Polar Orbiting Satellite Bias Monitoring System for ATMS and AMSU-A

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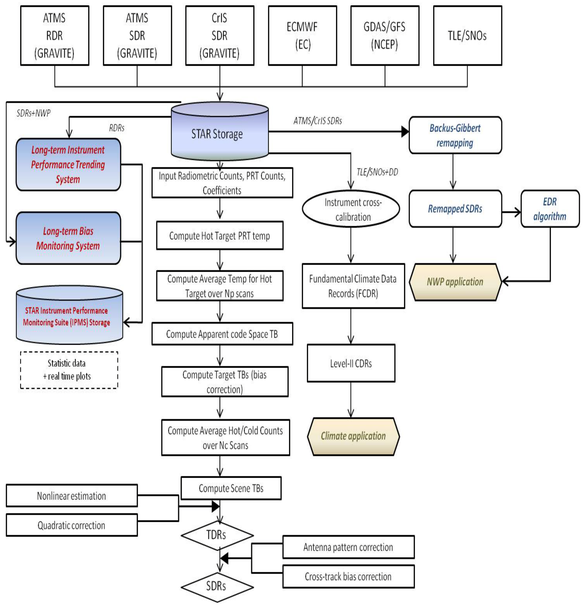
Introduction

The Cross-track Infrared and Microwave Sounding Suite (CrIMSS), consisting of the Cross-track Infrared Sounder (CrIS) and the first space-based, Nyquist-sampled cross-track microwave sounder, the Advanced Technology Microwave Sounder (ATMS), will provide atmospheric vertical profile information needed to improve numerical weather and climate modeling. Recently a near real-time bias monitoring system for the ATMS has developed in Center for Satellite Applications and Research (STAR). We simulate the brightness temperatures at 22 channels over oceans corresponding to each ATMS beam position and compare the simulated results with the measurements. The radiative transfer modeling used in this study is the JCSDA Community Radiative Transfer Model (CRTM). CRTM simulation is performed under clear atmospheric conditions over ocean using sea surface temperature (SST), wind vector, and temperature/moisture profiles obtained from the National Centers for Environmental Prediction Global Data Assimilation System (GDAS). Key features for this polar orbiting satellite bias monitoring system include global bias distribution, angular dependence distribution and time series monitoring. Similar bias monitoring system has been developed for the Advanced Microwave Sounder Unit A (AMSU-A). Assessment has been done for intercalibration between ATMS and NOAA-19 AMSU-A.

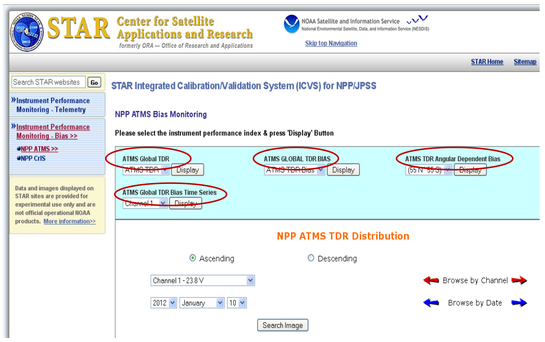
STAR ATMS Cal/Val Flow



Bias Monitoring Package Introduction

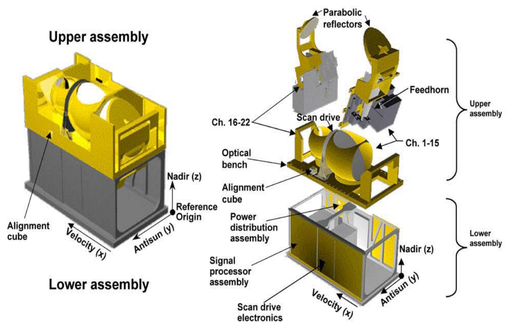
- Goal: To provide real-time/long-term instrument bias monitoring for instrument performance evaluation
- Instrument bias monitoring test using real-time ATMS TDR data has been performed.
- The JCSDA Community Radiative Transfer Model (CRTM) is used.
  - Temperature/moisture profiles are obtained from the NCEP Global Data Assimilation System (GDAS)
- Clear Sky identification
  - Physical Cloud Liquid Water Path retrieval algorithm applied to identify clear sky (Weng *et al.*, 2003)
  - CLW < 0.05 is considered as clear sky

Long-term Bias Monitoring System



GOAL: To provide real-time/long-term bias monitoring for instrument performance evaluation

http://www.star.nesdis.noaa.gov/smcd/spb/icvs



Evaluation Methods

ATMS TDR Bias O-B at Each Channel

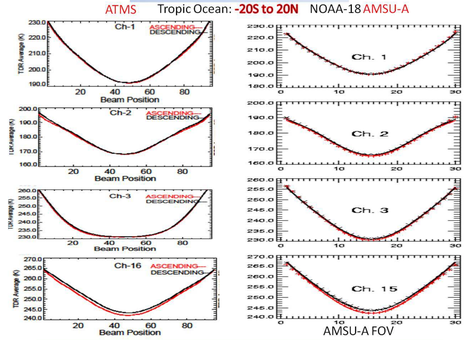
- **Over ocean (55 ^{O}N ~ 55 ^{O}S)**
- **Clear sky**
- **Ascend/Descend separated**

ATMS TDR Angular Dependent Bias O-B at Each FOV

- **Over ocean (55 ^{O}N ~ 55 ^{O}S)**
- **Clear sky**
- **Ascend/Descend separated**

