The impacts of MODIS and SSM/I total precipitable water on Hurricane Sandy forecasts in regional NWP model

Pei Wang[a,b], Jun Li[a], Tim Schmit[c], Jinlong Li[a], Yong-Keun Lee[a] and Wenguang Bai[a]

[a] *CIMSS, University of Wisconsin–Madison, WI, U.S.A. pei.wang@ssec.wisc.edu,* [b] *Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison, WI, U.S.A.,* [c] *Advanced Satellite Products Branch (ASPB), NOAA/NESDIS/STAR, U.S.A.*

Moisture observations are important for tropical cyclone (TC) forecasts. Studies found that the hurricanes that rapidly intensified tended to exist within a moister large-scale environment than weaker storms. The impacts of total precipitable water (TPW) from Moderate Resolution Imaging Spectrometer (MODIS) infrared (IR), and Special Sensor Microwave/Imager (SSM/I) on simulations of Hurricane Sandy (2012) are assessed and compared using the regional numerical weather prediction (NWP) model - the advanced WRF (ARW) modeling system together with the Community Gridpoint Statistical Interpolation (GSI) assimilation system. The assimilation is conducted every 6 hours with conventional data, SSM/I and MODIS total precipitable water, followed by 72 hours forecasts. The comparison of MODIS and SSM/I TPW with model background shows that the SSM/I TPW is higher and moister than the first guess, while the MODIS TPW is lower and dryer. The observation minus background (O-B) and the observation minus analysis (O-A) indicate that the MODIS data fit better with the background. To verify the impacts of assimilating MODIS and SSM/I TPW, the hurricane track, minimum sea level pressure (SLP) and maximum wind speed observations from national hurricane center (NHC) are used as references for comparisons with forecasts. The 24 hour accumulated precipitation from forecasts is verified against NOAA CPC Morphing Technique (CMORPH) high resolution precipitation analysis. Both the frequency bias and the equitable threat score (ETS) are computed to show the impacts of TPW on hurricane precipitation forecasts over ocean. The GOES-13 Imager brightness temperature measurements are also compared with that of simulated from forecasts, indicating that the mesoscale features around the hurricane Sandy can be well captured by assimilating moisture information from satellite.