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Very Fine-Scale Dual-Doppler and In Situ analysis of a Strong Tornado

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The OU RAXPOL and CSWR/NSF DOW7 mobile radars deployed near and in front of a large and intense tornado in southern Oklahoma on 09 May 2016, establishing an unprecedented 3.5 km dual-Doppler baseline. The tornado moved through the dual-Doppler lobes of the radars and crossed between them at a range of < 2 km to each radar.

Sweep update rates are 2 s for RAXPOL and 7 s for DOW7, resulting in the shortest time-scale dual-Doppler observations ever in a tornado. Gating is 12.5 m in DOW7 and 75 m for RAXPOL, with ~1 degree beamwidths. The result is 4D temporal-spatial resolution of 2 s (7 s) x 27 m x 27 m x 75 (12.5) m = 109,000 (64,000) m^3s for RAXPOL (DOW7) at the tornado's closest approach. Dual-Doppler analysis with volumetric gridding as small as ~ 60 m x 60 m x 60 m, at 7 s intervals, capable of revealing the vector-wind structure of sub-tornadic structures, is possible for the first time. Newly developed rotational space-time conversion will be implemented to accurately retrieve features spinning about the tornado. RAXPOL and DOW7 are both dual-polarimetric, providing unique fine-scale intercomparable ZDR and rho-HV observations of tornadic debris lofted by the tornado and its sub-vortices.

RAXPOL and DOW data revealed a large tornado with a core flow diameter of ~500 m, exhibiting a complex and rapidly evolving structure including intense sub-vortices. Peak Doppler winds of ~100 m/s were observed at times, as low as 17 m AGL. Interestingly, a maximum of EF-3 damage, corresponding to winds of only ~70 m/s, was observed to structures.

Preliminary dual-Doppler vector wind syntheses, dual-polarmetric analysis will be presented, documenting the evolution of the near-ground wind field and debris structure in this tornado.