Final Report for use of CSWR Mobile Mesonet and Tornado Pods
Facility Pool Request
Boundaries Across Severe Storms (BASS) Education Project

1. Educational objectives

The primary objective of the Boundaries Across Severe Storms (BASS) Project was to expose undergraduate students to such state-of-the-art facilities as the Center for Severe Weather Research (CSWR) mobile mesonet vehicle and tornado pods while sampling airmass characteristics across supercell thunderstorm gust fronts. Fifteen undergraduate students [1 engineering student from the State University of New York (SUNY) Environmental Science and Forestry college; the remainder were meteorology majors from SUNY Oswego, Brockport, Albany, and Penn State] were participants in the 2015 SUNY Oswego Storm Forecasting and Observation Program during which time they were trained by CSWR staff on how to operate these facilities and designed and carried out experiments. At first the students were nervous about driving and using the mobile mesonet, but after the training in Hays, KS on 31 May 2015, they overall enjoyed having the equipment and reported that having the data in real time and archived enhanced their learning. The analysis of the collected data occurred on the SUNY Oswego campus during a 4-day period after returning from the U.S. Plains in which students did brief research reports on topics of their choosing based on observations from the trip.

2. Deployment and class procedures

The mesonet vehicle collected data on most every day we had it from 1 to 9 June 2015. The students were divided into 3 teams: forecast, logistics, and equipment teams. The teams rotated each day so the team of 5 students on the equipment team one day had this responsibility again 3 days later. Four of the five-team members rode in the mesonet while one remained in the SUNY Oswego vans. This person would then be in the mesonet 3 days later. This was done to increase comfort.

The tornado pods were deployed during 1-4 different observation periods (e.g., pod 'K' sampled 4 events while 'O' sampled only 1). Generally the decision of when and where to deploy was made by the head instructor, but the students were the ones who physically ran through the methodology of finding a suitable surface and orientating the pod correctly and documenting the location with a GPS unit and pictures. The instructor attempted to place the pods where a supercell thunderstorm or gust front from the storm would propagate over the pod. Safety of the students was given top priority when deciding to deploy the pods.

3. Successes as viewed by professor and students

We learned a lot about strategizing to sample key parts of an actual storm, having multiple variables to consider; e.g., do we have time to deploy safely? Will we have time to come back and collect the pods by the next morning? How is the terrain by the road? Students (and instructors) gained an appreciation for how difficult fieldwork can be.

Some of the data were used in the student projects. For example, Matthew Wunsch analyzed data collected by the mesonet while it was stationary and a supercell's rear flank downdraft (RFD) moved overhead (see Figs. 1-5). He noted surges in wind speed associated with the RFD passage. This agrees with previous literature showing RFDs can have multiple gust fronts/surges (Lee et al. 2012). A continuation of this particular project and use of the data collected during BASS in future student class projects will have more interesting results for students to discover!

4. Outreach activities

The only outreach we were able to do was while on the road storm chasing. We were approached by the public at gas stations and hotel parking lots. The students and professors were more than happy to share with them what we were doing with the facilities. One of the days, we opened up the mesonet truck and placed one of the pods on the ground behind the truck. There were more than 30 other storm chasers around who visited.

5. Lessons learned

The main lesson learned was how difficult it is to plan pod deployment. Safety was the top concern, so we did not deploy within 5 miles of the suspected tornadic region in a storm. We wanted to have the pods sample the air masses on either side of a gust front (rear or forward flank), so finding places where this would work where the ground was even and had short grass in a small amount of time (minutes) was challenging. The other consideration was the fact that after we were done chasing, we needed to go back and pick up the pods. For this reason alone we usually did not deploy more than 2 pods during an event.

A couple of difficulties arose as the mesonet overheated in multiple instances and the air conditioning did not work. We thought we solved the overheating issue by adding more coolant to the truck, but had to return the mesonet and pods one day earlier than planned because it overheated while we were near Hays, KS (the drop off point).

