GSICS REPORT

Summary of highlights and request for guidance from GSICS Executive Panel

CGMS-43 WMO-WP-16

Peng ZHANG (GSICS-EP Chair)
Kenneth HOLMLUND (GSICS-EP Vice-Chair)
Jérôme LAFEUILLE (Secretariat)

Outline

1. GSICS overview
2. Highlights of recent activities
3. Organization status
4. Challenges and recommendations
5. Summary and conclusions

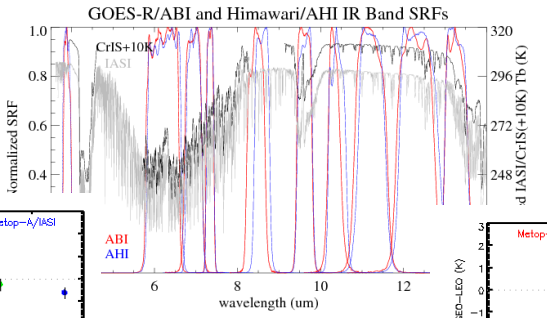
Why GSICS?

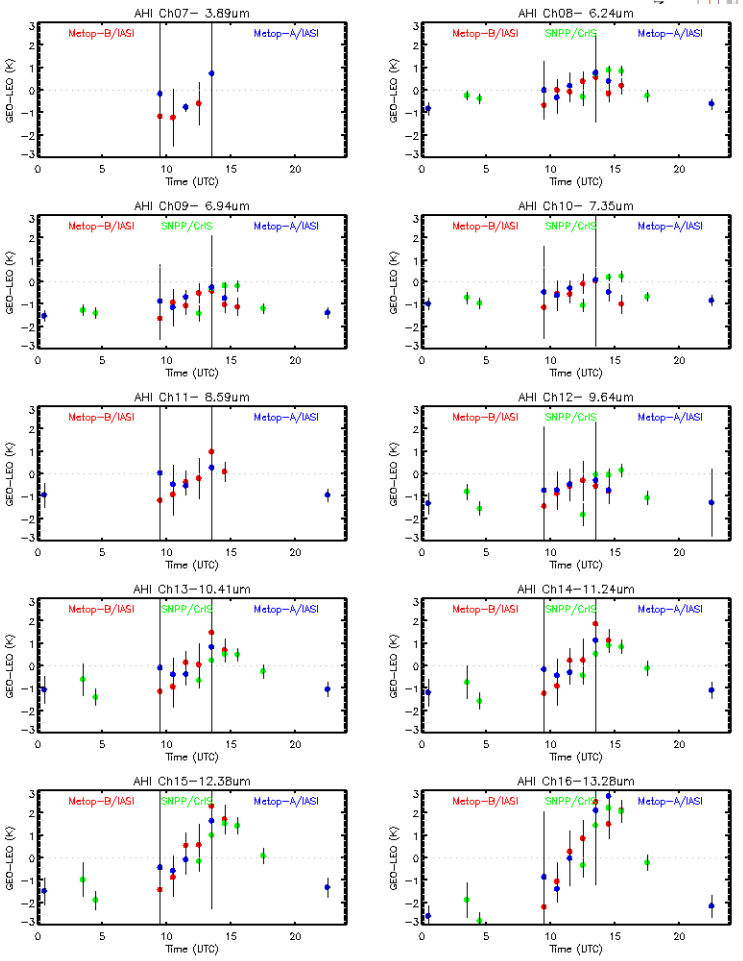
- Space-based observations required for weather and climate applications rely on multiple satellite missions from different agencies around the world
- To be reliable and interoperable, these different sources must be precisely calibrated with similar methods and common references. Poor or inhomogeneous calibration would result in degraded performance
- **GSICS members are collaborating to develop and apply "best practices" for state-of-the-art and homogeneous calibration**
- GSICS provides references, tools and guidelines, for prelaunch characterization, instrument performance monitoring, anomaly resolution, comparison of sensors, and correction if necessary.

Through GSICS satellite operators improve calibration and detect /correct anomalies

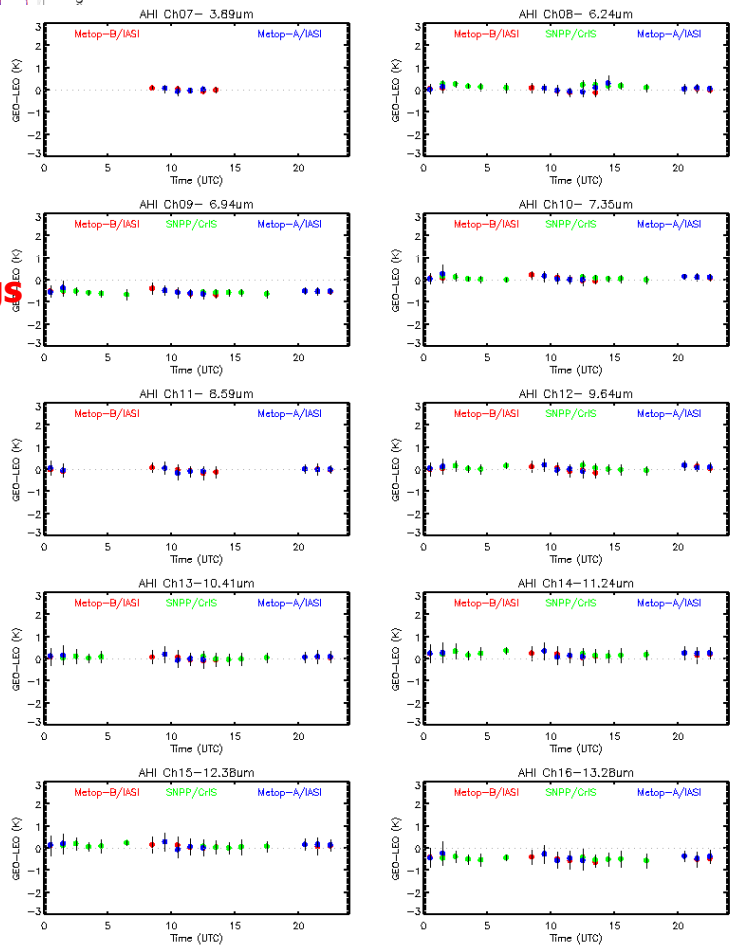
- Examples:
  - Correction of GOES IR bias through intercalibration with Metop/IASI and SNPP/CrIS
  - Adjustment of SRF of COMS/MI
  - Support to commissioning test of Himawai-8, INSAT-3D, FY-2G and FY-3C

