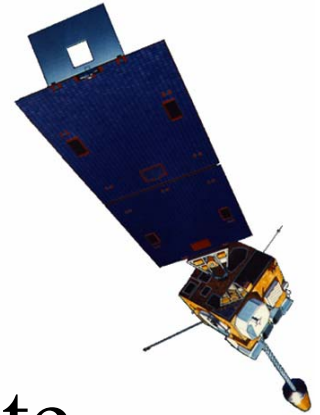




**National Environmental Satellite,
Data, and Information Service**

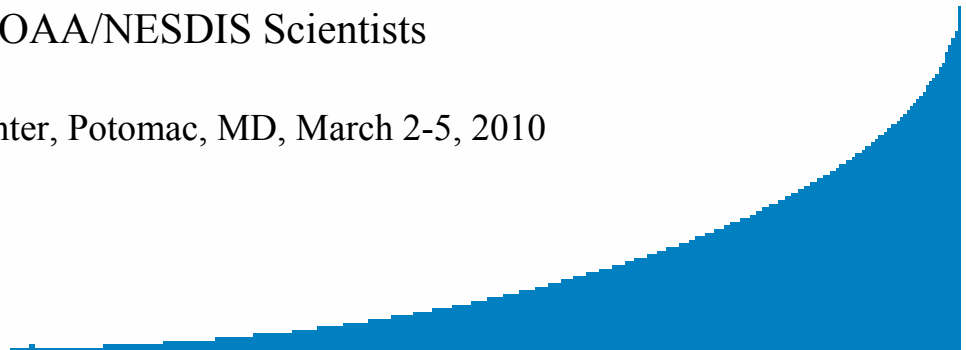


NOAA Calibration/Validation Update

Presented by Changyong Cao
NOAA/NESDIS/STAR

With contributions from NOAA/NESDIS Scientists

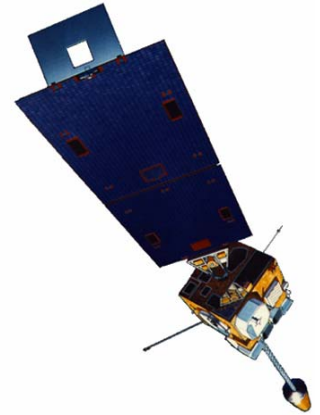
Presented at the WGCV31, Bolger Center, Potomac, MD, March 2-5, 2010

