DOW Educational Deployment Final Report

Texas A&M University

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Courtney Schumacher

Professor

Don Conlee

Instructional Professor

Department of Atmospheric Sciences

1. Overview

The DOW was requested to support multiple summer program educational objectives, including the NSF REU Site Atmospheric Sciences in the Gulf Coast Region, Youth Adventure Program Meteorology High School Camp, and the Summer Student Operational ADRAD Program (SOAP). The period of usage was July 20-29, 2015.

2. Deployment Procedures Summary by Program

a. NSF REU

The first activity of the REU with the DOW was an introduction to the CSWR DOW program and capabilities given by Alycia Gilliland on the afternoon of 20 July. The DOW then proceeded with the group to the field site in Galveston, TX on 21 July. By middle afternoon, the DOW was set up and a rotation of all 15 students was set up for training in operation.

Over the next three days, the DOW was used to continue to allow students to experience radar operation. This included a midday relocation to a more favorable site to capture bay-breeze related convection (Fig. 1), and a mobile deployment in conjunction with upper air launches (Fig. 2). The DOW was used to collect data, which will be processed into VAD wind profiles for comparison to a SODAR that was also obtained for the field experience. Students were rotated into the DOW in groups of three approximately every 1.5 hours during operation hours.

Figure 1. DOW7 deployment site near TAMU Galveston campus.

Figure 2. DOW7 deployment site near Alvin, TX.

Although the weather was not very cooperative in terms of seeing a traditional sea breeze and characterizing the sea breeze front and associated convection (Fig. 3), the DOW presence was key to an impactful field experience for the REU cohort. Students were exposed to multiple scan strategies, including adjustments to PRF, pulse length, and elevation angles. Owing to the lack of deep convection or precipitation during the campaign, particular emphasis was placed on clear-air methods for detecting boundary-layer convection (horizontal convective rolls) in the vicinity (Fig. 4). The DOW returned to College Station on 25 July to set up for the next usage.

