

PRESSES Project Report

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Summary

The Doppler on Wheels (DOW) visited the University Of Missouri from September 8, 2012 to September 29, 2012. The educational objectives were to expose students at the University to the meteorological technology presently being developed, and the potential of dual-polarization radar to increase knowledge and understanding of precipitation processes.

PRESSES

The idea of the PRESSES project was to collect precipitation observations over a sensitive urban catchment and relate rainfall retrievals from The DOW data and from surface based instrumentation. The precipitation observations are then to be used to model run-off into the creek, along with surface transport of sediment. Streamflow observations and measurements of sediment load were also collected. The overarching goal is to test whether the finescale radar observations available from the DOW, combined with drop-size distribution data from the dual-polarization capability, and detailed land cover information can improve estimates produced using other instruments.

Training of the students involved took place on September 8th. This introduced them to the operation of the radar. Project briefings started on September 8th and were conducted each day. On days when there was a prospect of rain the students predicted the timing of the onset and made a deployment plan based on that. In total the DOW was deployed five times during the project period. In each case the DOW was set up southeast of Columbia at Perry Phillips Park, on a ridge giving a good overview of the city. This site was identified as one of a very limited number with a lack of blockage of the watershed by topography and trees.

Table 1: Dates and times of deployments

Date	Start Time (UTC)	End Time (UTC)	Comments
09/13/2012	1600	0200	Class visits. Media events.
09/16/2012	1800	0200	
09/21/2012	0500	0700	
09/25/2012	0600	1200	Radiosonde launches
09/26/2012	0300	0620	
09/26/2012	1200	1300	

a. September 13th, 2012

A weakening cold front produced a long period of light rain associated with some slightly heavier periods persisted through the day. Radar data was collected continuously for more than eight hours. This prolonged deployment allowed a large number of students to observe the radar in action and help run it. This included students in Remote sensing for Atmospheric Science, Radiation in the Atmosphere, and Atmospheric Physics classes.

Through the day the University of Missouri, College of Agriculture, Food and Natural Resources Media Office shot video and interviewed the participants

b. September 16th, 2012

The prospect of a frontal passage enticed us to set up the radar on September 16th. As expected there were some small pre-frontal showers late in the afternoon, but by the time the front arrived there was very little moisture available for rainfall production. However, the front did produce a narrow band of heavy precipitation over the west of Columbia (see figure), before fizzling out.

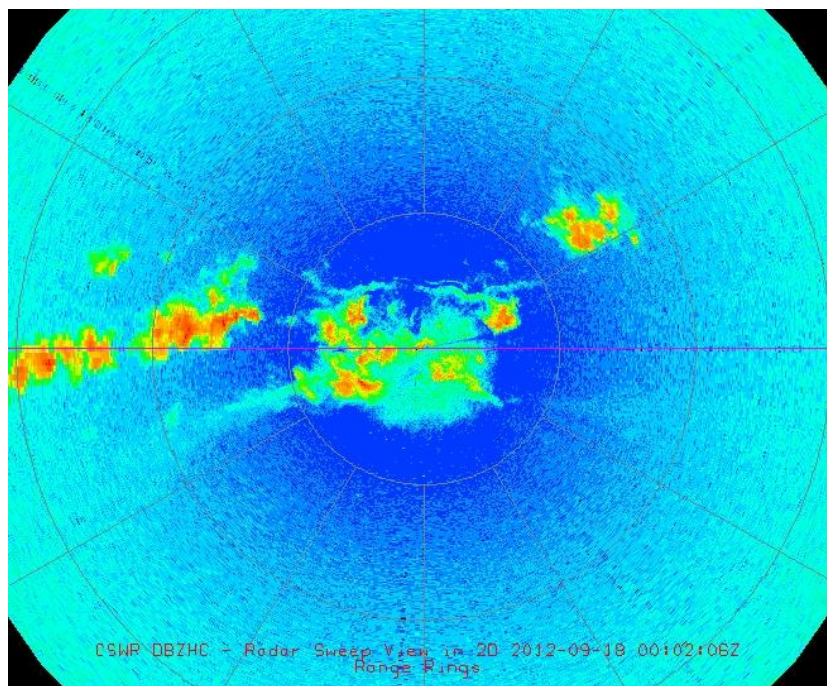


Figure 1: Reflectivity image showing line of showers associated with the frontal passage on 16th September

c. September 21st, 2012

A weak stationary front oriented west to east set up north of Columbia, but failed to move into the area, so a short deployment was aborted.

