CRTM Support to GMAO: Validation and Coefficient Generation

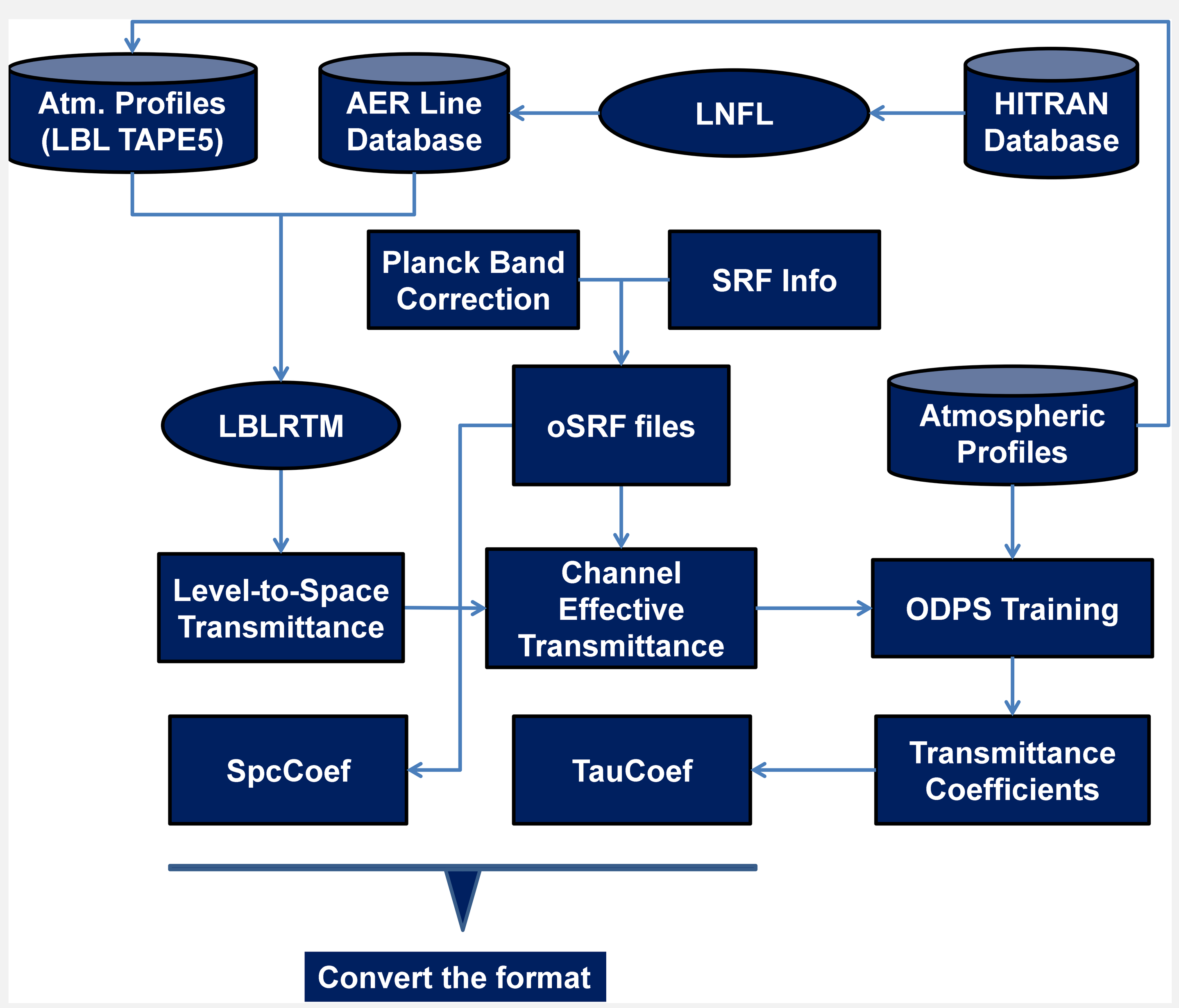
Isaac Moradi and Will McCarty, GMAO GSFC, NASA