NOAA Highlight
GEO-LEO Inter-calibration using CrIS/IASI as reference



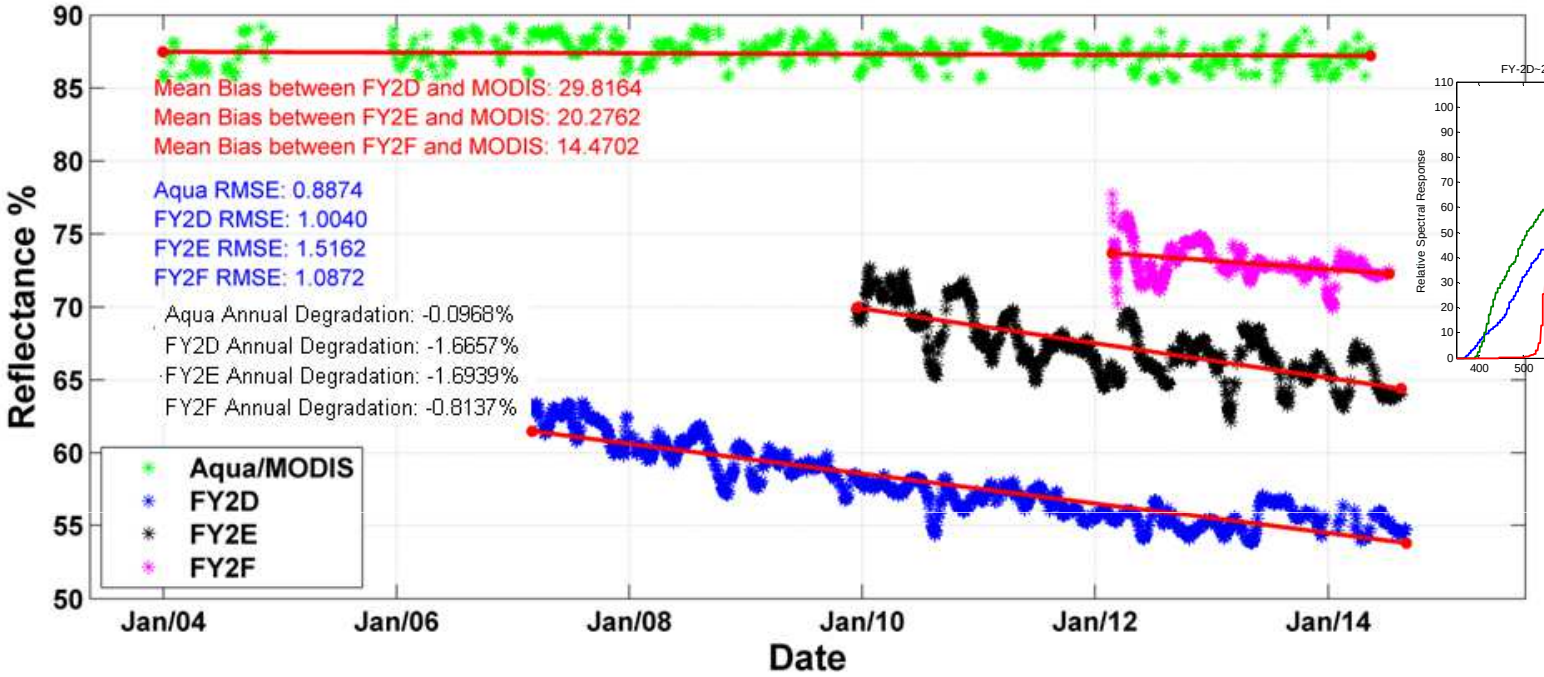


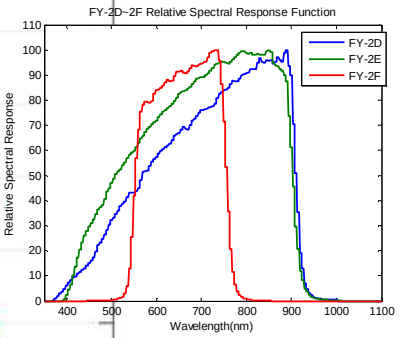
After "fixed" bugs



Courtesy.
FangFang Yu

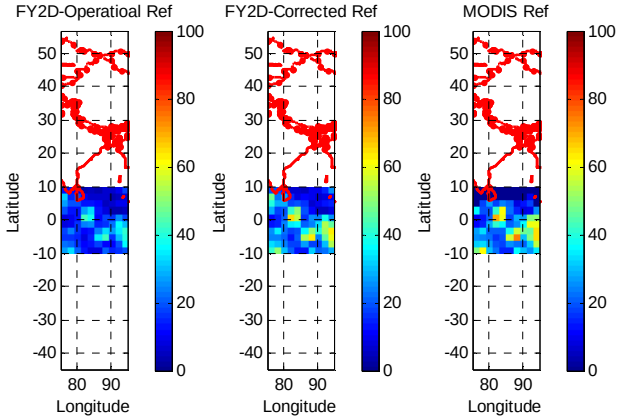
CMA Highlight: DCC monitoring for FY-2D/2E/2F



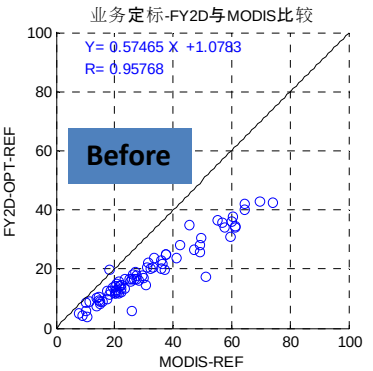


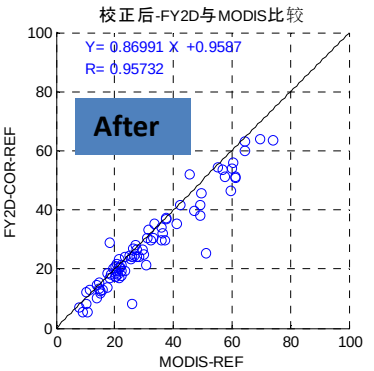
1.There is evident inconsistency between FY-2D/2E/2F and large bias with respect to MODIS.

2.There is long term degradation of FY-2 visible band.