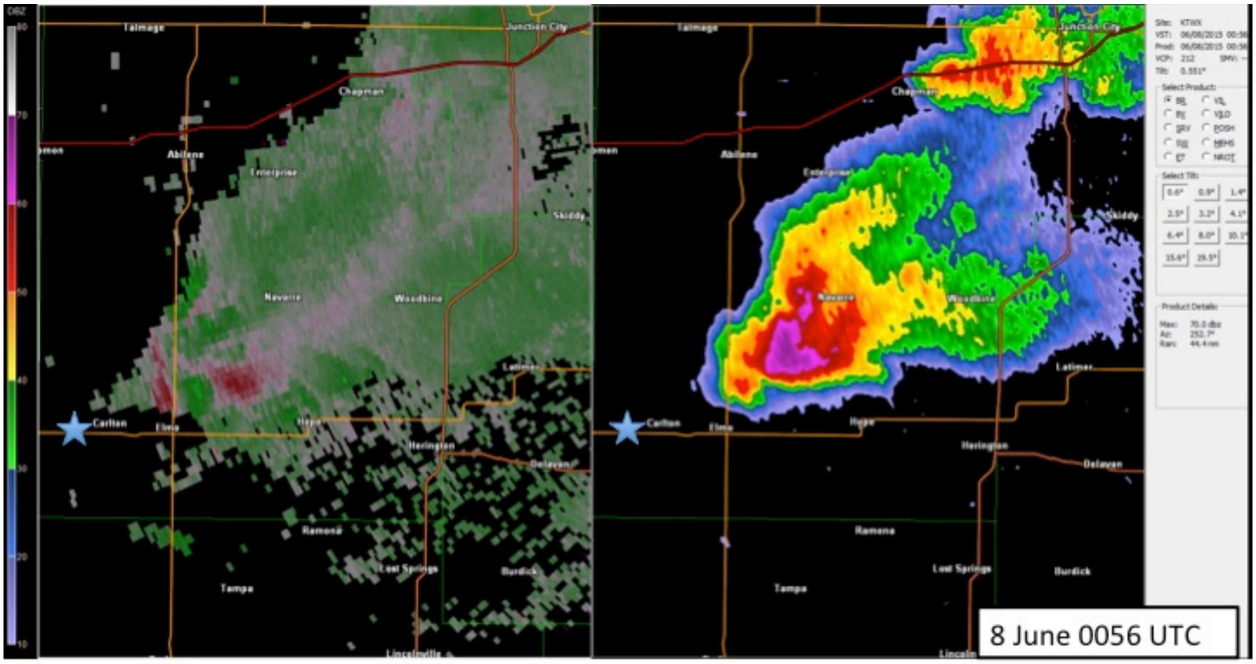
Having ham radios in each of our vehicles was key to keeping everyone safe. Thank you to Traeger Meyer for installing a ham radio we brought with us on 31 May!

With the experience gained, I plan to ask for these facilities again next chase season.

References

Lee, B. D., C. A. Finley, and C. D. Karstons, 2012: The Bowdle, South Dakota, Cyclic Tornadic Supercell of 22 May 2010: Surface analysis of rear-flank downdraft evolution and multiple internal surges. *Mon. Wea. Rev.*, **140**, 3419 – 3441.

Figures

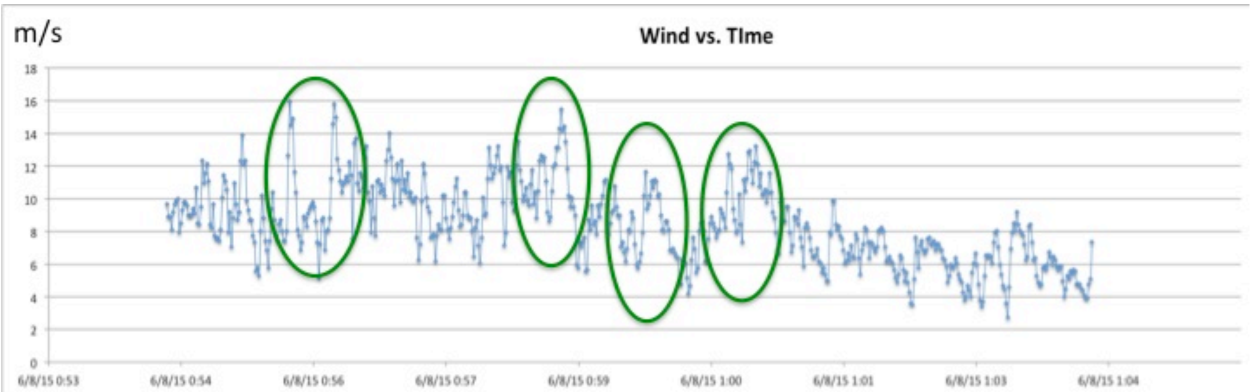


We stopped just to the west of Carlton, Kansas to watch the supercell and allow for the rear flank downdraft (RFD) to pass by.

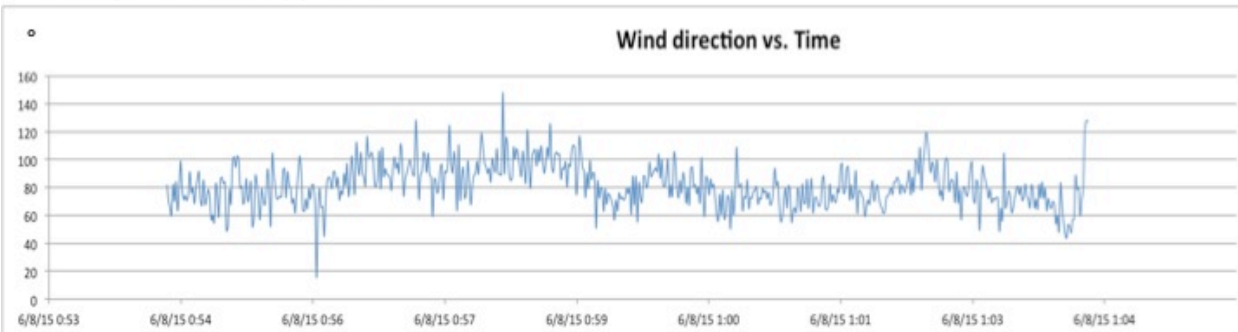
Fig. 1. Topeka, KS (KTWX) radial velocity (left; no scale shown) and reflectivity (right; scale shown to left of velocity) at 0056 UTC 8 June 2015. The star indicates the mesonet's location.

