



# JMA Inter-Calibration Activities under WMO GSICS Framework

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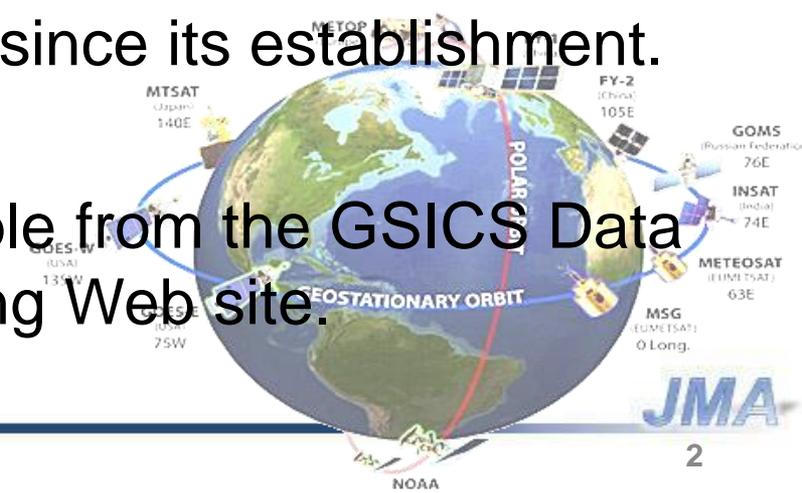
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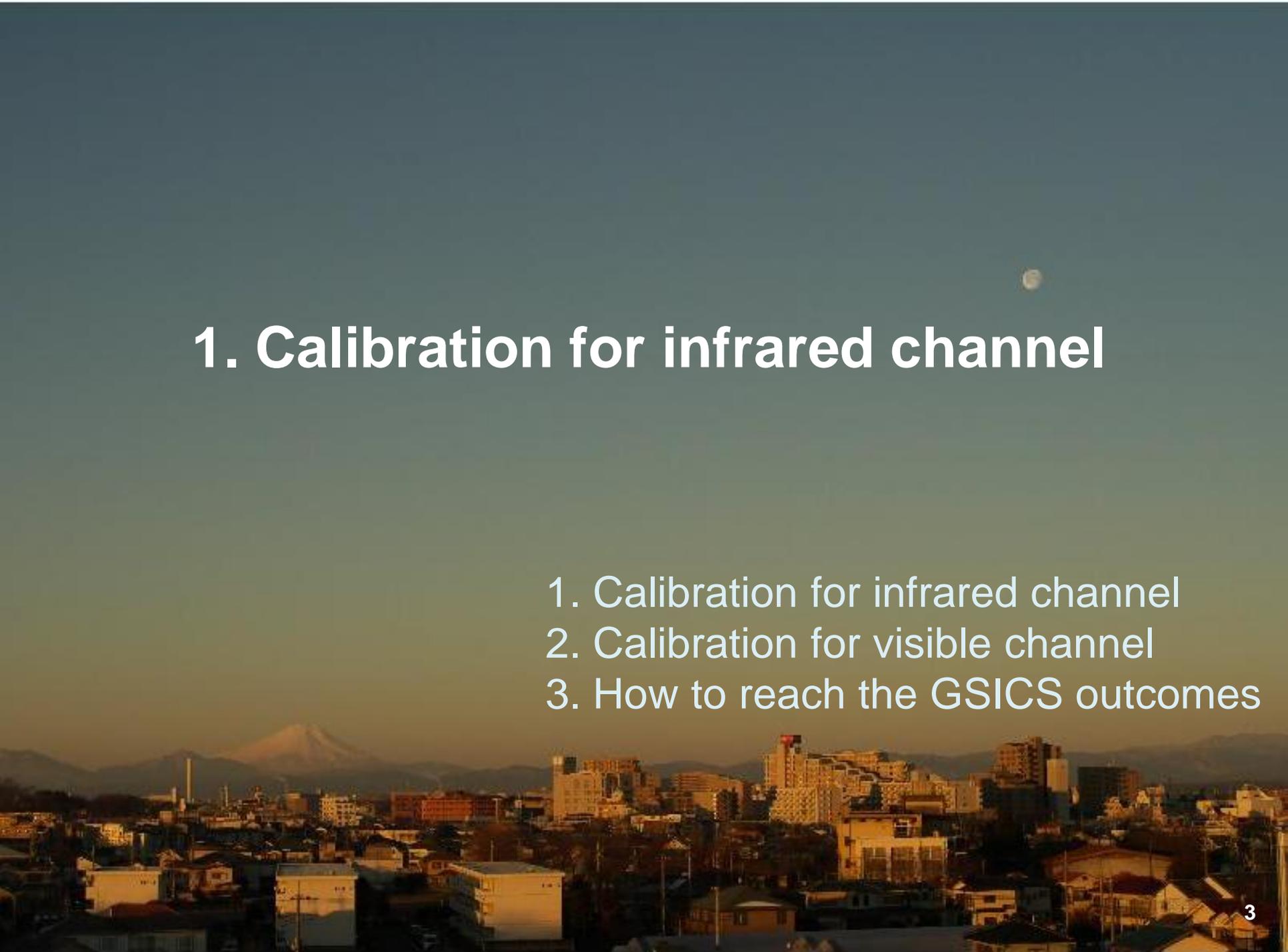
06 Dec. 2011