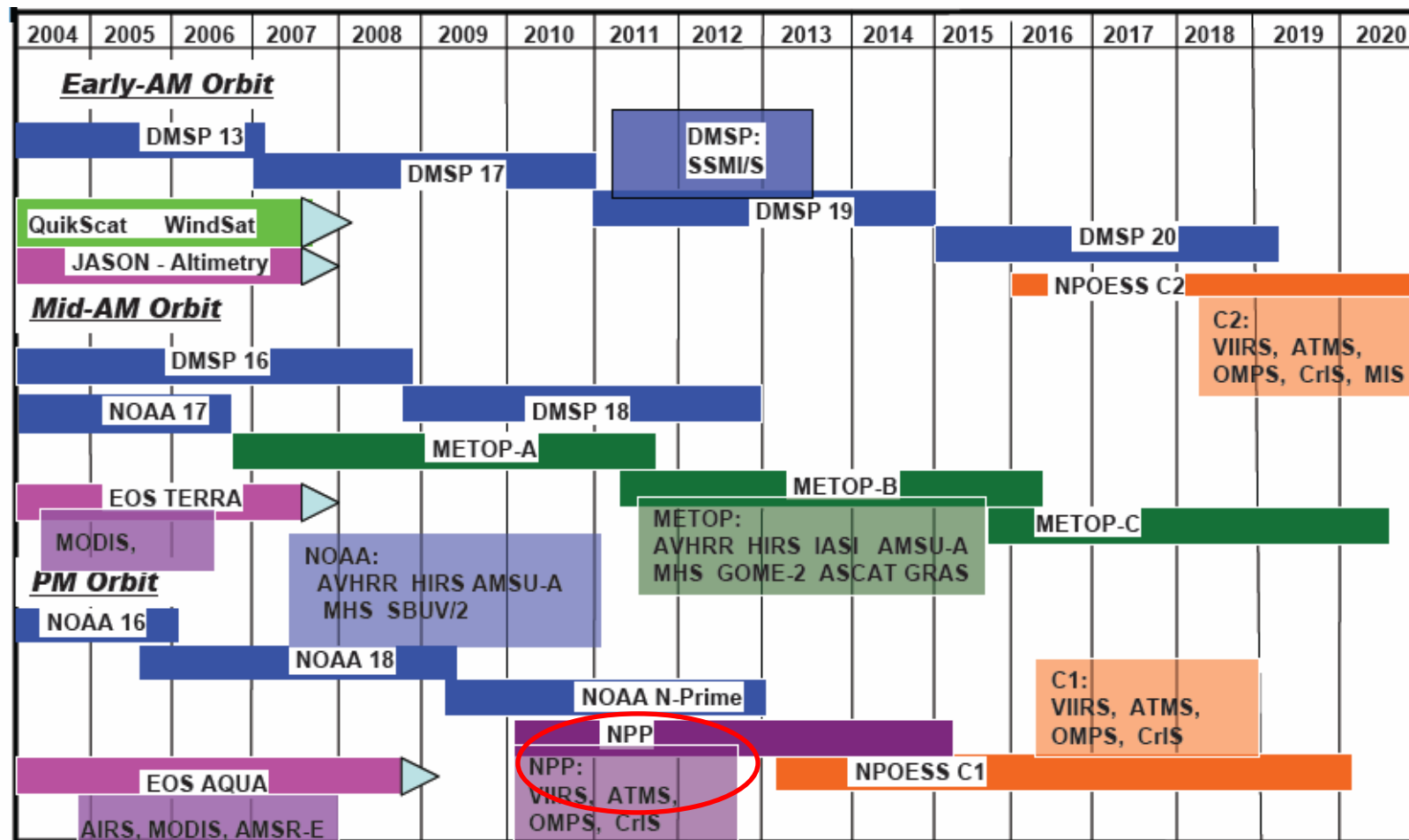


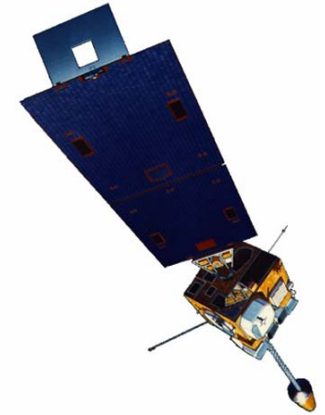


Outline

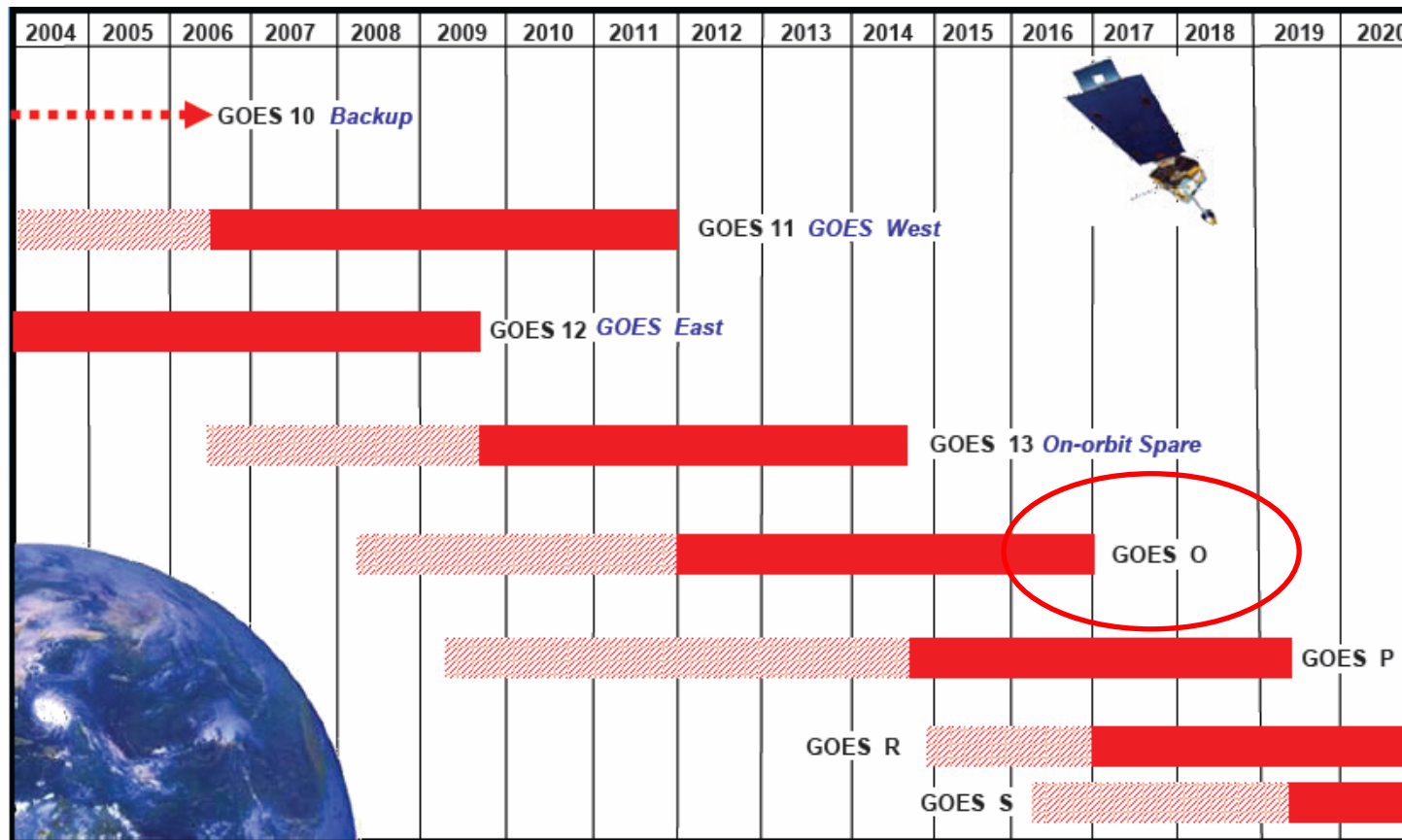
- NOAA polar-orbiting & geostationary satellite programs and changes
- NOAA Climate Service
- GOES-14 successful launch and on-orbit verification
- Calibration research and development
- GSICS update