d. September 25th, 2012

On September 25th a mesoscale convective system was forecast to form in northwest Missouri and track across the Columbia area. Radiosondes were launched at 02Z, 04Z and 06Z on 26th September to sample the pre-convective environment, and the radar was deployed at 06Z. Unfortunately, the MCS tracked to the north of the area, providing little rain over the Columbia area, but a spectacular lightning display to the North.

e. September 26th, 2012

An MCS developed to the West of Columbia and tracked over Mid-Missouri. The system weakened as it passed over Columbia, and the heaviest rain occurred to the South

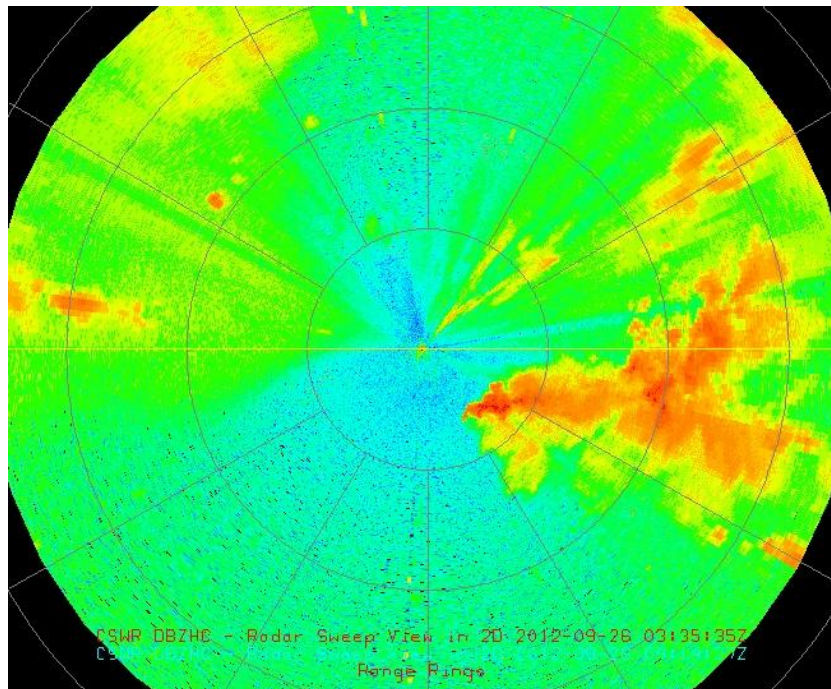


Figure 3: Radar reflectivity image from 26th September 2012

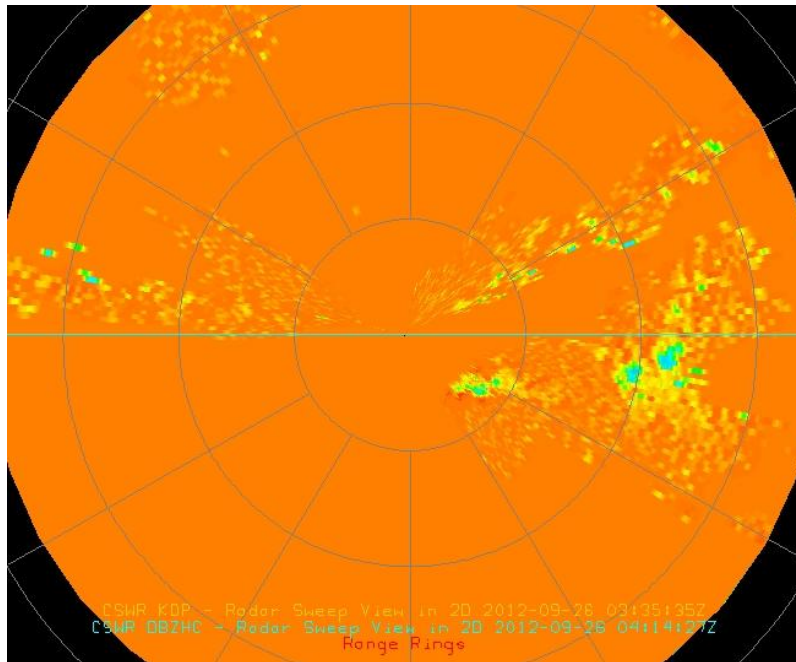


Figure 4: KDP image from the same sweep as figure 3.

Class procedures

The deployment on Thursday, September 13th coincided with class times for Atmospheric Physics, Remote Sensing for Atmospheric Science, and Radiation in the Atmosphere. On that day students from each of the three classes came out to see the radar in action. The students observed the radar and each had the opportunity to control the scanning sequence and observe the data in real time in the truck.

Data collected by the DOW is currently being analyzed by the Graduate students in “Radiation in the Atmosphere” who are comparing the radar products to disdrometer recorded drop size distributions.