for The Second Asia/Oceania Meteorological Satellite Users' Conference

# What is GSICS?

- Global Space-based Inter-Calibration System (GSICS)
- WMO Space Programme
  - GSICS Implementation Plan and Program formally endorsed at CGMS 34 (Nov. 2006)
- Goal - Ensure consistent accuracy among space-based observations worldwide and contributing to weather forecast, climate monitoring and environmental applications.
- JMA has cooperated the GSICS since its establishment.
- Calibration outcomes are available from the GSICS Data Servers and calibration monitoring Web site.





# 1. Calibration for infrared channel

1. Calibration for infrared channel
2. Calibration for visible channel
3. How to reach the GSICS outcomes

# Inter-calibration methodology(1)

## Collocation

- AIRS/IASI FOV ~ 3x3 MTSAT pixels

- **Criteria**

- **Time**

$$|t_{leo} - t_{geo}| < dt_{max}$$

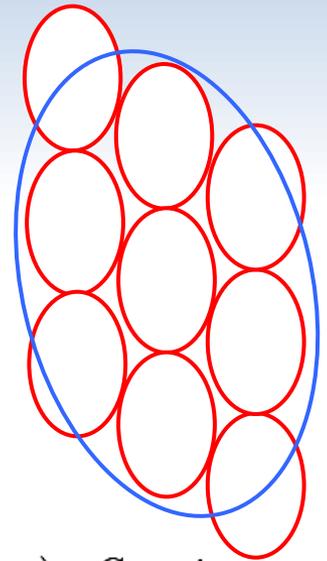
- **SZA**

$$|\cos \theta_{1leo} / \cos \theta_{geo} - 1| < \theta_{max}$$

- **Uniformity**

$$STDV(I_{geo})_{9 \times 9} < STDV_{max}$$

$$|\text{AVE}(I_{geo})_{3 \times 3} - \text{AVE}(I_{geo})_{9 \times 9}| < \frac{81 - 9}{9(9 - 1)} STDV(I_{geo})_{9 \times 9} \times \text{Gaussian}$$

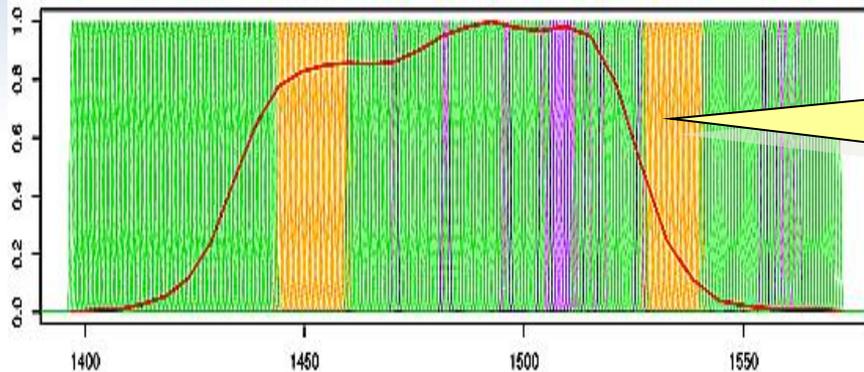


MTSAT-2 channel	Condition	dt <sub>max</sub> (minutes)	MaxRate OptPathDiff	MaxSTDV (mW.m <sup>-2</sup> .sr <sup>-1</sup> .cm)	Gaussian
IR1 (10.8 μm)	Clear	5	0.01	1.65	2
	Cloudy	5	0.03	3.31	2
IR2 (12.0 μm)	Clear	5	0.01	1.82	2
	Cloudy	5	0.03	3.64	2
IR3 (6.8 μm)	All	5	0.01	0.311	1
IR4 (3.8 μm)	Clear	5	0.01	0.0151	2
	Cloudy	5	0.03	0.0302	2

