



Preliminary Comparison of Radiometric Calibration Performance among CrIS, AIRS and IASI using GSICS GEO-LEO Inter-calibration

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8/30/2012

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What is GSICS



• What is GSICS?

- Global Space-based Inter-Calibration System
- International collaborative effort initialized in 2005 by WMO and CGMS
- Effort to produce consistent, well-calibrated data from operational weather and environmental satellites of the Global Observing System (GOS)

• What are the basic strategies of GSICS?

- Improve on-orbit calibration by developing an integrated inter-calibration system
 - Initially for GEO-LEO Inter-satellite calibration
 - Being extended to LEO-LEO
 - Using external references as necessary
- Best practices for prelaunch characterisation (with CEOS WGCV)

• This will allow us to:

- Improve consistency between instruments
- Reduce bias in Level 1 and 2 products
- Provide traceability of measurements
- Retrospectively re-calibrate archive data
- Better specify future instruments



EUMETSAT



CNES



JMA



NOAA



CMA



KMA



ISRO



NASA



WMO



USGS



NIST



JAXA



ROSHYDROMET



IMD



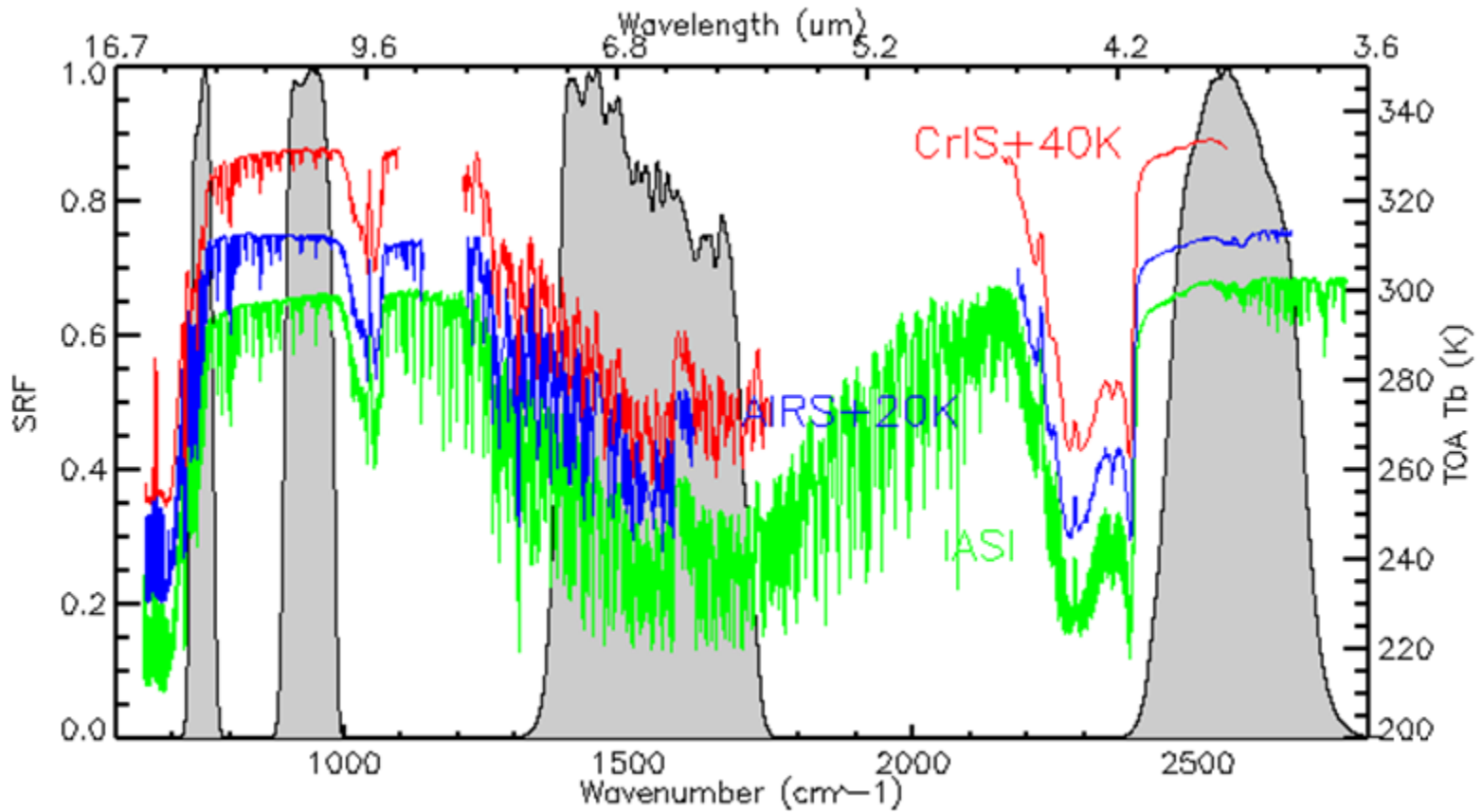
ESA



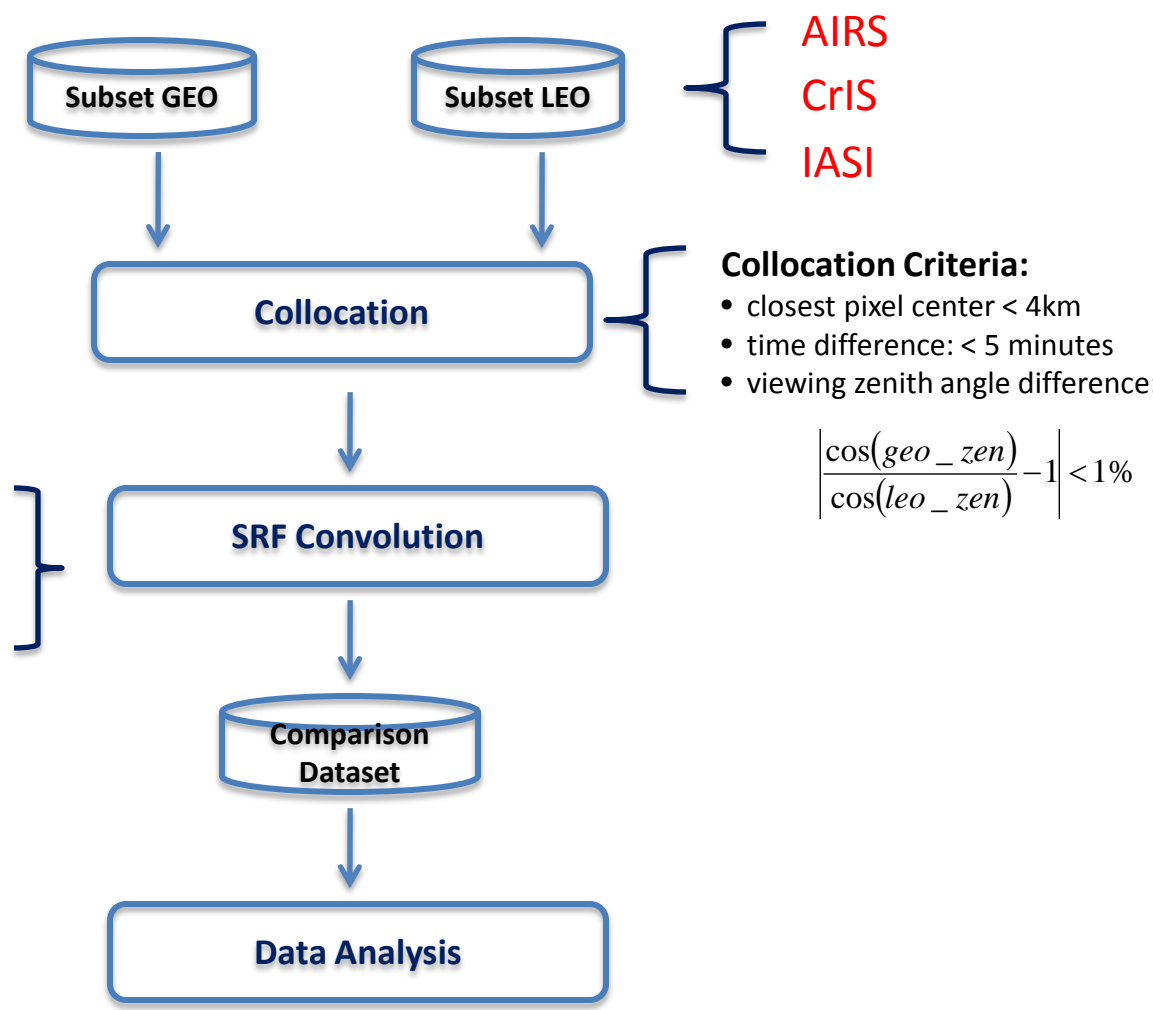
Objective

- GSICS was initiated with the GEO-LEO Infrared (IR) Inter-calibration in 2007
 - Reference to AIRS/IASI... CrIS
 - Algorithm is mature
- Objective: to evaluate the radiometric calibration performance among AIRS, CrIS and IASI, using the GSICS GEO-LEO collocation data
 - GOES Imager IR measurements as transfers
 - This method requires large amount of collocation data