Before and after DCC correction

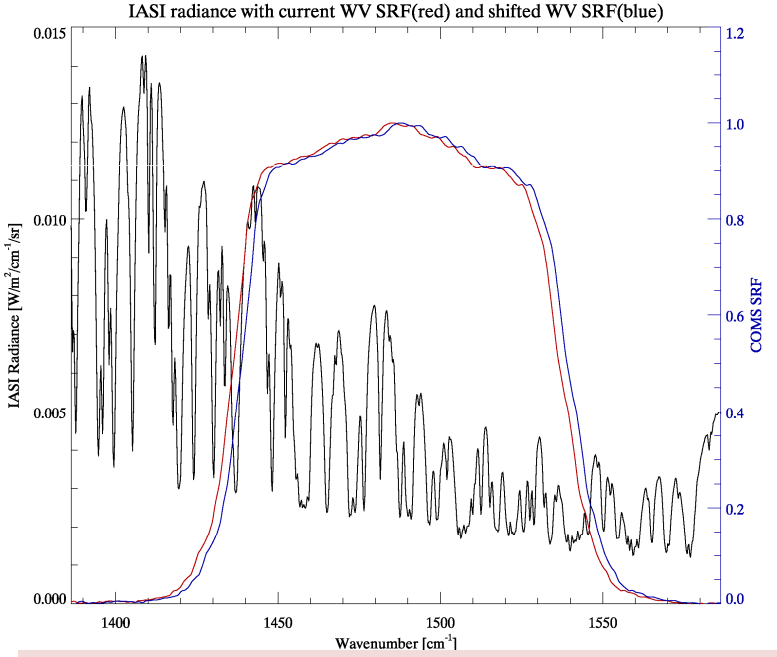


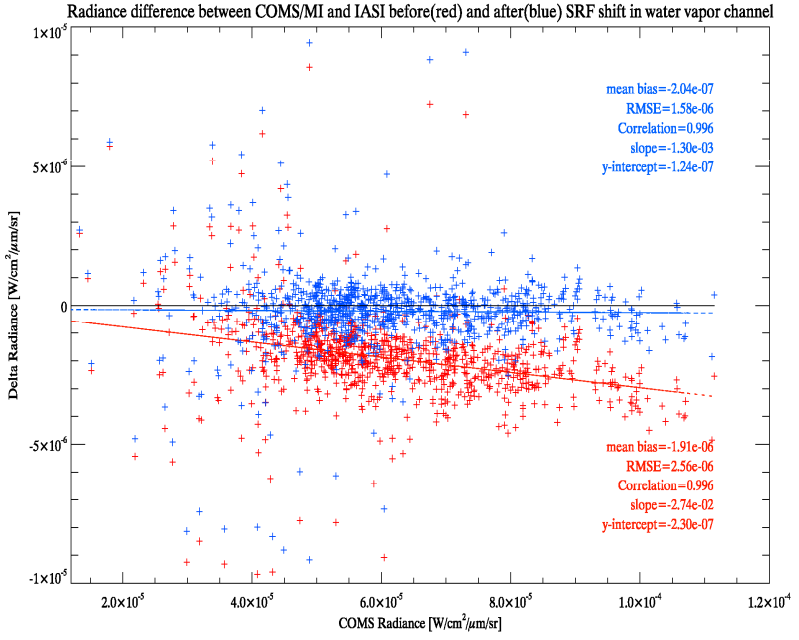


Highlights of KMA calibration activities

Cold Bias Correction in Water Vapor Channel

The radiance difference between COMS/MI and IASI as a function of the COMS/MI radiance for the data obtained before (red) and **after (blue)** the **SRF shifts**





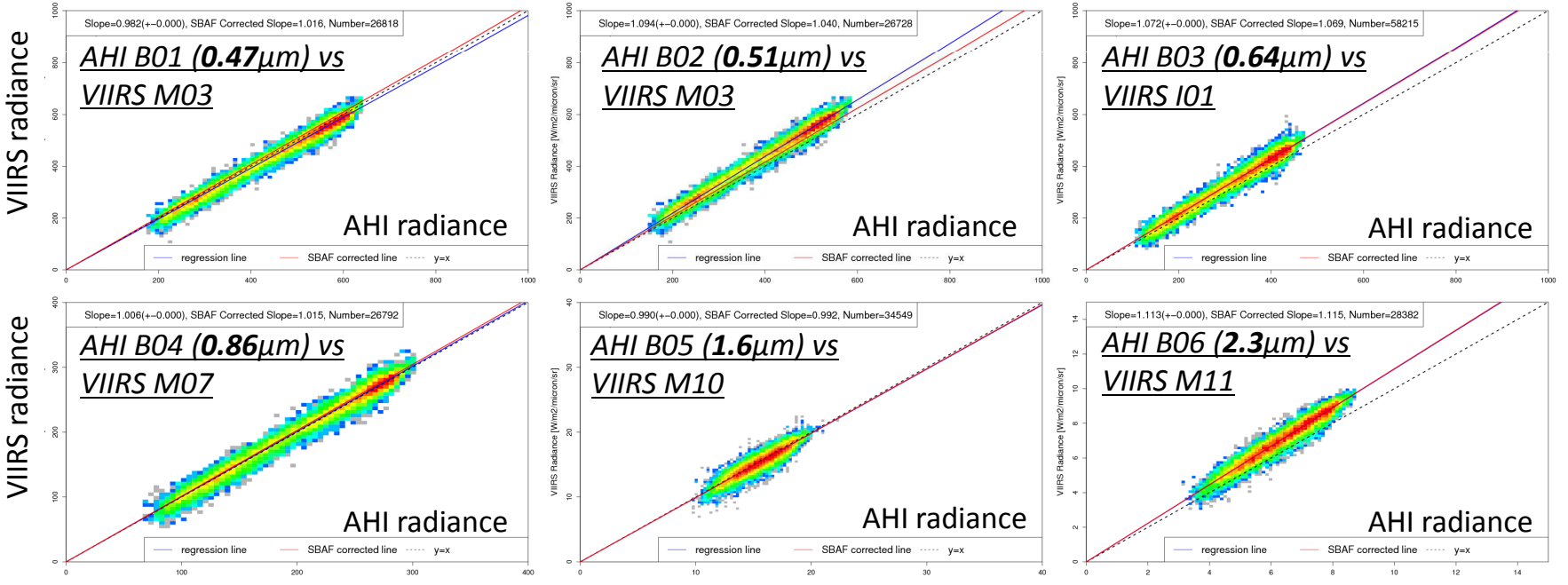
❖ **TB bias between MI and IASI reduced by ~ 0.4K (-0.71K → -0.32K)**

