P 198507

NPP/JPSS Instrument Performance Trending and Bias Monitoring in STAR Integrated Cal/Val System (ICVS)

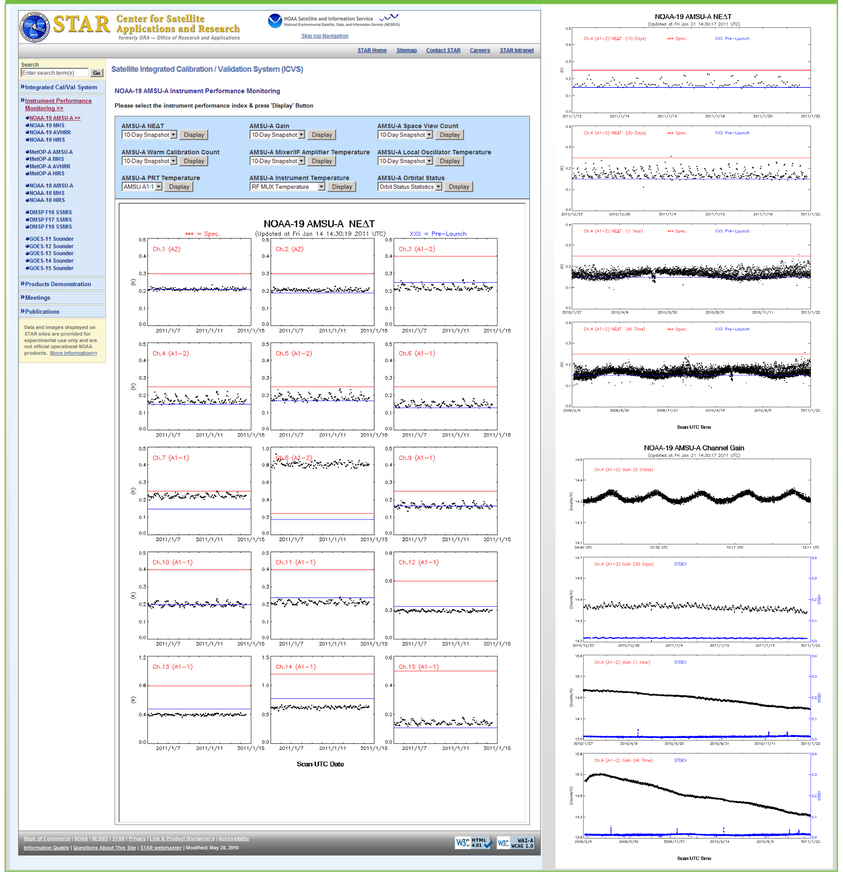
Ninghai Sun[1,2], Li Bi[2,3], Fuzhong Weng[2], Tsan Mo[2]

[1]ESSIC, University of Maryland, College Park, Maryland [2]NOAA/NESDIS/STAR, Camp Springs, Maryland, [3]ERT Inc., Laurel, Maryland

ABSTRACT

As the first of next generation operational polar-orbiting satellite system, NPP sensors will be bringing valuable data to the international community for both real-time weather and climate applications. The current NOAA POES Integrated CalVal System (ICVS) for instrumental performance trending can be updated to cover all NPP/JPSS sensors for real time in-orbit performance monitoring. The ICVS will trend the instrument noise and track instrument house-keeping information, and record the sensor anomalies into metadata files for future productions of climate data records. A global bias monitoring system (GBMS) is also developed for characterizing the NPP/JPSS sensor biases relative to both NCEP and ECMWF global forecasts (6-hour guess fields) as well as measurements from the reference sensors such as NOAA/METOP-A instruments. The WMO Global Space-Based Inter-Calibration System (GSICS) baseline algorithms (e.g. Simultaneous Nadir Overpassing, SNO and Double Difference Technique, DDT) are used to cross-calibrate NPP/JPSS sensors to the reference sensors. The in-orbit performance parameters and inter-sensor biases from these systems are extremely important for building robust NPP/JPSS climate data records. As a demonstration, JPSS ATMS data, after its cross-calibration, are used to generate the atmospheric temperature data record. The existing NOAA Microwave Integrated Retrieval System (MIRS) will be used to retrieve the temperature and water vapor profile retrievals. These new temperature data records will be connected to those derived from MSU and AMSU-A on board previous NOAA satellites for long-term climate monitoring, which requires consistency, high precision and accuracy.

