- TB difference
- Regression coef.

Statistics for GSICS Correction

- Scatter plot
- Month Day Year
- Sep11, 2015
- Sep12, 2015
- Sep13, 2015
- Sep14, 2015
- Sep15, 2015
- Sep16, 2015



GSICS Infrared Inter-calibration



Himawari-8/AHI IR Inter-calibration with AIRS, IASI-A/B and CrIS

AHI Infrared Bands

- Band07 (3.9 μm)
- Band08 (6.2 μm)
- Band09 (6.9 μm)
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- Band13 (10.4 μm)
- Band14 (11.2 μm)
- Band15 (12.4 μm)
- Band16 (13.3 μm)

LEO Data

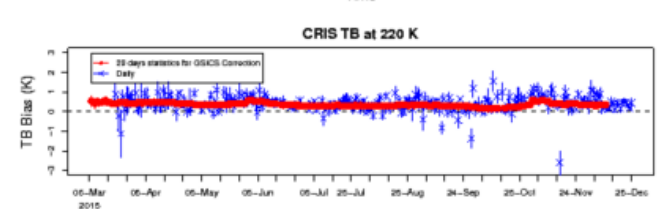
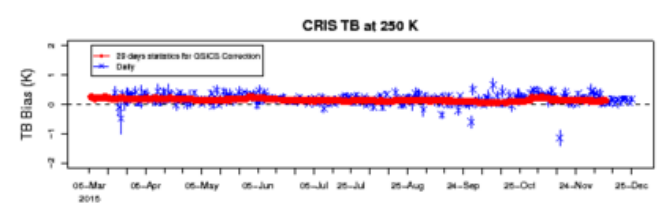
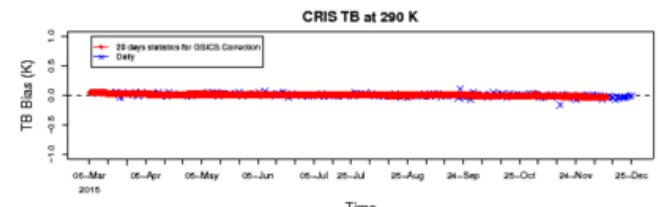
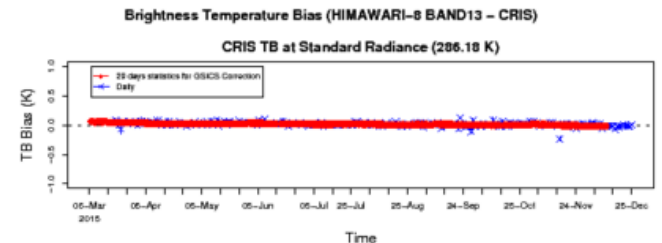
- AIRS (all)
- IASI-A (all)
- IASI-B (all)
- CrIS (all)
- AIRS (asc, 1:30pm)
- AIRS (des, 1:30am)
- IASI-A (des, 9:30am)
- IASI-A (asc, 9:30pm)
- IASI-B (des, 9:30am)
- IASI-B (asc, 9:30pm)
- CrIS(asc, 1:30pm)
- CrIS(des, 1:30am)

Time Series

- TB difference
- Regression coef.

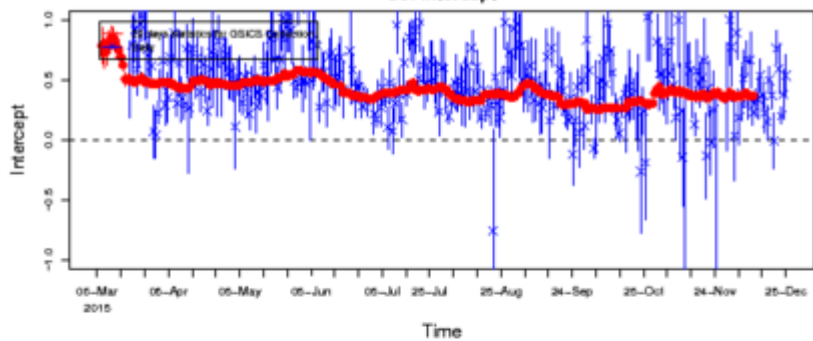
Statistics for GSICS Correction

- Scatter plot
- Month Day Year
- Sep11, 2015
- Sep12, 2015
- Sep13, 2015
- Sep14, 2015
- Sep15, 2015

