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Are lightning initiation locations and inferred charge regions influenced by local updraft variations?

Vanna Chmielewski (1), Donald MacGorman (1), Michael Biggerstaff (2), Daniel Betten (2), and Elizabeth DiGangi (3)

(1) NOAA/OAR/NSSL, Norman, Oklahoma, United States (vanna.chmielewski@noaa.gov), (2) School of Meteorology, University of Oklahoma, Norman, Oklahoma, United States, (3) Cooperative Institute for Mesoscale Meteorological Studies, University of Oklahoma, Norman, Oklahoma, United States

Non-inductive collisional electrification relies heavily on the environment, including water content, in which the collisions between graupel and smaller ice occur. Supercell updrafts are ideal for substantial electrification due to the large volumes of mixed-phase particles near the updraft core. Of course, hydrometeor distributions vary locally which can then affect non-inductive electrification and lead to a spectrum of electrification regimes within a single storm.

Analysis from two supercell storms in central Oklahoma will be presented. Both were sampled by multiple radars and the Oklahoma Lightning Mapping Array (OKLMA) over relatively large time periods. The first covered 69 minutes of an intensifying storm near Kingfisher on 29-30 May 2012 and the second covered 90 minutes and an entire mesocyclone cycle near Geary on 29-30 May 2004. Both storms contained instances of concurrent normal and anomalous charge structures as inferred by OKLMA analysis in close proximity to the updraft core, demonstrating that the electrification regimes were sensitive to the horizontal differences in environment. Dynamical factors such as updraft magnitude and height had little to no direct correlation with the inferred charge polarity, but did influence the initiation and propagation of flashes. Abundant VHF (very high frequency) sources at high altitudes were observed in each storm which did not meet the traditional criteria used to define a flash. These sources were even more tied to local dynamic properties. How these relationships differed between the two cases and with the evolution of each storm will be detailed in this study.