8 June 0055 UTC

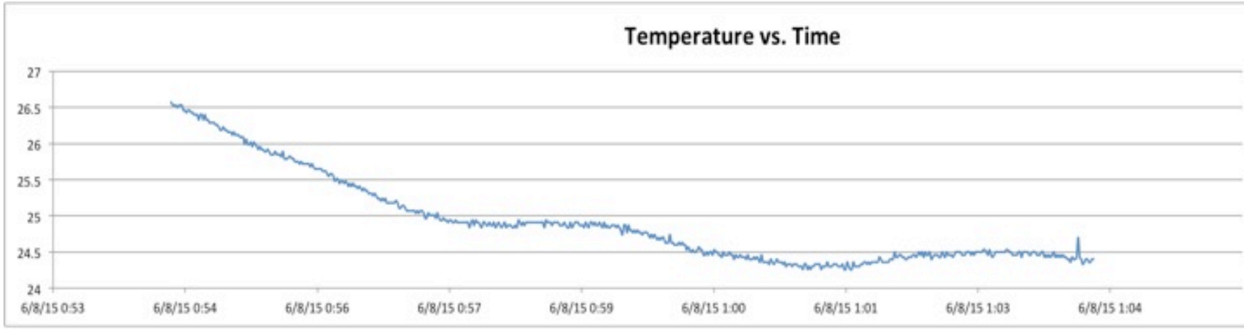
Fig. 2. Photograph taken by student Matthew Wunsch at our location shown in Fig. 1 looking east.



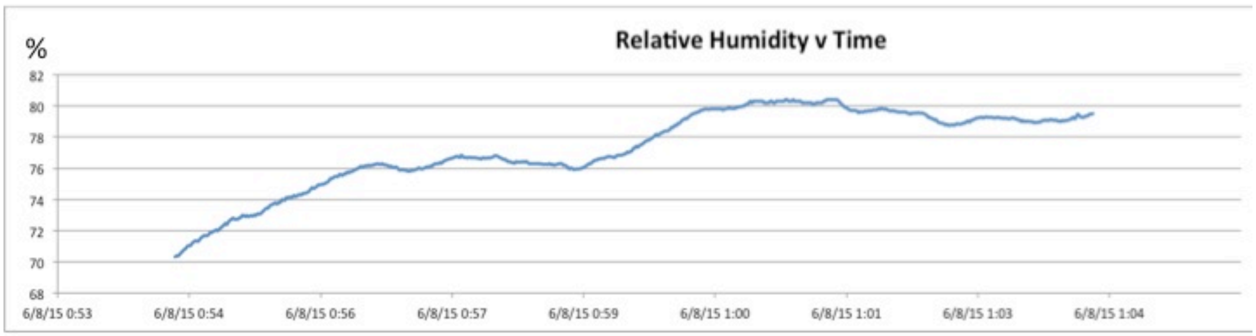
RFD surges become apparent.



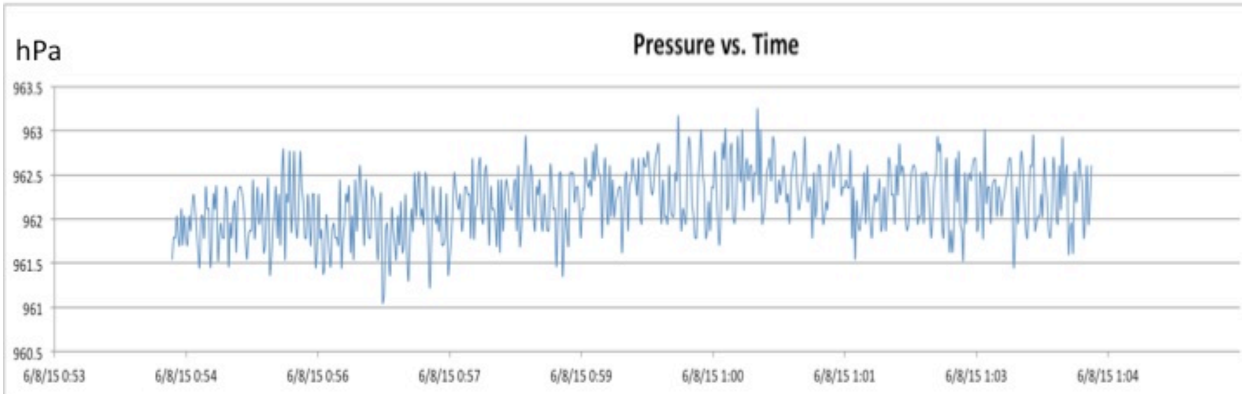
Figs. 3-5. Mesonet data (unsmoothed; we plan to do moving averages in the future with these data). Note: vehicle was not in motion during this time period. Time in UTC.



Temperature steadily decreases than levels out at about 24.5°C



Relative humidity increases from about 70% to 80%



Slow increasing pressure trend