GOES-13 Imager IR SRF & Simulated AIRS/CrIS/IASI TOA Tb over Clear Tropic Ocean

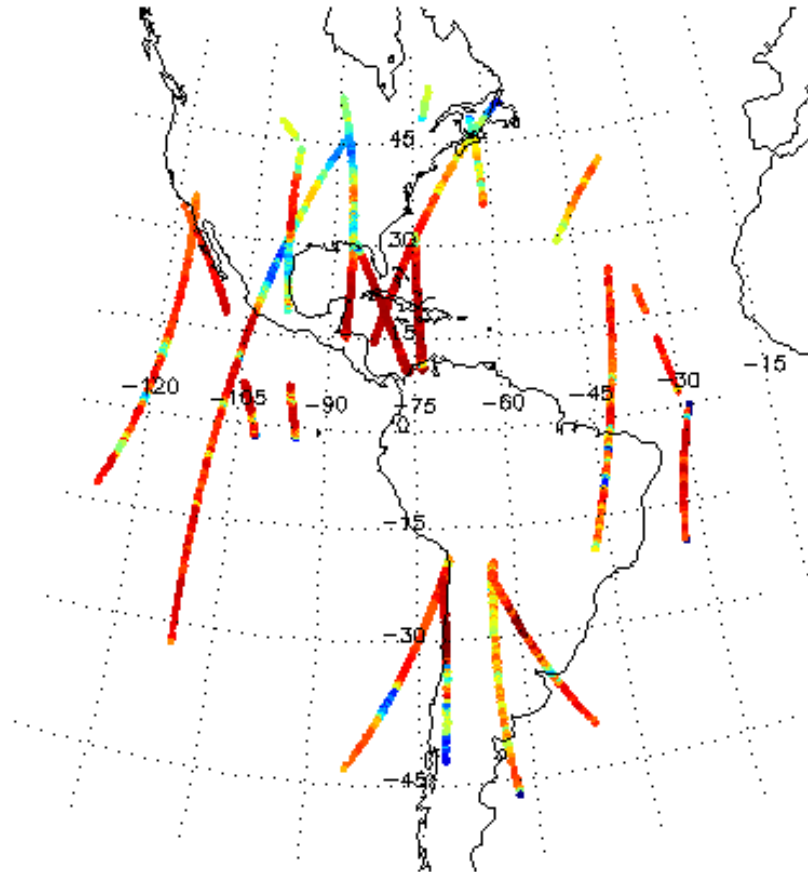


GSICS GEO-LEO Collocation Criteria



$$R_{GEO} = \frac{\int_{\nu} R_{\nu} \Phi_{\nu} d\nu}{\int_{\nu} \Phi_{\nu} d\nu}$$

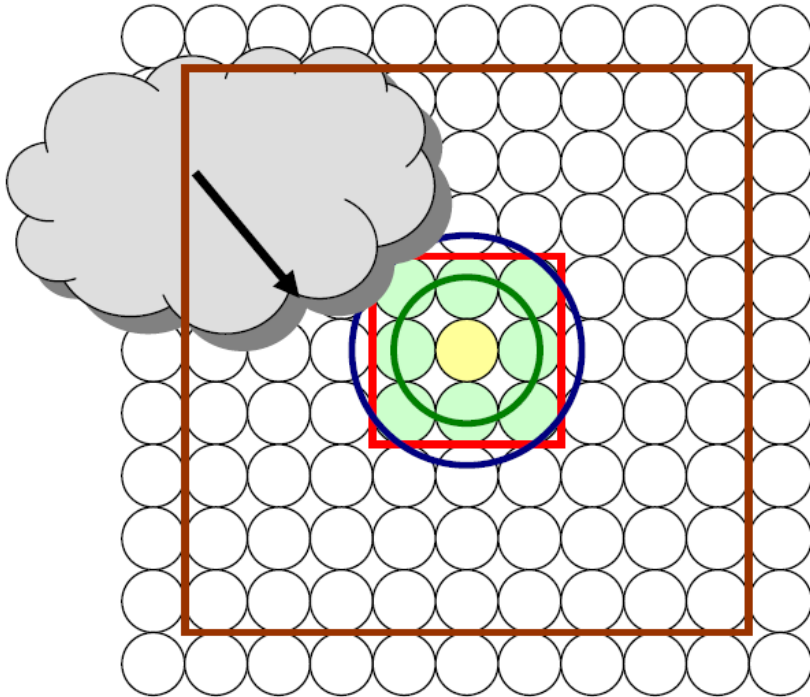
JMA's gap filling method used to fill the missing AIRS spectra



210.0 228.0 246.0 264.0 282.0 300.0K
GOES13.vs.CRIS Collocation 02/24/2012 Ch10.7um

- 1. Large temporal range:** Collocations range across multiple LEO orbits, ~4-5 hours for daily ascending/descending orbits.
- 2. Large Tb range:** Scene Tb range from extremely cold (~210K at Ch10.7um) to very hot (~300K)

Homogeneous Scenes



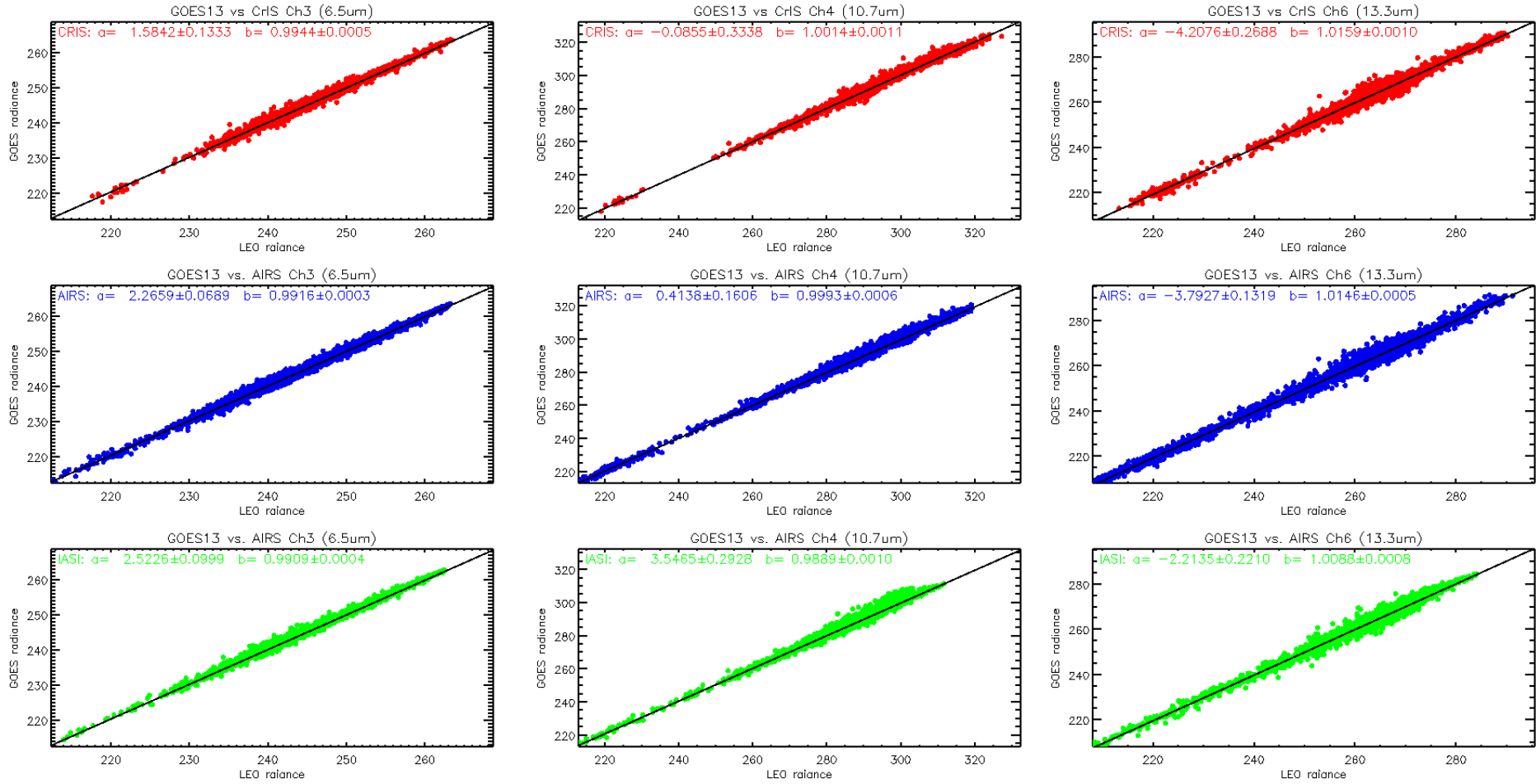
Target area:

