P 9.8 FINE-SCALE MOBILE MESONET AND STICK-NET OBSERVATIONS OF A NON-TORNADIC HP SUPERCELL NEAR SCOTTSBLUFF, NE

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1. INTRODUCTION

One of the biggest challenges facing severe thunderstorm researchers is obtaining temporally and spatially resolute surface observations in the local-storm environment. On June 11th, 2006, an isolated non-tornadic supercell near Scottsbluff, Nebraska, provided an opportunity for multiple in situ observations. Several features make this supercell unique, including the influence of a pre-existing outflow boundary, the presence of a butte, and interaction with another thunderstorm.

The aim of Project MOBILE (Multiple Observations of Boundaries in Local-storm Environments) is to sample storm-scale boundaries, in close proximity to a supercell thunderstorm, in order to determine the magnitude of horizontal baroclinic vorticity generation across a boundary. Boundaries of interest include forward-flank and rear-flank gust fronts, and preexisting outflow boundaries from previous convection. The augmentation of horizontal vorticity by boundaries is believed to be necessary for tornadogenesis (Markowski et al. 1998). Numerical simulations suggest that boundaries play a critical role in the genesis of low-level rotation in supercells (Klemp and Rotunno 1983; Atkins et al. 1999). However, in situ observations of boundaries, particularly in the forward-flank region of supercells, are scarce (Shabbott and Markowski 2006).

2. METHODOLOGY

Five mobile mesonet probes and one Stick-net probe were deployed on June 11th, 2006, in order to sample various boundaries in the local-storm environment.

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Three mobile mesonet probes performed transects within the forward-flank region of the thunderstorm, attempting to sample a thermal gradient. Two mobile mesonet probes remained stationary, with one in the inflow and another in close proximity to the forward flank region, while the stationary Stick-net platform was deployed near the circulation center of the storm.

Observations taken during this case will be used to locate boundaries, calculate thermodynamic gradients, and resolve the associated effects on horizontal vorticity generation.

3. PRELIMINARY RESULTS

The supercell thunderstorm in this case formed in eastern Wyoming within an environment marginally favorable for severe convection, and remained the dominant thunderstorm in the region for several hours. By 2330 UTC, it had crossed the Nebraska border, where mid-level rotation was visually identified. As the storm approached Scottsbluff, mobile mesonet probes were deployed to begin sampling. However, at this point in time, there was no detectable horizontal thermodynamic gradient.

By 0100 UTC on June 12th, the thunderstorm was located immediately to the southwest of Scottsbluff, and the Stick-net probe had been deployed (Fig. 1). The storm progressed slowly to the east-southeast, showing deviant propagation to the right of the mean wind vector. A large butte was directly in the path of the thunderstorm, and it is possible that this terrain feature may have affected the motion of the thunderstorm. Transects were performed immediately to the east and southeast of the circulation center for over one hour.

The overall trend for equivalent potential temperature (θ_e) was downward, which was expected as the ambient air in the vicinity of the thunderstorm was evaporatively cooled. However, there are several instances where sharp gradients in the thermodynamic and kinematic variables (Fig. 2) exist that may be representative of boundaries (e.g., a

forward flank boundary). Virtual potential temperature ($_v$) plots reveal the presence of multiple boundaries as well (Fig. 3). In particular, the Stick-net probe sampled an approximate 7 K local decrease in $_v$ over the course of twenty minutes, which is likely indicative of a storm-scale boundary.

By 0145 UTC, a decaying thunderstorm to the southwest had quickly propagated toward, and merged with, the target thunderstorm. This merger resulted in a rapid weakening of the target thunderstorm. The Stick-net probe sampled this interaction, and recorded a large drop in $_e$ as cooler, near-saturated air accompanied the outflow of the second storm (Fig. 1).

