# Sounding Observations of Lake-Effect Precipitation Experiment – Radar Education and Outreach (SOLPEX-REO)

W. James Steenburgh
Department of Atmospheric Sciences
University of Utah
Salt Lake City, Utah

## 1. Introduction

The University of Utah requests a one-month (21 Oct – 21 Nov 2011) on-campus deployment of one of the dual-polarimetric Doppler on Wheels (DOW) radars managed by the Center for Severe Weather Research (CSWR). We plan to use the DOW for the following education and outreach activities:

1. Student-Directed Field Research: A team of 15–20 undergraduate and graduate students (the former students enrolled in Synoptic-Dynamic Meteorology I during the Fall semester) will plan and execute several field deployments of the DOW to examine lake-effect, orographic, and frontal precipitation events. In the case of lake-effect events, the DOW will supplement additional mobile-sounding observations collected as part of the Sounding Observations and Lake-Effect Precipitation Experiment (SOLPEX), a National Science Foundation (NSF) sponsored field program directed by the PI and involving about 20 graduate and undergraduate students.

2. Lecture and on-campus DOW demonstration for general education students: The Department of Atmospheric Sciences presently receives support from the NSF Course Curriculum and Laboratory Improvement (CCLI) Program to enhance experiential learning opportunities for students enrolled in general education atmospheric sciences courses. As part of this effort, a lecture and on-campus demonstration of the DOW will be given for students enrolled in Atmospheric Sciences 1010: Severe and Unusual Weather, with data collected during the DOW visit integrated into course activities later in the semester.

3. Class and Capstone Project Educational Activities: A library of DOW data will be archived at the University of Utah for use in several classes including Mountain Weather and Climate, Synoptic-Dynamic Meteorology I & II, Environmental Instrumentation, Mesoscale Meteorology, and Remote Sensing of the Environment. Undergraduate students will be encouraged to consider investigating cases observed by the DOWS as part of their senior capstone project.

4. K-12 Outreach: The University of Utah operates a NSF-sponsored science education program called "Think Globally, Learn Locally" (TGLL) to enhance inquiry based science teaching and education in area middle schools. Leveraging existing TGLL partnerships and learning activities, outreach visits will be made to up to 7 K-12 institutions in the Salt Lake Valley, including 3 Title I schools with significant underserved populations. TGLL Graduate Students from the University of Utah will assist in these efforts. We also plan to make an outreach visit to the Salt Lake Center for Science Education, a science focused charter school.

## 2. Educational Activities and Benefits

The University of Utah Department of Atmospheric Sciences has a strong history of integrating field research into its educational programs. For example, during the past winter, the SOLPEX and Persistent Cold-Air Pools (PCAPS) field programs were held in the Salt Lake Valley and surrounding environs and involved the participation of nearly all of our graduate and upper-division undergraduate students. In both field programs, students helped with the field program design, as well as the installation and operation of surface-based and upper-air observing systems. For example, the PCAPS Facebook page provides a retrospective feed highlighting many of these activities (http://www.facebook.com/group.php?gid=232805320100).

**Figure 1. Students prepare an upper-air sounding during the PCAPS field program.**

Lacking from these recent efforts has been the deployment and use of a precipitation radar. The DOW last visited the University of Utah in 2000, when it was successfully deployed for the Intermountain Precipitation Experiment (IPEX, Schultz et al. 2002; Schultz and Trapp 2003; Cox et al. 2005), but this was long before the current generation of students arrived on campus. For upper-division undergraduate and graduate students, we would like to use the DOW to (1) provide a hands-on experience in the design and execution of a field radar to examine precipitation systems (2) to create a case-study library that can be used in future courses and/or for students to use for their senior capstone research projects.

Because there is tremendous interest at the University of Utah in Mountain Meteorology, we are especially interested in building a case-study library of precipitation events in which orographic and land-surface processes contribute to the precipitation dynamics. Such a unique library would greatly appeal to our students and would be utilized in the following courses:

- Atmos 5110/6110/5210/6210: Synoptic-Dynamic Meteorology I & II (Prof. Jim Steenburgh), which examines the weather of northern Utah from a multiscale perspective, including the processes responsible for orographic and lake-effect snowstorms.

- Atmos 3210: Mountain Weather and Climate (Prof. Dave Whiteman), a popular course given the geographic setting of the University of Utah that can utilize DOW imagery for orographic precipitation lectures.

- Atmos 5050/6050: Environmental Instrumentation (Prof. John Horel), which has traditionally emphasized in situ observations, but will be able to better address issues related to radar observations and analysis in complex terrain using the DOW data.