Instrument Performance Monitoring Suite - Telemetry



Objectives:

1. **Provide real time instrument radiometric telemetry monitoring for satellite calibration**
2. **Provide real time instrument sensitivity analysis for operational missions**
3. **Provide long term instrument stability monitoring for satellite climate change study**
4. **Provide X-Cal bias correction coefficients for satellite climate change study**

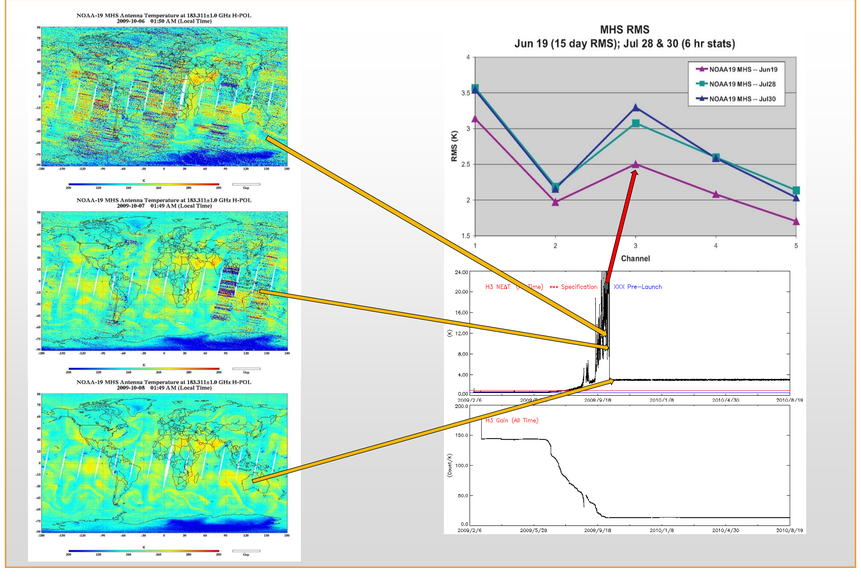
Satellites:

- **NPP ATMS/CrIS/VIIRS/OMPS**
- **AMSU/MHS/AVHRR/HIRS onboard NOAA-19, MetOP-A, NOAA-18**
- **SSMIS onboard DMSP F-16, F-17, F-18**
- **GOES 11/12/13/14/15 Sounder**

Monitored Parameters:

	ATMS	AMSU-A	MHS	HIRS	AVHRR	SSMIS	GOES
Noise Equivalent Temperature Difference (NEΔT)	22 Channels	15 Channels	5 Channels	20 Channels (NEΔN)	3 IR Channels	N/A	18 (NEΔN) 18 (NEΔT)
Gain	22 Channels	15 Channels	5 Channels	20 Channels	3 IR Channels	24 Channels	N/A
Warm Load Calibration Count	22 Channels	15 Channels	5 Channels	20 Channels	3 IR Channels	24 Channels	18 Channels (internal)
Cold Space Calibration Count	22 Channels	15 Channels	5 Channels	20 Channels	5 Channels	24 Channels	18 Channels (internal)
Warm Load PRT Temperature	8 for K/KA/V 7 for W/G	3 per Unit (A1-1/A1-2/A2)	5 Readings	4 Warm 1 Cold	4 Readings	3 Readings	internal
Digital Housekeeping Telemetry	28	45	24	20	12	28	internal
Analog Housekeeping Telemetry	36	27	18	16	22	N/A	internal
Orbital Status/Statistics	QC Flags	QC/Calib. Flag	QC/Calib. Flag	QC/Calib. Flag	QC/Calib. Flag	N/A	N/A
Tb Bias	22 Channels	15 Channels	5 Channels	N/A	N/A	24	18 Channels (AIRS/IASI)