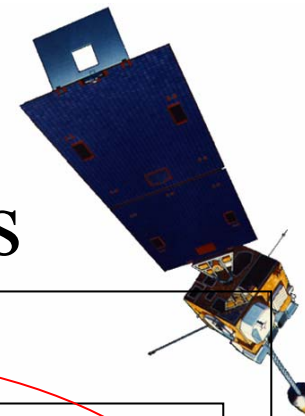




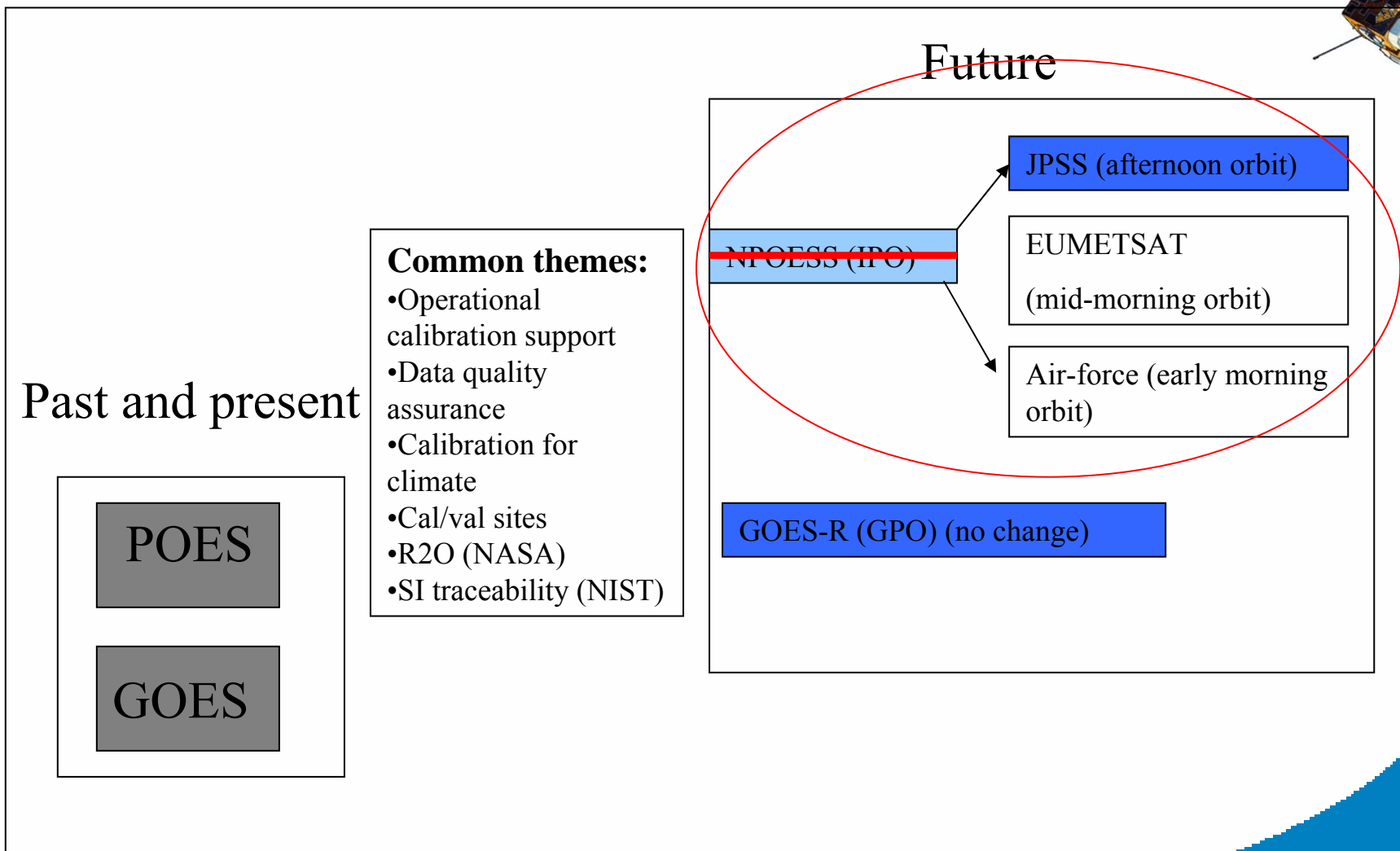


Geostationary Satellites



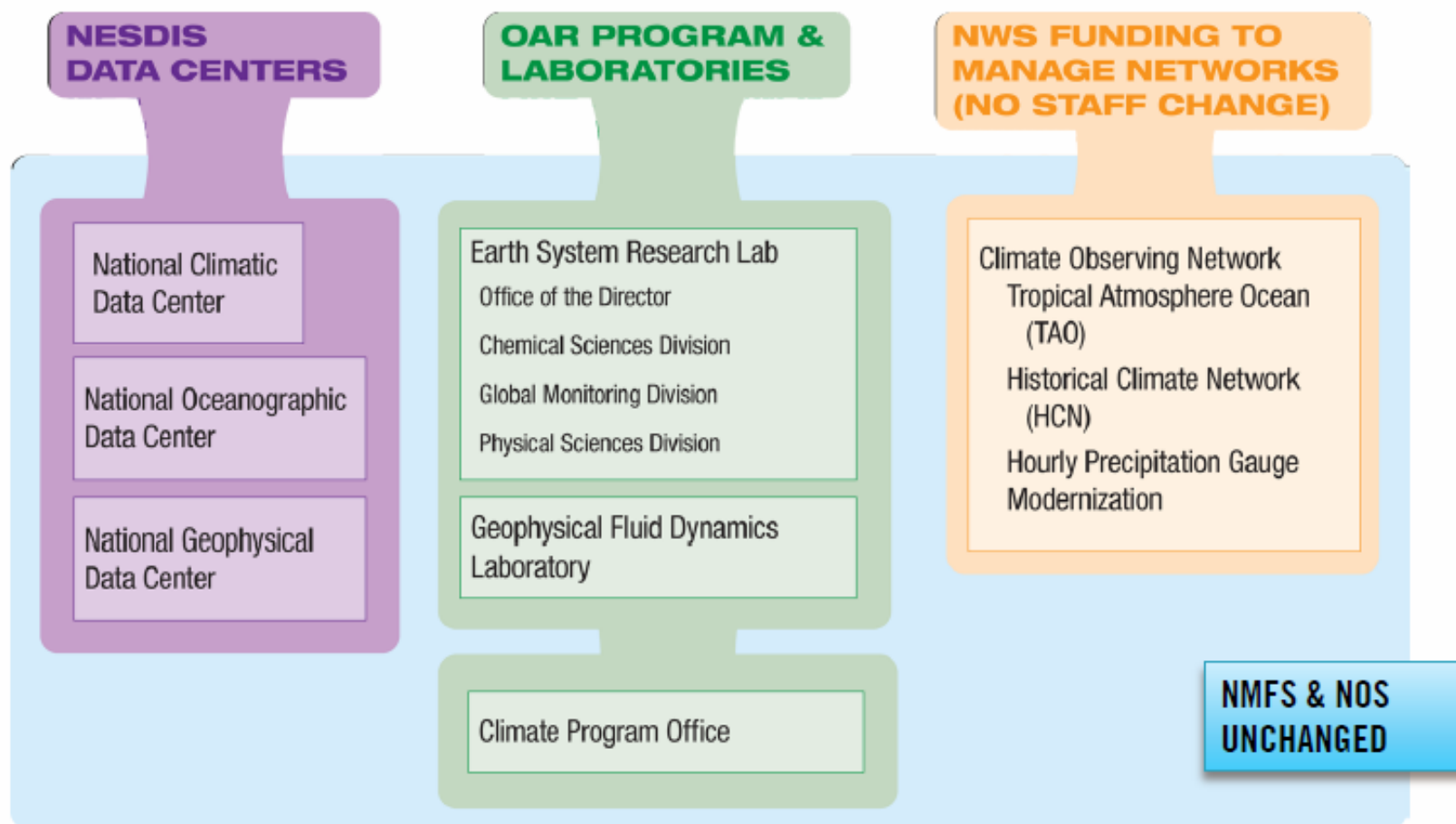


NOAA Satellite Program Changes





Proposed NOAA Climate Service (NCS)