- Atmos 5230/6230 Mesoscale Meteorology (Prof. Ed Zipser) will be able to utilize the DOW data to provide instruction in the use of polarimetric radar.

The Department also has a new senior capstone project requirement, and cases examined by the DOW will be of great interest for students wishing to complete a case study as part of this requirement. DOW data will be converted to a format readable by the Unidata Integrated Data Viewer (IDV), which will allow three-dimensional visualization and integration with other datasets used by the students.

Finally, with support from the NSF CCLI program, the Department has been working to increase experiential learning opportunities for students in *Atmos 1010: Severe and Unusual Weather*, a general education science course taken primarily by non-majors. Radar data is used regularly in the class, but the DOW will allow us to provide a much more intimate first-hand experience for the students.

# 3. Outreach Activities

Through the TGLL program (http://tgll.utah.edu), the Department of Atmospheric Sciences has strong ties with middle and high school teachers in the Salt Lake City school district. Three of our students presently serve as TGLL graduate student fellows and, along with graduate student fellows from the Departments of Biology and Geology and Geophysics, work with these teachers to promote learning in the atmospheric, biological, and geological sciences. Weather and climate feature prominently in these efforts.

Working with the TGLL fellows and middle and high school teachers, we will exhibit the DOW for up to 7 Salt Lake schools, including 3 Title I schools with significant underserved populations and the Salt Lake Center for Science Education. The students will be given a hands-on look at the DOW and be given instruction in weather safety, especially issues of importance in the State of Utah.

Field program activities at the University of Utah have traditionally garnered considerable local media attention. We will contact the *Salt Lake Tribune* and local television stations and encourage them to cover our efforts.

# Facility Request Form for Educational Activities

## Part I: General Information

| | |
|---|---|
| Requestor Name | W. James Steenburgh |
| Institution and Address | 135 South 1460 East Room 819<br>Department of Atmospheric Sciences<br>University of Utah<br>Salt Lake City, UT 84112-0110 |
| Phone and Email | 801-581-8727<br>jim.steenburgh@utah.edu |
| Faculty Advisor Name (if student requestor) | N/A |
| Institution and Address | N/A |
| Phone and Email | N/A |

## Part II: Project Description

| | |
|---|---|
| Project Title | Sounding Observations of Lake-effect Precipitation Experiment–Radar Education and Outreach (SOLPEX-REO) |
| Project Location | Salt Lake City, UT |
| Start and End Dates of Field Deployment | 21 Oct – 21 Nov 2011 |
| NSF Facilities requested (type and # of systems) | 1-DOW |
| Number of Expendables requested (if applicable) | N/A |

## Part III: Educational Activities Description

| | |
|---|---|
| Number of students involved | Graduate: 10-20<br>Undergraduate: 10-15 |
| Desired training activities conducted by Facility Staff incl. time in the field | 1. Infield training of select team of graduate and undergraduate students on deployment and use of DOW. |
| Desired teaching activities conducted by Facility Staff incl. time in the field | 1. Lectures and on-site demonstration of components and operation of a research radar.<br>2. Lecture and on-site demonstration of DOW for general education course, Atmos 1010: Severe and Unusual Weather. This activity related to NSF-CCLI Grant: Observing Snow and |

| | |
|---|---|
| | Wind: Using the Environment to Engage Students in Science and Engineering. |
| Additional special requirements that pertain to Facility support | Students will plan missions, deployments, and scanning strategies for lake-effect, orographic, and frontal precipitation events in complex terrain. University of Utah mobile sounding systems, mesonet systems, and an ice-crystal imaging system will also be available. We do not anticipate any special needs at this time for the DOW, although deployments could involve operations during snow. |
| Ancillary/Opportunistic K-12 Outreach Activities[1] | 1. Outreach visits to up to 7 K-12 institutions in the Salt Lake Valley, including 3 Title I schools with significantly high underserved populations. As part of a NSF GK-12 program, graduate students from the University of Utah presently are involved in outreach at these schools and will assist with these efforts.<br><br>2. Outreach visit to the Salt Lake Center for Science Education, a science-focused charter school. |

## Part IV: Operational Requirements

| | |
|---|---|
| Please specify data access needs (e.g. real time) | None. Students on-site will evaluate radar data and consult with PI on siting and scan strategies. |
| Please specify data analysis needs | |
| Please specify communications needs | Cellular phone communications. Cell modem to view selected images preferred but not necessary. |

[1] Please note that NCAR and NSF **strongly** encourage additional educational activities that focus on K-12 audiences to expand NSF Facilities outreach even further.