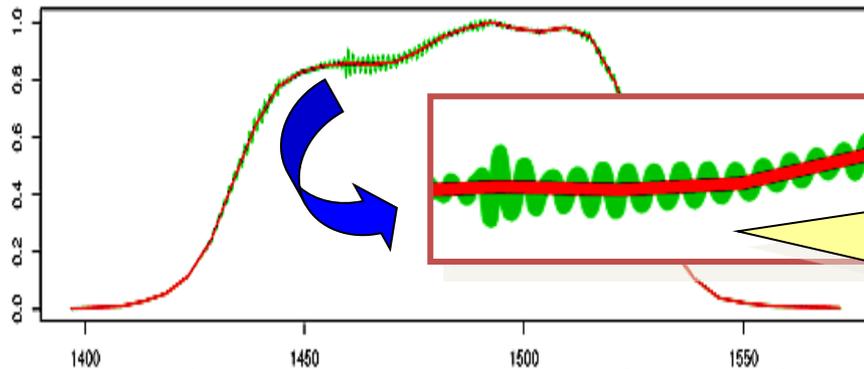
\* Clear if TB(IR1) > 275 K

# Inter-calibration methodology(2)

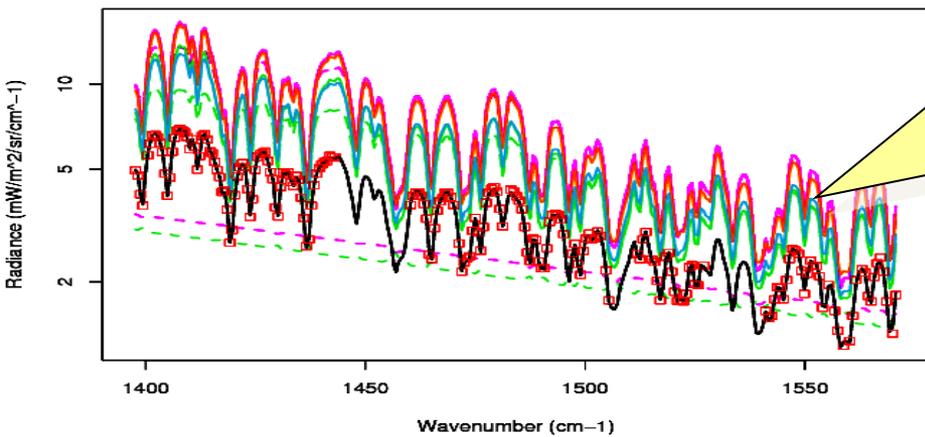
## GEO Radiance Estimation from Hyper Sounder Obs.



1. **“Gap channels”** introduced  
To fill the spectral gaps of a LEO hyper sounder



2. **“Super channel”** generated  
To imitate a GEO channel from the hyper and gap channels by the “constraint method”



3. **Radiances of missing hyper and gap channels** estimated by using valid hyper channel observations and beforehand simulated radiances for 8 profiles

# Intercalibration outcomes

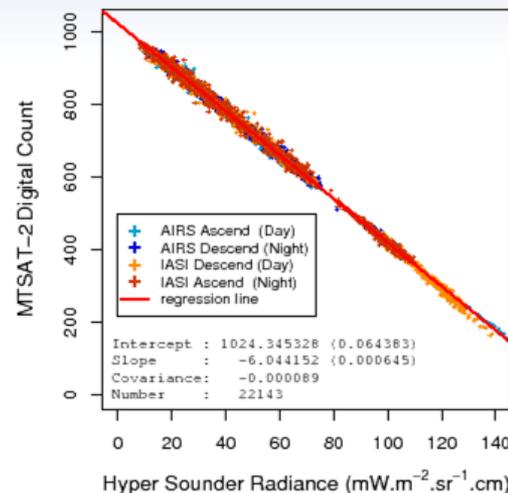
- Statistics

- Regression coefficients
- TB residuals at references
  - 290 K, 250 K and 220 K
- All MTSAT-1R/2 IR channels

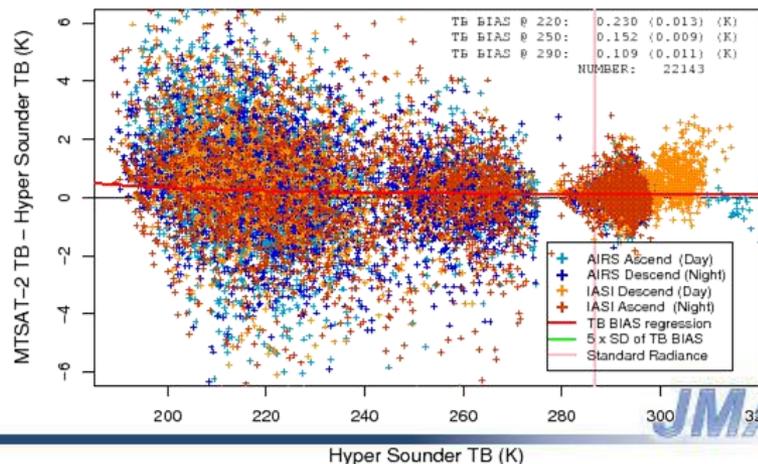
- Showcase

- Temporal sequence charts
- Scatter plots
- GSICS Correction

MTSAT-2 IR1 vs. AQUA/AIRS, METOP-A/IASI  
01 Oct 2011 (Period: 16 Sep 2011 to 15 Oct 2011)



