Hurricane boundary layer: rolls, Low level winds , and building shadows

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Since 1996, the DOW radar network has deployed in 12 landfalling hurricanes along the Gulf of Mexico and/or Atlantic coasts. DOW radars, forwardly deployed, sample pristine on shore flow in the hurricane boundary layer with fine-scale spatial and temporal resolution. Frequently, in situ 1-2 m AGL weather stations and mobile mesonets instrumented with anemometers at 3.5 m AGL collected near surface data. Data from three hurricanes (Isaac, Frances, and Isabel) will be presented.

Three DOWs (DOW6, DOW7 and the Rapid-Scan DOW) were deployed on levees surrounded by inundated marshland in Plaquemines Parish, LA during the passage of Hurricane Isaac (August 2012). The dual-Doppler baselines ranged from 1.72 km to 6 km, which is the smallest multiple Doppler network in a hurricane, to date. Radar resolution volumes in the dual-Doppler lobes created by the 1.72 km baseline are ~20 m, providing the opportunity for extremely fine-scale single- and dual-Doppler retrievals. In addition, over a dozen 1-meter and 2-meter above ground level (AGL) in situ weather stations and a 10-meter AGL Florida Coastal Monitoring Program (FCMP) weather station were deployed within the multi-Doppler network. A hybrid scanning strategy, which alternated between deep dual-Doppler volumes (1 – 10 degrees in elevation) and continuous 7-second single-, low-level updates, was employed. This scanning strategy ensured that both a comparison of low-level radar winds to surface wind measurements and a three-dimensional analysis of the hurricane boundary layer were possible. Much of the area became flooded during the event, providing both open exposure and residential exposure measurements. Preliminary dual-Doppler and integrated in situ analysis will be presented.

Near surface (< 100 m ASL) ultra-fine-scale DOW radar velocity data reveal a systematic decrease in wind speeds in the hurricane boundary layer in the wake of tall structures. This wake persists for a couple to a few kilometers. Analyses of DOW data showing these effects during obtained during the landfalls of Hurricanes Frances (2004) and Isabel (2003) will be presented. Radar sweeps obtained at 0.5 degrees elevation are analyzed on both sides, upstream, and in the wake of large buildings, such as shore front condominiums and a nuclear power facility. Differences in the decrease of wind speeds as parcels proceed across barrier islands with and without structures are compared.