Highlights of JMA calibration activities

Himawari-8/AHI ray-matching with S-NPP/VIIRS

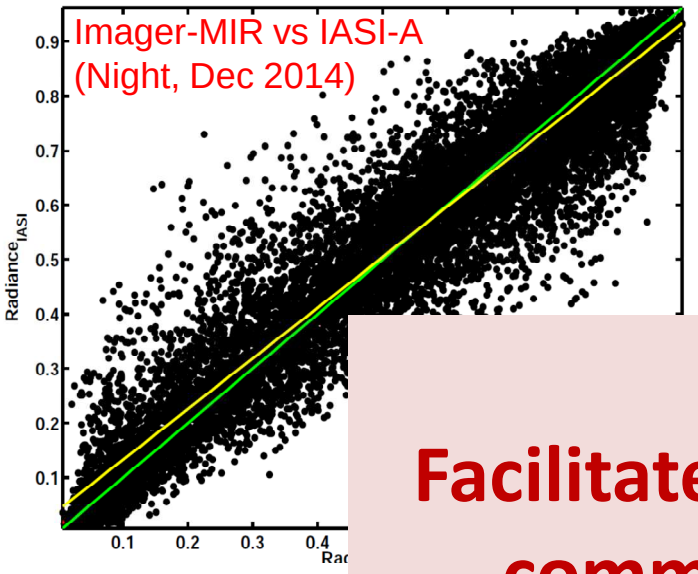
- Bands #3 (0.64μm) and #6 (2.3μm) show 5 to 10 % discrepancy
- Roughly consistent with vicarious calibration using RT simulation

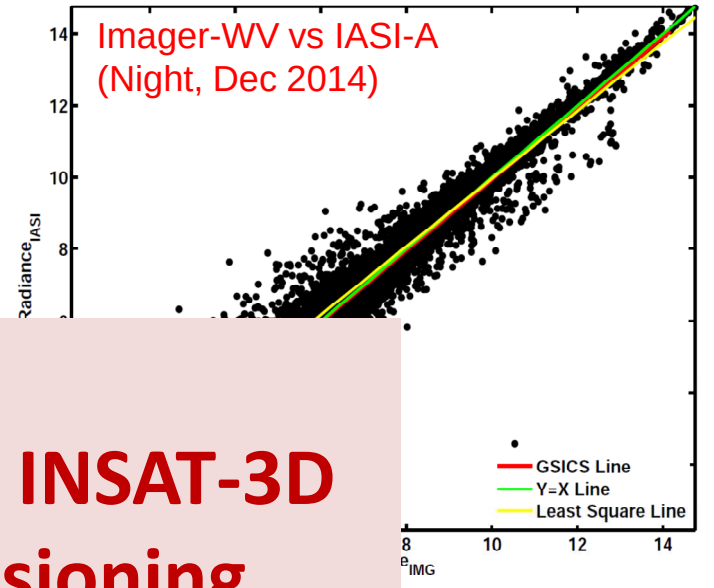
Facilitated Himawari-8 commissioning



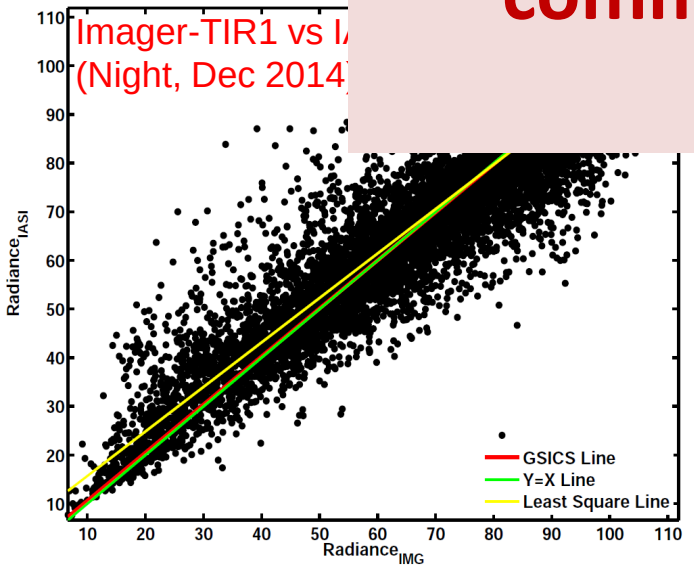
Blue: regression line Red: regression after SRF difference correction between AHI and VIIRS

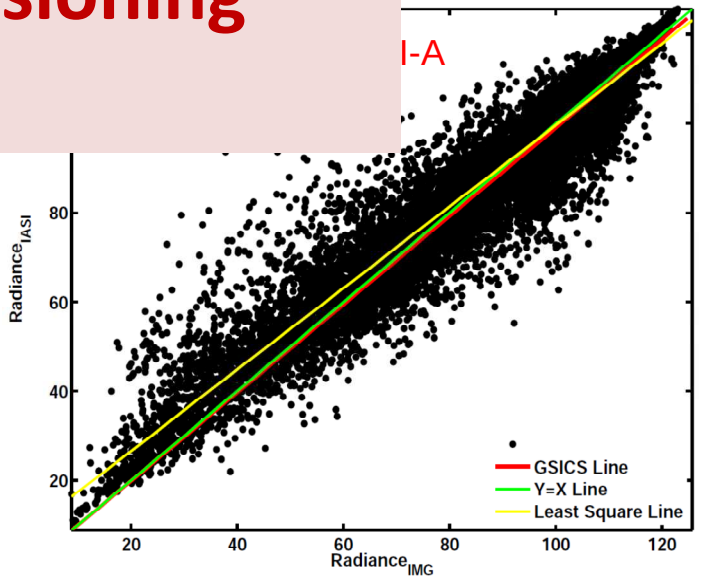
Sample Intercalibration Results: INSAT-3D Imager





Facilitated INSAT-3D commissioning





Who benefits from GSICS ?

- **Satellite operators benefit from participating in GSICS**
  - Sharing development effort and sharing resources (calibration references, datasets, software tools)
  - Capacity building in sharing best practices (for instrument monitoring, traceability, sensor comparison and correction)

- **Satellite data users benefit from GSICS**
  - Calibration is improved
  - Corrections available to align to a common reference
  - Assessments, reports, for better understanding
  - Algorithms enabling to reprocess data records

  - ➢ Improved and consistent calibration across the different agencies builds confidence on reliability of each other's data
  - ➢ Interoperability increases the benefit of data exchange

Outline

1. GSICS overview
2. **Highlights of recent activities**
3. Organization status
4. Challenges and recommendations
5. Summary and conclusions