MTSAT-2 IR1 vs. AQUA/AIRS, METOP-A/IASI  
01 Oct 2011 (Period: 16 Sep 2011 to 15 Oct 2011)



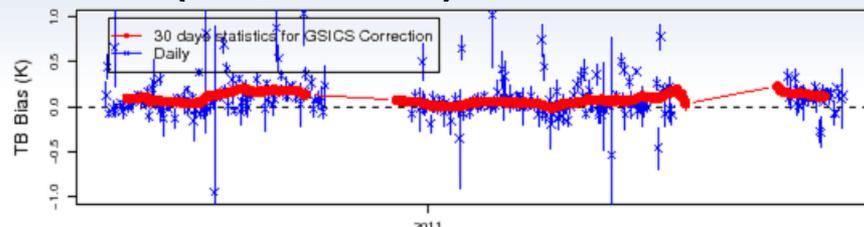
# Diagnosis

- Midnight calibration error
  - MTSAT-2 infrared channels have TB bias compared with IASI and AIRS in eclipse season midnight.
  - This error is significant for 12.0um(IR2) and moderate for 10.8um(IR1) and 3.8um(IR4).
  - Maximum bias for the 12.0um is around +1.0K.

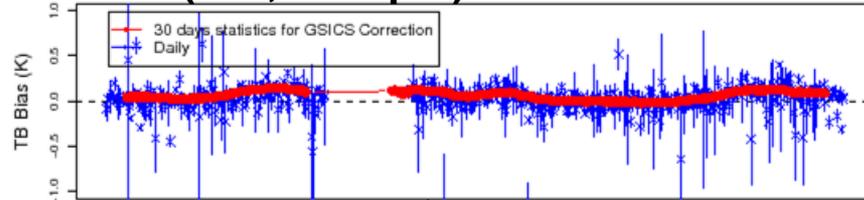
\* Bias = MTSAT2 – AIRS/IASI

## MTSAT-2 12.0um(IR2) TB bias at Std. Radiance (285.94K)

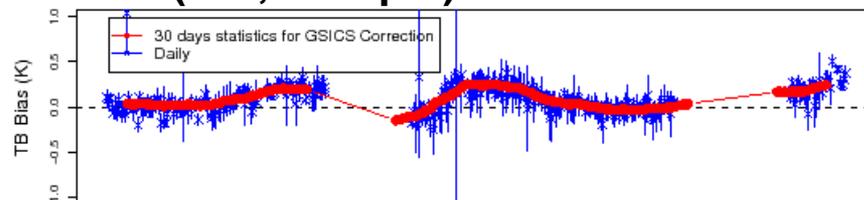
### IASI (des,09:30am)



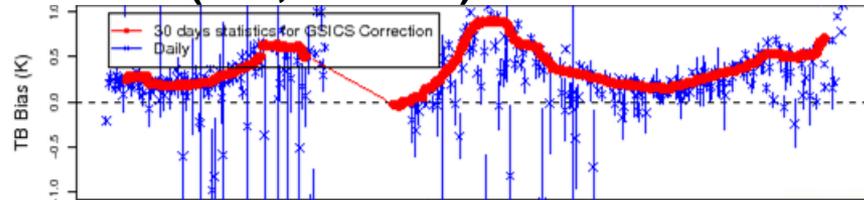
### AIRS (asc,01:30pm)



### IASI (asc,09:30pm)



### AIRS (des,01:30am)



May 2010

Jan.2011

Oct.

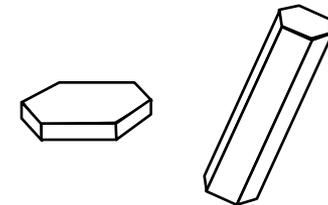
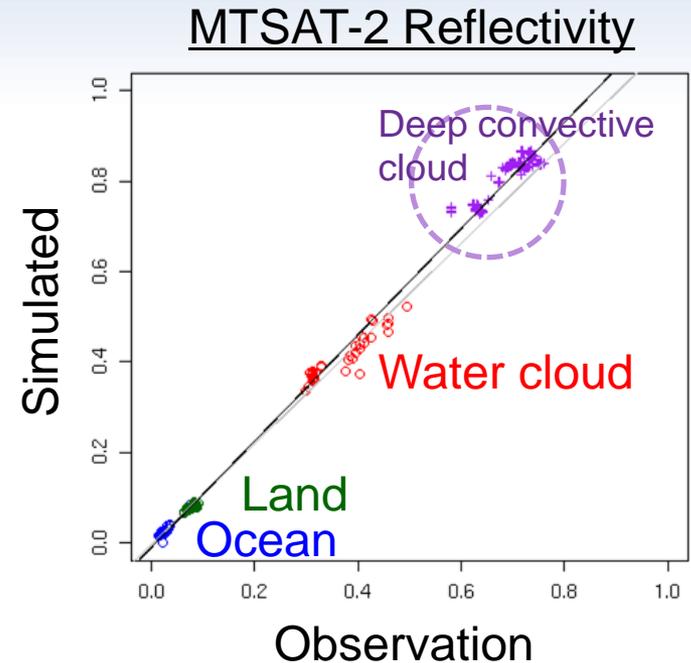


