1.9 AN ANALYSIS OF SEVERE CONVECTION IN CENTRAL OKLAHOMA DURING JOINT URBAN 2003

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1. Introduction

During the early morning hours of 30 July 2003, convective storms moved through the Oklahoma City metro area. The convective system included severe storms which produced winds in excess of 80 mph in the suburban areas. The combination of observations collected by instruments involved in the Joint Urban 2003 (JU2003) field project and the existing networks in Oklahoma provide a unique opportunity to study the impacts of this convection and its effect on urban areas. Thus, this study provides a preliminary analysis of the convective event and the impacts of the event on the suburban environment and the urban environment of Oklahoma City.

2. Existing conditions

The synoptic features in the morning hours of 30 July represented a typical summer pattern in the central plains. A ridge was present in the southwestern United States and a trough was present in the northern plains. Across Oklahoma winds above the surface were light from the west and northwest. Winds were approximately 10 m/s at both 500 mb and 300 mb. Surface winds across central Oklahoma were light and northeasterly with temperatures of approximately 24^{o}C and dewpoints near 21^{o}C. Soundings from Oklahoma, Kansas, and Texas on 30 July at 0000 UTC revealed a weakly capped environment with over 1500 J/kg of Convective Available Potential Energy (CAPE). Several small clusters of storms developed in southern Oklahoma, which moved east and south of the Oklahoma City metro area. A second cluster of storms developed in extreme northwestern Oklahoma and moved towards Oklahoma City. Shortly before 1100 UTC, a cell intensified just west of Norman, OK and moved directly through Norman. This cell produced measured winds gusts of over 35m/s and caused extensive damage in Norman.

3. Analysis

Thunderstorms with severe winds are typical across Oklahoma during the spring and summer months. However, this event is unique in that is evolved quickly in a weakly sheared environment, and was most intense for a short duration of time. The structure of the storm was similar to that of a bow echo, though smaller than is generally assumed by the term bow echo. Using the Oklahoma Mesonet surface observations (Brock et al. 1995), as well as radar from KTLX, the rapid evolution of this storm was analyzed.

Figure 1 shows the storm complex to the west of Norman at 1015 UTC. The Minco, OK mesonet site (MINC) received sustained winds of 12.5 m/s. However, while west of Norman, the storm did not show signs of the bow echo structure that moved through Norman. Figure 2 is from 1105 UTC, approximately 40 minutes later in the event as the storm entered Norman. Maximum sustained winds were 15 m/s at this time, which were slightly stronger than in Minco. Figure 3, which is from 1120 UTC, displays a similar plot of radar and sustained winds as in Figures 1 and 2. However, by this time the bow-like structure is apparent, and winds were sustained at 25 m/s at the Norman Mesonet site. Figure 4 shows sustained winds, as well as wind gusts at this time which were coincident with the maximum wind gusts reported. Finally, a unique aspect of this event was that gusts over 25 m/s were reported for nearly 20 minutes from the Norman Mesonet site.

The increase in wind speeds from Minco to Norman combined with the radar presentation of this storm demonstrates how it was at it maximum intensity as it passed through Norman. Figure 5 shows winds from both Minco and Norman. During the 45 minute period between when the

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storm impacted Minco and when it impacted Norman, maximum gusts increased from near 20 m/s to 35 m/s. Furthermore, the sustained winds at Norman were higher than the gusts that occurred at Minco.

4. Joint Urban 2003

During June and July 2003, the JU2003 field project occurred in downtown Oklahoma City. JU2003 was the largest urban dispersion experiment ever conducted in North America and focused on understanding atmospheric processes within the urban environment. As such, an extremely dense observing network was installed in and around downtown Oklahoma City including over 140 3-D sonic anemometers for surface-based and tower-based measurements, 13 2-D sonic anemometers, over 30 surface meteorological stations, seven surface energy budget stations, two CTI wind tracer lidars, three radiosonde systems, three wind profiler/RASS systems, one FM-CW radar, three ceilometers, and nine sodars (including midi- and mini-sodars).