GMAO
Global Modeling & Assimilation Office

Summary

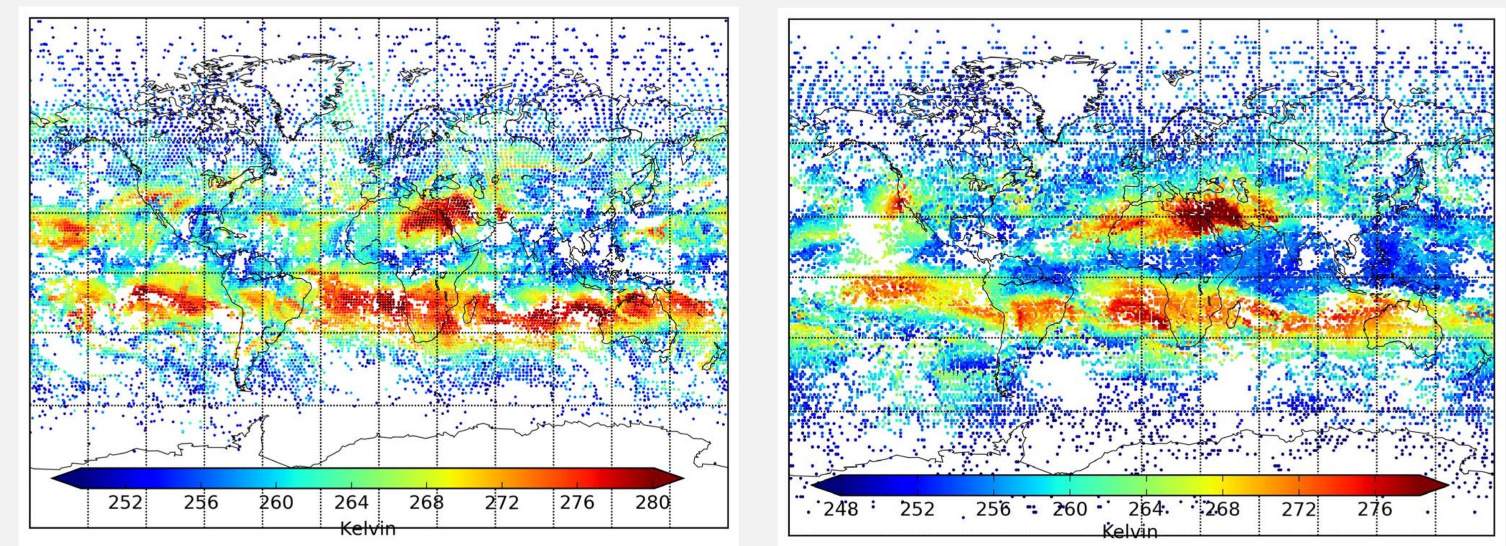
Radiative transfer (RT) models play a very critical role in assimilating satellite radiances into NWP models. Community Radiative Transfer Model (CRTM) developed by Joint Center for Satellite Data Assimilation is widely used in the U.S. as the forward operator for the assimilation of microwave and infrared satellite radiances. This work shows an snapshot of the GMAO radiative transfer modeling activities to advance the assimilation of satellite radiances as well as to facilitate the GMAO activities on Observing System Simulation Experiments (OSSE).