## 2. Calibration for visible channel

1. Calibration for infrared channel
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# Calibration methodology

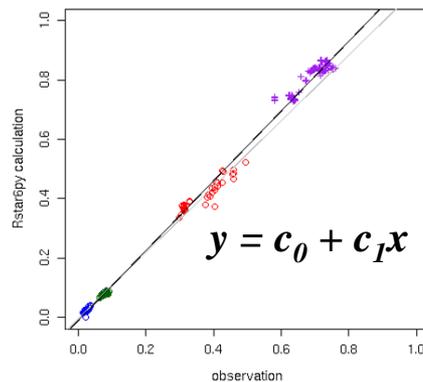
- Vicarious calibration approach
- Observation data is evaluated via radiative transfer model (RSTAR).
- Cloud-free ocean, Cloud-free land and Water cloud top, are adopted as simulation targets.
- Cloud and aerosol optical parameters are retrieved from MODIS L1B.
  - Cloud analysis tool (CAPCOM)
  - Aerosol analysis tool (REAP)
- Deep convective cloud target is current issue.
  - Scattering process by non-spherical ice particles are investigated.
  - Light scattering analysis tool(LISAS\_goa)



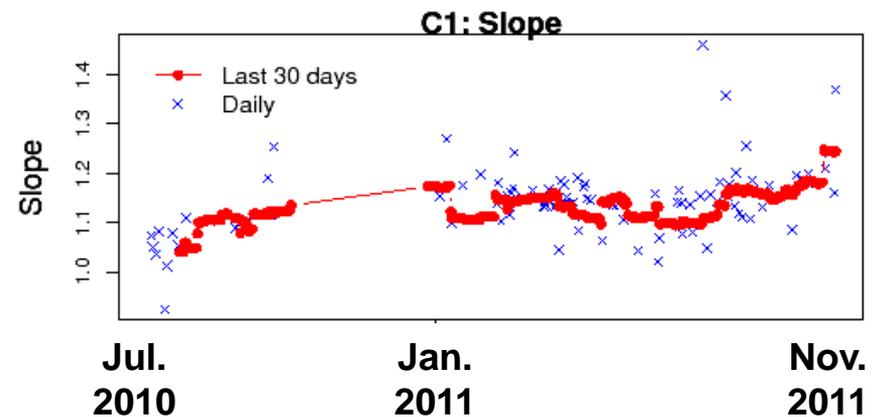
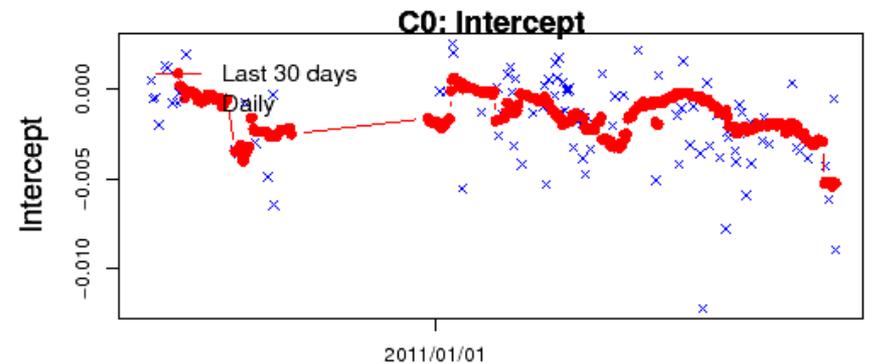
Visible calibration related works have been pursued with collaborative researches with Atmosphere and Ocean Research Institute (AORI), the University of Tokyo and Center for Environmental Remote Sensing, Chiba University (CEReS).

