GPM and GSICS Coordination

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NOAA/NESDIS

1st NOAA GPM User Workshop
August 18-19, 2010

Global Space-based Inter-Calibration System

- **What is GSICS?**
  - Global Space-based Inter-Calibration System
  - Initiative of CGMS and WMO
  - An effort to produce consistent, well-calibrated data from the international constellation of operational meteorological satellites

- **What are the basic strategies of GSICS?**
  - Best practices/requirements for prelaunch characterisation (with CEOS WGCV)
  - Improve on-orbit calibration by developing an integrated inter-calibration system
    - Initially by LEO-GEO Inter-satellite/ inter-sensor calibration

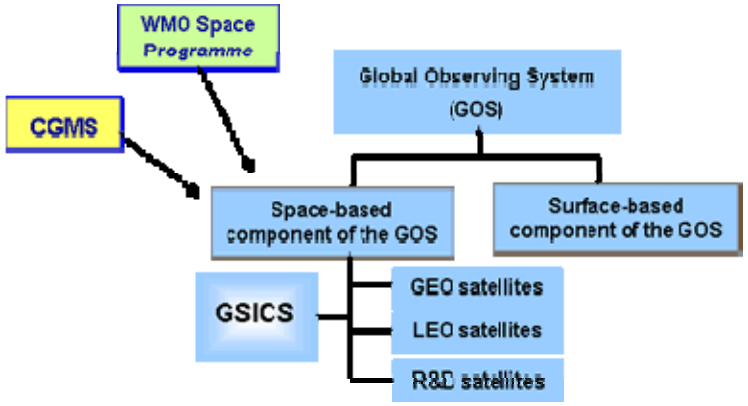
- **This will allow us to:**
  - Improve consistency between instruments
  - Produce less bias in Level 1 and 2 products
  - Retrospectively re-calibrate archive data
  - Better specify future instruments

GSICS organization

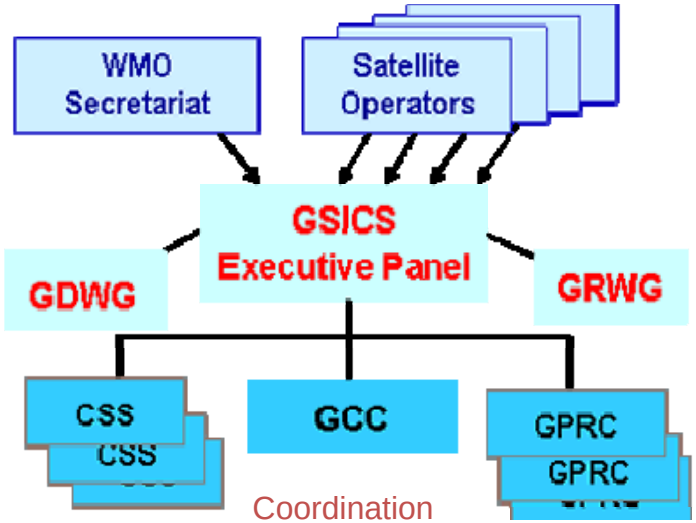
- **Organizations contributing to GSICS:**
  CMA, CNES, EUMETSAT, ISRO, JAXA, JMA, KMA, NASA, NIST, NOAA, WMO

- **Overseen by GSICS Executive Panel Assisted by Research Working Group and Data management Working Group**