CRTM Coefficient Training

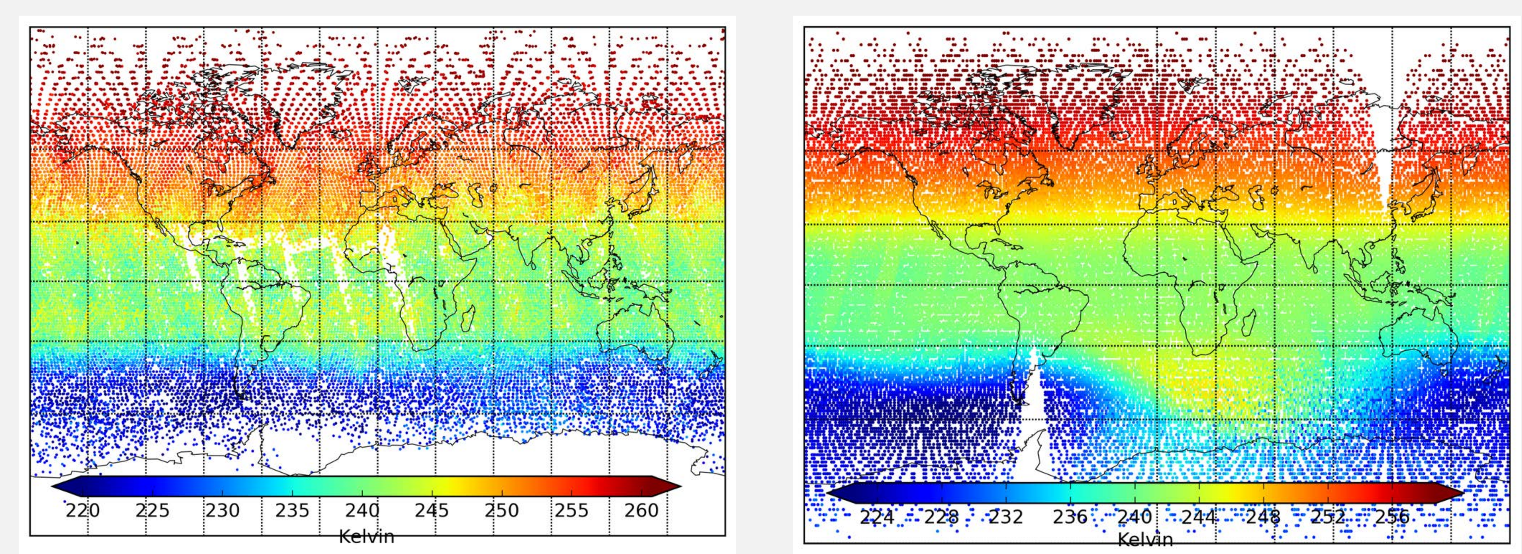


The CRTM Training process includes four major steps: (i) generating the SpcCoef files which include the sensor specific information, e.g., frequency of the channels, (ii) calculating the absorption coefficients using a line-by-line model, (iii) convolution of the absorption coefficients and the sensor response function, and (iv) regressing the sensor absorption coefficients vs. geophysical variables such as water vapor, ozone, temperature, and/or a combination of them.