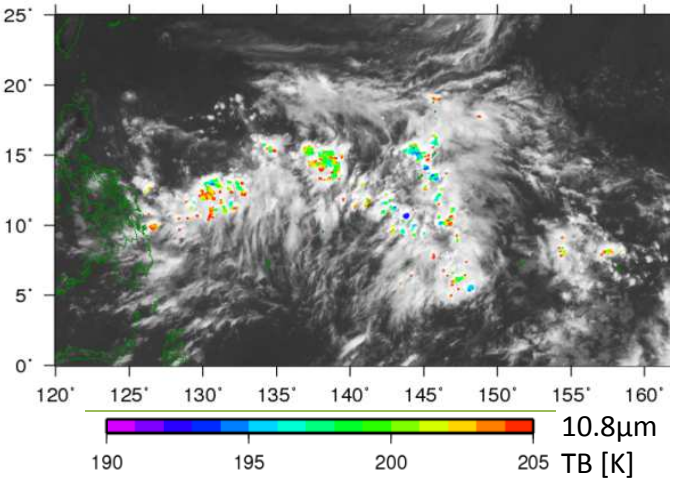
Development highlights

- Joint meeting of Research/Data Working Groups
  - 16-20 March 2015, in New Delhi
- Data management and tools
  - New collaboration server
  - Product development template
- IR calibration with multiple reference spectrometers
  - IASI-A current primary reference for GEO, LEO intercalibration
  - Towards a combined reference including IASI-A, IASI-B and CrIS ensuring stability and seamless transition between consecutive instruments
- GEO-LEO solar channel calibration (VIS/NIR)
  - Using Deep Convection Cloud (DCC) as pseudo-invariant targets
  - Using Lunar calibration combined with ground-based Moon observation
  - Development of a combined approach

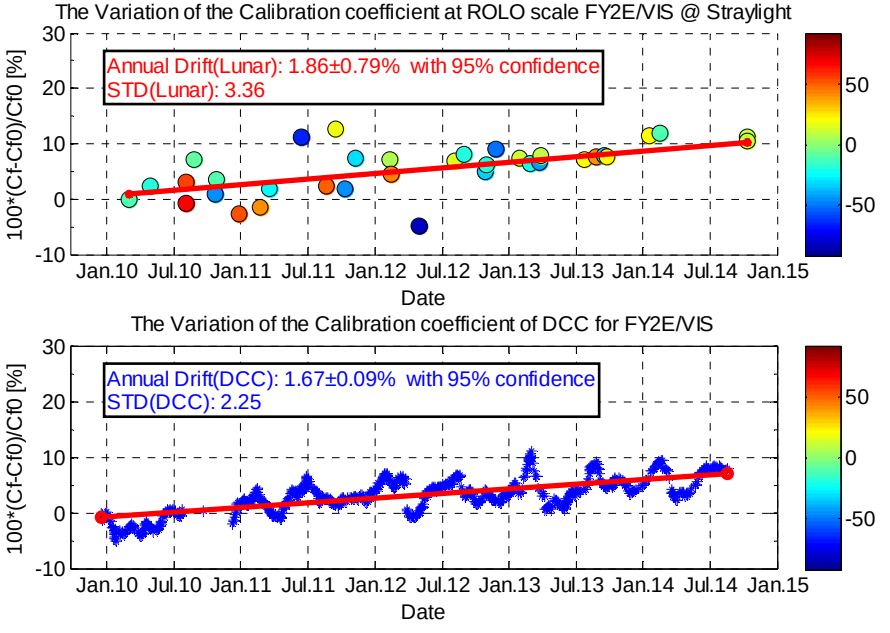
GEO-LEO VIS/NIR

- Currently two main activities on-going:
  - Inter-calibration of GEO imagers with MODIS using Deep Convective Clouds as transfer target
  - Lunar calibration , and using the Moon for inter-calibration.

