The 19 August 2009 Twin Cities Area Tornadoes: High Resolution Observed and Modeled Characteristics

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ABSTRACT

The Twin Cities and nearby areas in west central Wisconsin were impacted by numerous EF-0 and EF-1 tornadoes during the afternoon of 19 August 2009. These storms formed in an environment characterized by low CAPE and high shear, particularly 0-1 km AGL shear. Most of the storms were too distant from the KMPX and TMSP radars for detailed high resolution sampling of their low level characteristics. However, the storm which impacted the city of Minneapolis was in fairly close proximity to both radars, allowing for a more complete analysis of its low-topped supercell structure. A detailed radar review of this storm will be presented, along with a fine scale evaluation of available observations in the area. Given the storm's location, a substantial amount of mesonet data was available for review, aiding in the assessment of the storm's development and evolution.

In an effort to more completely understand the development, structure, and evolution of the storms on this day, very high resolution numerical simulations of the event were performed, with horizontal grid spacing as fine as 111 m. The simulations were performed with resources from the Minnesota Supercomputing Institute, using a nested configuration of the Weather Research and Forecasting (WRF)-Advanced Research WRF (ARW). Data from the North American Regional Reanalysis (NARR) served as initial and lateral boundary conditions for the simulations. Although the simulations failed to precisely capture the individual tornadic storms, a detailed analysis of the output allowed for better understanding of the environment in which the storms developed, while providing some information on the low level vorticity budget and mode of tornadogenesis. Simulations such as these help highlight both the limitations and potential of real-time storm scale numerical weather prediction, which will become increasingly integrated into warning operations in the years to come as forecasters attempt to move toward a Warn-on-Forecast paradigm.