$$\text{STDV}(\text{GEO_Rad}) / \text{Mean}(\text{GEO_Rad}) < 0.05$$

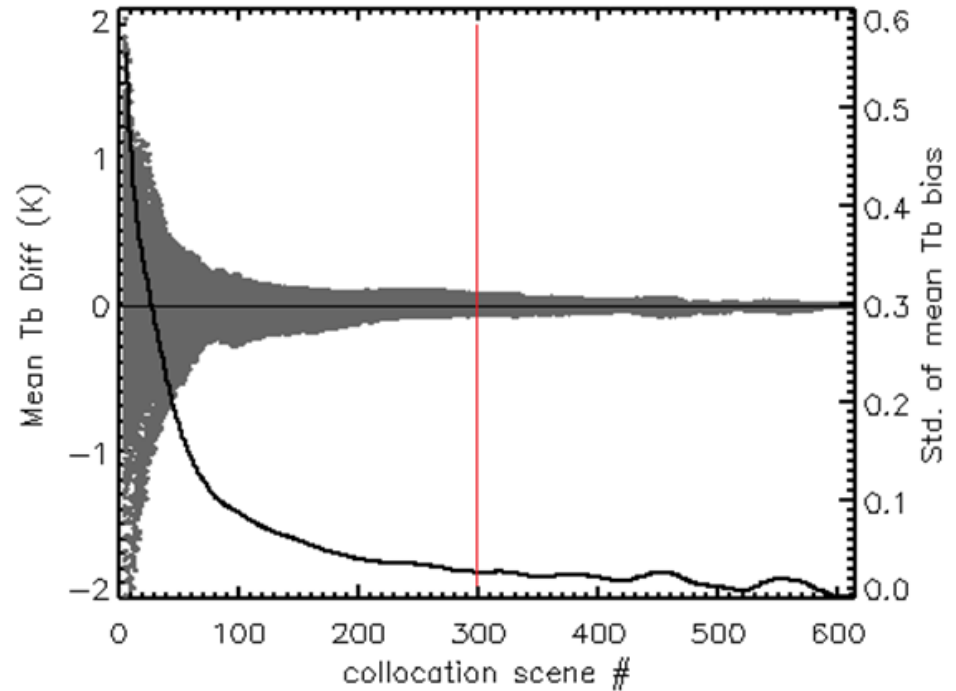
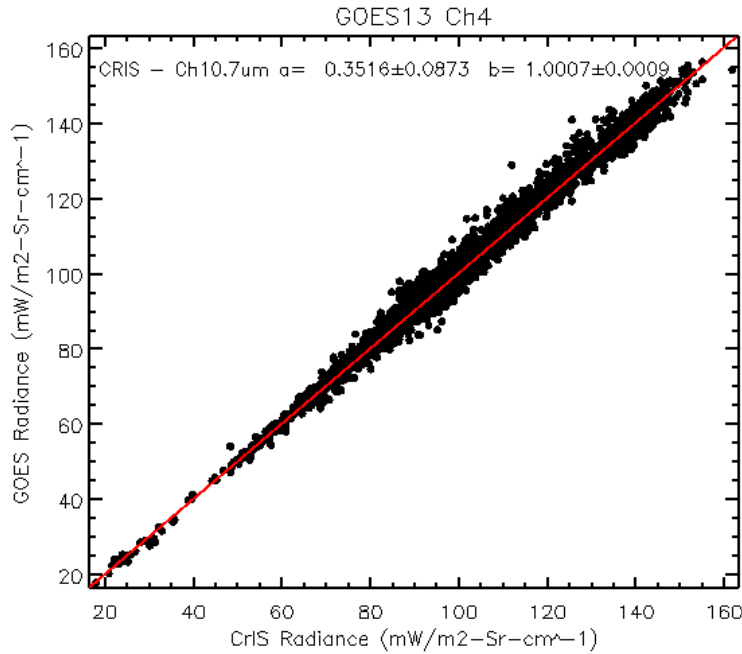
Environment area:

$$\text{STDV}(\text{GEO_Rad}) / \text{Mean}(\text{GEO_Rad}) < 0.05$$

Scatter-plot of the Day-time Collocated Homogeneous Scenes



Using mean Tb bias to characterize calibration difference



- Homogeneous scenes
- #collocation pixel > 300
- Tb bias is of Gaussian distribution

