AMSU-B/MHS Asymmetry

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Overview

- **Background:**
  - Part of a project supported by the NOAA Climate Data Record (CDR) program
- **Goals:**
  - Develop FCDR's for Advanced Microwave Sounding Unit-A (AMSU-A), Unit-B (AMSU-B), and Microwave Humidity Sounder (MHS) window and water vapor channels
    - AMSU-A: 23.8, 31.4, 50.3, 89.0 GHz
    - AMSU-B/MHS: **89, 150/157**; 183±1, 183±3, 183±7/190.3 GHz
  - Develop TCDR's for hydrological products (rain, snow, etc.)
- **Source Data**
  - NOAA-15,16,17,18,19 & MetOp-A L1B data

AMSU-B/MHS instrument

- Cross-track scanner
- NOAA-15, -16, and -17 : AMSU-B instrument
- NOAA-18, -19 and MetOp-A: MHS instrument
- AMSU B channels (GHz): 89, 150, 183±1, 183±3, 183±7
- MHS channels (GHz): 89, 157, 183±1, 183±3, 190.3
- 90 IFOVs of AMSU-B/MHS: 1.1^{o}/ 1.1111^{o} ± 10%
- Spatial Resolution (Km): 16 x 16 (nadir) - 26 x 52
  - AMSU-A IFOV ≅ 3 AMSU-B/MHS IFOV

Products using AMSU-B/MHS

- Rain rate (use all AMSU-B/MHS channels)
- Ice water path (uses 89 and 150/157 GHz, AMSU-B has 150 GHz and MHS has 157 GHz)
- Snow cover (uses 89 GHz)
- Snow water equivalent (uses 89 GHz)