On 30 July 2003, convection did impact the downtown Oklahoma City area, though no storms were equal to the intensity of the cell that passed through Norman. As data becomes more available from the JU2003 project, further analysis of the impacts of convection on the urban environment of Oklahoma City will be performed. In particular, winds within the central business district and urban canyons of Oklahoma City will be analyzed both before and during the convection.

5. Conclusions

The storms that occurred on 30 July 2003 evolved rapidly and caused much damage in Norman. From the existing observation networks, a unique dataset has already been attained. As more observations collected during the JU2003 project become available, the potential information about convection in the urban environment of Oklahoma City will be unprecedented.

6. Acknowledgments

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7. References

Brock, F. V., and coauthors, 1995: The Oklahoma Mesonet: A technical overview*, J. Atmos. Oceanic Technology,* **12**, 5-19.

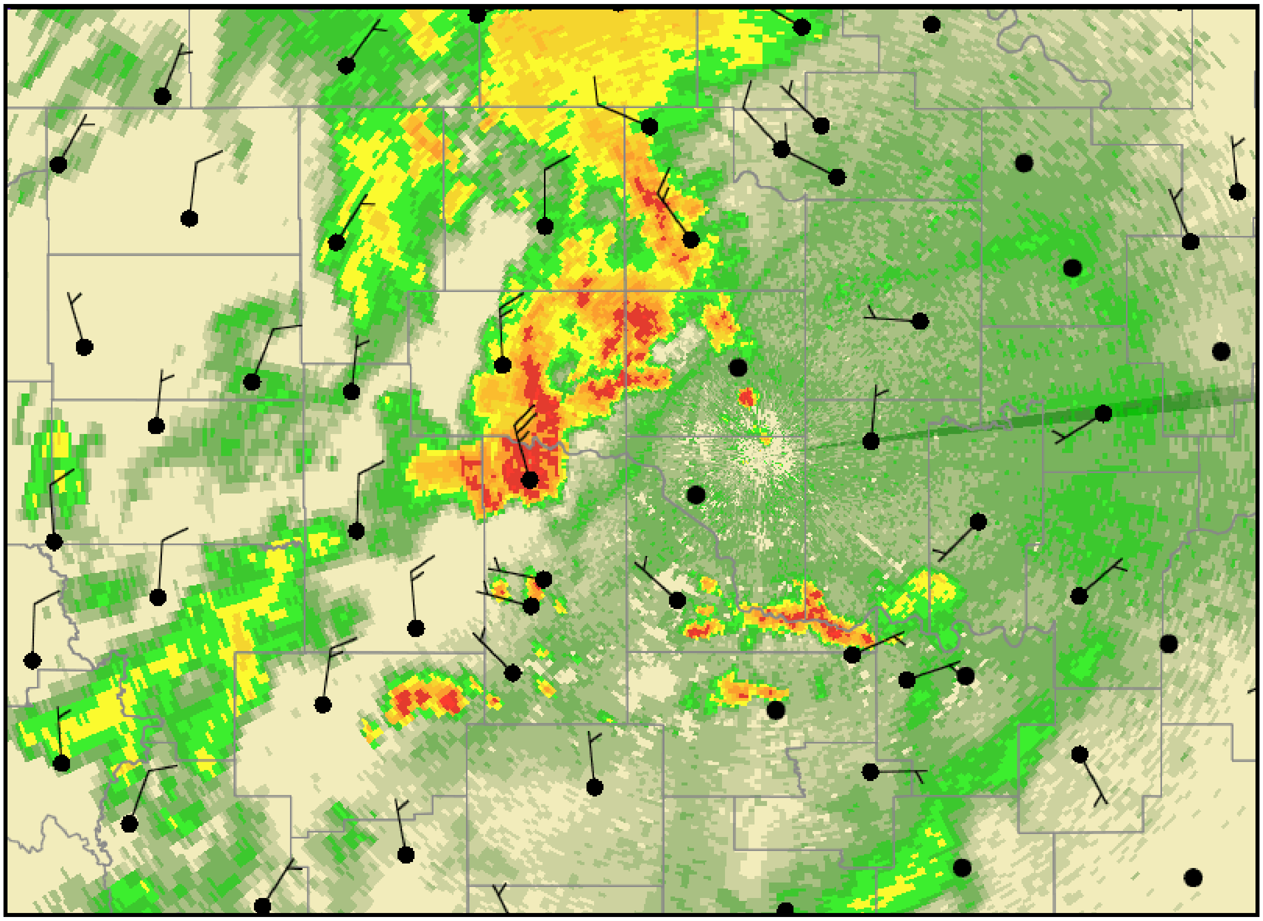

Figure 1. Surface map from 30 July 2003 at 1015 UTC. Radar is from KTLX, and wind barbs are surface winds in m/s from the Oklahoma Mesonet.

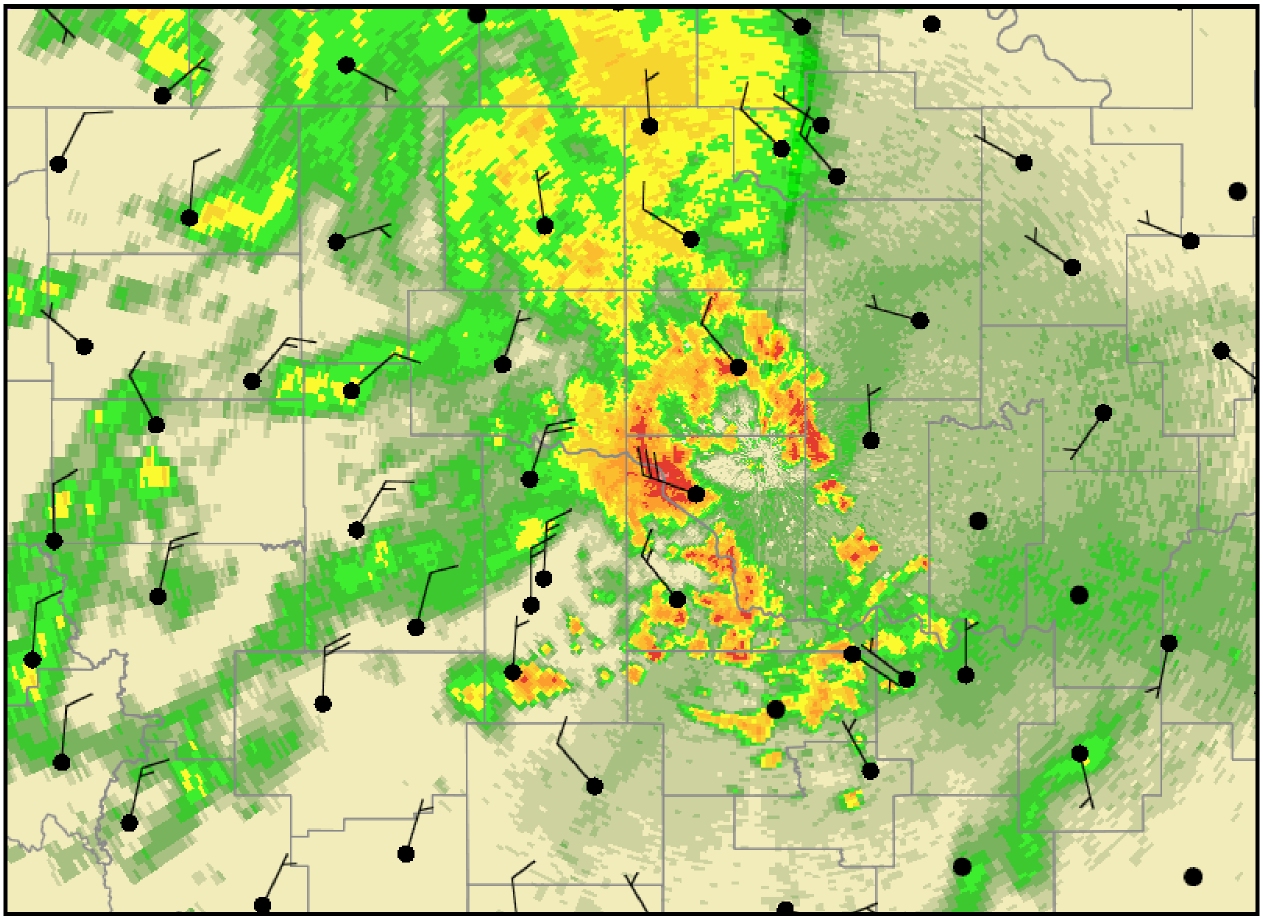

Figure 2. Same as Figure 1 except at 1105 UTC.