	Ch6.5um	Ch10.7um	Ch13.3um
Typical scene	245K	284K	267K

Double difference

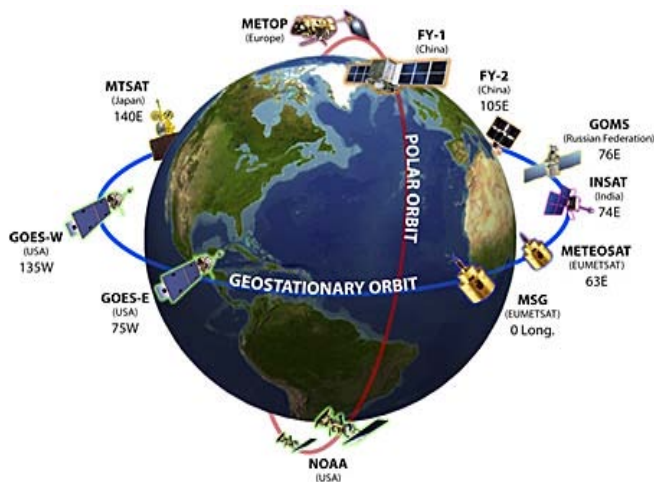
Using GOES measurements as the transfer:

$$LEO_{A,t1} - LEO_{B,t2} = (LEO_{A,t1} - GEO_{t1}) - (LEO_{B,t2} - GEO_{t2}) - (GEO_{t2} - GEO_{t1}) + \varepsilon$$

A and B are two LEO instruments with equatorial crossing times at t1 and t2, respectively.

GEO_{t1} and GEO_{t2} are the GOES measurements at t1 and t2 time.

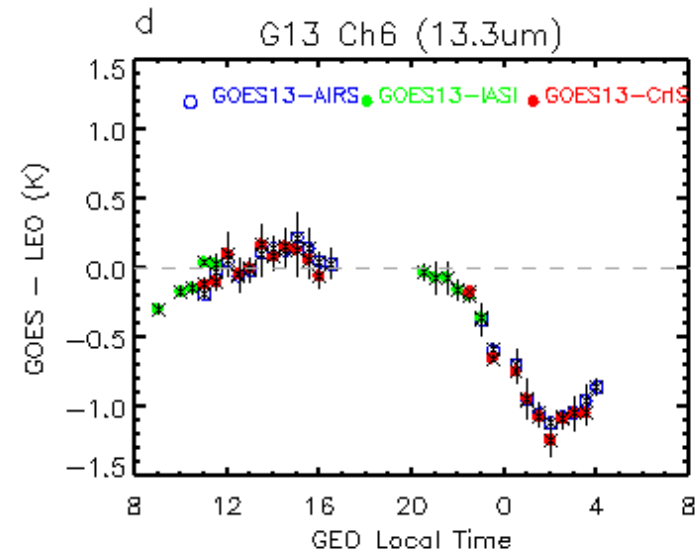
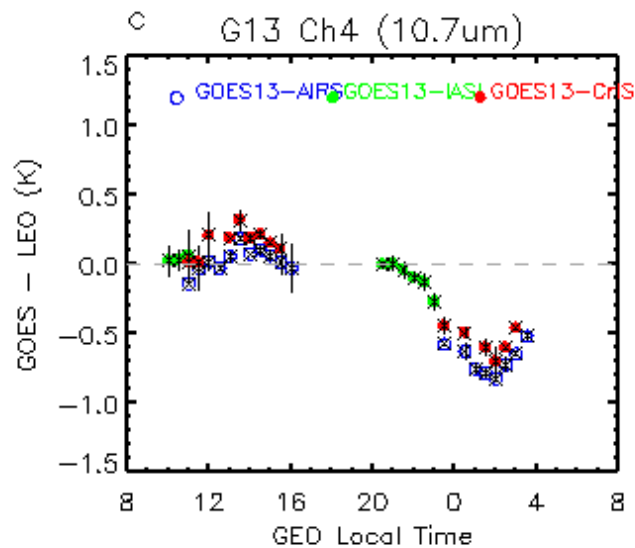
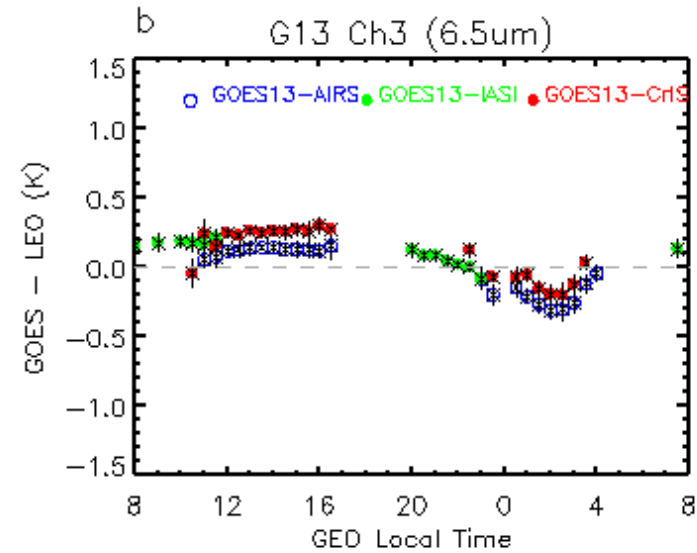
ε is the uncertainty of GEO-LEO inter-calibration algorithm



