ASSIMILATION STUDY OF MICROWAVE SENSOR WATER VAPOR SOUNDING CHANNELS IN NCEP GLOBAL FORECAST SYSTEM

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Abstract

Microwave humidity sounding channel measurements have been available from NOAA, Metop, DMSP, and Fengyun-3 satellites. Presently, the data from NOAA-18 - NOAA19, and METOP-A are assimilated into the NCEP Global Forecast System (GFS) and show some small positive impacts on the global medium range forecast, as shown in Figure 1. Lack of a significant positive impact from assimilation of water vapor sounding channels is due primarily to problem associated with prediction of water vapor field in the GFS model. Figure 2 compares the mean biases of brightness temperatures at three water vapor sounding channels and standard deviations using two types of water vapor profiles which are provided in the GFS forecast and analysis fields. Obviously, assimilation of water vapor channels has improved analysis fields but somehow can't produce the impacts on the forecasts. This phenomenon is also found when hyperspectral infrared water vapor radiances are assimilated in the GFS (Jung et al., 2009).

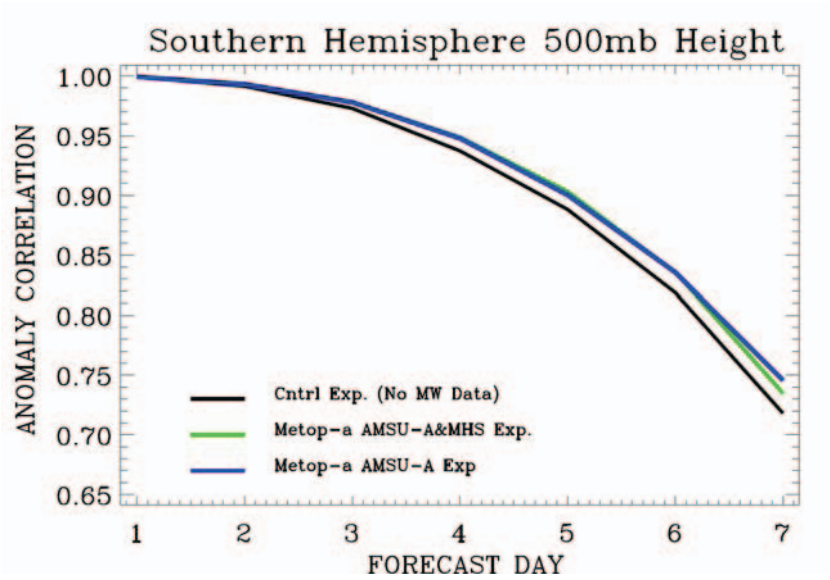

Figure 1 Anomaly correlation at 500 mb for one control and two test runs over Southern Hemisphere. 'Cntrl. Run' uses all conventional and non-microwave sensor data; 'Metop-a AMSU-A Exp' is the same as 'Cntrl. Run' but adding the Metop-a AMSU-A data; 'Metop-a AMSU-A&MHS Exp.' is the same as 'Metop-a AMSU-A Exp' but adding the Metop-a MHS data.

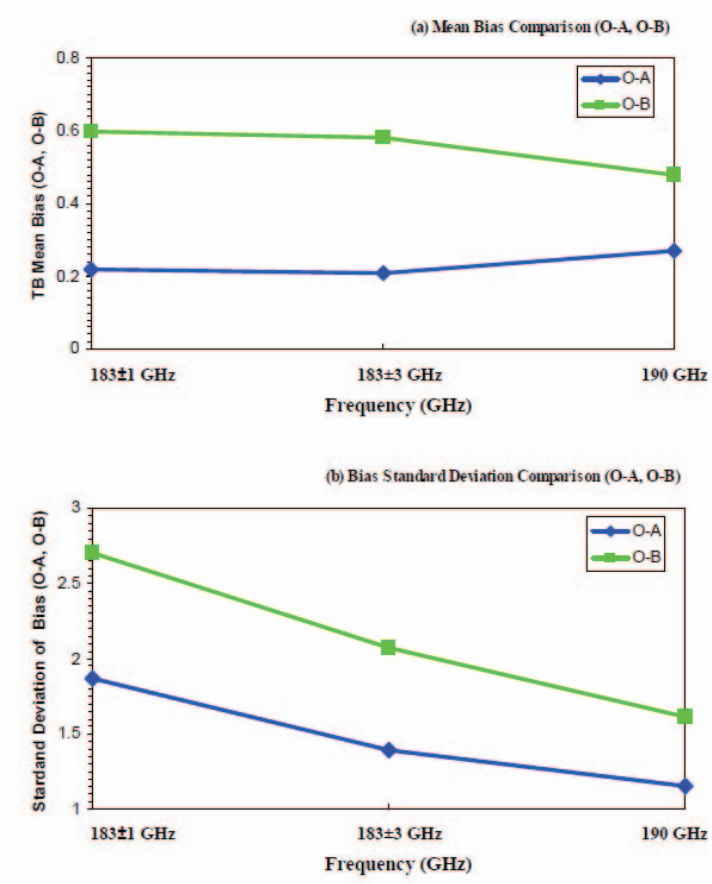

Figure 2 Mean biases of brightness temperatures at three water vapor sounding channels and standard deviations using two types of water vapor profiles which are provided in the GFS forecast and analysis fields. (a) Mean biases of brightness temperatures. (b) Standard deviations of biases.

This study will investigate the problems associated with assimilation of microwave water vapor sounding channels. First, we will improve the quality control of microwave water vapor sounding data used in the GFS. It is shown that the water vapor channels are highly affected by thick ice phase clouds and thus an ice cloud detection algorithm (Sun and Weng, 2010) will be tested in new assimilation experiments. For F16 and F17 satellites, the water vapor sounding channels are contaminated by the antenna emitted radiation and must be dealt with a specific correction algorithm as we have done for the correction of radiance anomalies in their low atmospheric temperature sounding channels (Yan et al., 2010). The SSMIS on F18 satellite which was launched in October 2009 and is now functioning very well. This new instrument and several current MHS instruments on satellites including METOP-A and FY3 offer an opportunity to

characterize bias distribution of three water channels on F16 satellite. In addition, snow and sea ice emissivity algorithms are also developed and will be incorporated into data assimilation experiments.

References:

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