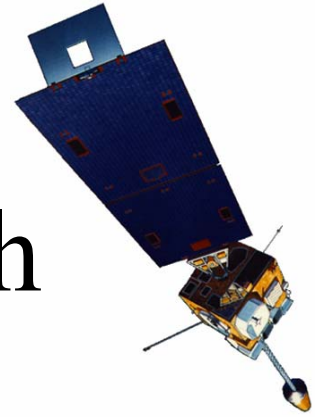


The physical location of these facilities will not change



GOES-14 Successful Launch

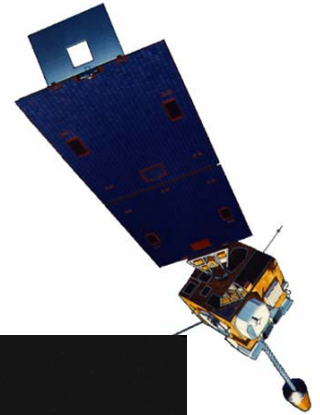
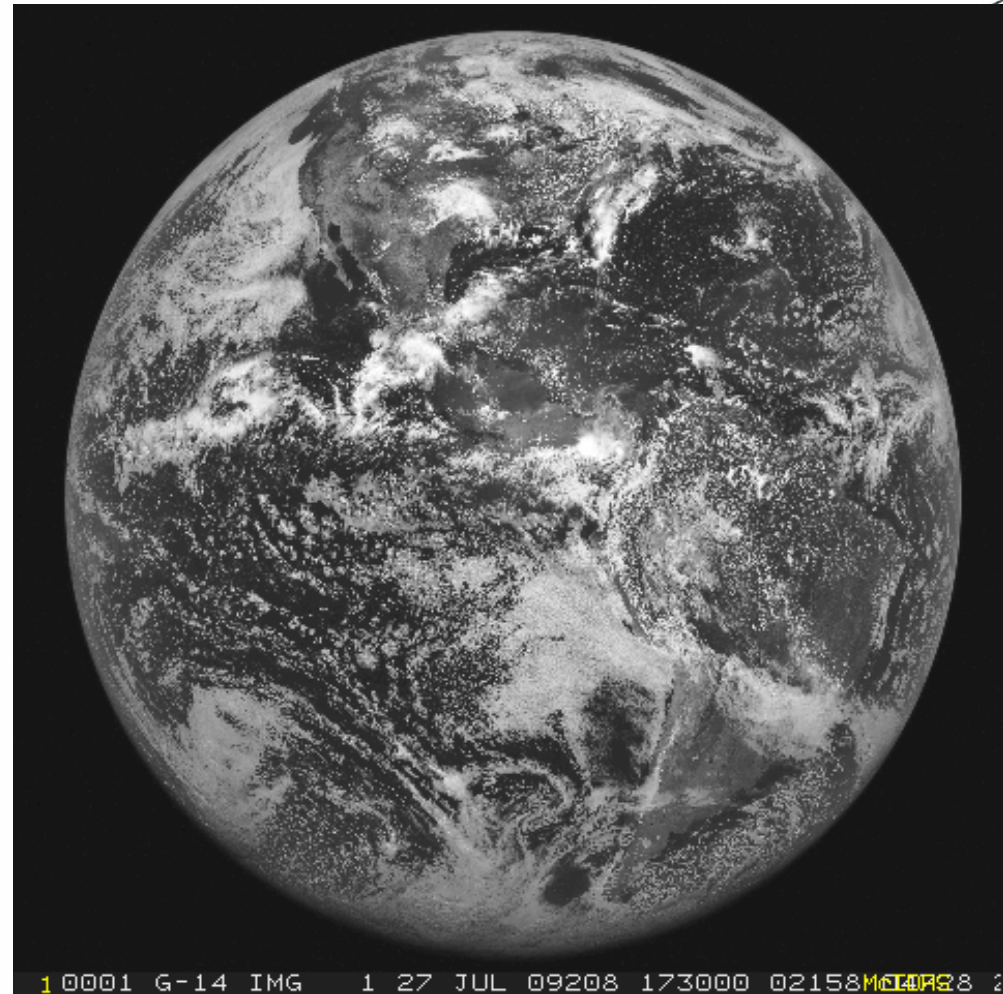
- Delta 4 launches GOES-O on June 27, 2009
- Instruments:
 - GOES Imager/Sounder
 - Space Weather instruments

