

# **Improving tropical cyclone forecasts by assimilating satellite sounding measurements**

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## **Abstract**

Reliable and stable forecasts on tropical cyclones (TCs) such as Isaac and Sandy landed onto CONUS in 2012 are critical for decision making and better preparation. Observations of atmospheric temperature and moisture information in environment and hurricane region are very important to the prediction of the genesis, intensification, motion, rainfall potential, and landing impacts of TCs through numerical weather prediction (NWP) models. The AIRS/AMSU on Aqua, IASI/AMSU on Metop, CrIMSS (CrIS and ATMS) on Suomi NPP provide atmospheric temperature and moisture information with high vertical resolution and accuracy, which is critical for the prediction of hurricane evolution. In order to maximize the benefit of satellite microwave and advanced infrared (IR) sounder measurements for TC forecasts, real time assimilation and forecasting system is developed at CIMSS, it is called satellite Sounder Data Assimilation for TC forecasts (SDAT). The regional NWP models (WRF - Weather Research and Forecasting, and HWRF – Hurricane WRF) along with the operational Community Gridpoint Statistical Interpolation (GSI) assimilation system developed by NCEP (National Centers for Environmental Prediction) are used as the frames of SDAT, which comprises of data ingestion, processing, assimilation and forecasting. The conventional and satellite sounder observations (microwave and IR radiances, soundings, layer precipitable water - LPW etc.) are ingested into Bufr file used by GSI, then 72-hour forecasts are conducted after each assimilation. SDAT can not only assimilate radiances, but also can assimilate products such as high temporal resolution total precipitable water (TPW) from geostationary satellites such as GOES and MSG.

AIRS/AMSU, IASI/AMSU and CrIMSS radiance measurements are used in assimilation and forecast experiments for hurricanes Irene (2011), Isaac (2012) and Sandy (2012). Radiance assimilation (3DVAR) and product assimilation (1DVAR/3DVAR) are compared for TC forecasts, comparable impacts were found between two approaches, although there are pros/cons of the two approaches. Overall, positive impact of assimilating microwave and advanced IR sounder measurements (both from radiances and soundings) on hurricane track and intensity forecasts is found.