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Assimilation of AHI Infrared Radiance Measurements for Improved Tropical Cyclone Forecasts Using HWRF

Xiaolei Zou(1), Fuzhong Weng(2)

(1) Earth System Science Interdisciplinary Center,
(2) NOAA/NESDIS/STAR

Observations of tropical cyclones had to rely mostly on airborne and meteorological satellite data over oceans. Direct assimilation of radiance observations from various remote-sensing instruments on board Polar-orbiting Operational Environmental Satellites (POES) made a significant positive impact on forecast skills of global numerical weather prediction (NWP) models. Direct assimilation of radiance observations from GOES imagers on board Geostationary Operational Environmental Satellites (GOES) lagged behind the assimilation of radiances from POES for several reasons. However, GOES imager instruments provide nearly continuous, high horizontal resolution observations at visible and infrared channels within and around tropical cyclones. Thus, the GOES data are unique for capturing fast evolving weather systems such as tropical cyclones. In this study, the radiance data from the Advanced Himawari Imager (AHI) channels 7-16 were assimilated into the Hurricane Weather Research and Forecasting (HWRF) system through the National Centers for Environmental Prediction (NCEP) Gridpoint Statistical Interpolation (GSI) system. Improvements were made to bias correction (BC) and quality control (QC) of AHI data, especially AHI channel 7 (3.9 μm) for which residual sun glint effects are found in O-B fields for those data already pass the GSI QC. Numerical results showed positive impacts of AHI radiance assimilation on hurricane track and intensity forecasts as well as the importance of satellite QC and BC algorithms on direct assimilation of AHI imager radiances for tropical cyclone forecasts using HWRF. Further developments are needed for the quality control of AHI data in HWRF system.