Introduction

Much of what we understand about supercell thunderstorms comes from idealized simulations containing homogeneous environments. However, determining how a supercell will respond to changes in their environment, such as heterogeneity due to boundaries, the transition from day to night, or interactions with other storms, is much more challenging. Our current understanding of how supercells evolve given those complexities is somewhat limited. The present study seeks to fill this gap by examining the 11 June 2009 VORTEX2 case in southeastern Colorado, wherein two supercells were within proximity of each other and a nearby surface boundary. In conjunction with these complexities, the supercell pair also occurred within a low CAPE, high-shear environment, as well as during the nocturnal transition. This study aims to investigate how this supercell pair evolved in response to these environmental complexities.

Data and Methods

- **Observations**
  - Radar data were obtained from available VORTEX2 mobile radars (DOW6, DOW7, and SR1) and the local WSR-88D (KPUX) between 0000 UTC and 0300 UTC on 12 June 2009.
  - A series of near-inflow soundings were launched between 2300 UTC on 11 June and 0300 UTC on 12 June (Fig. 1).
    - A number of thermodynamic and kinematic parameters were computed for each sounding to assess the temporal and spatial variability of the environment (Fig. 2).
    - Associated storm reports from the Storm Prediction Center

- **Storm Timeline (Fig. 5)**
  - The concentration of warnings and LSR’s is fairly evenly distributed.
  - MDA and TVS signatures are most concentrated between 0030 UTC and 0130 UTC, after the storms began to merge.
  - Both the low- and mid-level mesocyclones strengthen when the storms began to merge; only the mid-level shows intensification when the mesocyclones merge.
  - 0-1 km, 0-3 km, and effective layer SRH values all increase during this time frame.

- **Radar Summary (Fig. 3)**
  - Cell A formed around 2030 UTC on 11 June.
  - Cell B initiated off of Cell A’s outflow boundary around 2250 UTC.
  - The two supercells strengthen and merge between 2300 UTC and 0200 UTC, completing the merger by 0210 UTC.

- **Near-Inflow Environment**
  - CAPE decreased over time, while CIN increased (Table 2).
  - Low-level and elevated parcels stabilized over time (Fig. 4).
  - Effective SRH, 0-1km SRH and 0-3 km SRH all increased through approximately 0100 UTC; only 0-3 km SRH continued to increase (Table 2).

- **Summary and Future Work**
  - The near-inflow environment evolved into high shear/low CAPE as CAPE decreased and SRH strongly increased (Table 2; Fig. 4).
  - As Cell A and Cell B merged, the storms intensified, based on low- and mid-level velocity differentials, as well as MDA and TVS signatures (Fig. 5).
  - Strengthening also coincided with increases in SRH and SCP (Table 2).
  - The storms interacted for quite some time without inhibiting the other.
  - Future work will focus on performing a dual-Doppler analysis of the supercell pair, using mobile radar data from VORTEX2 to quantify changes in updraft strength, vertical vorticity, etc.

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Table 2: Kinematic and thermodynamic parameters calculated from the 4 near-inflow soundings (see Fig. 1).

Figure 1: Locations of the soundings (indicated by blue dots) overlaid on base reflectivity from KPUX. The near-inflow sounding utilized at each time is circled in purple.

Figure 4: Vertical CAPE/CIN Profiles

Figure 5: Timeline of velocity differential, max reflectivity, storm reports, and warnings.

Figure 3: KPUX base reflectivity (left) and velocity (right) over time, illustrating the evolution of the pair of supercells on 11-12 June 2009.