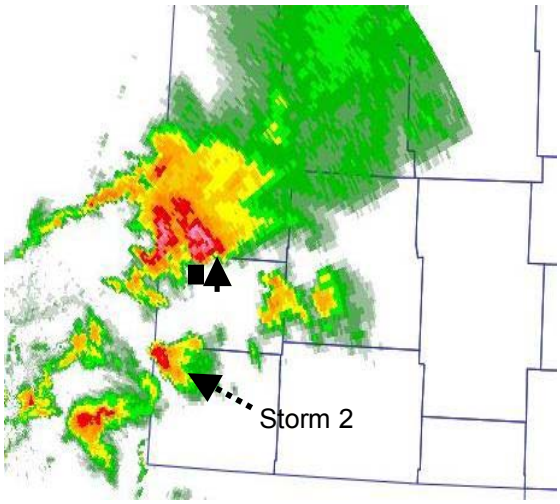

Figure 1. KCYS radar image at 0111 UTC, June 12, 2006. Black square indicates Stick-net position. Black arrow indicates transect paths for mobile mesonet probes. Dashed arrow indicates thunderstorm that eventually merges with target storm.

4. CONCLUSIONS AND FUTURE WORK

The isolated HP supercell located near Scottsbluff, NE, provided a unique opportunity to deploy five mobile mesonet probes and one Stick-net probe in an attempt to sample storm-scale boundaries. Although the storm was non-tornadic, several boundaries were sampled and will provide insight into the magnitude of generated horizontal vorticity.

Future work will include comprehensive analysis of all data collected, and further attempts to collect more datasets related to Project MOBILE. It would be extremely beneficial to obtain additional datasets in order to provide comparisons between non-tornadic and tornadic cases.

5. REFERENCES

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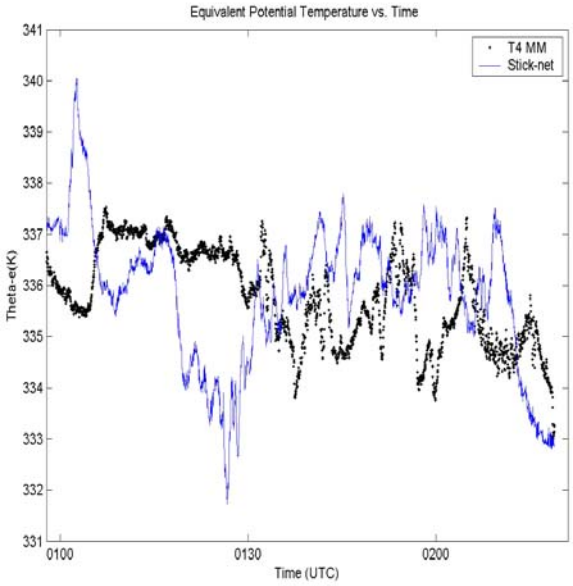

Figure 2. Theta-e (K) plotted versus time (UTC). The black dotted line indicates mobile mesonet transect data. The blue line indicates Stick-net data.

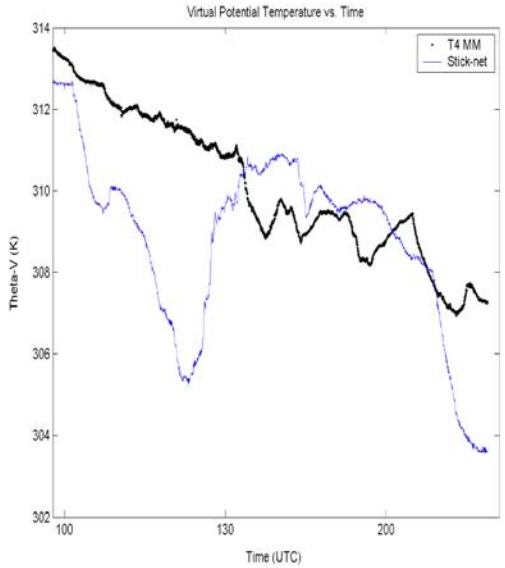

Figure 3. Theta-v (K) plotted versus time (UTC).The black dotted line indicates mobile mesonet data. The blue line indicates Stick-net data.