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Using High-Resolution Diagnostics to Facilitate the Short-Term Threat Assessment of Tornadoes during Tropical Storm Gabrielle (2001)

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Abstract

Together with the National Aeronautics and Space Administration (NASA) at the Kennedy Space Center, FL (KSC), the National Weather Service (NWS) at Melbourne, FL (MLB) configured a local adaptation of the Advanced Regional Prediction System (ARPS) Data Analysis System (ADAS) to facilitate short-term forecasting efforts during hazardous weather situations. The ADAS was modified to assimilate nationally and locally available in-situ and remotely-sensed observational data into a series of high-resolution gridded analyses centered around east central Florida. It is initialized with the 40-km Rapid Update Cycle Model (RUC, now 20-km RUC) as the background and assimilates a variety of information such as visible and infra-red satellite, Doppler radar, area surface observations (from several networked sources), ascent/descent aircraft observations, and data from the NASA/Kennedy Space Center mesonet, (including tower winds, profilers, etc.) for a full volume depiction of the local atmosphere. The MLB ADAS was configured with nested domains with spatial resolutions of 10 km and 2 km respectfully (now updated to one domain at 4 km), and with a temporal resolution of 15-min. Operationally at MLB, ADAS diagnostics have been used to increase forecaster confidence regarding the threat of severe local storms within the 0 to 3 hour time frame by providing detailed analyses of the pre-storm environment. This has greatly enhanced the local outlook process. More so, it has proven to be a valuable contribution to the warning decision making process within the 0 to 60 minute time frame, depicting the evolution of the near-storm environment during difficult severe local storm situations.

On the morning of 14 September 2001, four tornadoes struck Brevard County in east central Florida resulting in several swaths of damage. These tornadoes were associated with Tropical Storm Gabrielle which tracked west to east across the Florida peninsula from near Sarasota to Cape Canaveral. Three of the tornadoes were F0 on the Fujita scale, and one reached F1 intensity as it moved through the town of Cocoa, FL, causing significant damage to multiple homes and business, while totally unroofing one house. Importantly, three of the tornadoes were associated with the same mini-supercell as it moved onshore and through Brevard's coastal zone, crossing barrier islands and an intracoastal waterway while advancing several

miles inland (1125-1248 UTC). At one marina, significant damage occurred as a large section of the main boat house roof was peeled back and many boats were tossed about. Confirming eye-witness reports were received from storm spotters and weather observers at Patrick Air Force Base, FL. These tornadoes occurred within the leading outer convection of Gabrielle. In the hours and moments leading up to the tornadoes, ADAS output was used to facilitate the assessment of the local tornado threat by revealing the evolution of various stability and shear parameters. In post analysis, 0-3 km helicity depictions were generated to examine potential utility for future tropical cyclone events. This presentation will examine the value of real-time high-resolution diagnostics during the Gabrielle tornado event as it occurred over east central Florida and their contribution to the local outlook and warning efforts.