Cloud resolving models (CRMs) have been extensively used to understand the dynamical and microphysical evolution of severe convective storms. Linkage between storm thermodynamics and associated lightning characteristics reveals the dominant role of cloud microphysics in noninductive charging due to rebounding collisions between mixed-phase hydrometeors. Downward and upward ice mass fluxes (i.e. graupel and ice crystals respectively) have been found to correlate well with the total lightning flash rates.

Storm dynamics and thermodynamics (e.g., updraft intensity and cold pool) are highly sensitive to the microphysical representation in a numerical weather model. Ice-phase microphysics schemes are crucial to replicate the predict the distribution of graupel and ice crystals which are inherently involved in noninductive charging. Thus, an in-depth study of the microphysical processes and their impact on the evolution of dynamical characteristics of a storm is crucial for better understanding of severe weather. Recent advancement in development of multi-moment bulk parameterization schemes reveals that higher-order moment schemes can better replicate important microphysical processes (e.g. size sorting) and associated observed polarimetric signatures (e.g. $Z_{DR}$ arc, $Z_{DR}$ column, $K_{DP}$ foot etc.) in deep convective storms.

Using an ensemble Kalman filter (EnKF) method, we assimilate radar reflectivity and Doppler velocity observations of the 19 May 2013 Edmond-Carney tornadic supercell into a three-dimensional, fully non-hydrostatic, convection-allowing model called the Advanced Regional Prediction System (ARPS). The data assimilated are from the KOUN S-band, polarimetric radar, which scanned this cyclic supercell and associated EF-1 tornado as it passed near Edmond, Oklahoma. The radar scanned the tornadic storm in PPI scan mode from a lowest tilt of 0.5° to 10°, producing volume scans every two minutes.

Using output from the NSSL triple-moment microphysics scheme, we simulate ice mass fluxes, and polarimetric variables from model-based particle size distributions. The EnKF analyses will help us in understanding the impact of different microphysical processes on storm features like updraft, downdraft, cold pool intensity, and total lightning flash rates (which were observed by the Oklahoma Lightning Mapping Array). Linkages between lightning and cold pool intensity can potentially improve our conceptual understanding of temporal evolution of storm dynamics and microphysics.

Keywords: Tornado, Microphysics, EnKF, S-band radar, Lightning, Cold pool