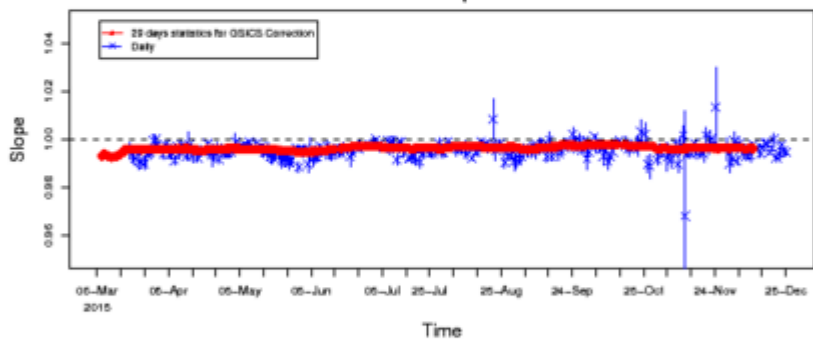


Regression Coefficients between HIMAWARI-8 BAND13 radiance and IASI Radiance
 $I(\text{HIMAWARI-8 BAND13}) = C_0 + C_1 \cdot I(\text{IASI})$

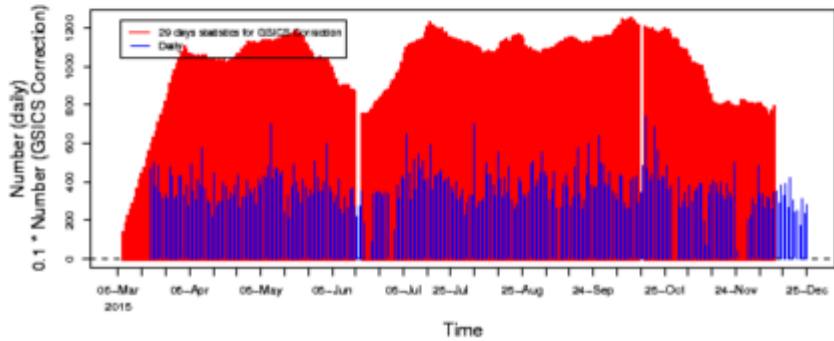
C0: Intercept



C1: Slope

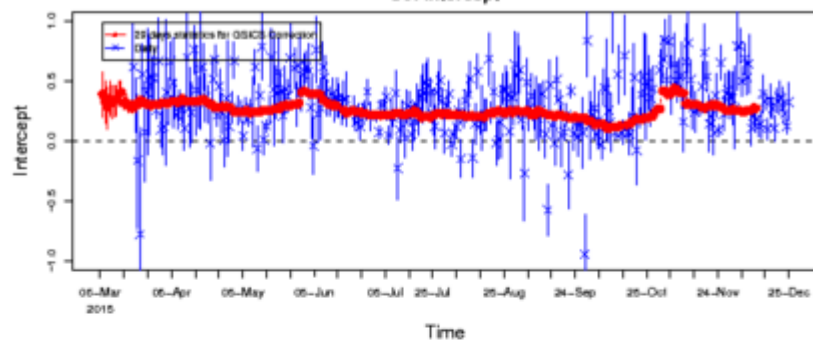


Number of Intercalibration Collocation Points

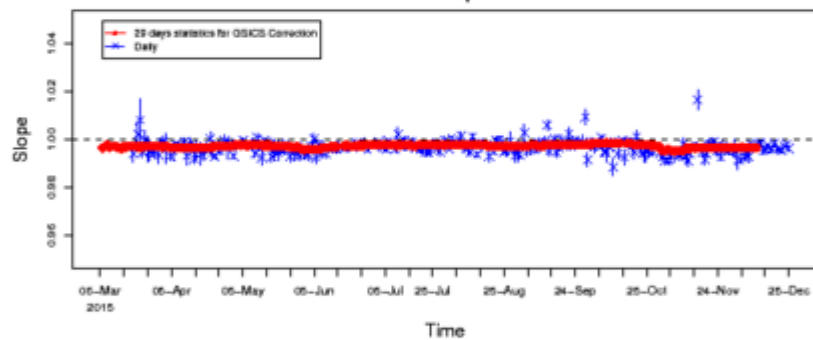


Regression Coefficients between HIMAWARI-8 BAND13 radiance and CRIS Radiance
 $I(\text{HIMAWARI-8 BAND13}) = C_0 + C_1 \cdot I(\text{CRIS})$