Across scan asymmetry in AMSU-B

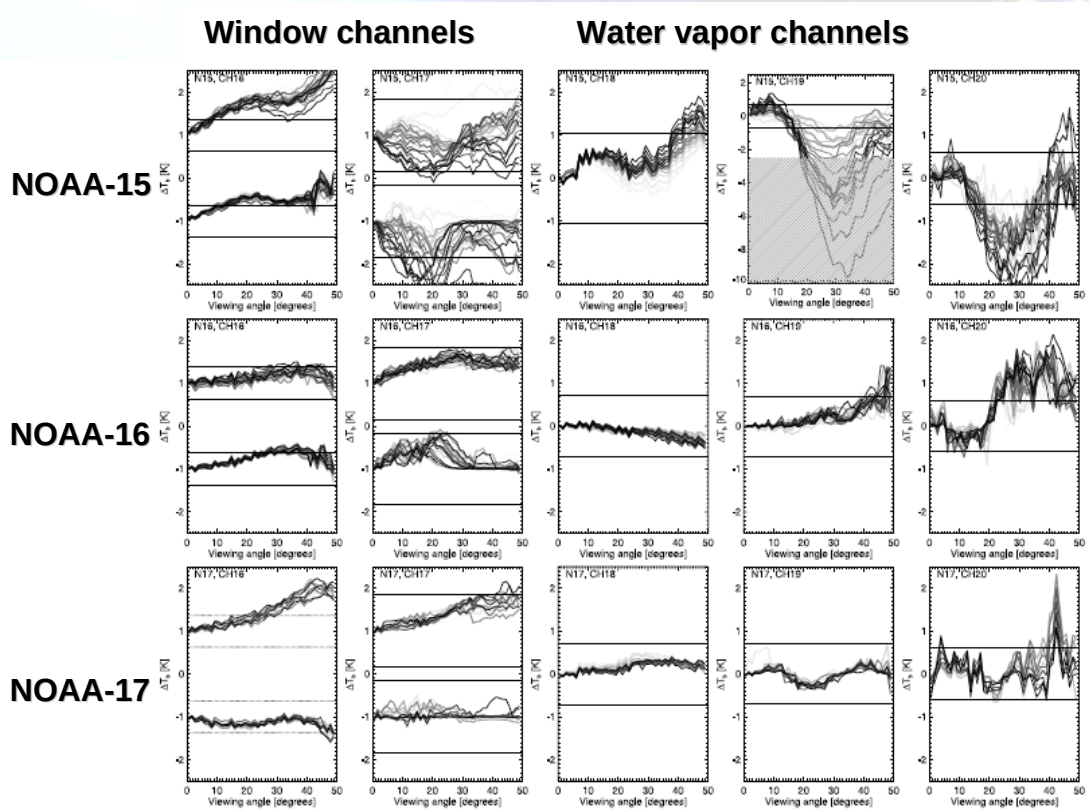


Figure 1. The asymmetry ΔT_b (left side minus right side in flight direction) as a function of viewing angle. Nadir is at zero degree viewing angle. The rows of plots from top to bottom correspond to the satellites NOAA 15, 16, and 17, the columns from left to right correspond to the AMSU-B channels 16, 17, 18, 19, and 20. Note that the y-axis scale for Channel 19 on NOAA 15 is different from the others. The different lines correspond to different three-monthly time periods, the lines for recent data are darker. Horizontal lines indicate the noise equivalent temperature. The two sets of lines for Channel 16 and 17 are data over land (plus 1 K offset) and sea (minus 1 K offset).