Instrument/ Satellite	LECT– ascending node	LECT – descending node
AIRS/Aqua	1:30pm	1:30am
CrIS/Soumi-NPP	1:30pm	1:30am
IASI/Metop-A	9:30pm	9:30am

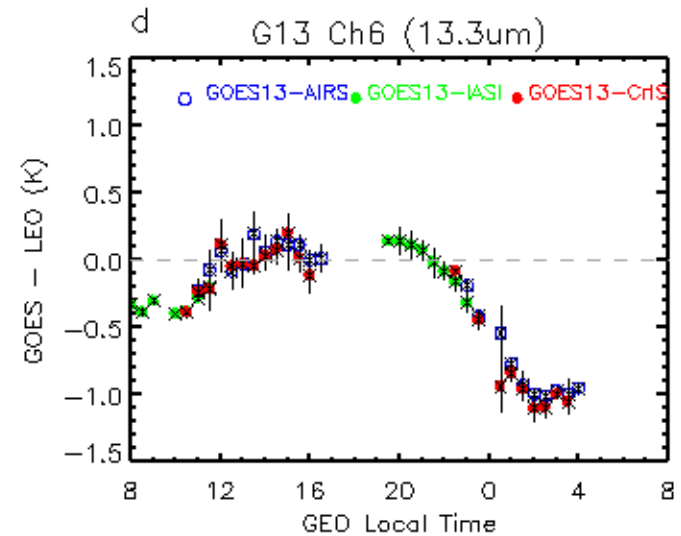
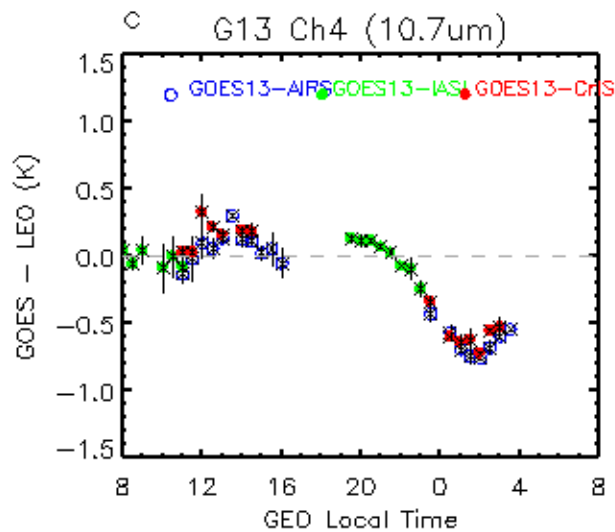
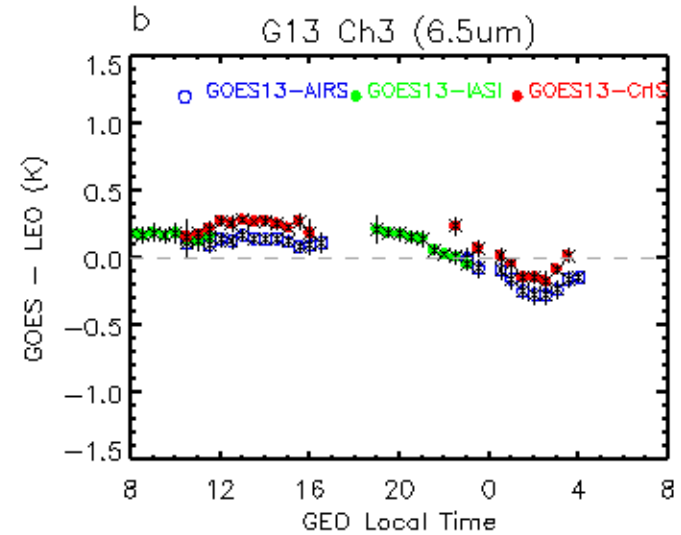
Diurnal Variation – 1