Many of the students in Remote Sensing and Atmospheric Physics are enrolled in the Radar Meteorology where the imagery and data collected by the DOW will be integrated into the class material.

Instructor perspective

The project galvanized many of the students and initiated a number of student led projects and ideas. In particular, students were exposed to an aspect of meteorological science that they had not previously encountered. This encouraged a number of them to investigate avenues they had not considered, and at least two students are now changing their plans to dual-major in atmospheric science and electrical engineering. Two graduate students who were in search of projects have decided to work on radar data based programs.

On the other hand the project exposed the difficulties of operating a mobile radar in this area. The combination of terrain and obstructions made identification of good sites problematic. The location we used was good, possibly the best in the vicinity of Columbia, but by no means perfect. Even though there was heavy rain around on September 25th and 26th it seemed impractical to drive to areas where there may have been a better view of it without knowing if a good site would present itself. The advantage of staying in Columbia was that, even if the rain was not the heaviest, there was a satisfactory radar site supported by the network of surface instruments.

If I were to do this again I would look at identifying alternative areas, but this would entail extensive scouting further afield. It would be difficult to engage the students in the same way during the semester with such an approach and it would help to have a team equipped with instrumentation that could be deployed efficiently.

Student Research

1. Undergraduate research

An interdisciplinary research project was established to promote research by undergraduate students. Four students were selected: Nicole Hoban (Atmospheric Science), Mike Huslinger (Forestry), Grant Eliot (Biological Engineering), Kayla Flamm (Geography). The project centers on the Hinkson Creek watershed that runs through Columbia, MO, and is a mixed land use catchment that is considered impaired. There is a network of weather stations that has been established within the catchment, and a number of others around the area.

The research was designed to use the high-resolution precipitation observations from the DOW as input into a hydrological model of the catchment to investigate whether such fine observations can improve the modeling of run-off and sediment transport.

The period of the project followed a long dry period and the rainfall recorded during the period was not heavy enough to produce significant run-off. However, the rainfall totals can still be studied, and the presence of the DOW has catalyzed a continuing collaboration that will focus on heavier precipitation events at other times.

2. Graduate Research

Graduate students in Dr. Fox's Radiation in the Atmosphere class are comparing drop size distribution collected using a Parsival disdrometer to the dual-polarization radar data from the DOW.

The data from the DOW will be incorporated into two graduate student research projects, as the students compare the dual-polarization data to that retrieved from NWS radars. As the nearest WSR-88D to Columbia, MO is near St. Louis, about 150 km away, the lowest beam is at least 2500 m above the surface. Comparisons between DOW's near-surface radar observations, those from the NWS radar,

and drop size distributions from the disdrometer along with the rain gauge observations collected across the catchment will be used to investigate the accuracy of precipitation estimates derived from dual-polarization radar parameters.

Outreach Activities

There were three main outreach activities: A public lecture and display, a showcase event, and an American Meteorology Society Local Chapter meeting.

1. Saturday Morning Science

The University of Missouri runs a public science lecture series on Saturday Morning. On September 15, 2012 Neil Fox delivered a lecture on advances in weather radar, focusing on dual-polarization technology and the capabilities of the DOW. At the end of the lecture the audience was invited outside, where the DOW was parked, to inspect it.

The lecture was attended by 152 people of all ages and can be viewed at <http://satscience.missouri.edu/multimedia.php>



Figure 5: Attendees at the Saturday Morning Science event examine the DOW outside the University of Missouri Natural Resources Building.

2. University of Missouri AMS Chapter meeting

On September 19, 2012 the DOW featured at a meeting of the Local Chapter of the American Meteorological Society at the University of Missouri. About 50 people attended, mostly students, and were given a detailed tour and explanation of the DOW.

3. South Farm Showcase

From 10 am to 4 pm on September 22, 2012 the College of Agriculture, Food, and Natural Resources (CAFNR) held its annual showcase event at South Farm, just outside Columbia, MO. The DOW was a featured exhibit at the popular family event. The organizers estimate that more than 8000 people attended the event, and for about 4 hours there was a near continuous line of people lining up to talk about the DOW and climb inside (see photo below). It is hard to estimate how many people visited the DOW, but there were a lot of elementary school age children.



Figure 6: A line of visitors waits to explore the DOW at the South Farm Showcase

Table 2: Activities and attendee numbers

Activity	Date	Time (CT)	Number of attendees
Training	09/08/2012	0900-1100	30
Saturday Morning Science	09/15/2012	1030-1200	152
Meteorology Club	09/19/2012	1930-2100	46
South Farm Showcase	09/22/2012	1000-1600	>1000