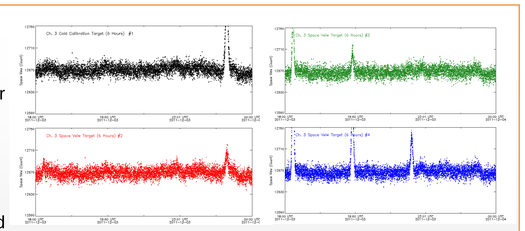
ANOMALY EXAMPLE – NOAA 19 MHS



❖ NPP ATMS Lunar Intrusion

Space View contaminated by Lunar Intrusion;

The scale and duration are related to beamwidth and viewing angle. Lower frequency channels, with larger beamwidth got more affected

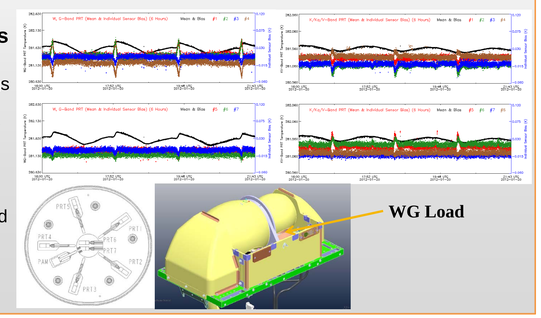


❖ NPP ATMS 4-W PRT Jumps

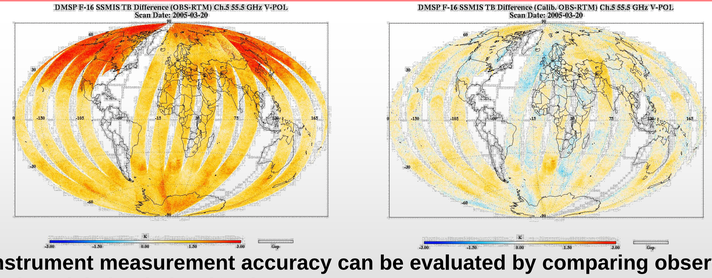
Small jumps in individual readings

W/G-Band is higher than K/KA/V Band

Possible reason,
Solar direct heating on W/G-Band PRT and indirect heating on K/KA/V-Band PRT



Instrument Performance Monitoring Suite - Bias



- **Instrument measurement accuracy can be evaluated by comparing observation and model simulation (O-B)**
- **O-B bias helps identify instrument calibration problem**
- **Long term bias trending provide valuable information for climate data records generation and new instrument design**

SUMMARY AND FUTURE WORKS

- **ICVS-LTM provides real time instrument telemetry, digital and analog, and sensitivity key information for satellite application in NOAA operational missions**
- **ICVS-LTM provides long term instrument stability information for production of climate data records (CDRs) for global climate change study**
- **ICVS-LTM will provide instrument bias trending relative to NCEP and ECMWF numerical products to produce cross-calibration coefficients for CDR generation**
- **ICVS-LTM is ready for the future NPP/JPSS satellites for the JPSS Program**

REFERENCES AND ACKNOWLEDGMENT

1. Mo, T., 2002: Prelaunch calibration of the advanced microwave sounding unit-A for NOAA-K. *IEEE Transactions on Geoscience and Remote Sensing*, **44,** 1460 -1469.
2. Sun, N. and F. Weng, 2008: Evaluation of Special Sensor Microwave Imager/Sounder (SSMIS) Environmental Data Records. *IEEE Transactions on Geoscience and Remote Sensing*, **46,** 1006-1016.
3. Yang, S., F. Weng, N. Sun, B. Yan and M. Goldberg, Accepted: Special Sensor Microwave Imager (SSM/I) Intersensor Calibration Using a Simultaneous Conical Overpass Technique, *J. Appl. Meteor. and Clim.*