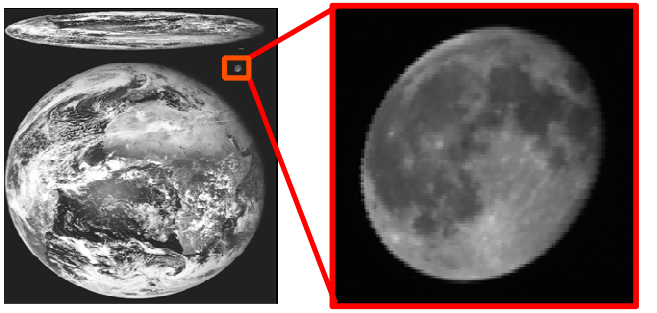
MTSAT-2 DCC detection 2012-07-01T04



The coincident result from Lunar and DCC for FY-2E



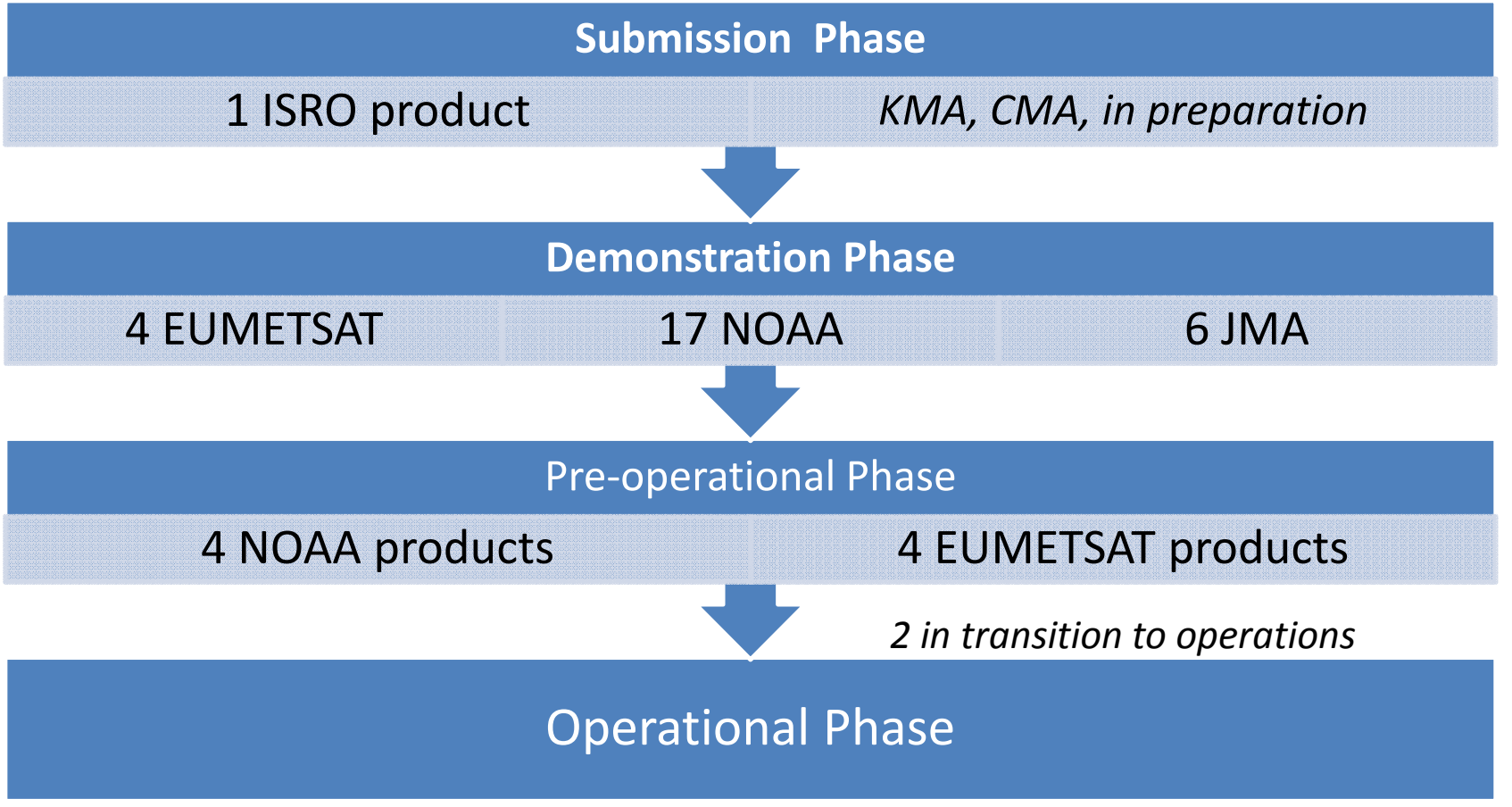
SEVIRI L1.0 image



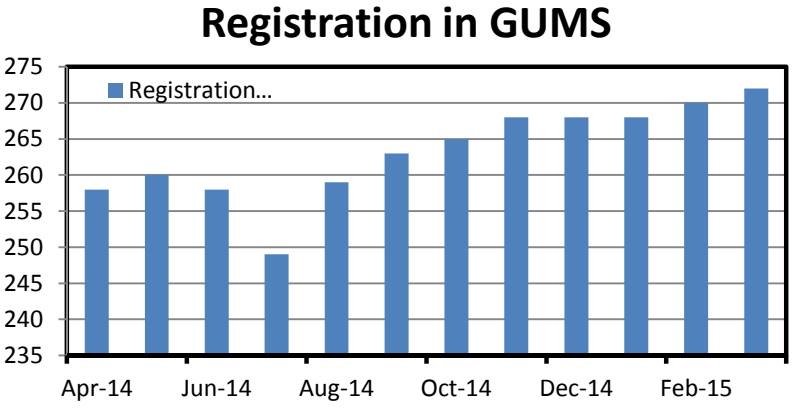
GSICS holdings and deliverables

	Holdings or Deliverables	Examples
Resources	Calibration references and databases	GIRO lunar model, ground sites Solar irradiance spectrum
	Software and hardware tools	Plotting tool, THREDDS servers, product generation environment, wiki
	Standards, conventions, guidelines	Formats, etc.
Products	Calibration methodologies	ATBD for NRT correction or re-calibration
	Analysis, monitoring results, assessments	Updated SRF; assessment of bias, of non-linearity, polarization sensitivity,
	Routine operational corrections	Near Real Time or delayed corrections
Services	Information on GSICS &calibration	Science publications, GSICS Quarterly, Outreach material
	User registration, product subscription	
	Web services	

Operational coordination: GSICS Procedure for Product Acceptance

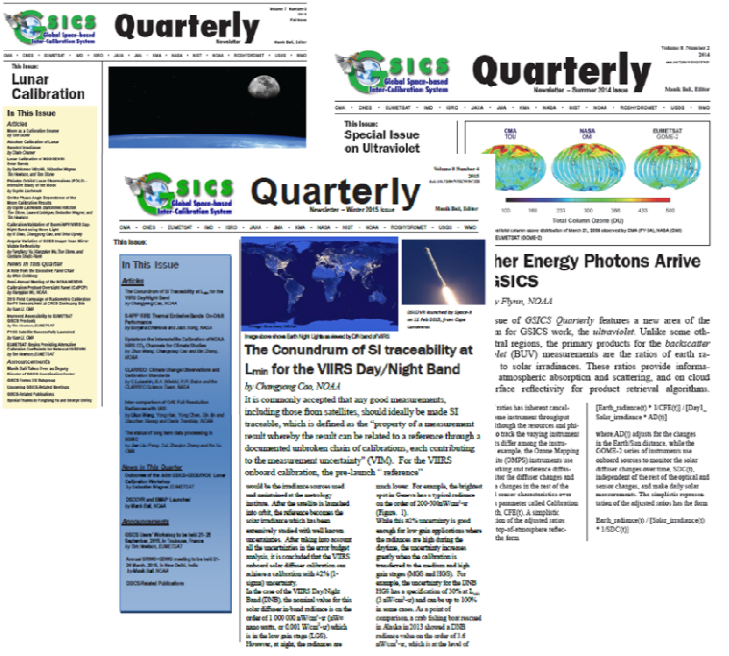


User services



- Growing audience of GSICS user messaging service

- Widely disseminated GSICS Quarterly
- GSICS User Workshops
  - 2014: Shanghai
  - 2015: Toulouse



Responding to HLPP Targets

- Establish a consistent inter-calibration for thermal IR channels using hyper-spectral sounders as reference. The implementation will be done successively by the individual satellite operators.
- Establish a consistent inter-calibration for solar channels using instruments with adequate in-orbit calibration and vicarious methods as reference. The implementation will be done successively by the individual satellite operators.

Status of HLPP Targets

- IR is currently being performed by most agencies operating geostationary imagers – albeit at different levels of maturity. The algorithm is also being rolled out to other platforms/instruments by some agencies. So not yet “fully achieved” – however roughly 80% achieved
- VIS is still in development, with the first demonstration GSICS products for the VIS channel of geostationary imagers, based on Deep Convective Clouds, and referenced to MODIS are expected this year. Counterpart products for other satellites will follow. The algorithm will then be extended to include the Moon as a calibration transfer, which is also applicable to channels in the NIR. Roughly 30% achieved

Outline

1. GSICS overview
2. Highlights of recent activities
3. **Organization status**
4. Challenges and recommendations
5. Summary and conclusions

GSICS membership

GSICS members:

- China Meteorological Administration (CMA)
- Centre National d'Etudes Spatiales (CNES)
- European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)
- Indian Space Research Organization (ISRO)
- India Meteorological Department (IMD)
- Japan Aerospace Exploration Agency (JAXA)
- Japan Meteorological Agency (JMA)
- Korea Meteorological Agency (KMA)
- National Aeronautics and Space Administration (NASA)
- National Institute of Standards and Technology (NIST)
- National Oceanic and Atmospheric Administration (NOAA)
- Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)
- United States Geological Survey (USGS)
- World Meteorological Organization (WMO)