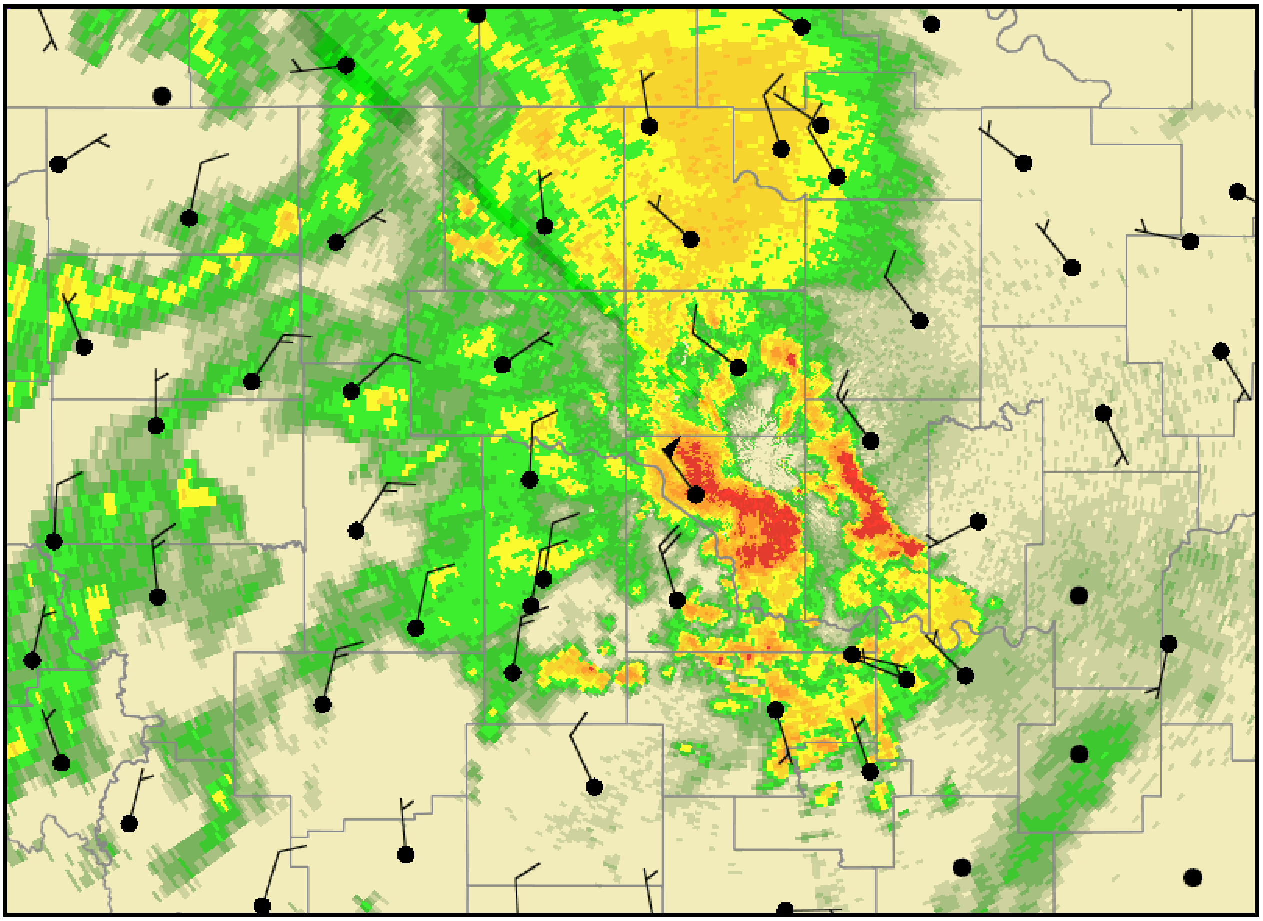

Figure 3. Same as Figure 1 except at 1120 UTC.