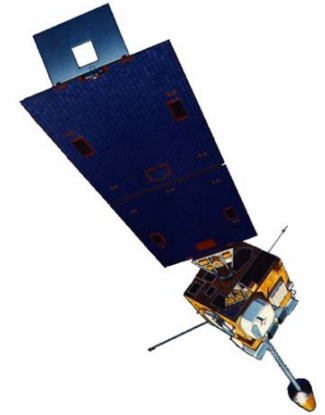




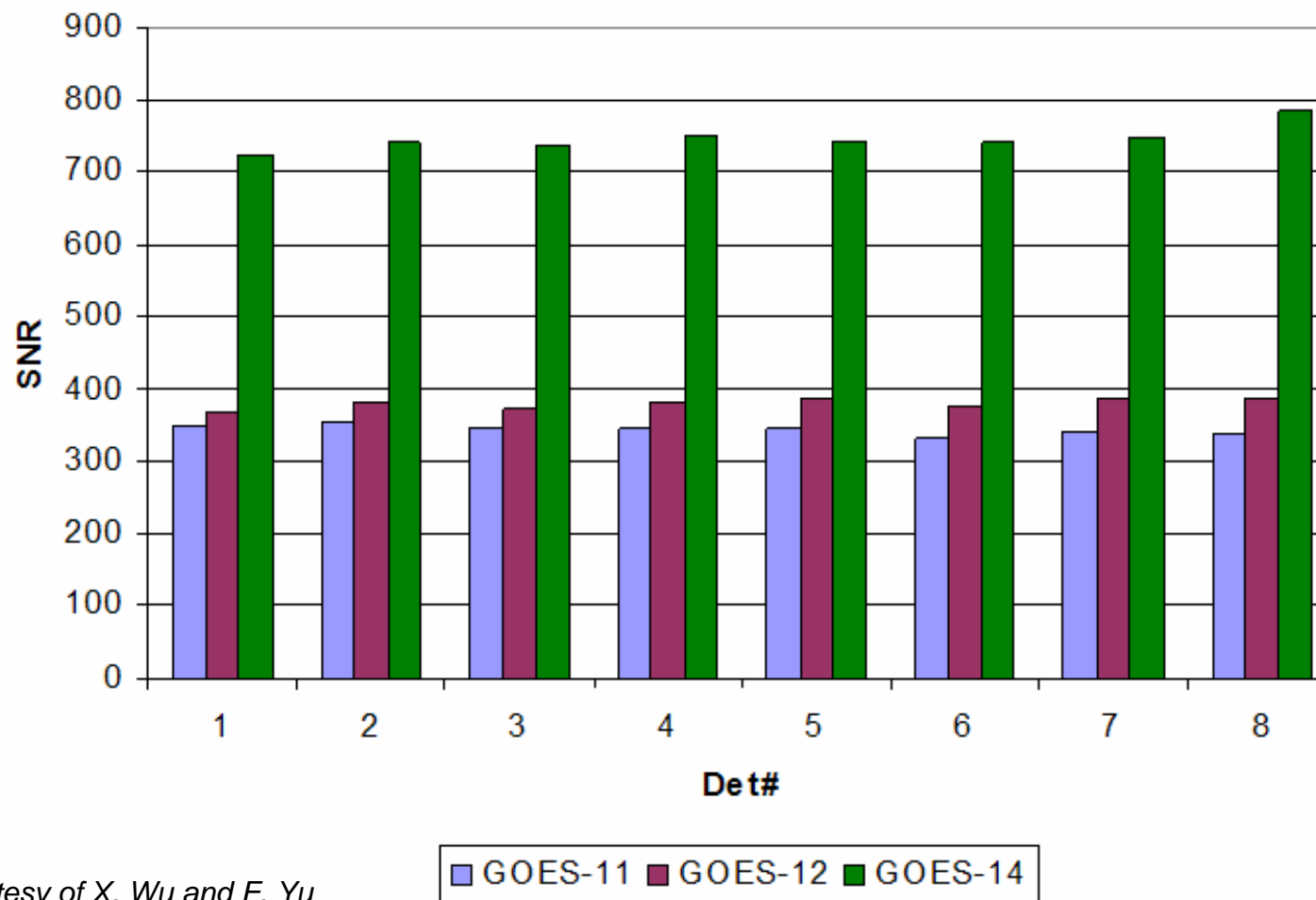
GOES-14 First Image

- One month after launch on 27 July 2009, began receiving full disk visible images from GOES-14.
- GOES-14 is located at 90 degrees west longitude.
- The first infrared image, was received about another month later.

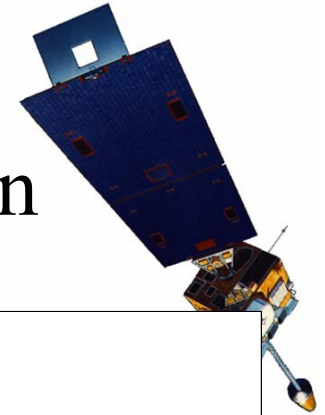




GOES-14 Imager has the Best SNR in the Visible Channel

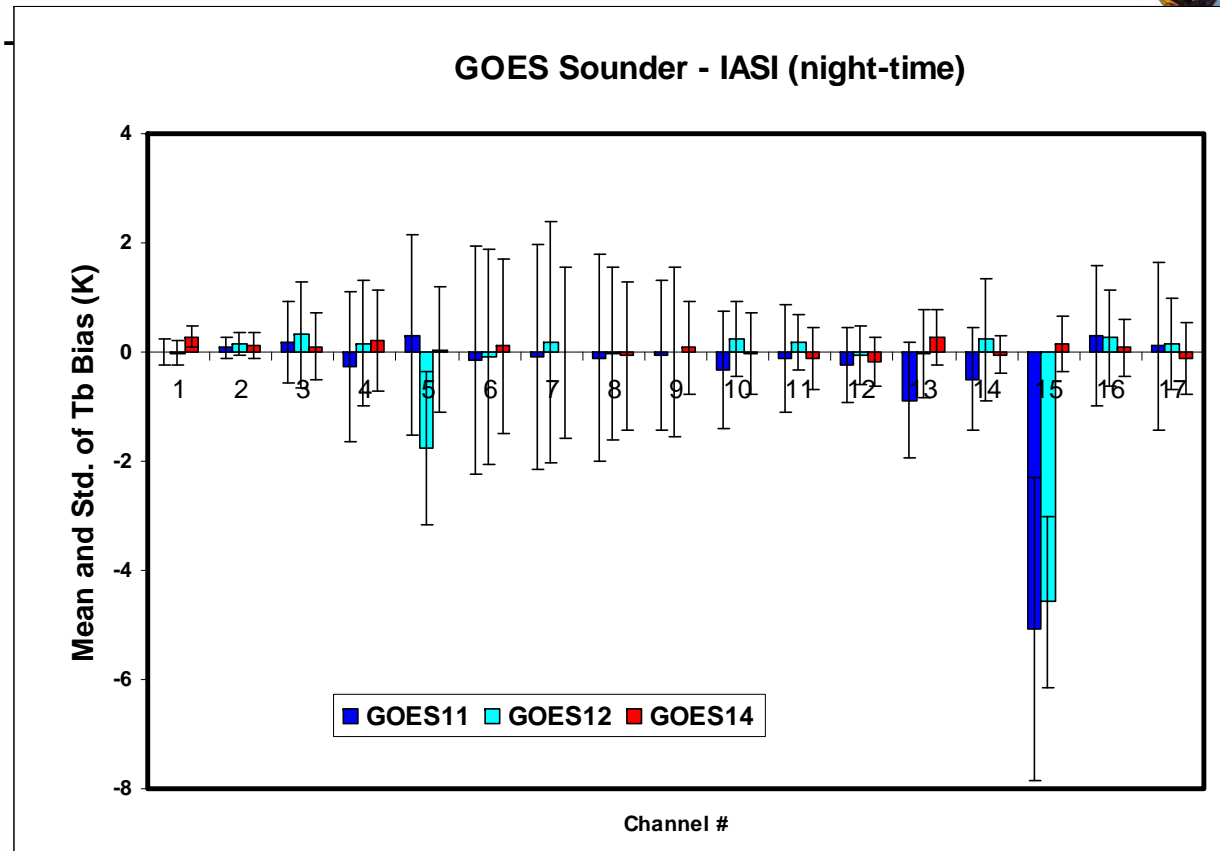


Slide courtesy of X. Wu and F. Yu



GOES-14 Sounder On-orbit Verification

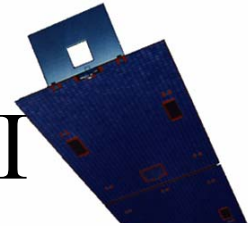
- Analysis suggest that GOES-14 Sounder performance is comparable with GOES-11/12, with significant improvement for a few channels (most notably Ch.15).
- GSICS is an important tool during the GOES-14 Post-Launch Test (PLT) and the investigation of GOES-14 Sounder “loose lens” anomaly.
- Routine Instrument Performance Monitoring (IPM) is implemented.