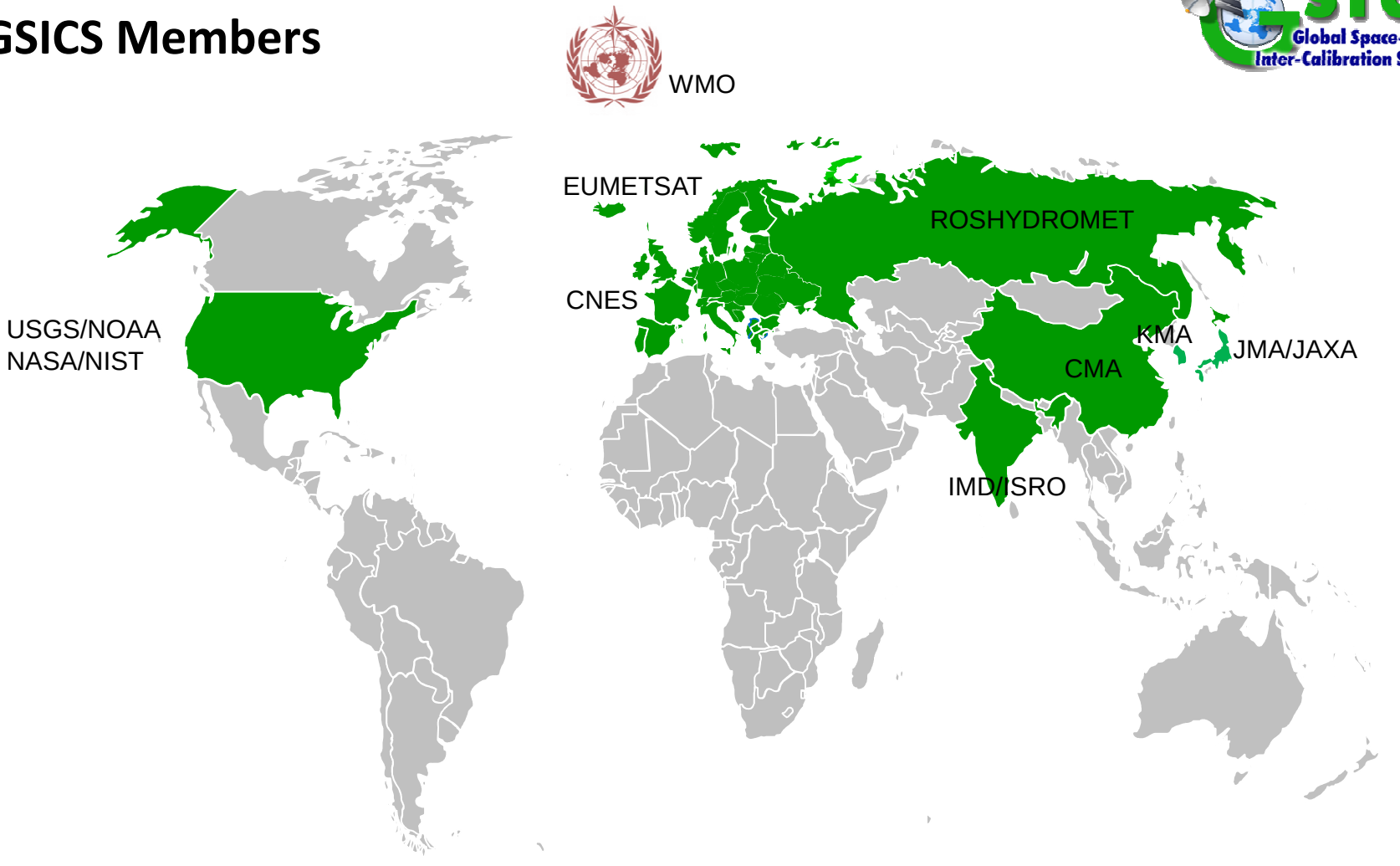
Associate member:

- Inter-satellite Calibration WG of the Global Precipitation Measurement Mission (GPM X-Cal)

Observer:

- European Space Agency (ESA)
- CEOS (CEOS) Working Group on Calibration and Validation (WGCV)
- **Occasional participation of CNSA, ROSCOSMOS, encouraged to join as observer**

