

Impacts of Assimilating Doppler Aerosol Wind (DAWN) Wind Measurements on Numerical Simulations of Tropical Convection during the NASA Convective Processes Experiment (CPEX)

Z. Cui, Z. Pu, G. D. Emmitt and S. Greco

Abstract

During the May-June 2017 NASA Convective Processes Experiment (CPEX) field campaign, the Doppler Aerosol WiNd lidar (DAWN), dropsondes and other remote sensing instruments were flown aboard a NASA DC-8 aircraft to study the wind fields and convective processes in the Gulf of Mexico, Caribbean Sea, and the western Atlantic Ocean. This was done for conditions ranging from undisturbed or isolated convection through organized deep convection within Tropical Storm environments.

Using the mesoscale community Weather Research and Forecasting (WRF) model, we have conducted data assimilation experiments with the DAWN data to assess the impact on numerical simulations of tropical convection. The data assimilation methods chosen in this study to be compared with the CTL experiment are the NCEP Gridpoint Statistical Interpolation System (GSI) 3D Variational Data Assimilation (3DVAR) method and the NCEP GSI-Based Ensemble-Variational Hybrid Data Assimilation (HYBRID) method. The experiment results for several cases, namely, a non-convective case, two tropical convective cases, including one in the environment of Tropical Storm Cindy, will be presented.

Data assimilation results show that the assimilation of DAWN wind profiles presents notable adjustments in the initial divergence field for WRF simulations in all cases. The forecast verifications show good agreement of wind forecasts with radiosonde observations. The precipitation analysis also indicates improved quantitative precipitation forecasting (QPF) skill. In general, the HYBRID data assimilation method is deemed more promising for DAWN data assimilation.

Additional diagnoses will be emphasized the roles of vertical wind shear in deep, and weak convection is compared as is the evolution of wind fields and their relationship with precipitation in different convective conditions. Detailed results will be presented at the conference.

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