Data: 04/18/2012 – 05/28/2012



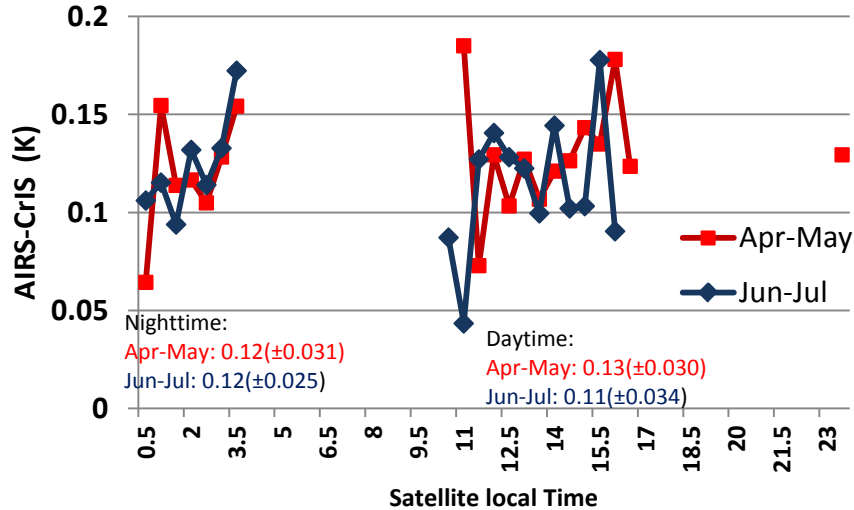
Diurnal Variation – 2

Data: 06/2/2012 – 07/12/2012

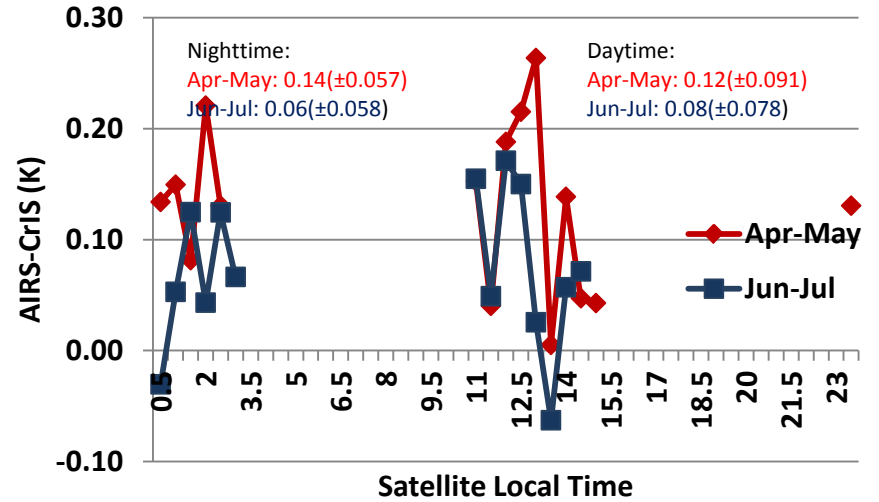


ARIS-CrIS (diurnal variation)