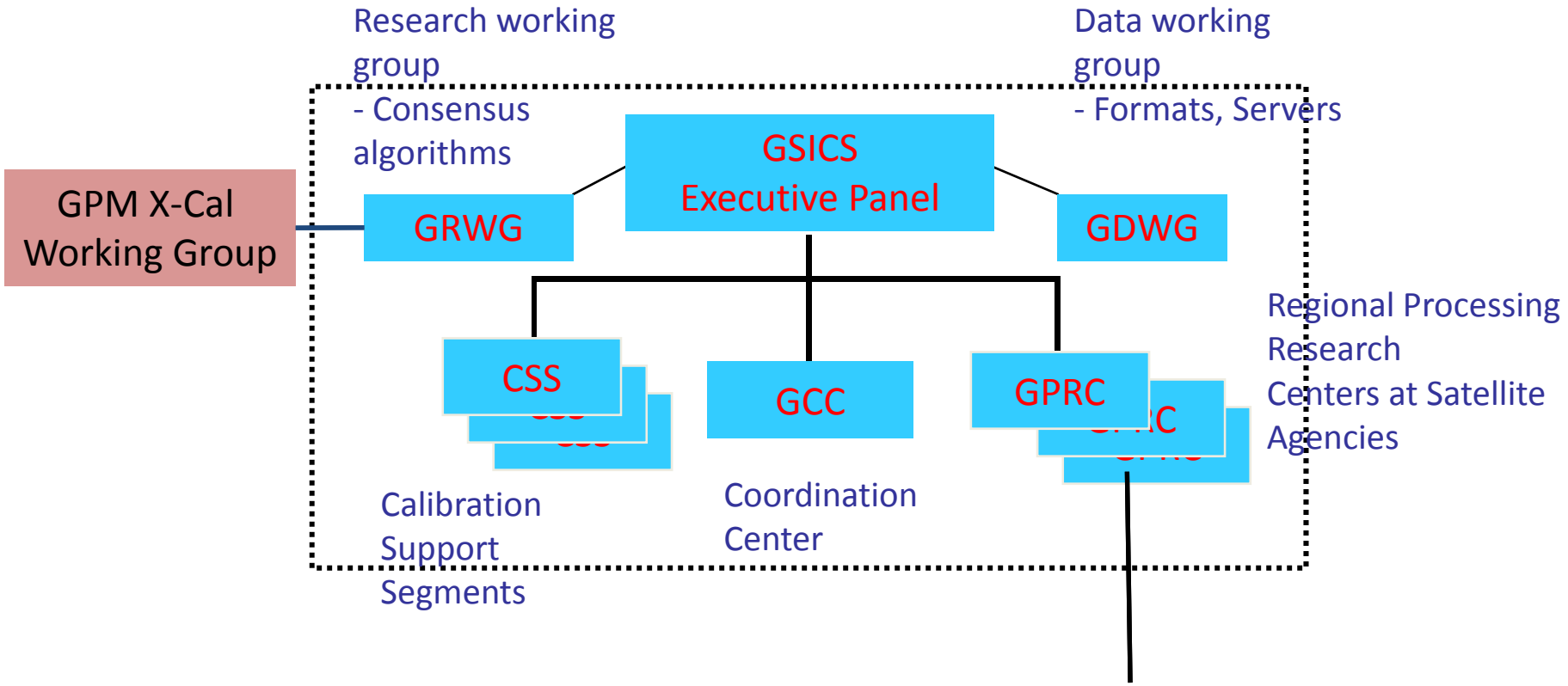
- **GSICS activities rely on:**
  - **GSICS Coordination Centre (GCC)**
  - **operated by NOAA/NESDIS**
- **Processing & Research Centres (GPRC)**
  - **operated by each satellite operator**
- **Calibration Support Segments (CSS)**
  - **including field sites and laboratories**