# Calibration outcomes

- Statistics
  - Regression coefficients
- Showcase
  - Temporal sequence charts
  - Scatter plots
  - Statistics in text (CSV)



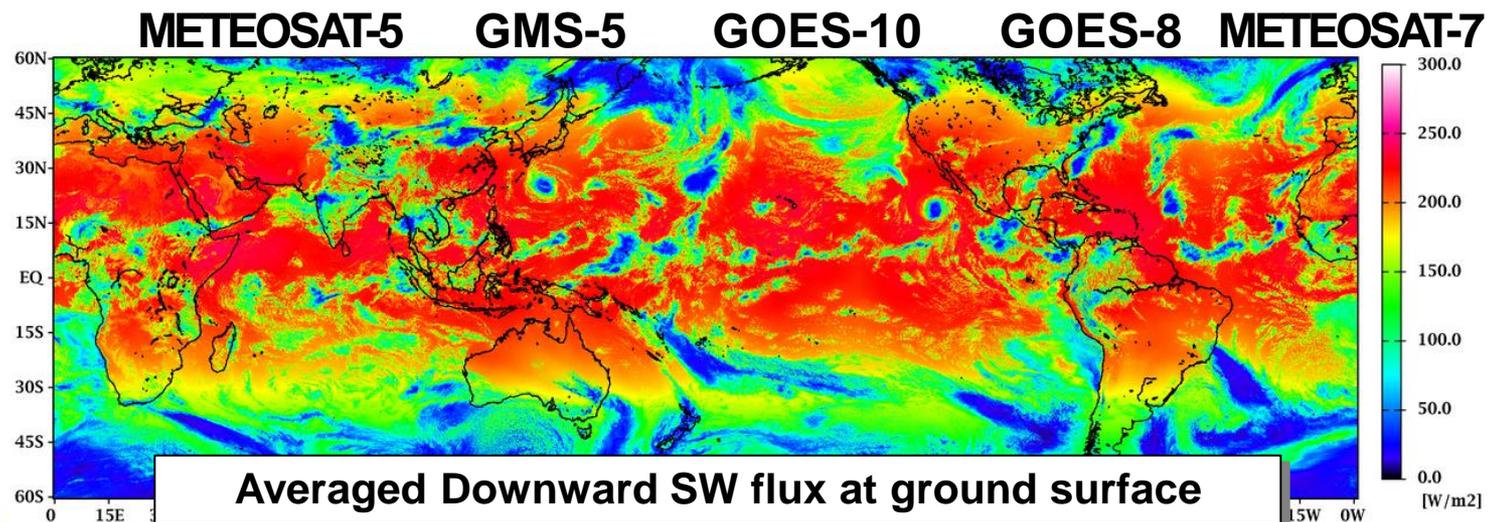
MTSAT-2 Visible  
calibration coeff.



# Application

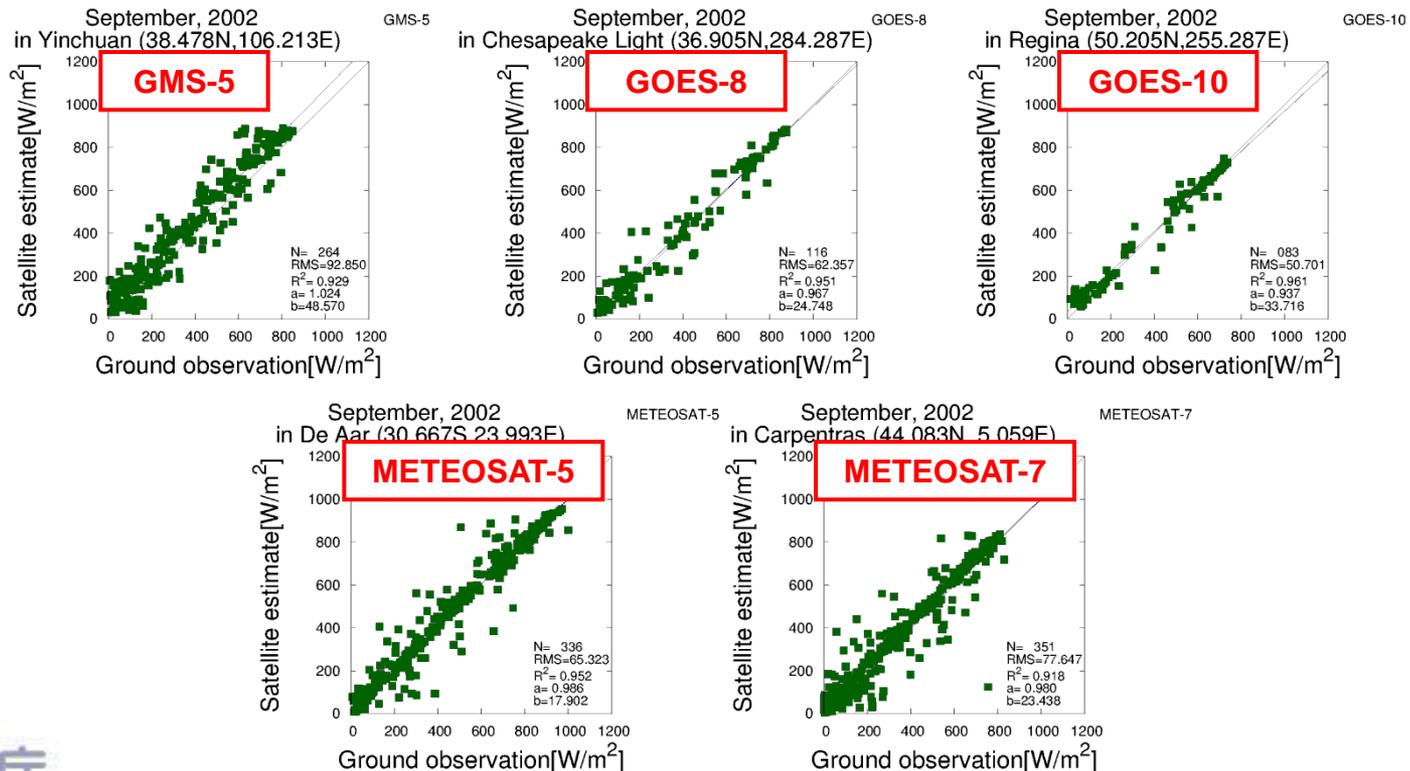
## *Downward shortwave flux at ground surface*