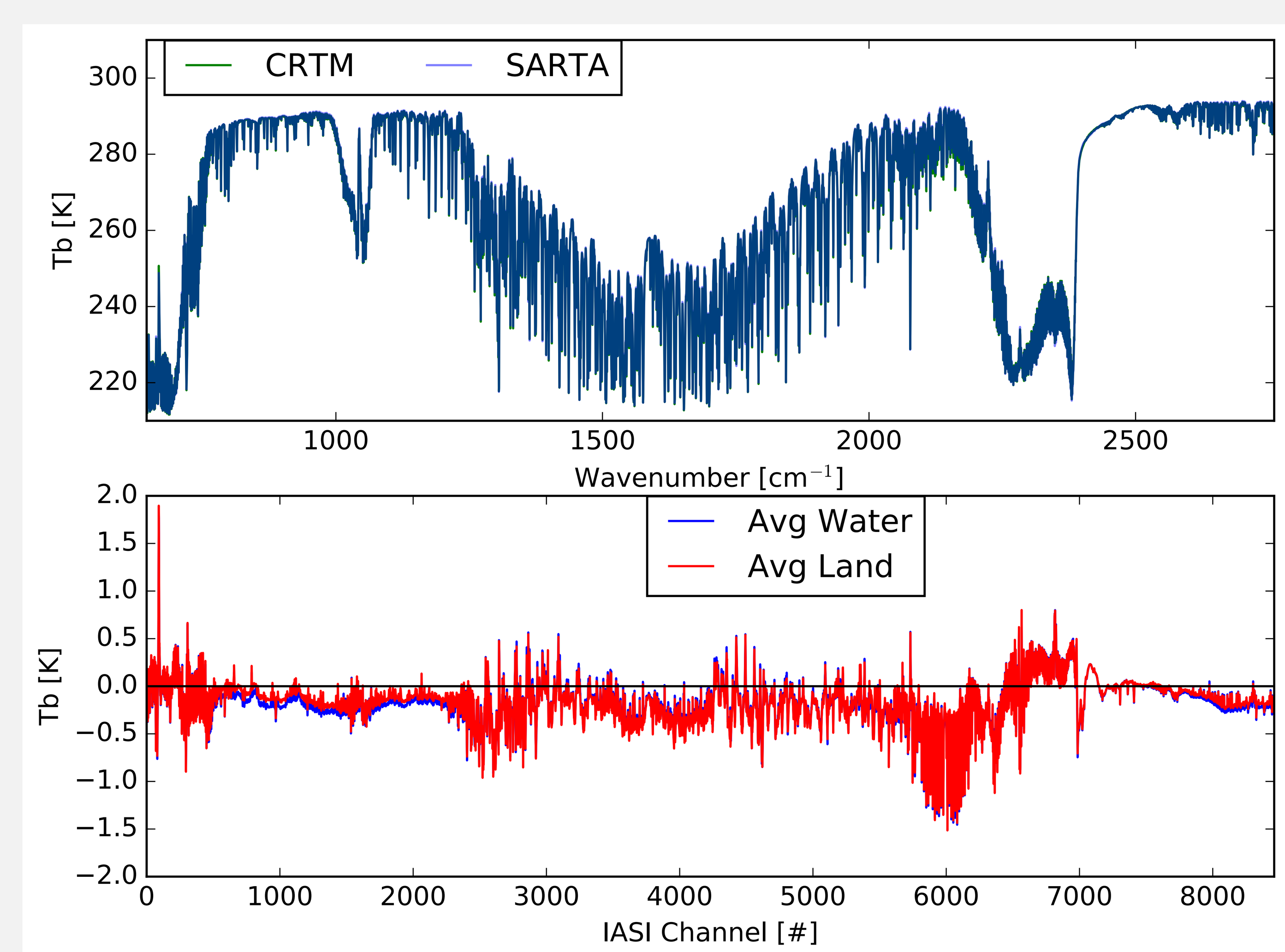
Validation of CRTM



Real (left) versus simulated (right) MISTiC observations (Channel 1839.15 cm^{-1}). Synthetic observations are used in the GMAO OSSE activities. The real observations were generated from the IASI full spectrum observations.