GSICS as an element of the space-based component of the Global Observing System



GPM is now an affiliater with GSICS



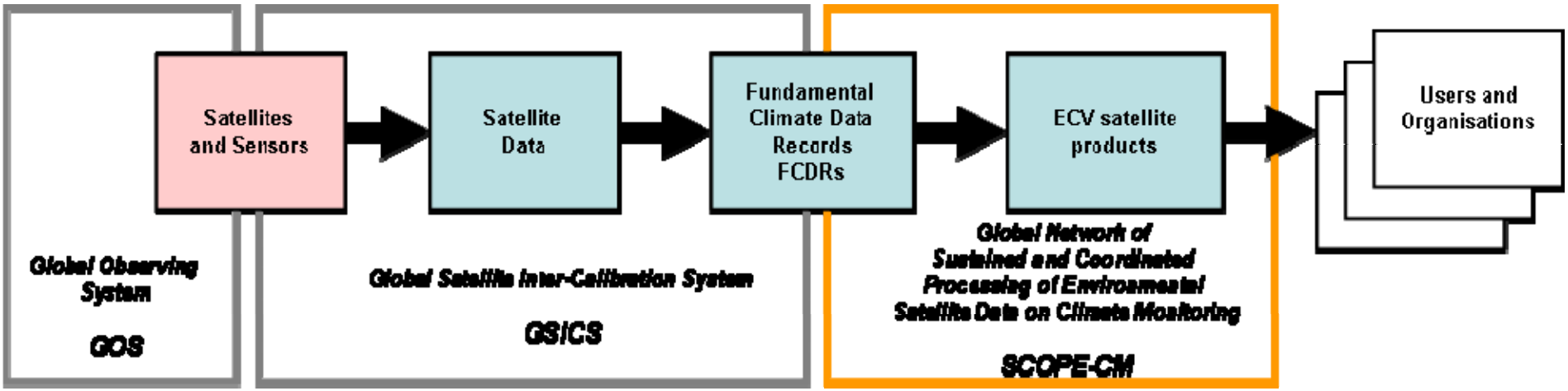
GPM X-cal:

- Plan to sustain X-cal in future
- Similar Structure to GSICS
- Interested in using GSICS product acceptance procedure

GSICS Interface to SCOPE-CM

- Sustained & Coordinated Processing of Environmental satellite data for Climate Monitoring (SCOPE-CM)
- WMO Initiative based on activities of existing initiatives (GOS, GCOS and GSICS)
- Provides international cooperation and coordination framework
- To generate multi-mission and global satellite climate data records (FCDRs & TCDRs)
- Serve users and other organisations
  (e.g. WMO Regional Climate Centres RCC, National Weather Services)

