

Assimilation of Wind Data from the Doppler Aerosol Wind (DAWN) to Improve the Numerical Simulations and Understanding of Convective Systems over the Gulf of Mexico and Its Vicinity

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In May-June 2017, NASA conducted the airborne 2017 Convective Processes in the Tropics Experiment (CPEX). During the field campaign, the Doppler Aerosol WiNd lidar (DAWN), dropsondes and other remote sensing instruments aboard a NASA DC-8 aircraft were operated to collect data for studying convective processes and circulations in the tropics. Sixteen NASA DC-8 missions were flown into the Gulf of Mexico, Caribbean Sea, and the Atlantic Ocean and obtained a comprehensive set of observations, particularly winds from DAWN and the dropsondes near the isolated, scattered, and organized deep convection during all phases of the convective life cycle. The datasets provide an excellent opportunity to improve the numerical simulations and understand the convective systems over the Gulf of Mexico and its vicinity with data assimilation.

In this study, we conduct data assimilation experiments with the NCEP Gridpoint Statistical Interpolation System (GSI) data assimilation system to assimilate DAWN wind speed and direction into the mesoscale community Weather Research and Forecasting (WRF) model. Three study cases are included in the data assimilation experiments: A intense convective cases during the tropical storm Cindy, a deep convection case on June 16-17, and a weak convection case on June 23-24. Impacts of DAWN data on numerical simulations of these convection systems are examined. The roles of vertical wind shear in developing, evolution, and dissipation of the intense, deep, and weak convective systems will be compared. The evolution of wind fields and their relationship with precipitation in different convective conditions will also be characterized and discussed.