AN INVESTIGATION OF THE RELATIONSHIP BETWEEN DOPPLER VORTEX SIGNATURES AND POLARIMETRIC DEBRIS SIGNATURES IN DAMAGING TORNADOES

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In recent years, several high spatiotemporal resolution datasets have been collected by a rapid-scan, X-band, polarimetric Doppler radar (RaXPol) operating near strong tornadoes. In many of these cases, strong divergence in the sampled velocity field was observed during periods of heavy debris loading, followed by oscillating convergent and divergent signatures after debris is shed from the vortex. These observations have often been accompanied by significant deviations in the tornado's track and substantial changes in intensity. While these observations have prompted interesting questions regarding potential effects of debris on tornado vortices, the inability of typical Doppler radar observations to distinguish between the background flow and the flow of debris in a tornado has hindered obtaining answers to those questions.

Doppler and polarimetric spectra can be obtained from radar observations using I/Q radar data, which may theoretically allow for the decomposition of air and debris motions within strong tornadoes given a sufficient number of collected samples. However, the inability to frequently collect radar data near damaging tornadoes makes attempting this technique challenging. This study uses a Doppler radar emulator to simulate the collection of I/Q radar data "near" a strong, LES-generated tornado with and without simulated tornado debris. Analyses of the generated I/Q data will be used to assess (1) the ability of Doppler and polarimetric spectra to capture different flow regimes within a strong tornado and (2) the logistical feasibility of applying this technique in future field observations.