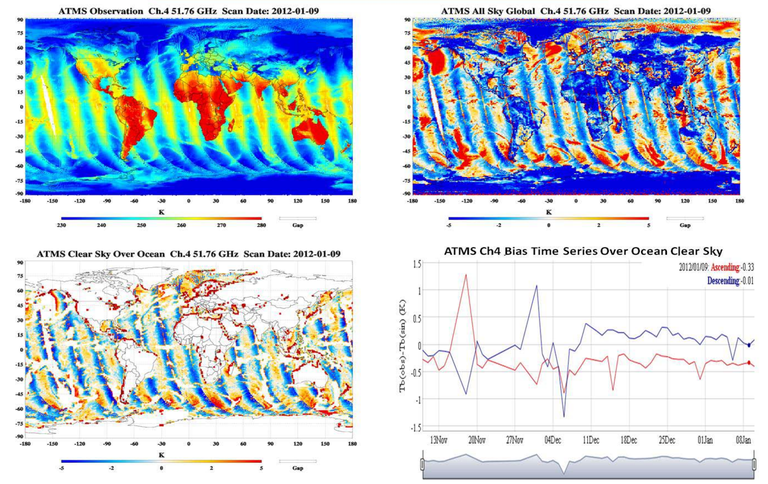
Comparison with NOAA-18 AMSU-A

ATMS Tropic Ocean: **-20S to 20N** NOAA-18 AMSU-A

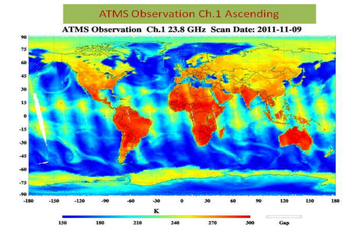


ATMS mean TDR temperature at each FOV is consistent with NOAA-18 AMSU-A

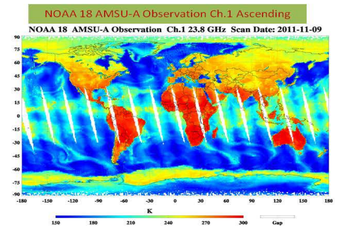
Available Products from Bias Monitoring Package



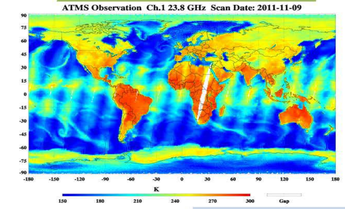
ATMS Observation Ch.1 Ascending



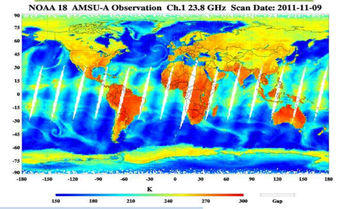
NOAA 18 AMSU-A Observation Ch.1 Ascending



ATMS Observation Ch.1 Descending

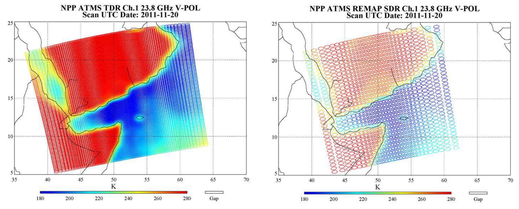


NOAA 18 AMSU-A Observation Ch.1 Descending

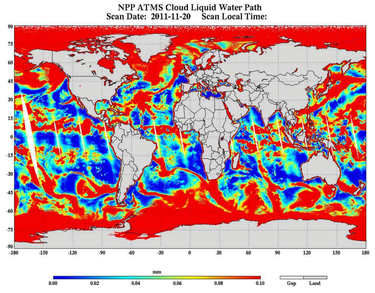


ATMS TDR show nice global coverage with less data gap

Initial look of ATMS TDR *vs.* REMAPPED SDR



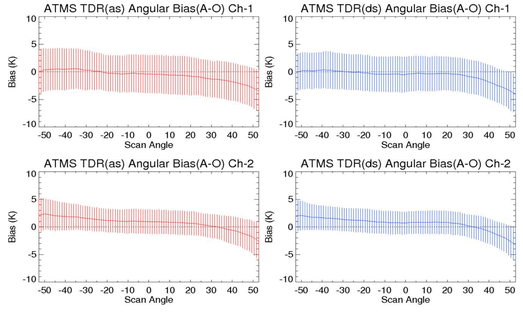
Clear Sky Identification



- **Physical Cloud Liquid Water Path retrieval algorithm applied to identify clear sky (Weng, *et al.*, 2003)**
- **CLW < 0.05 is considered as clear sky**

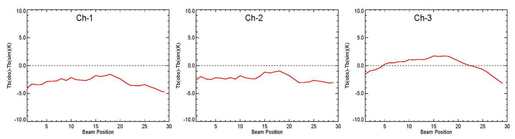
ATMS TDR Cross-Track Asymmetry

Angular dependent bias (A-O) Dec, 16-22, 2011



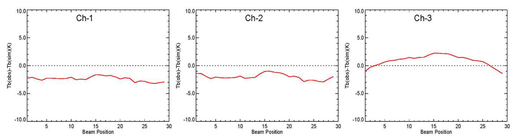
Offline study, courtesy of Tong Zhu

NOAA19 AMSU-A Angular Dependence Over Ocean Clear-Sky 2012-01-16 +/-55deg Latitude



Ascending Angular Dependence Bias
NOAA 19 AMSU-A *vs.* ATMS Remapped TDR

Remapped ATMS TDR Angular Dependence Over Ocean Clear-Sky 2012-01-16 +/-55deg Latitude



Future Work

- Improve cloud identification algorithm
- Quantify scan asymmetry bias
- Verify operational TDR to SDR conversion coefficients
- Assessment of intercalibration between ATMS and NOAA-19 AMSU-A
- Evaluate ATMS remapped SDR vs. ATMS TDR
- Continue update current bias monitor package
  - Test high resolution background input for RT simulation
  - Provide more bias monitoring parameters to the package