=> The way toward operational production of high quality ECVs on a global scale



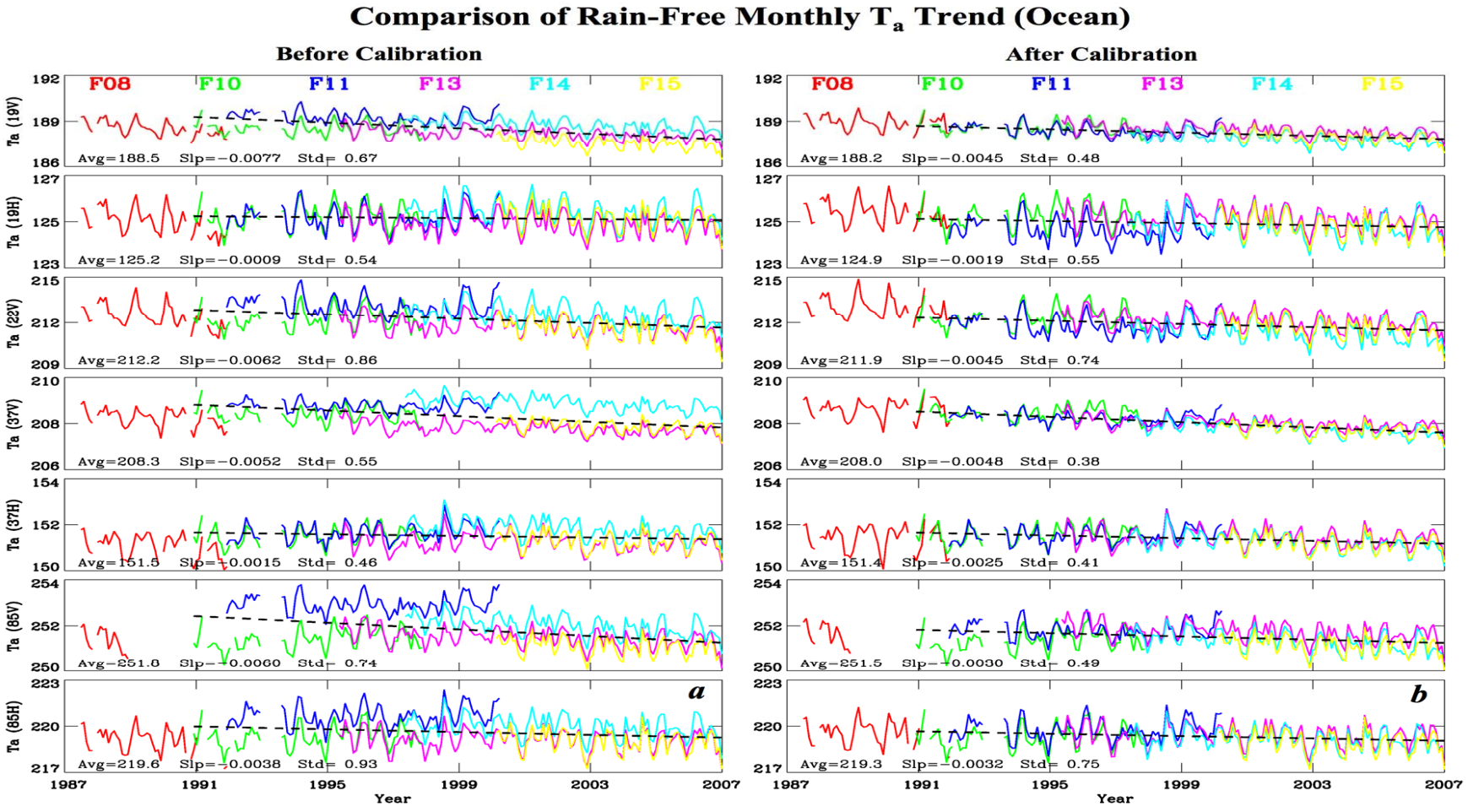
GSICS Microwave Products

- Who are GSICS users? – Consult at Users' Workshops
  - Internal – to generate level 2 products & Re-processing
  - NWP centres – apply own bias correction
  - SCOPE-CM projects
  - Satellite Application Facilities – e.g. CM-SAF produce TCDRs & ECVs
- What do they want?
  - Which instruments/channels/time periods, etc...?
  - What is not met by existing activities? Need for Coordination
  - We can approve external products meeting GSICS standards
- GSICS Products:
  - GSICS Bias Monitoring & GSICS Correction
  - Double difference using NWP model
  - Inter-calibration of level 1 radiances