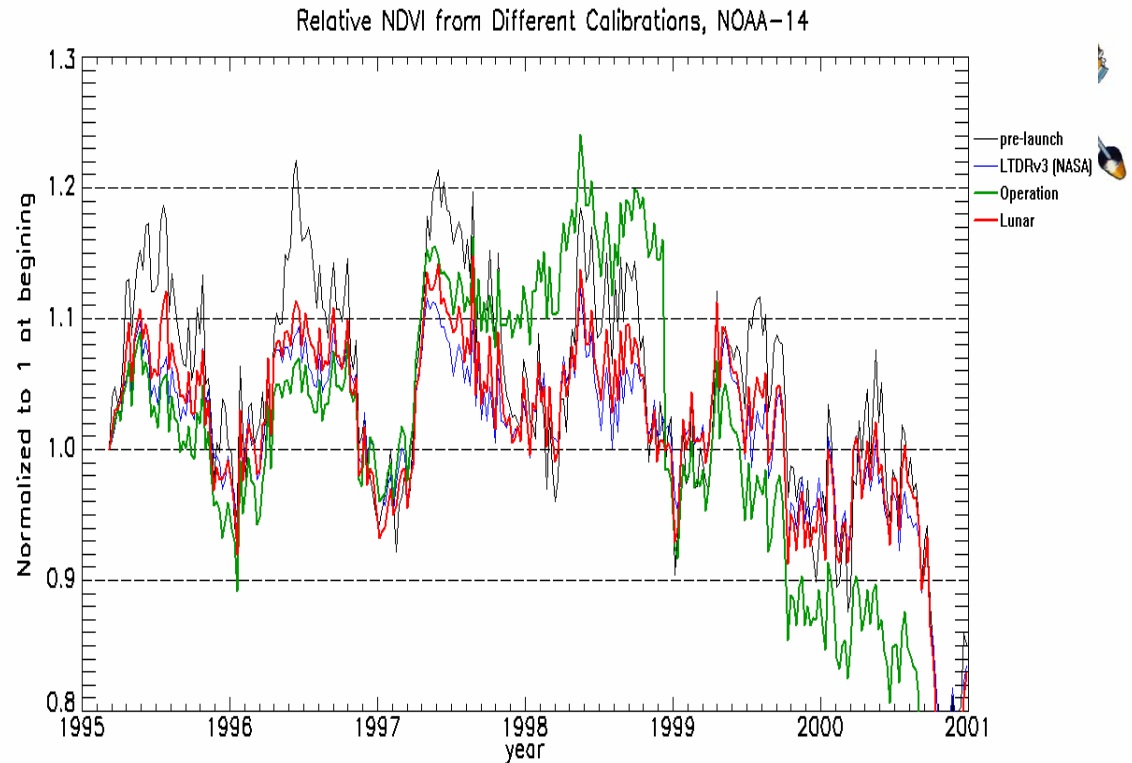
*GOES-11/12/14 Sounder brightness temperature bias
relative to IASI in December, 2009.*



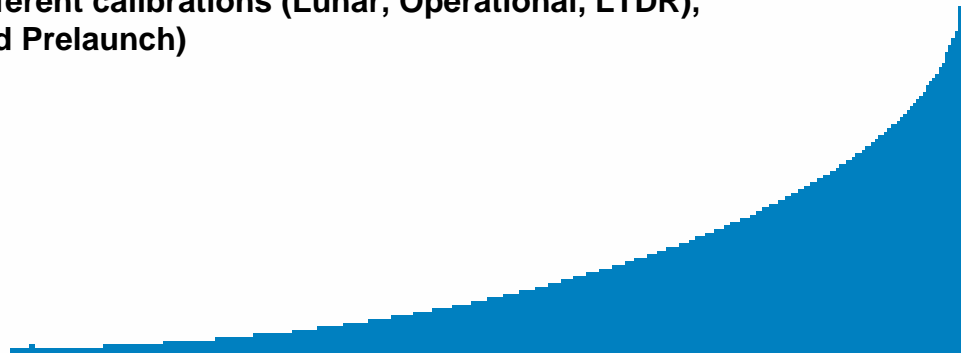
Lunar Calibration Applied to NDVI



- AVHRR Lunar calibration has been applied to NOAA-14 NDVI (Normalized Difference Vegetation Index)
- Relative NDVI reveals discrepancies in the operational calibration especially between 1998 and 2001
- Consistency in the absolute NDVI values between calibrations yet to be established
- Lunar calibration produced consistent results with that of NASA's LTDR (Long-term Data Record)

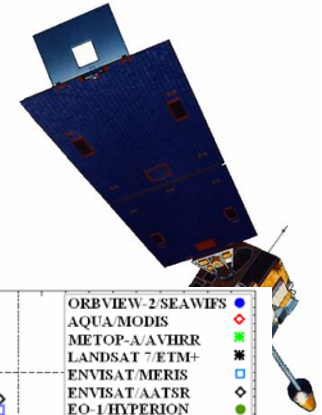


Comparison of NOAA-14 NDVI time series with different calibrations (Lunar, Operational, LTDR, and Prelaunch)