Satellite: NOAA-15, 16, 17

Observation period: 2000-2005

NOAA-15: strong asymmetry in WV channels

NOAA-16: lesser asymmetry

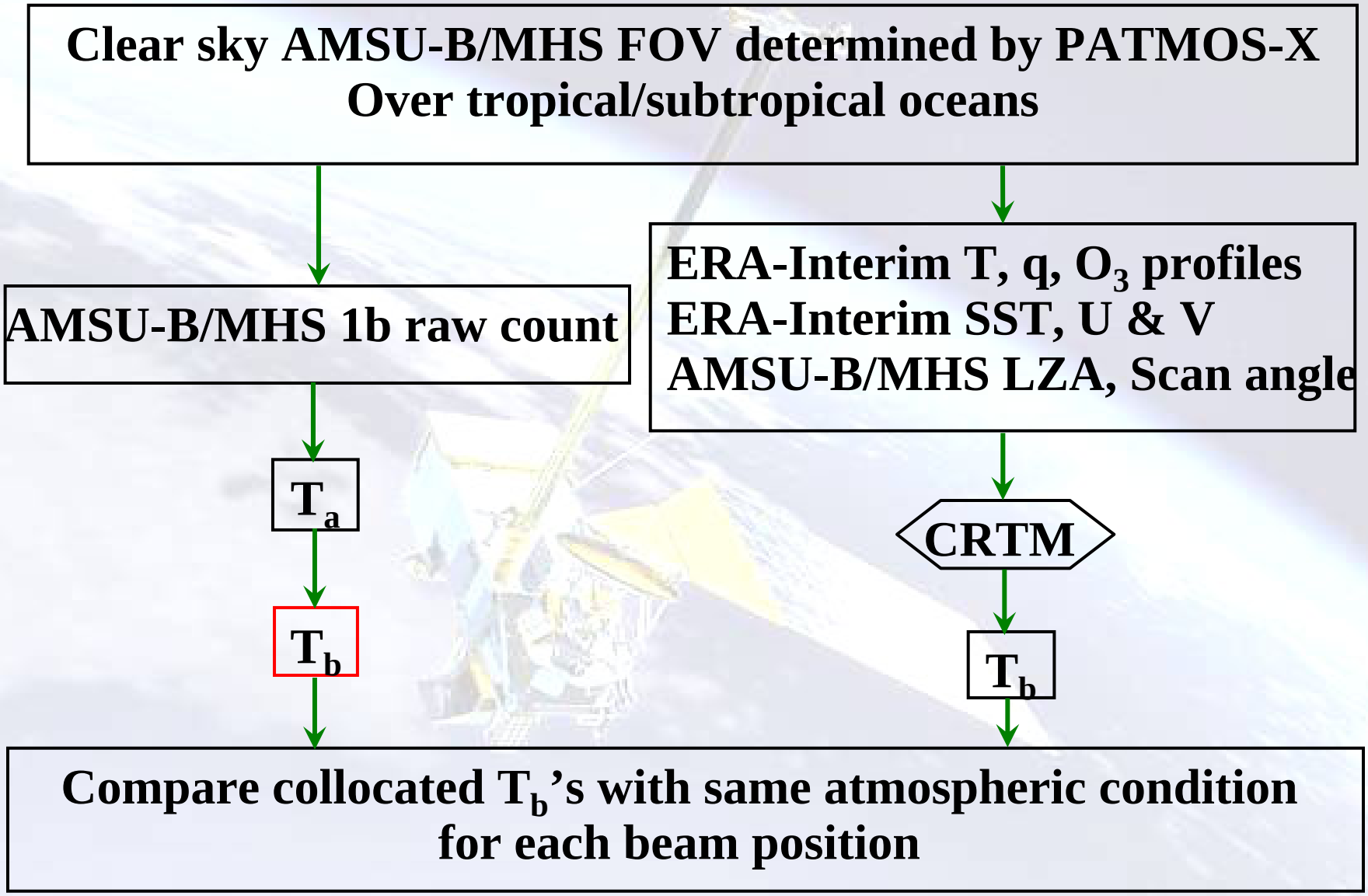
NOAA-17: least asymmetry

Time evolution: Steadily increasing asymmetry for AMSU-B instrument on NOAA-15 except for 89 GHz channel

Before RFI correction

Buehler, S. A., M. Kuvatov, and V. O. John (2005), Scan asymmetries in AMSU-B data, Geophys. Res. Lett., 32, L24810.