GPM X-cal Activities

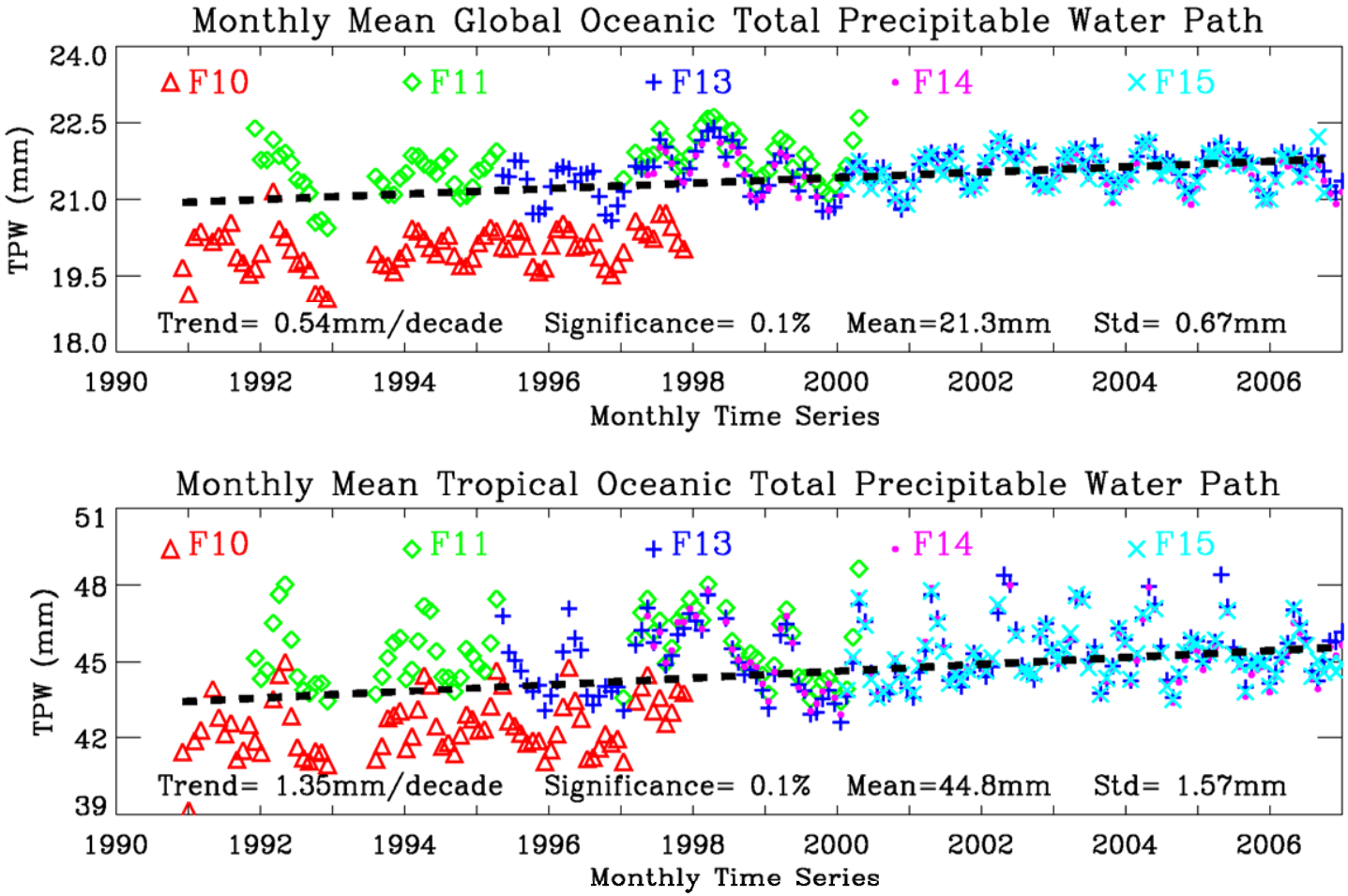
- GPM X-cal activities are well-developed for TRMM Microwave Imager, TMI-WindSat (Lead: Tom Wilheit)
- Plan to extend analysis to include AMSR-E
- Interested in Leo2Leo xcal (SSM/I vs SSMI/I, Windsat/SSMI)
- Plan to use vicarious sites (Amazon Rainforest and cold SST Oceans, etc)
- Also interested in NWP Double-differencing

Preliminary Results: SSM/I FCDR Trend



Comparison of SSM/I Monthly Oceanic Rain-free FCDR Trend using F13 as reference. The trend at FCDR level from all satellites are more consistent after inter-calibration.