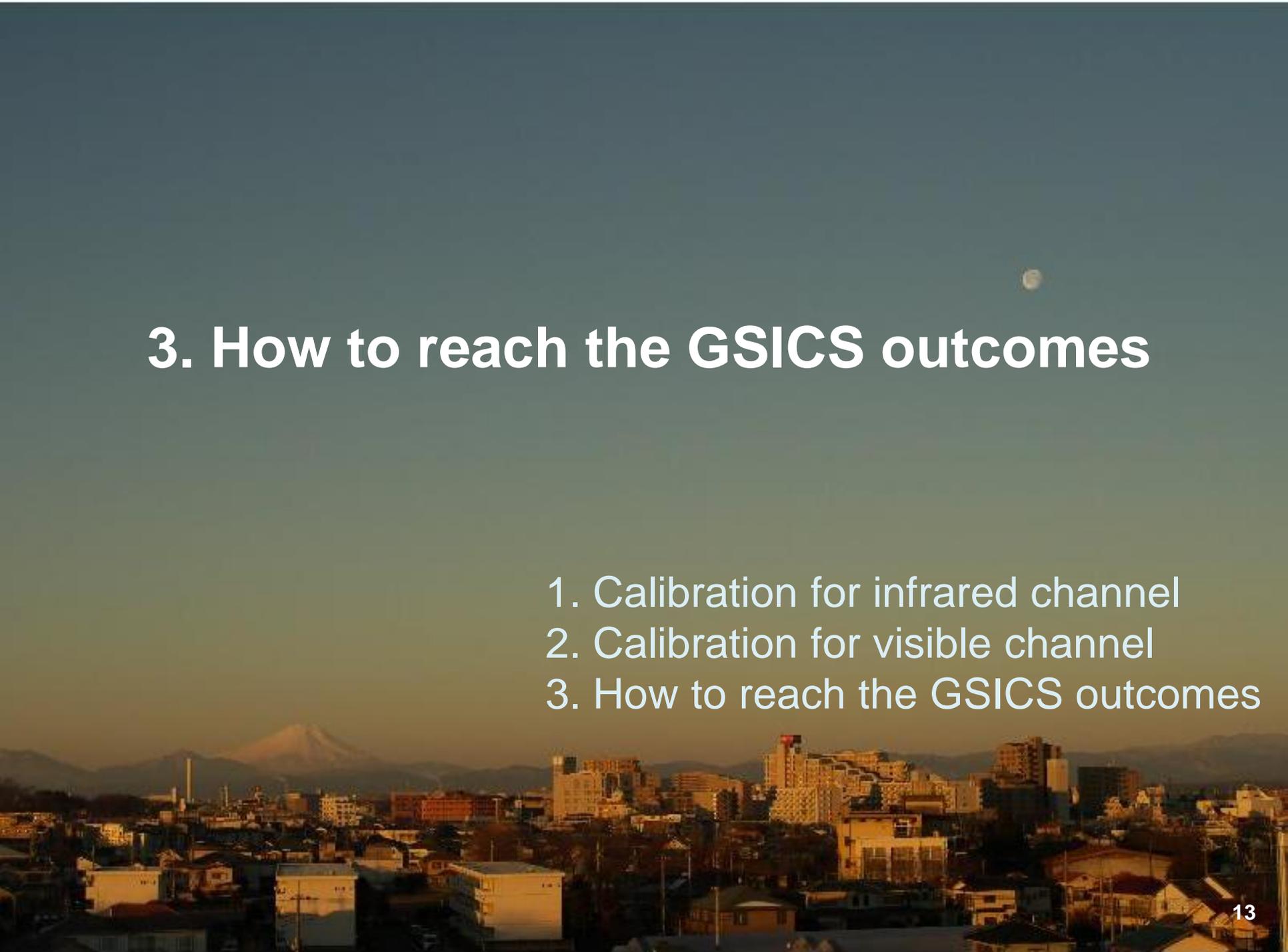
- The calibration method can be applicable to other GEO satellite imagers, such as GOES and METEOSAT.
- Downward solar flux can be retrieved from the GEO satellite images and compositted.
- There seems to be no “gap” on the composite solar flux image.
- All GEO satellite data looks well calibrated.