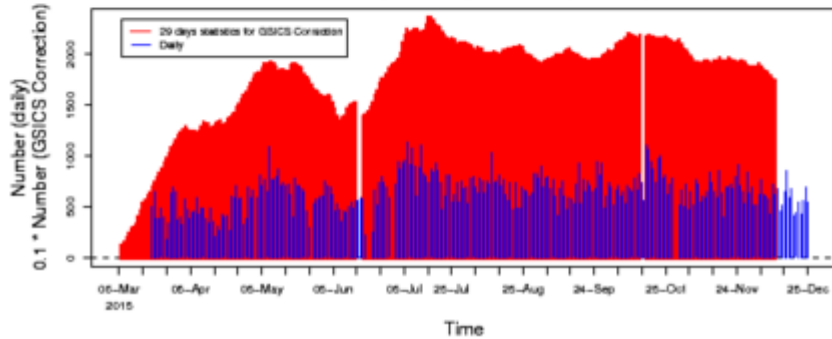
C0: Intercept



C1: Slope



Number of Intercalibration Collocation Points



Introduction

Time Sequence

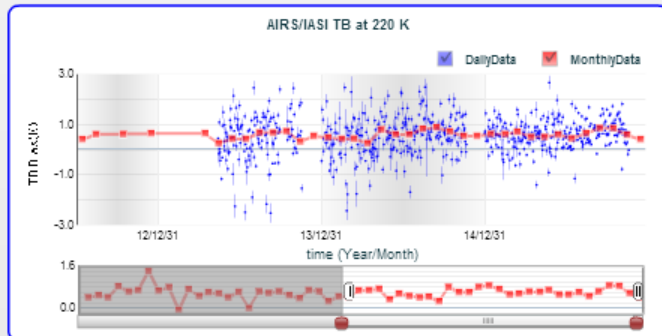
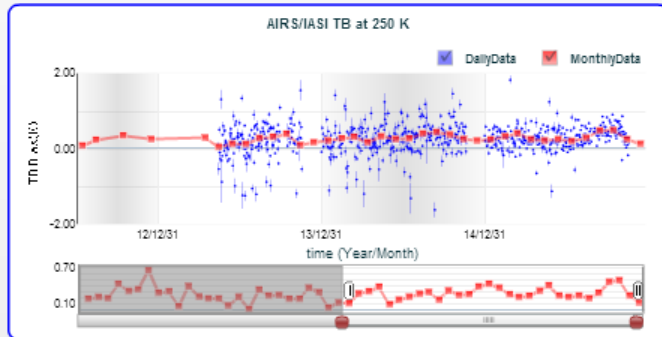
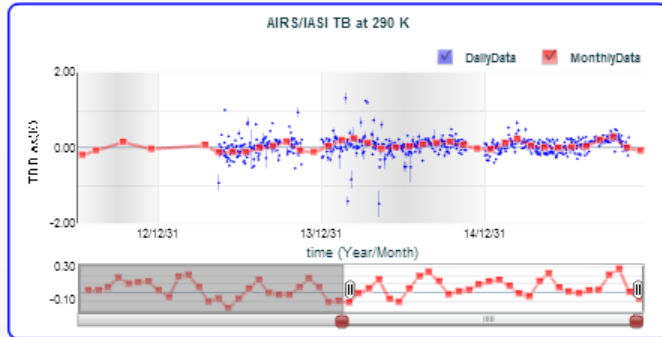
Scatter Plot

Download

IR Chann: LEO Dat: Display:

Date: ~

Brightness Temperature Bias(COMS-1R IR1 - AIRS/I)



X-CAL

You Are Here: HOME > X-CAL > Bias Re-analysis

X-CAL

FY-2 VS. LEO

-- Near Real-Time

-- Bias Re-analysis

-- Double Difference

FY-3 VS. LEO

FY-FY

Track Prediction

Data Monitor

Bias Re-analysis(Monthly Statistics and Time Sequences)

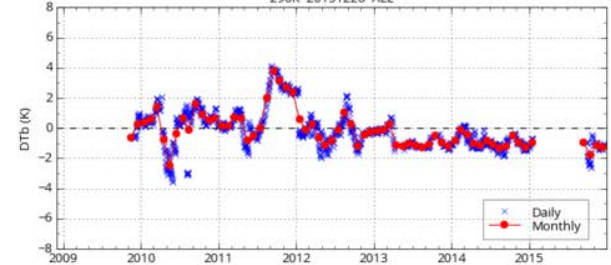
卫星+传感器_卫星+传感器 精度 时间:

Bias Re-analysis

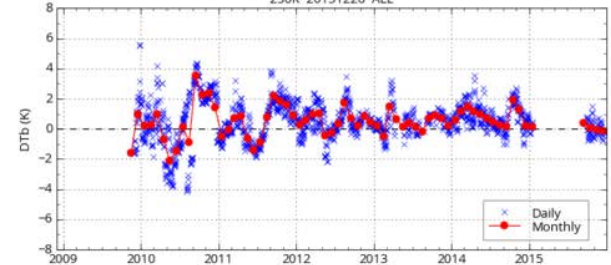
Display: Date: Year All

Refer T:

Brightness Temperature Bias Between FY2E-MetopA+IASI IR1 290K 20151226 ALL



Brightness Temperature Bias Between FY2E-MetopA+IASI IR1 250K 20151226 ALL



Brightness Temperature Bias Between FY2E-MetopA+IASI IR1 220K 20151226 ALL