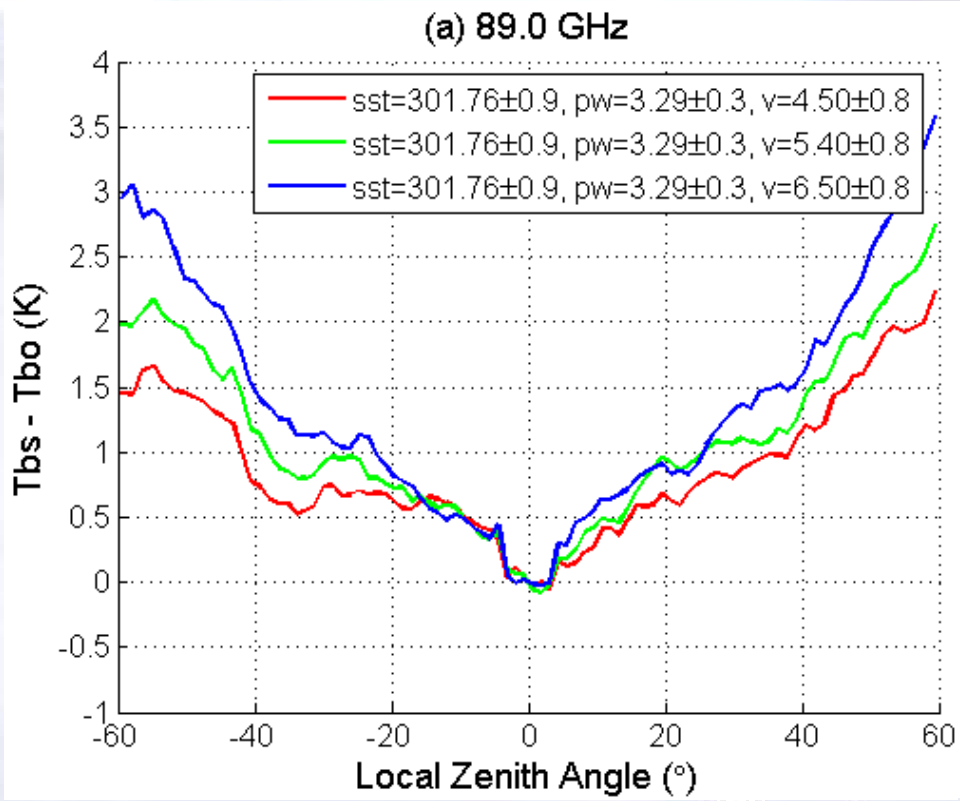
Methodology

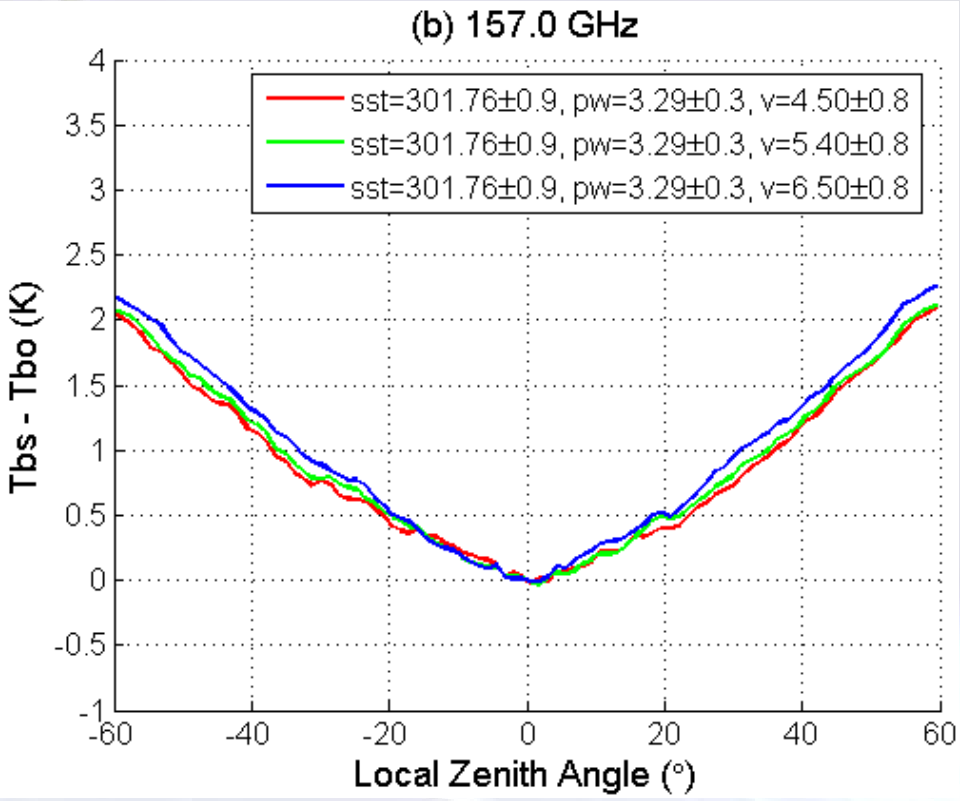


MHS across scan bias analysis

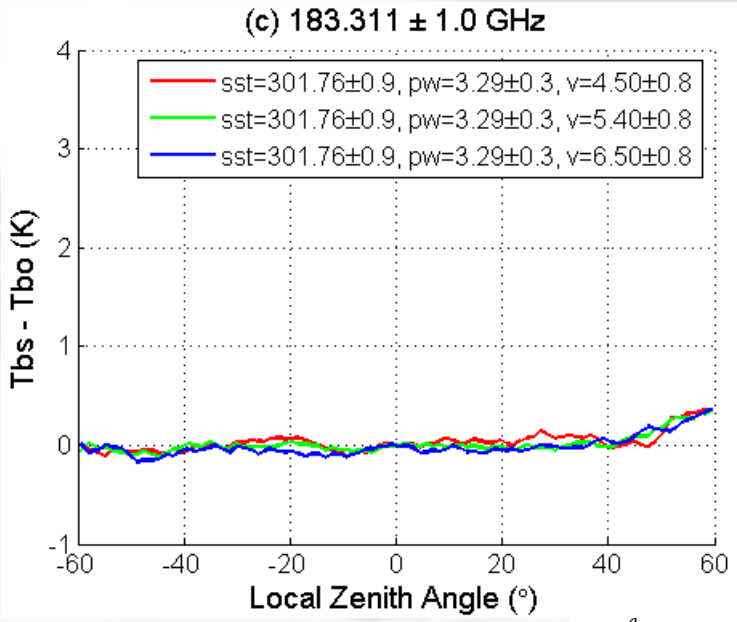
- Satellite: NOAA-18
- Observation year: 2008