# Validation

- Comparison with BSRN and SKYNET
  - The composite solar flux is compared with ground observation, BSRN and SKYNET to evaluate the calibration technique.
  - Following figures show good consistency between the retrieved and observed solar fluxes.



A cityscape at sunset with a mountain in the background and a moon in the sky. The sky is a gradient of blue and orange, with a small crescent moon visible in the upper right. The city below is illuminated by the warm light of the setting sun, with buildings and houses visible. A large mountain, likely Mount Fuji, is visible in the distance on the left side of the frame.

# 3. How to reach the GSICS outcomes

1. Calibration for infrared channel
2. Calibration for visible channel
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# GSICS portal and Wiki

The image shows a screenshot of the GSICS Wiki portal. At the top, there is a banner with the GSICS logo (a satellite orbiting Earth) and the text "GSICS Global Space-based Inter-Calibration System". Below the banner, the page title is "GSICS Wiki > Home web > WebHome (18 Apr 2011, MarkRomer)". There is a "Jump" search box in the top right corner. Below the title, there are tags and a "Welcome to the GSICS Wiki" message. The main content area shows a page titled "Data and Products Servers" with a breadcrumb trail "GSICS Wiki > Development web > DataAndProductsServers (15 Sep 2010, AleksandarJelenak)". The page content includes a list of "Currently operating servers of GSICS data:" with two URLs: <http://gsics.eumetsat.int/thredds> and <http://gsics.nesdis.noaa.gov:8080/thredds>. A red box highlights the "How" link in the left sidebar. A purple speech bubble points to the first URL with the text "GSICS Correction for MTSAT is in EUMETSAT server." The bottom of the page has a blue footer with navigation links: "Edit | Attach | Print version | History: r2 < r1 | View wiki text | Edit wiki text | More topic actions".

GSICS Global Space-based Inter-Calibration System

Jump

to examine and harmonize data from  
to improve climate mo

GSICS Wiki > Home web > WebHome (18 Apr 2011, MarkRomer)

Tags:  + create new tag, view all tags

Welcome to the GSICS Wiki

This wiki is  
(GSICS [GSICS](#)  
operational

If you a

...A Use GSICS Wiki > Development web > DataAndProductsServers (15 Sep 2010, AleksandarJelenak)

Jump

to examine and harmonize dat  
to improve climat

This site is  
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some links

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Data and Products Serv

Currently operating servers of GSICS data:

- <http://gsics.eumetsat.int/thredds>
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How

Time

Edit | Attach | Print version | History: r2 < r1 | View wiki text | Edit wiki text | More topic actions

**GSICS Correction for MTSAT is in EUMETSAT server.**

# How to get GSICS Correction

Catalog <http://gsics.eumetsat.int/thredds/catalog.html>

Dataset	Size	Last Modified
 GSICS Source Data		--
 <u>EUMETSAT/</u>		--
 <u>CNES/</u>		--
 <u>JMA/</u>		--
 GSICS Intermediate Data		
 <u>EUMETSAT/</u>		
 <u>JMA/</u>		
 GSICS Products		
 <u>EUMETSAT/</u>		
 <u>JMA/</u>		
 GRAS COLLABORATED DATA SETS		

## GSICS Correction:

Calibration information to link satellite observation to radiance or brightness temperature(TBB).

- For Infrared channels
- NetCDF format
- Calibration coefficients and LUT (Digital number to TBB) are contained.

# Summary

- Infrared channel
  - Inter-calibration has been performed by using hyper-sounder AIRS and IASI observations.
  - Calibration monitoring page and calibration dataset are available on JMA/MSC Web site and GSICS data server, respectively.
- Visible channel
  - JMA/MSC has developed a vicarious calibration approach using a radiative transfer model with collaborative researches with the AORI and the CEReS.
  - Calibration monitoring is available on JMA/MSC Web site.
- How to reach the GSICS outcomes



***Thank you !***

