Effects of Spectral Response Function (SRF) on Characterization of ATMS Bias

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Evaluation of Imbalanced Spectral Response Functions (SRFs) on Brightness Temperature Simulations for ATMS Water Vapor Channels

- ATMS G-band channels 18-22 are located on a strong H₂O absorption line centered at 183 GHz frequency
- JPSS-1 ATMS SRFs for channels 18 to 22 are provided by vendor in July, 2016
- Even though this dataset is outdated now, it’s still of great value to evaluate the imbalance shown in the side-band channels 18-22 on brightness temperature simulations
- The dataset includes the flight mode (FM) filter digitized SRF data at base-plate temperature of 20°C and at primary local oscillator (LO) bias levels of G-band channels, which are used in the present study
- With the measured SRFs, the average gain difference between the lower- and higher-sideband, which is called as “imbalance” for each channel can be assessed
- To save computational time, the SRF is truncated at -20 dB to keep the 99% of the maximum SRF for each band of each channel

Comparison of BT Simulations Between Boxcar and Measured SRFs for JPSS-1

Comparison of Antenna Patterns Between S-NPP and JPSS-1

Comparison of Main Beam Efficiencies Between S-NPP and JPSS-1

Summary

- Both magnitude and shape of imbalanced SRFs are critical for brightness temperature simulations of water vapor channels
- It’s suggested a necessity of providing the actual SRFs from all bands carefully measured by the instrument vendor to NWP users to build an accurate fast RTM for satellite data assimilation in NWP models
- Antenna efficiencies are required for ATMS TDR to SDR conversion
- G-band antenna beam efficiencies of J1 ATMS are much higher than those of S-NPP ATMS
- Detailed antenna pattern measurements are needed for the data assimilation when the spatial resolution of NWP model is higher than FOV.