SSM/I Total Precipitable Water Trend Before Cross-Calibration



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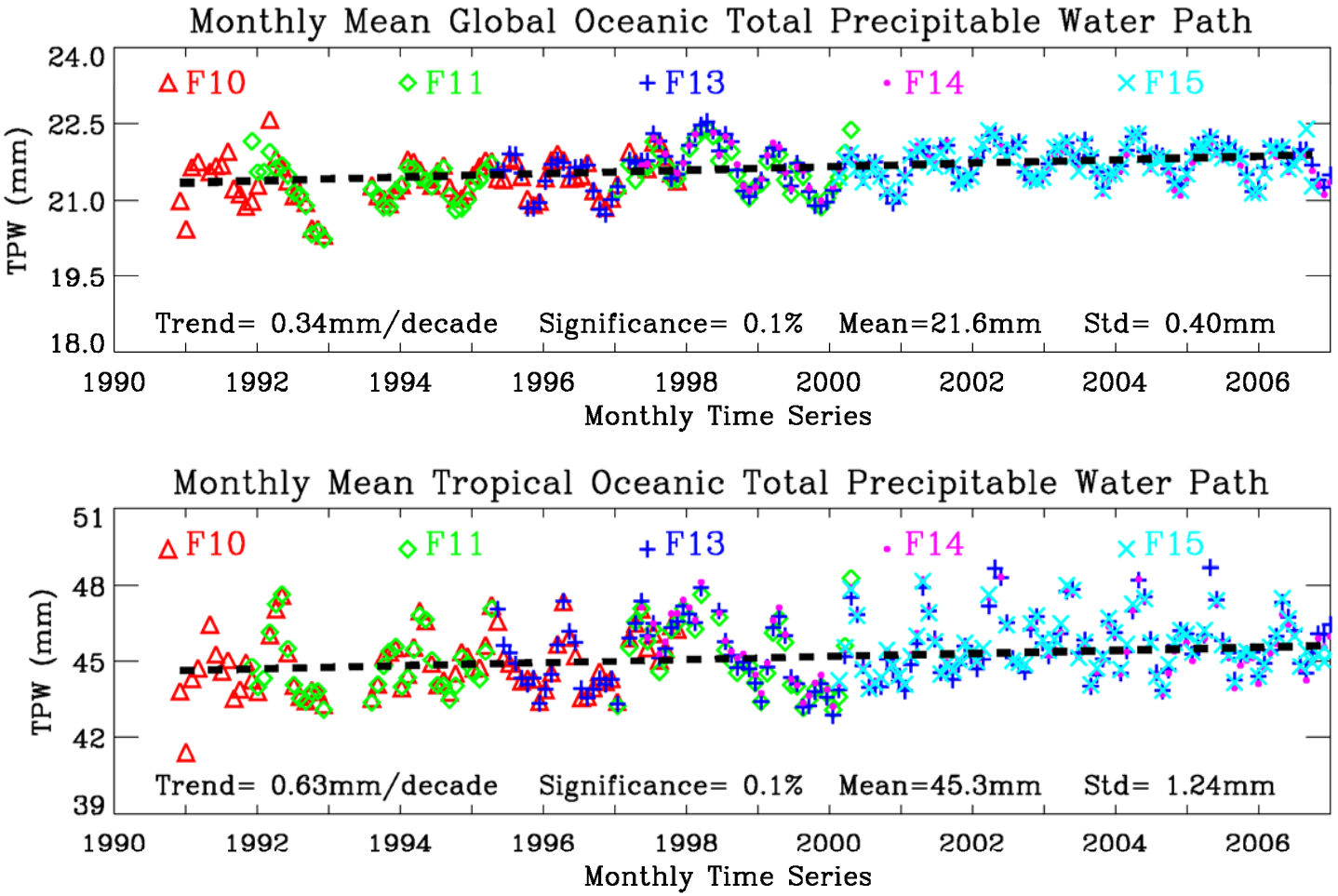


Roles of NWP in CalVal

- More satellite data assimilation makes forecasts more accurate
  - Spatial distribution of O-B, O - A
  - O – B, O - A Histogram distribution
- Easy collocation with any observation including satellites (e.g. ECMWF T799 - high resolution)
- Uses for xcalibration through double difference technique (DDT) (O1 - B1) – (O2 –B2)

Double Difference Technique:
A Robust Way for Estimating Sensor to Sensor biases

- It reduces the impact related to temporal difference when two instruments have distinct orbits
- It reduces the errors related to forward models and from forecast models
- It works in the region where the forward model has the same error characteristics

$$(O_1 - B_1) - (O_2 - B_2)$$
$$= dO_{ins} + dO_{time} - dB_{rtm} - dB_{time}$$
$$\approx dO_{ins}$$

Assumptions:

The same temporal difference from observations and simulations

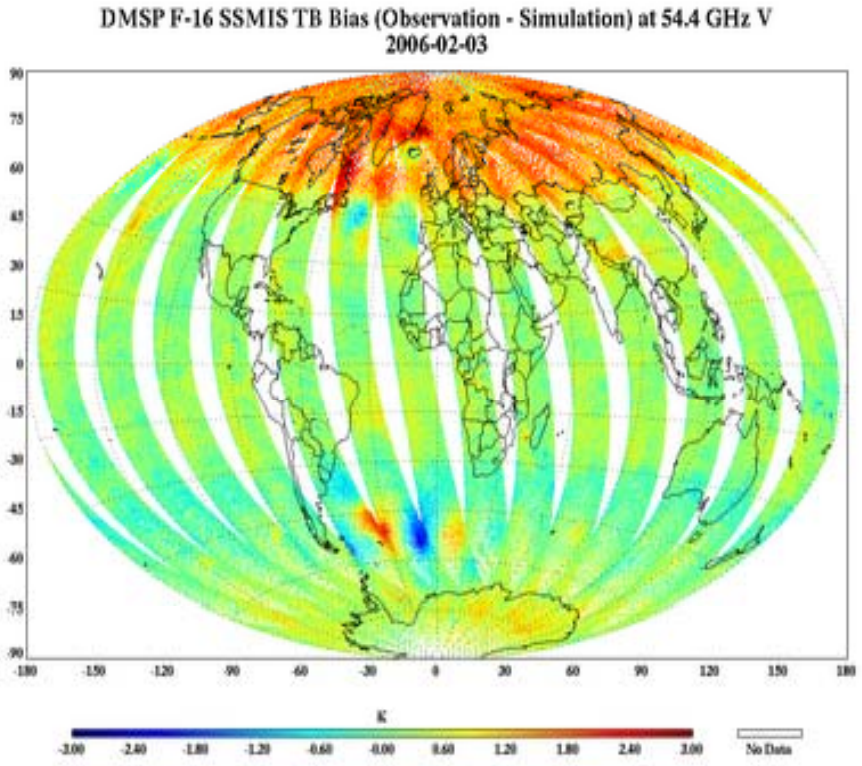
$$dO_{time} - dB_{time} \approx 0$$

Negligible forward model biases for two instruments

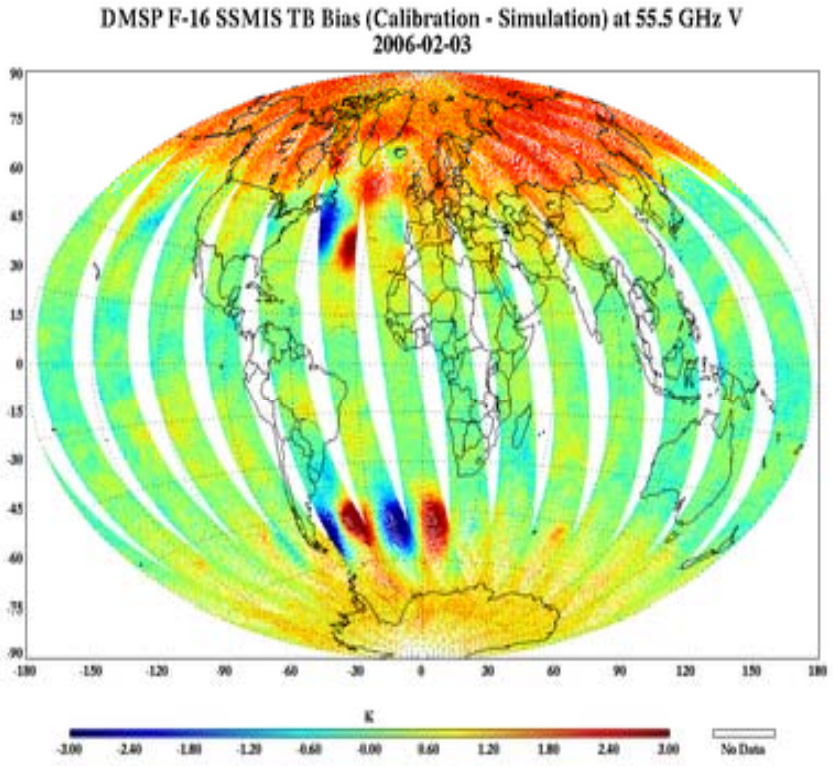
$$dB_{rtm} \approx 0$$

SSMIS TDR Anomalies

(Observation – Simulation)