- PATMOS-X cloud data screening threshold for detecting clear sky: 50%
- Stratification of different environmental conditions: temperature, humidity and wind
- Antenna temperature (T_a)

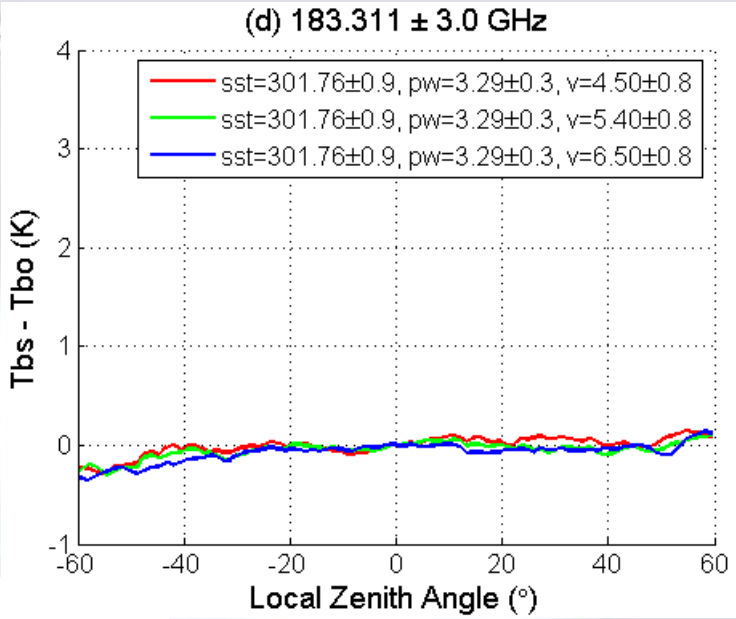
MHS across scan bias analysis: Window channels

