

Polarimetric radial velocity estimates in intense tornadoes observed by a high-resolution, rapid-scan, polarimetric mobile radar

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Between 2011 and 2013, a polarimetric, rapid-scan, mobile Doppler radar (RaXPol) sampled several violent tornadoes at close range (<5 km) in central Oklahoma. Polarimetric radars have been used for the detection of tornadic debris, but there has been comparatively limited discussion of the expected variances with velocity estimates obtained from polarimetric radars. With an increasing number of polarimetric radar datasets containing near-ground observations of tornadoes, it is prudent to consider potential errors in the velocity estimates. Since the signals in the horizontal and vertical channels are comparatively uncorrelated within the tornado debris field (where the co-polar cross-correlation coefficient is often very low), velocity estimates from each channel are essentially independent. Consequently, the variance in velocity estimates should be reduced if data from both the horizontal and vertical channels of a polarimetric radar are used to obtain the radial velocity estimates within the tornado debris field. In addition, differential velocity magnitudes exceeding 10 m s⁻¹ have been found to be associated with the polarimetric tornado debris signature.