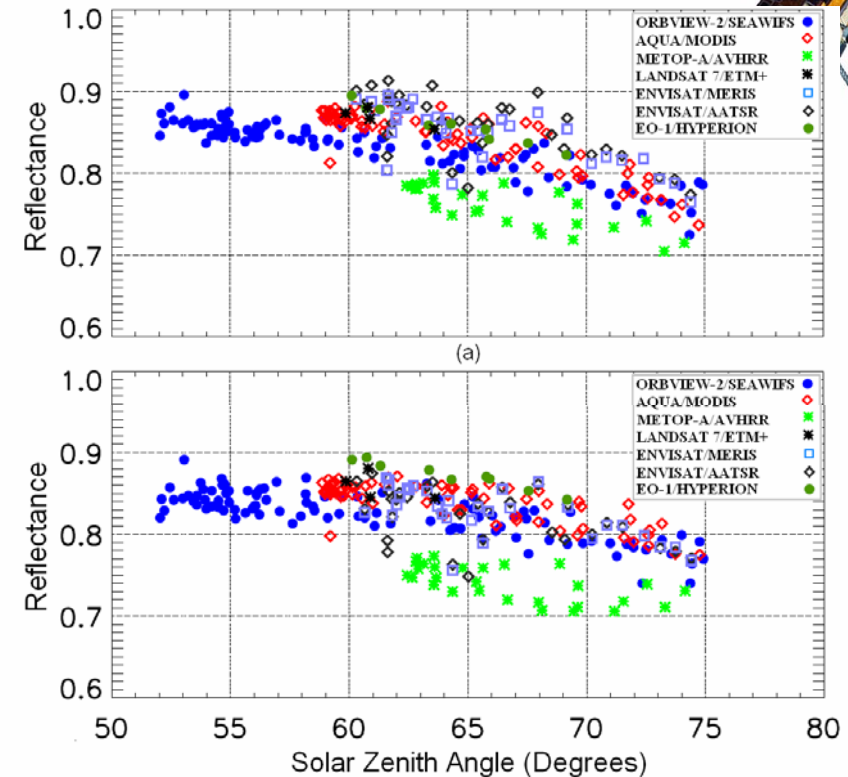




Dome C Inter-comparison Project Phase 2 Study Completed



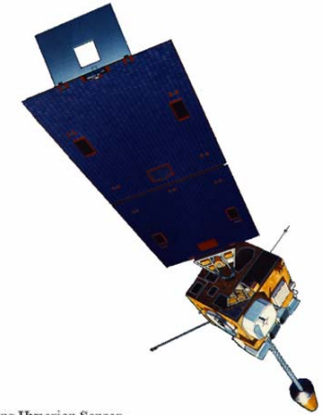
- CEOS/WGCV (Committee on Earth Observation Satellites/Working Group on Cal/Val) coordinated an international comparison of satellite radiometers at the Antarctic Dome C calibration site.
- Completed the Phase 2 study which focused on the Inter-comparison of 7 radiometers from US and European space agencies, and spectral characterization of the site.
- Study reveals traceability and standard, as well as stability issues for some instruments. An invited paper has been submitted to the Canadian Journal of Remote Sensing.
- Reached a major milestone towards establishing common reference standard sites for all space agencies.



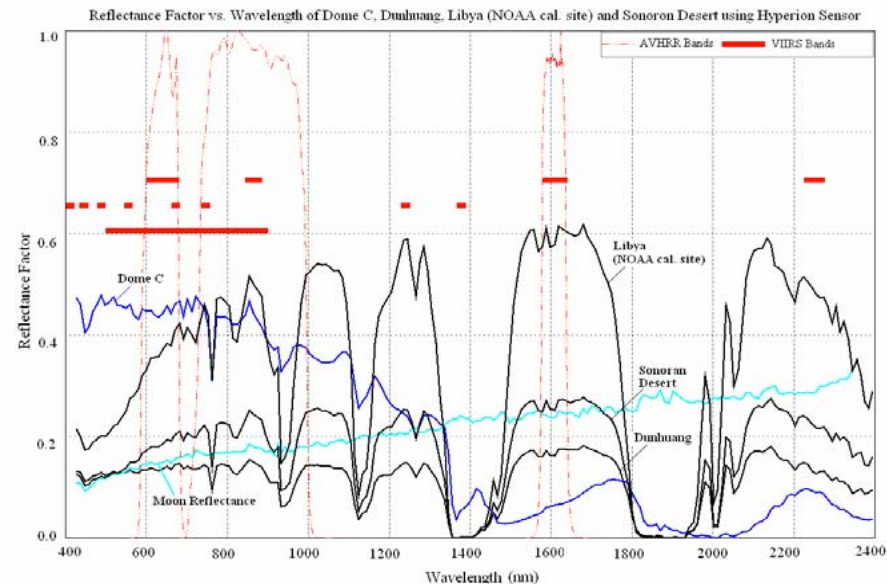
Reflectance comparison at the Dome C Site (a)
0.64 μm band (b) 0.86 μm band



Spectral Characterization of Vicarious Calibration Sites using NASA's Hyperion Observations



- In establishing standard calibration sites under the CEOS initiatives, the spectral characterization of several sites is performed using NASA's EO-1/Hyperion observations (400-2500nm spectral range).
- Each site has unique spectral characteristics, with the moon and Antarctic Dome C being the most stable with less spectral variability.
- Desert sites are significantly affected by the atmosphere but with complementary features.



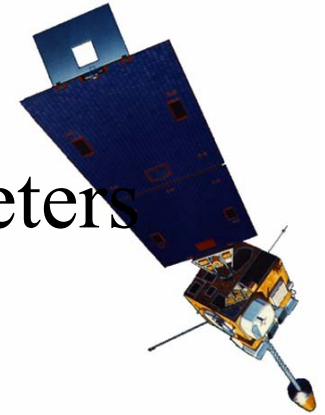
Spectral characterization of calibration sites using Hyperion observations