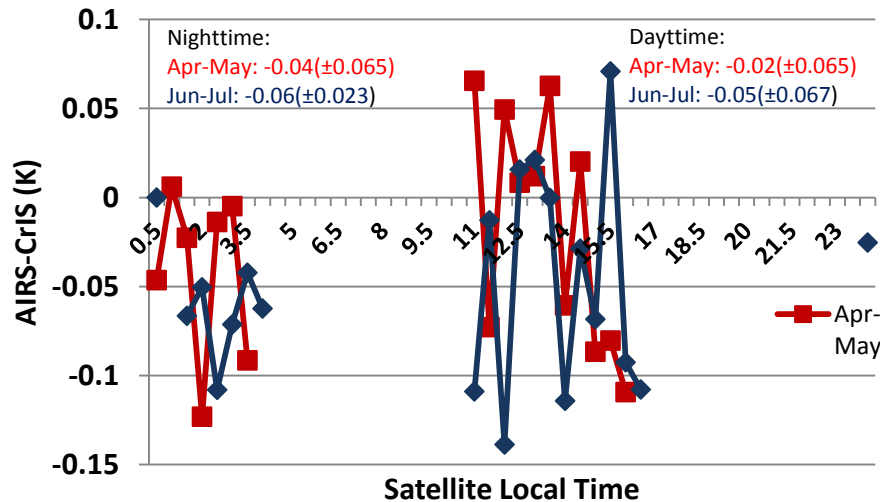
Ch3(6.5um) AIRS-CrIS



Ch4(10.7um) AIRS-CrIS

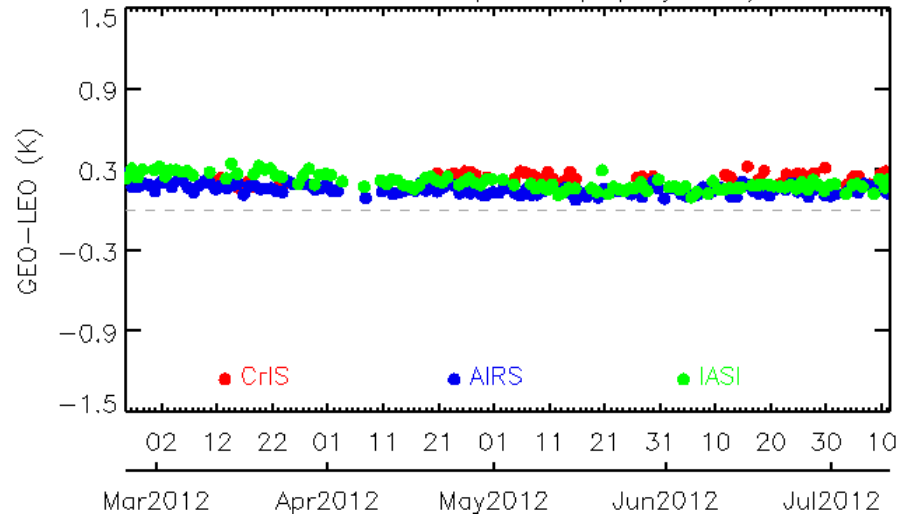


Ch6(13.3um) AIRS-CrIS

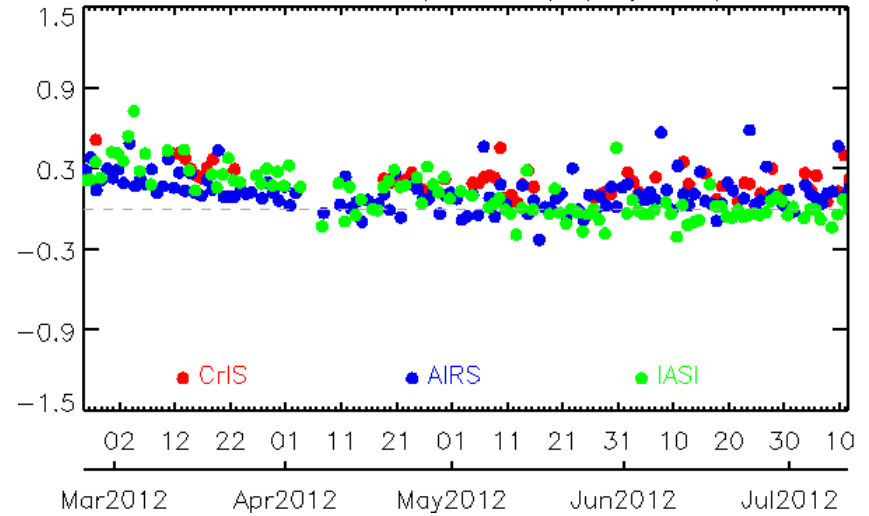


Time-Series of GEO-LEO Tb Difference

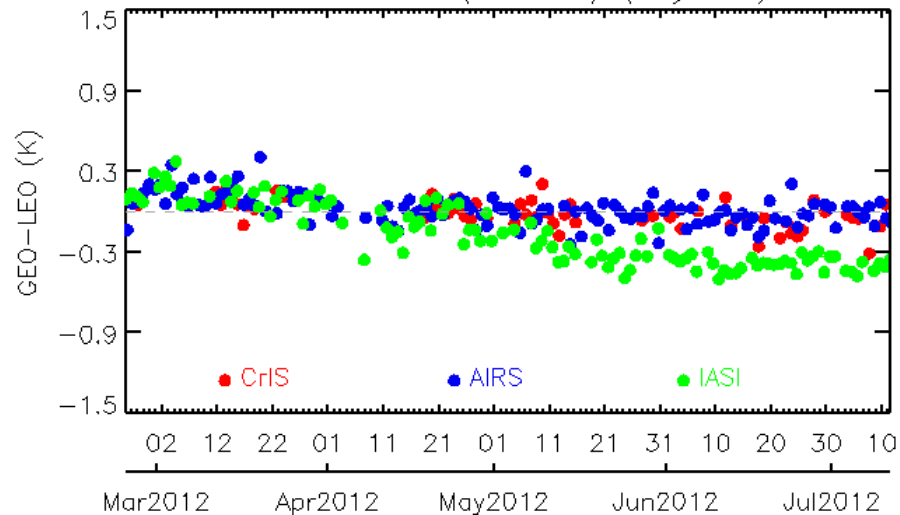
GOES13 Ch3 (6.5um) (Daytime)



GOES13 Ch4 (10.7um) (Daytime)



GOES13 Ch6 (13.3um) (Daytime)





Summary

- Consistent diurnal Tb difference in between AIRS and CrIS
- The difference among AIRS/CrIS/IASI in general is less than 0.2K
- AIRS is slightly warmer than CrIS at $\sim 0.2\text{K}$ at Ch6.5um
- AIRS is slightly warmer than CrIS at Ch10.3um, however, the Tb difference seems smaller at Jun-July than Apr-May at night-time data
- Among the three GOES IR channels, Tb difference between AIRS and CrIS is smallest at Ch13.3um
- CrIS overall radiometric calibration accuracy is very stable and comparable with AIRS/IASI during the study period



GSICS Users Messaging Service

- Linked at WMO GSICS portal and GSCIS GCC website

<http://gsics.wmo.int>

http://www.star.nesdis.noaa.gov/s_mcd/GCC/index.php



The screenshot shows the GSICS Portal website. The main content area features a diagram titled "GSICS in the Global Observing System" which illustrates the integration of various satellite systems (CGMS, Global Observing System, etc.) into the GSICS framework. A red circle highlights the "On line user registration to receive GSICS information" link at the bottom of the page. A red arrow points from this link down to the taskbar.



The screenshot shows the GSICS Coordination Center (GCC) website. The main content area features a diagram titled "GSICS Coordination Center" which illustrates the roles and responsibilities of various satellite systems (GOES, METOP, etc.) in the GSICS framework. A red circle highlights the "Sign Up for the GSICS User Messaging Service" link in the left sidebar. A red arrow points from this link down to the taskbar.



GSICS Users Messaging Service



GSICS User Messaging Service

Welcome to the Global Space-based Inter-Calibration System ([GSICS](#))! This form is your entry into the world of official GSICS communication.

Don't worry, you will not need yet another user name and password here. Just supply the required information, select from the options, and click on the subscribe button.

By registering, you will receive the GSICS quarterly newsletter. The other available options allow you to fine tune what additional GSICS information you want to receive. If you later wish to change your choices or alter any of the supplied contact information, a link for doing so will be available in all our emails.

We will never share your contact information with anyone else and every email you receive will contain a link to unsubscribe.

Thank you for your interest in GSICS activities.

The GSICS Coordination Center
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 - GSICS Quarterly newsletter
 - Options for other GSICs information