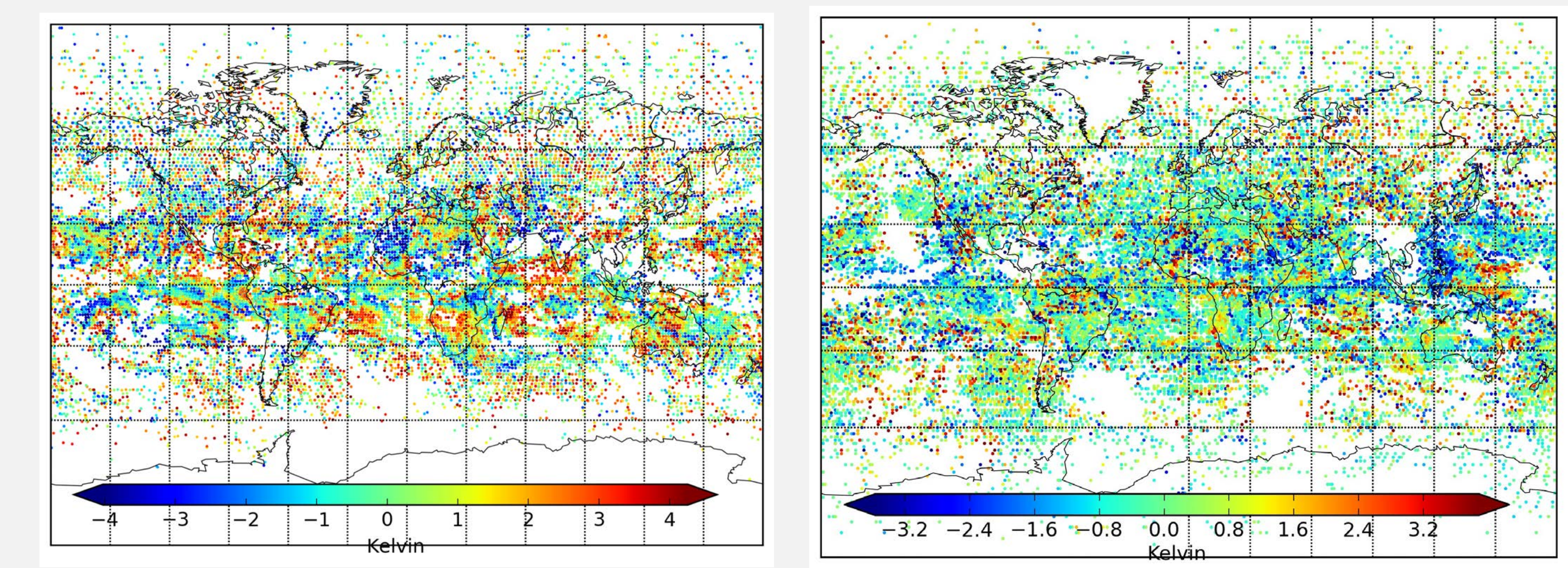


Real (left) vs. simulated (right) MISTiC observations (Channel 2359.77 cm−1). Difference between the real and simulated data is due to the non local-thermal equilibrium (NLTE).

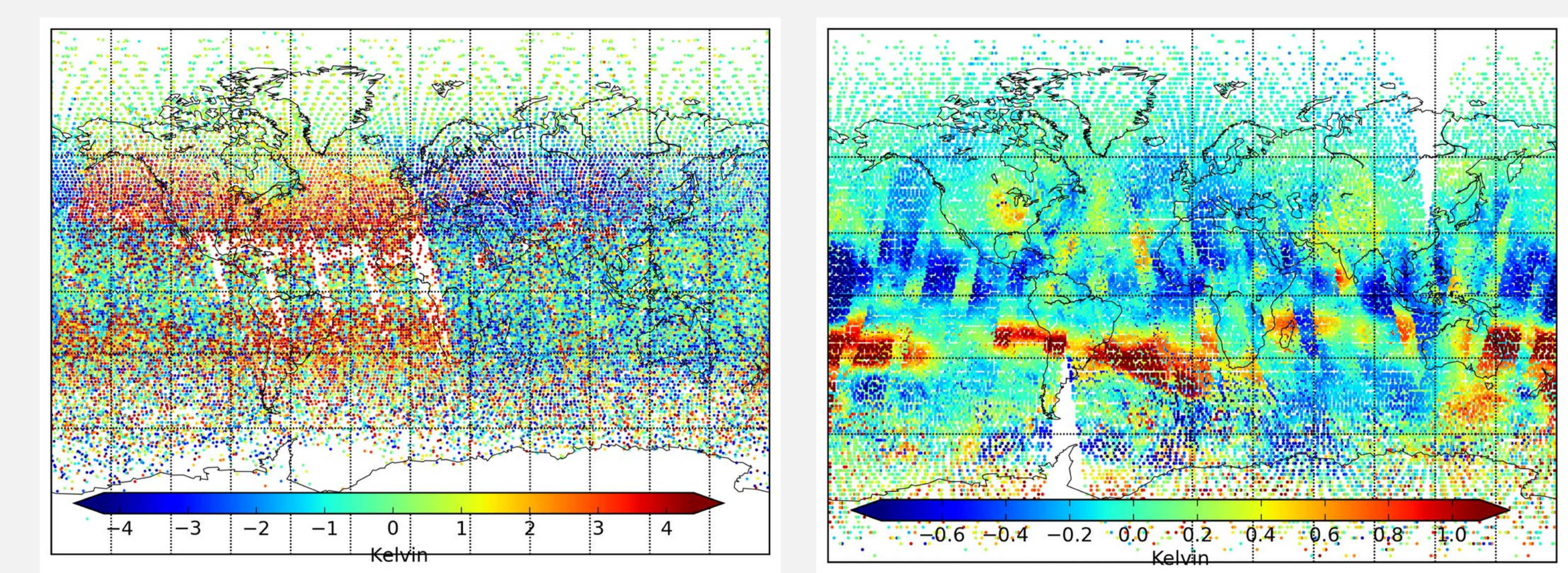


Comparison of CRTM and SARTA over land and ocean for the IASI instrument. The MISTiC instrument covers the spectrum range from 1734.70 cm−1 to 2449.18 cm−1 (590 channels).

