Using Dual Polarization Radar to Determine Supercell and QLCS Characteristics Just Prior to Tornadogenesis and Tornado Dissipation

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ABSTRACT

Research during the past several years has highlighted the importance of analyzing characteristics of the near-storm environment, when attempting to determine the severe and tornadic potential of convective storms. Highly precise and accurate measures of near-storm environmental characteristics are often lacking operationally, with forecasters typically forced to rely on lower-resolution datasets to infer storm-scale environmental characteristics, such as low-level shear, LCL heights, etc. However, recent observations associated with the implementation of dual polarization capabilities to the National Weather Service (NWS) Weather Surveillance Radar Doppler (WSR-88D) network, has indicated that this upgrade may allow meteorologists to more directly infer important storm-scale information, by identifying specific hydrometeor characteristics within different sectors of convective storms.

In this presentation, storms were investigated from four separate, tornadic cases over the Northeastern United States (two supercell events (29 May 2013 and 22 May 2014) and two quasi-linear convective system (QLCS) events (19 April 2013 and 8 July 2014)). Specific and consistent patterns in differential reflectivity (Zdr) and specific differential phase (Kdp) were noted in the inflow, rear-flank downdraft (RFD), and hook echo regions of the evaluated supercells, particularly just before both tornadogenesis and tornado dissipation times. An examination of the QLCS events indicated some similarities and some differences compared to evolutions seen with the supercells. Building upon previous research (Crowe et al. 2012, French et al. 2014, Kumjian 2011, and Markowski et al. 2002, among others), it will be demonstrated how Zdr and Kdp positioning and magnitude trends illuminated certain hydrometeor properties within different portions of these storms, and what clues these properties gave as to impending tornadogenesis, or tornado dissipation.