EnKF and Polarimetric Analyses of the 31 May 2013 El Reno, Oklahoma Supercell during Tornadogenesis

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Cyclic mesocyclogenesis occurs between 2255 and 2300 as an occluded, weak tornado moves rearward with respect to the RFD gust front and a new mesocyclone develops underneath the storm updraft

An intense downdraft develops northwest of the developing mesocyclone by 2258

Pre-Tornadogenesis (2255 - 2300 UTC)

Tornadogenesis (2300 - 2305 UTC)

Tornado Intensification (2305+ UTC)

Methodology

- 54-member ensemble of NCOMMAS simulations with 2-moment ZVD microphysics similar to Skinner et. al. 2015
- Multifunction Phased Array Radar and RaXPol data are assimilated using a LETKF filter
- 500 m analyses at 1-min from 2247 - 2312

Figure Descriptions

EnKF ensemble mean analyses are overlain on low-level RaXPol scans to compare storm-scale kinematic features with radar signatures. Attenuation-corrected radar reflectivity (top row), differential reflectivity (middle row) and select spectrum width, correlation coefficient, and specific differential phase RaXPol scans are provided. EnKF divergence (middle row) at the lowest model level or vertical vorticity (top row) at ~450 m are contoured. Wind vectors are overlain and wind speeds >25 m s⁻¹ are shaded white. The El Reno tornado damage track is contoured in thin black and annotations are placed in identical positions for each plot to facilitate intercomparison. The bottom row provides a broader view of ensemble mean wind speed, divergence, and simulated reflectivity.

Rapid intensification of the tornado coincides with development of an organized near-surface wind field consisting of a broad, arcing downdraft wrapping from the storm inflow to the rear of the tornado

The downdraft is co-located with X-band polarimetric signatures indicative of hail; including attenuation in Zₓ and ZₓDR, CC values below 0.9, and very large Kdp values that are normally associated with a large amount of melting hail (Kumjian 2013)

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