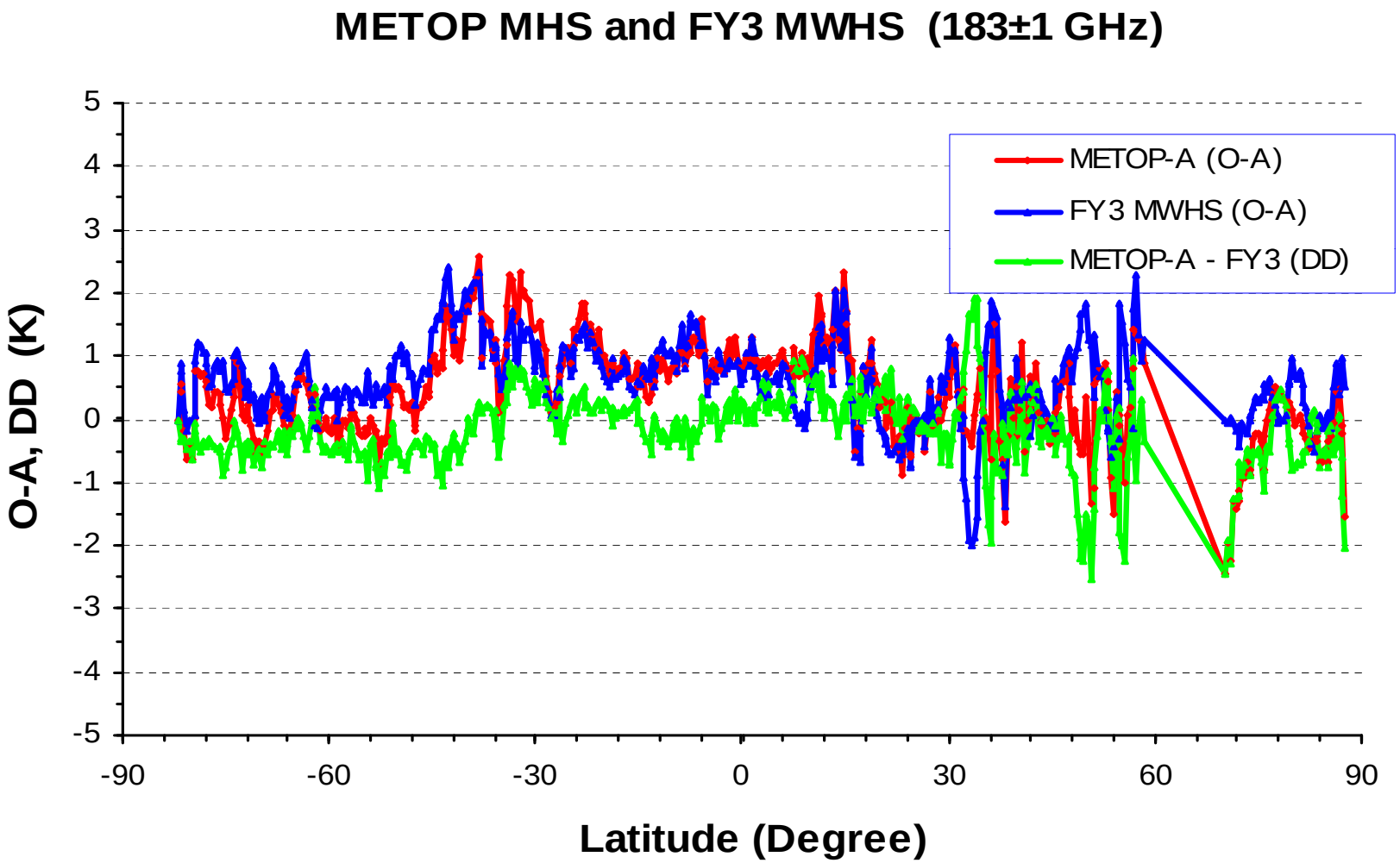


54.4 GHz V



55.5 GHz V

Double Difference Technique (DDT)



Summary

- GSICS/GPM microwave sensor Xcal have lots of components in common and need to be well coordinated
- GSICS NWP monitoring and double difference techniques are unique for GMI high-frequency calibration
- GPM Xcal science at the sensor level adjustments will be critical and serve as benchmark for GSICS MW calibration product validation