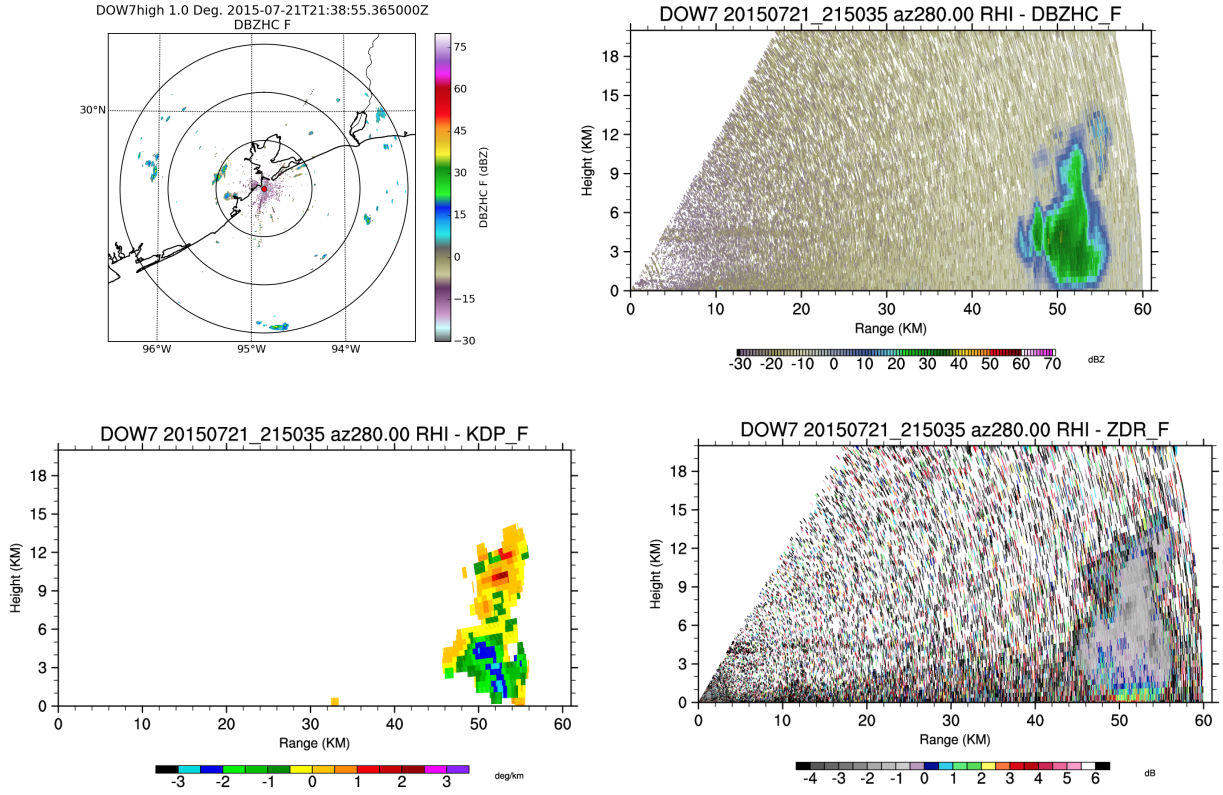

Figure 3. PPI at 1.0 degree of reflectivity and RHIs of reflectivity, KDP, and ZDR from 21 July 2015 from Galveston Island.

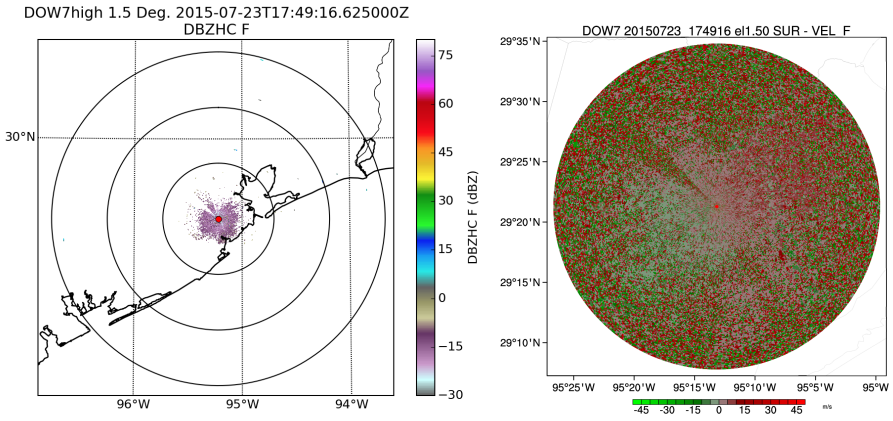

Figure 4. PPIs at 1.5 degrees of clear air return near Alvin, TX on 23 July 2015.

b. Youth Adventure Program (YAP) Meteorology CAMP

Wednesday, 29 July was the RADAR day for our YAP camp, combining a field deployment of DOW with usage of our own fixed S-Band Radar, ADRAD (Fig. 5). Two factors shaped our utilization of DOW for that day in execution: First, DOW had experienced a major failure of systems, enabling no storage of collected data and limiting operation to approximately a 30 degree pie wedge facing the rear of the truck. Second, the weather continued to offer little to no appropriate targets. The decision was made to use DOW in the morning mostly in a show-and-tell mode, but utilizing the mast observations in conjunction with in-situ instruments at different heights manned by the high school students. This allowed DOW to begin its trip home a little earlier, which was favorable to the schedule of Ms. Gilliland. RADAR day continued in the hot afternoon with ADRAD.

Figure 5. YAP campers on Texas A&M campus.

Although DOW system failures limited its utility for YAP, the presence of the DOW did increase the impactfulness of our camp program. We received favorable comments from the students even though they did not get to see significant operation.

c. Summer SOAP Program

Although the formal portion of the Summer SOAP hands-on student research program ended prior to DOW arrival (we would have asked for earlier arrival but PECAN limited earliest availability), two activities provided opportunities for a portion of the students of this program to engage with the DOW. First, three of the SOAP students joined the REU cohort for the field experience, getting all the same benefits of working with the DOW. Second, a time was set up for an "open truck" that was available to SOAP students remaining in town, and a few were indeed able to get a DOW introduction.

d. "Open Truck" opportunities and Outreach

The DOW was set up in a relatively open parking lot on the edge of campus on three evenings, allowing for current and former students, as well as faculty and their families, to tour the radar. The

Atmospheric Sciences Corporation SODAR was also operating next to DOW for visitors to have an explanation. During these three evenings, approximately 20 students, 4 faculty, and several family members and friends were able to see the DOW in operation. By the 3rd evening, the aforementioned system failures had reduced the DOW operation considerably, but for the purposes of this event, this did not have significant impact.

