• GPM/GMI was launched in February 2014. It is a microwave radiometer (imager) with a conical view of the Earth, measuring rain, snow and other hydrological variables (Fig 1). It has 13 channel at 10 – 183 GHz.

• GMAO has developed the procedure to assimilate GMI and TRMM/TMI level 1 radiance data. GEOS-5 assimilation algorithm (GSI) now has the capability to assimilate GMI and TMI radiance observations.

• We are currently expanding the system to assimilate all-sky GMI radiance data.

• This research presents results from GEOS-5 experiments assimilating GMI and TMI data in clear sky conditions.

1. Assimilation Procedure and Quality Control

• In GEOS-5 ADAS, GMI data are thinned before these observations are screened. GEOS-5 only assimilates data over the ocean with skin temperature above 275 K (Fig 2). Data are not used if the observations suggest there is rain or thick clouds. These threshold vary by channels. The difference between GMI observations (O) and those model produced (forecasts, F) are adjusted through cloud and other bias correction processes (BC), in GSI (Fig 3).

• GMI level 1C-R and TMI 1B radiance data are investigated. However, channels 1 and 2, 10 GHz, are not actively used in atmospheric data assimilation because of biased background departure (Fig 4).

2. Assimilate GMI Radiance Observations With GEOS-5

The experiments are conducted with 0.5° x 0.5° (latitude by longitude) grid resolution. The control experiment is conducted with the full observation data set used for GEOS-5 operational processing. GMI data are added in the Experiment. Both experiments are conducted between mid-April and May 2014.

3. Assimilate TMI Observations – Bridge the Microwave Image Data Gap in GEOS-5 Reanalysis

• In GEOS-5 reanalysis, there is a microwave imager radiance data gap between November 2009 – April 2014 after SSMI (F13) data set was lost and before GMI observation started.

• Experiment period: mid Nov 2004 – Jan 2005 when there was no major observation system change in GEOS-5 reanalysis.

Investigation 1: TMI data’s impact during the SSMI/TMI overlap period 1998-2009.

• Improvement in GEOS-5 forecasts is neutral after GMI data are assimilated in clear-sky conditions. We are testing all-sky microwave radiance data assimilation framework using these data.

• TMI observations can bridge the microwave imager data gap between 2009 – 2014 in GEOS-5 reanalysis.

• GMAO is also developing a sea surface temperature assimilation methodology using buoy observations and space-borne infrared data. TMI and GMI 10.6 GHz radiance data are being investigated for this purpose.

Investigation 2: The potential impact of TMI data in the next analysis during the period 2009 – 2014.

4. Summary and ongoing work

• Improvement in GEOS-5 forecasts is neutral after GMI data are assimilated in clear-sky conditions. We are testing all-sky microwave radiance data assimilation framework using these data.

• TMI observations can bridge the microwave imager data gap between 2009 – 2014 in GEOS-5 reanalysis.

• GMAO is also developing a sea surface temperature assimilation methodology using buoy observations and space-borne infrared data. TMI and GMI 10.6 GHz radiance data are being investigated for this purpose.