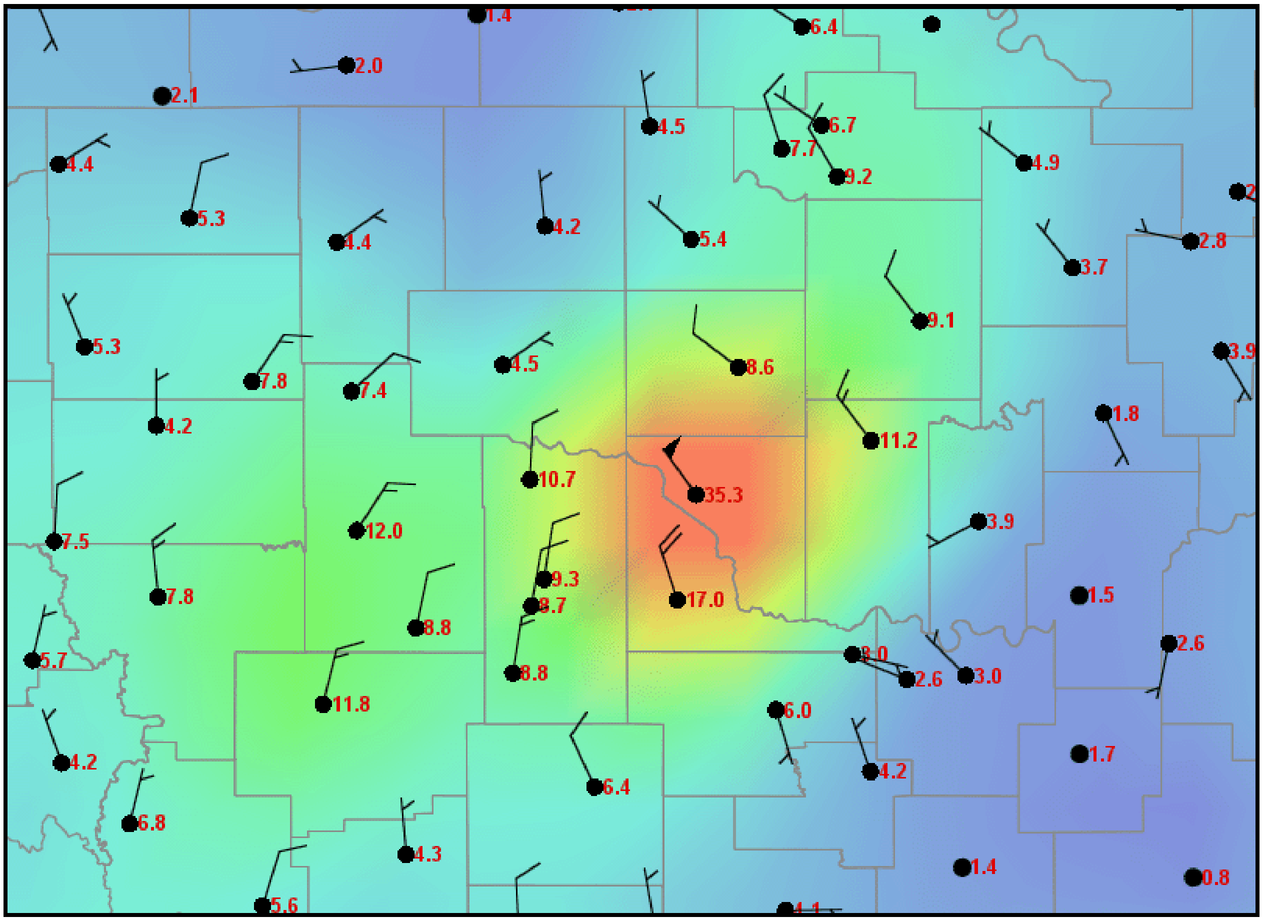

Figure 4. 30 July 2003 at 1120 UTC. Barbs are sustained winds speeds in m/s, with gusts in red in m/s. The background shading is maximum wind gusts.