3. Assessment

a. Instructor Point of View

Overall, having the DOW made substantial positive impact on all of the programs it touched. Access to and control of a mobile radar was a tremendous boon to the program. As an instructor, the DOW was crucial in conveying concepts related to radar site selection, scan strategy, and data interpretation for a variety of applications. The flexibility of a mobile, relatively high-resolution X-band radar was essential to the success of our summer programs, especially considering the lack of "interesting" weather during our deployments.

b. Student Point of View

Student comments on the presence of the DOW were uniformly positive across the programs.

Examples:

"The field experiments in Galveston with the weather balloons, DOW radar, and SoDAR was very beneficial."

"I can say that I was not able to take the radar course here at ____ because of scheduling conflicts, so it acted as a supplement for that class for me. Otherwise, I would have gone through my undergrad career without really having any experience with radar.

"The field research experiences were also very educational, since I have not had the opportunity to participate in fieldwork in the past."

"Although we didn't see much [referring to the field experience lack of convection], looking at the small convective rolls under reflectivity and velocity, going through the struggle of finding a suitable location for the DOW, or even struggling to get interesting weather was a good scientific experience."

Five students of the 12-member YAP Camp mentioned the DOW as one of the most positive aspects of the class.

c. Lessons Learned

Having a DOW coming off of a major field experiment adds risk in terms of reliability for the educational deployment, but the timing of our programs and PECAN demanded this arrangement. It was still worthwhile even with the problems we encountered towards the end of the deployment, and this would not keep us from asking for an asset in the future even if the situation was the same. The DOW is "Big Science" and for our programs will always make a big impact even with limited

operation.

One factor that limits the educational deployment utility is the relative lack of ability to recall, display, and perform limited processing on recently collected data sets in near-real time during the deployment. This capability, for example, is relatively easy in the IRIS-based software that many radar systems have available. In a true field experiment setting this may not be a large problem, as most data is just collected and analyzed later. In an educational deployment, especially a mini-field campaign, many of the lessons need to be learned during the experience itself. It is in this usage where a very user-friendly recently-collected data display and processing native to the DOW would be very beneficial.

Another challenged faced during our deployments was limited knowledge by the TAMU instructors on ideal scan strategies specific to the DOW for clear-air mode. While the DOW has been used in previous research applications to detect clear air signals with great success, there was some difficulty in reproducing this particular application in the field. While experimentation with scan strategies was an educational experience (both for the instructors and the students), in future educational deployments it would be helpful from a data collection standpoint, if a resource were available to provide specific scan strategies/configurations specific to the DOW hardware for varying atmospheric conditions/applications.

Formatting of DOW portable hard drives in a PC and Mac-readable format would be helpful for retrieving data prior to the DOW departing.

A final lesson-learned is that we probably missed opportunities for PUBLIC outreach in both College Station and Galveston. The unusually hot and quiescent weather was not optimal for such activities, but we will plan better in our next educational deployment for these chances to showcase federal investments in science to the taxpaying public, as well as foster STEM interest among young learners.

4. Individuals Reached by DOW

a. NSF REU: 12 students, 3 instructors

b. YAP Summer CAMP: 12 students, 3 counselors, 3 ATMO TAMU student helpers

c. SOAP: 5 students

d. Open DOW: 20 TAMU students, 4 faculty, 10 friends and family members: 34 total.

e. Outreach of opportunity: 2 citizens and one sherrif's deputy stopped to inquired and received information on the Dow. The deputy was intensely interested and received a full tour.

e. In total, approximately 75 individuals experienced the DOW on this deployment.