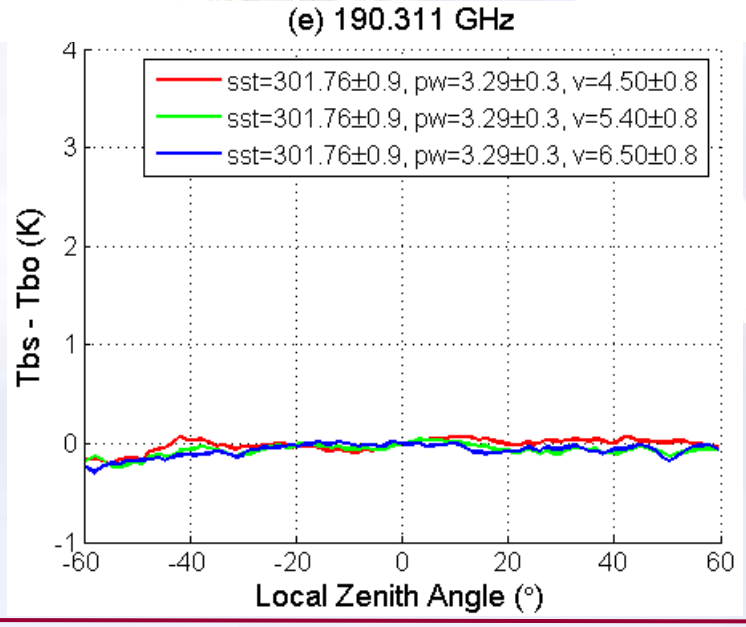




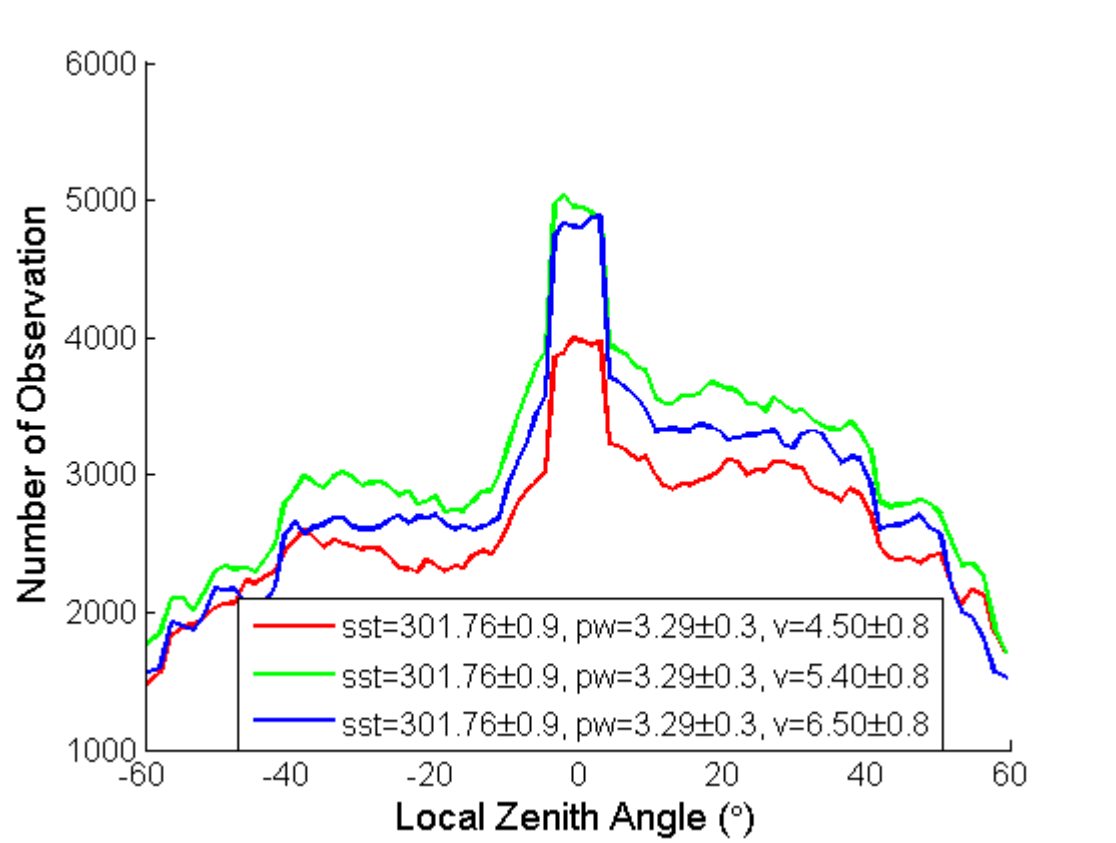
MHS across scan bias analysis: Water vapor channels







MHS across scan bias analysis: Results



Number of observation as a function of scan position

Summary and next steps

- Preliminary scan bias characterization in different channels of NOAA-18 2008 data using CRTM simulations

- ATOVS and AVHRR Pre-processing Package (AAPP) for T_a to T_b
- Influence of ascending and descending nodes
- Characterize scan bias in window channels of AMSU-B and MHS
- Correct scan bias in window channels of AMSU-B and MHS