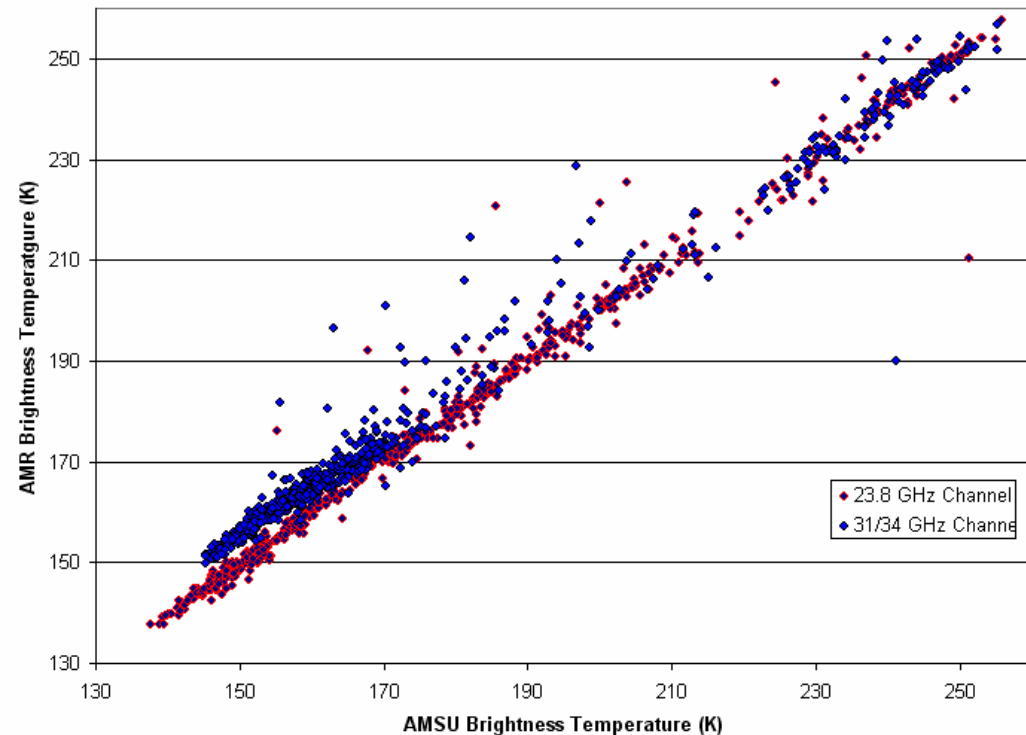


Inter-Comparison of Microwave Radiometers

AMSU and AMR at the SNOs



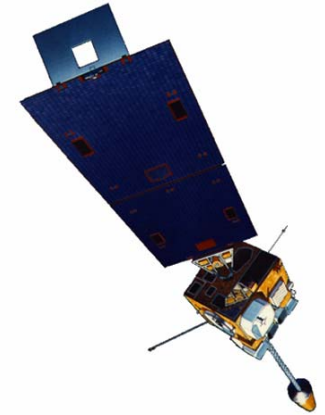
- Jason Calibration Stability Assessment
 - Altimeter for ocean surface topography
 - Research to Operations (CNES, EUMETSAT, NASA, NOAA)
 - Microwave radiometer calibration & water vapor correction
 - Sea-level rise & climate change detection
 - Jason/AMR comparison with AMSU for the 23.8 and 34 GHz channels



Courtesy of C. Cao and R. Chen



GSICS Developments in 2009



- First Potential GSICS Products Defined (limited to Level 1)
 - GSICS Bias Monitoring }
 - GSICS Correction } Defined by Hierarchical ATBD
- Now have prototypes of these products for IR channels of 9 GEO imagers:
 - Meteosat-7,-8,-9, FY-2C,-2D,-2E, MTSAT-1R, GOES-11,-12
- Implemented a product baseline algorithm as a verification against individual GPRC results.
- Definition of GSICS Data Conventions
 - netCDF format for variables and attributes
 - WMO filenames
 - Climate and Forecasting metadata convention
- Development of GSICS Data and Products Server
 - To exchange, access and/or archive datasets
- GSICS Product Acceptance Procedure is being implemented on prototype products
 - 3-stages: Demo → Pre-Op → Operational
- Users' Workshop
 - Identify next products: GEO Solar + LEO Microwave

GSICS Procedure for Product Acceptance

- A GSICS product acceptance form has been created as a product point of entry to the acceptance procedure
- Acceptance procedure now consists of three product modes - Demonstration, Pre-operational, and Operational – based on QA maturity
- EUMETSAT, JMA, and NOAA submitted their GEO-LEO IR products for acceptance, and we hope these products will be promoted to Demonstration Mode in the next couple of months, and Operational Mode by the end of the year



GSICS Product Acceptance Form

Version 1.0

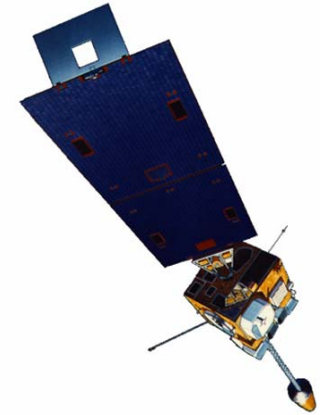
GSICS Coordination Center

November 2009



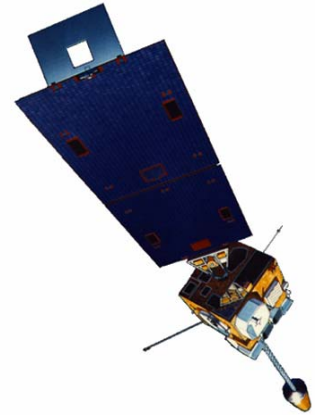
GSICS Research Activities in 2010

Solar Band Inter-Calibration Strategy



- Aim to develop GSICS products for Solar channels to complement those for IR:
 - GSICS Bias Monitoring
 - GSICS Correction
 - Initially for Visible and Near-infrared channels of current GEO imagers
 - Will apply to LEO imagers from 2011
- Definition of Inter-Calibration Reference
 - Assumed to be Terra/MODIS – to be confirmed at web meeting
- Defined General Strategy:
 - Assign PIs to coordinate review of 8 potential inter-calibration methods (Deep Convective & Liquid Water Cloud, Deserts, Rayleigh Scattering & Sun Glint from Sea Surface, Moon & Stars and Direct Ray-matching)
- By next meeting (2011-03) PIs to:
 - Define the method in detail
 - Describe its potential application to GEO imagers
 - Evaluate the following criteria: Independence, Stability, Traceability, Precision, Availability, Latency, Cost
 - Perform full error propagation to estimate uncertainties including systematic and random errors
 - Assess accuracy – absolute and relative to adjacent time/date/space intervals, other channels/instruments
 - Following example to be circulated and discussed at web meeting
- During 2011:
 - Will recommend combinations of methods for each monitored instrument
 - Develop Demo versions of GSICS Products for solar GEO channels





Summary

New progress since last meeting

- Changes to the NPOESS program (JPSS)
- GOES-14 successful launch and OV
- NOAA Climate Service
- Continue calibration research and development
- GSICS progress

