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P-6 “Clean Experiment” of Satellite Radiance Data Assimilation in HWRF for Debby Forecast

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Numerical weather prediction (NWP) relies increasingly on direct assimilation of satellite radiance data to improve its forecasting accuracy. The channels to be assimilated need be carefully selected, based on the channel characteristics, ability of forward radiative transfer calculation to simulate the satellite brightness temperature, etc. This study investigates the impact of channel selections in the satellite data assimilation in Hurricane Weather Research and Forecasting (HWRF) system on the forecasts of tropical storm Debby that occurred in 2012 in the Gulf of Mexico. In the National Centers for Environmental Prediction (NCEP) Gridpoint Statistical Interpolation (GSI) data assimilation system, the HWRF model top is raised to ~0.5 hPa and the cold start embedded in the HWRF system is changed to a warm start. Satellite radiance data from the Advance Microwave Sounding Unit-A (AMSU-A) on board NOAA-18, NOAA-19, and MetOp-A, the hyperspectral Atmospheric Infrared Sounder (AIRS) onboard Aqua, the High resolution InfraRed Sounder (HIRS) onboard NOAA-19 and MetOp-A, and the Advanced Technology Microwave Sounder (ATMS) onboard Suomi National Polar-Orbiting Partnership (NPP) satellite are assimilated. Two satellite data assimilation experiments are designed. In Experiment one, channels with peak weighting function above 0.5 hPa and water vapor channels are not included in the assimilation, and Experiment two is same as Experiment one except for further excluding channels with peak weighting functions below 600 hPa. It is shown that, compared to the forecast without satellite data assimilation, Experiment one produces better intensity forecast, and Experiment two can further improve the track forecast.