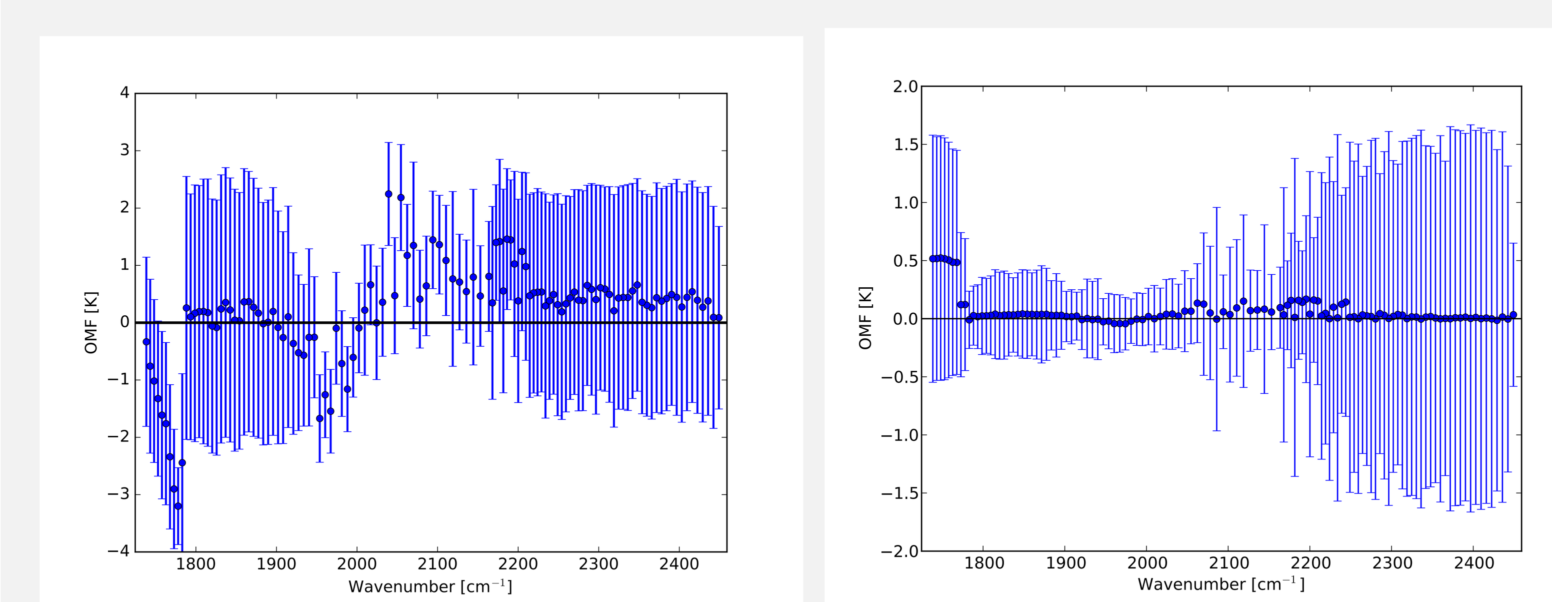
Data Assimilation and OSSE



Observation minus forecast (OMF) for the MISTiC observations (Chan. 1839.15 cm^{-1}) assimilated using the GMAO GEOS-5 data assimilation system. Left panel is for the real and right for the synthetic OSSE observations.



The OMF statistics for the MISTiC Chan. 2359.77 cm^{-1}) (left: real and right: synthetic OSSE observations). The large difference between the real and OSSE statistics is due to the NLTE.



OMF and corresponding standard deviations (error-bars) as a function of MISTIC channels (left: real and right: synthetic OSSE data).

E-mail: isaac.moradi@nasa.gov | *Web:* gmao.gsfc.nasa.gov

National Aeronautics and Space Administration

NASA