GSICS Members

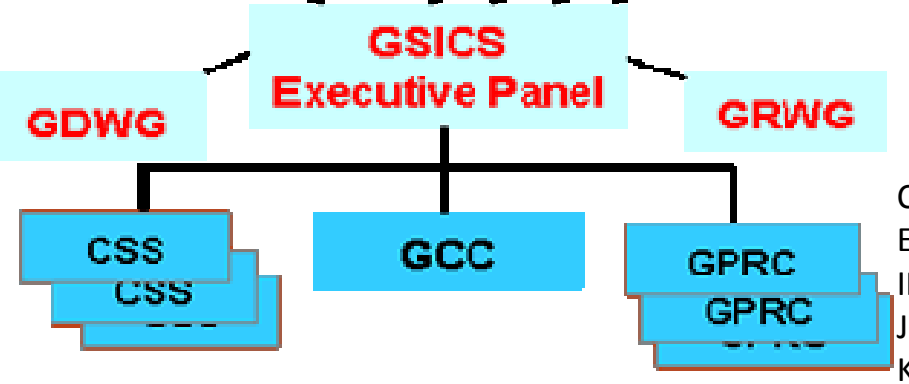


Obs. **ESA + CEOS**
ASSO. **GPX**

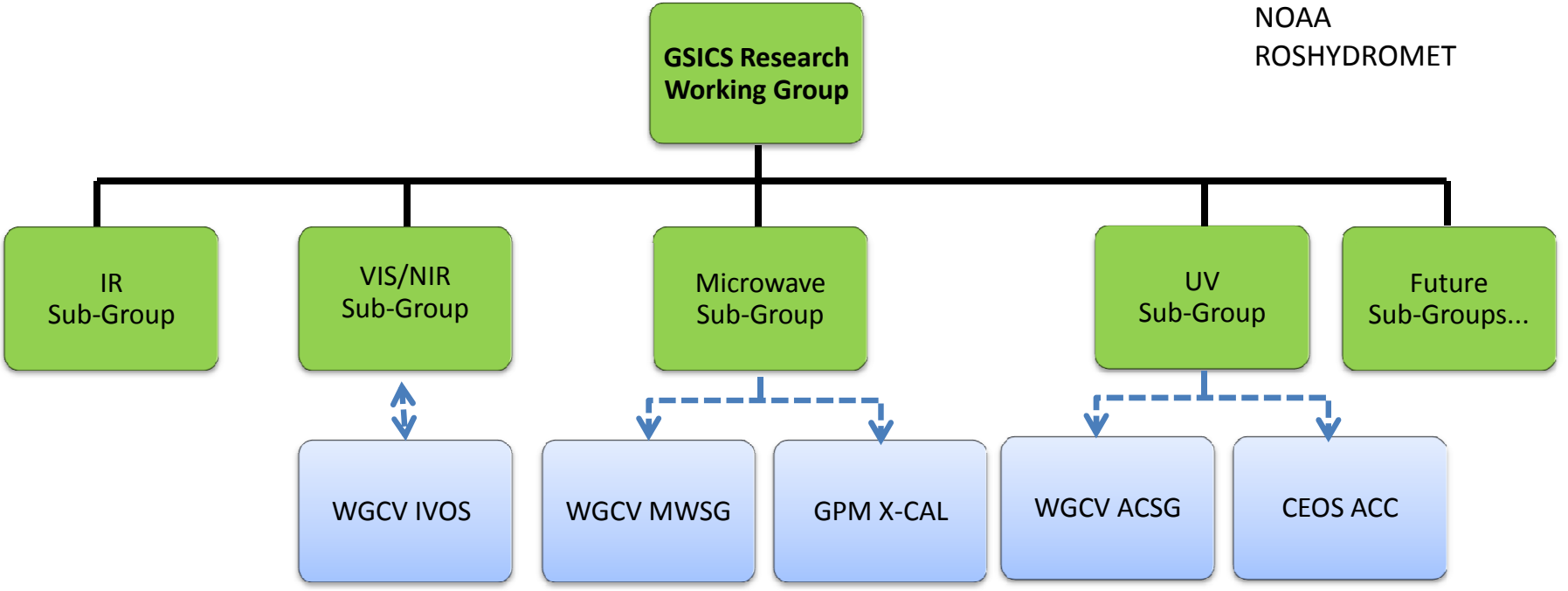
14 Members Worldwide

GSICS Structure

- Updated Terms of Reference approved by EP-16



CMA
EUMETSAT
IMD
JMA
KMA
NOAA
ROSHYDROMET



GSICS leadership et Secretariat

- Executive Panel:
  - Peng Zhang (CMA) elected Chair by EP-15 with Ken Holmlund (EUMETSAT) as Vice-Chair
- GRWG
  - Dohyeong Kim (KMA) designated by EP-16
  - Tim Hewison (EUMETSAT) and Scott Hu (CMA) Vice-Chairs
- GDWG
  - Peter Miu (EUMETSAT) and Masaya Takahashi (JMA) Co-Chairs
- GSICS Coordination Centre (GCC)
  - Larry Flynn, Manik Bali (NOAA)
- Secretariat
  - Jérôme Lafeuille (WMO)

All the Chair and vice-chair positions have now rotated once !

Outline

1. GSICS overview
2. Highlights of recent activities
3. Organization status
4. **Challenges and recommendations**
5. Summary and conclusions

Challenges/Recommendations (1)

- **Engagement of GSICS members**
  - More active participation of GSICS members is required in GRWG and GDWG to ensure sufficient progress and early benefits
  - Current under-representation in the GSICS Data Management Working Group (GDWG)

  Recommendation: All satellite operators should participate to be afterwards in a position to implement the agreed practices and standards

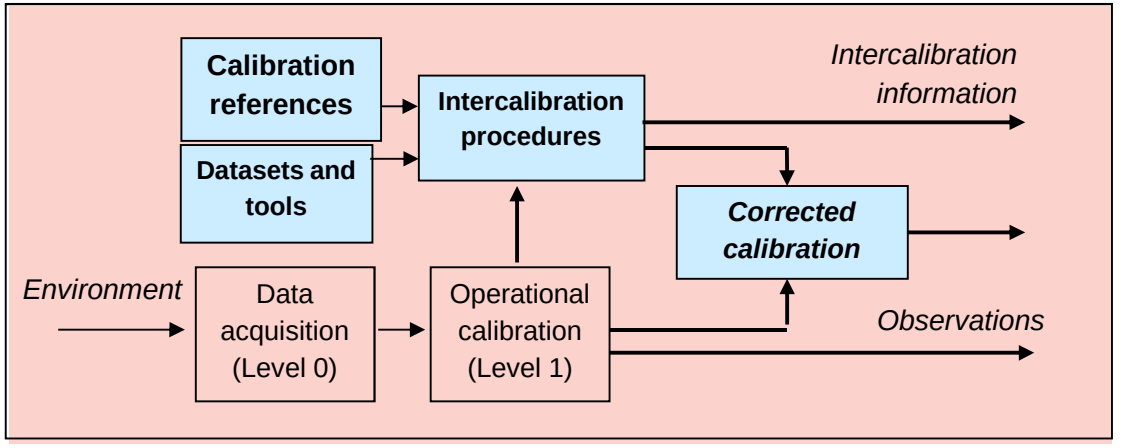
  Target contribution to actions: at least one man-month for a GRWG or GDWG member
- **User requirements**
  - User requirements are often vague and informal

  Recommendation: all satellite operators and user communities to evaluate their requirements for GSICS resources, products and services to serve the needs of their users

Challenges/Recommendations (2)

- **Role of GSICS in the Architecture for climate monitoring**
  - Procedures ensuring the consistency of data records through accurate and harmonized calibration should be part of the Architecture
  - These belong to the «sensing pillar» (space segment design, pre-launch characterization, maintaining references, instrument monitoring and calibration) and to the «CDR creation and preservation pillar» (intercalibration, re-calibration)

Recommendation : best practices of GSICS and CEOS/WGCV should be considered as elements of an architecture for climate monitoring



Challenges/Recommendations (3)

- **As an element of WIGOS, documenting GSICS is initiated**

  Recommendation: More efforts on the updated set of GSICS Reference documents

  – For a clear understanding and shared vision of GSICS among members

  – For more external visibility, and recognition of GSICS as a building block of WIGOS and of the Architecture for Climate Monitoring from Space

Challenges/Recommendations (4)

- **Importance of calibration references**
  - Efforts towards in-orbit reference instruments should be supported

  Recommandation: to give increased attention to ground calibration sites
- **In particular: ground-based Moon observation**
  - The traceability of satellite instruments calibration by lunar observation is achieved by ground-based Moon observatories.
  - Absolute uncertainty currently limited by their performance

  Recommendation: consider enhancing Moon observatories

Outline

1. GSICS overview
2. Highlights of recent activities
3. Organization status
4. Challenges and recommendations
5. **Summary and conclusions**

Summary of recommendations

- Members to strengthen their engagement in GSICS and in particular in its GDWG
- Members to analyze their requirements for calibration
- Give increased attention to ground calibration sites
- Consider enhanced Lunar observation capability
- Acknowledge the role of GSICS in the Architecture for Climate Monitoring from Space
- Support GSICS efforts for outreach: to further document GSICS and communicate to ensure visibility and full benefit

A continuing progress !

- Upon its 10th anniversary the GSICS community is gradually encompassing all CGMS members
- A great capacity building and collaboration opportunity
- Increasing product maturity
- GSICS value demonstrated in the commissioning of recent satellites
- Several recommendations are proposed to CGMS members