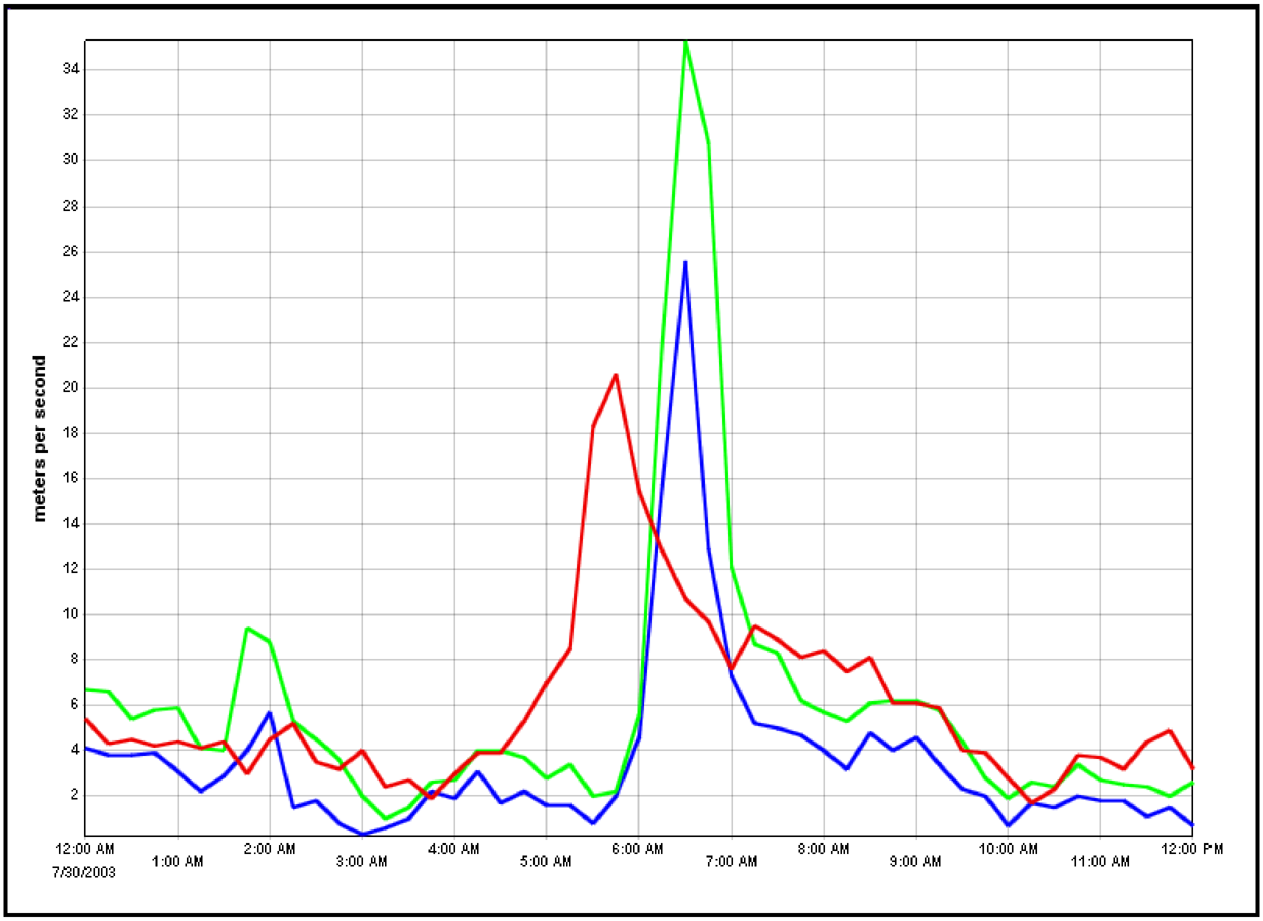

Figure 5. Time series of wind speed measured by the Oklahoma Mesonet. The blue line is sustained winds speeds at Norman, the red line is maximum wind gusts at Minco, and the green line is maximum wind gusts at Norman.