

# The 2014 University of Northern Colorado Front Range Doppler on Wheels (FR-DOW) Educational Project

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## 1. Introduction

The University of Northern Colorado (UNC) requests the Doppler on Wheels (DOW), operated by the Center for Severe Weather Research (CSWR), for up to 5 ad-hoc daily deployments and 1 educational/outreach tour during the 2014 Fall Semester. The primary goals of the Front Range Doppler on Wheels (FR-DOW) project and tour are to provide upper-level undergraduate students in meteorology a hands-on experience in data collection and analysis with a state-of-the-art radar system, and to allow non-meteorology majors enrolled in introductory meteorology courses a glimpse into the world of current meteorological research through NSF-supported instrumentation. This is the first such request initiated by UNC, which has recently applied to become a UCAR Member institution, and requests in future years will be guided and refined based on experiences gained in this venture.

The proximity of the University of Northern Colorado to the CSWR office and hangar allows for a fiscally and temporally advantageous relationship between our organizations, where deployments can occur on relatively short (24-hour) notice. Up to 5 deployments are requested on an as-needed basis when meteorological phenomena worthy of observation are occurring, or are forecast to occur. No overnight deployments will be necessary, and in general, operations can occur during the hours of 0800 - 2000 LT. Anticipated locations of DOW deployment are in or near Greeley, CO, depending on the location of the meteorological phenomena to be observed. In order for collected data to be analyzed for projects in the *Radar and Satellite Meteorology* course during the 2014 Fall Semester, deployments could occur in a range of days within 12 October - 15 November 2014. Costs associated with this project would consist only of transportation between Boulder, CO and Greeley, CO, and likely would not exceed \$1,000.

Fall weather along the Front Range of the Rocky Mountains features a wide variety of mesoscale meteorological phenomena. This includes the passage of cold fronts, allowing investigation into cold pool structure and depth, passage of shortwaves and enhancement of convergence and convection, upslope precipitation, outflow boundaries, and even "thundersnow" events. Any of these occurrences would be appropriate for an undergraduate meteorology student to analyze in-depth for a term project.

## 2. Educational Activities

The primary focus for educational activities is to provide a field experience for students enrolled in *Radar and Satellite Meteorology* (MET 465) that will enhance their understanding of radar theory and application through data collection and analysis, culminating in a final project. *Radar and Satellite Meteorology* is a junior-level course for undergraduates, which requires a background in calculus, physics, and physical meteorology. This course has recently been redesigned to incorporate more rigorous material in the fundamentals of radar theory and interpretation of radar imagery, and a project involving data collection and analysis is an ideal complement to the content of course lectures. 6 undergraduates are currently enrolled in this course. An additional 3-5 undergraduates and 1 graduate student in the meteorology program within the Department of Earth and Atmospheric Sciences will be invited to participate. These students will be trained in DOW operation in order to assist with data collection on deployments. All participating students will be strongly encouraged to pursue further analysis of data collected during FR-DOW as part of a (non-required) senior research project.

The first month of *Radar and Satellite Meteorology* is devoted to electromagnetic theory, components of radar hardware, and fundamentals in radar theory that will provide students with a solid foundation for working with the DOW. At least two homework assignments will be directly connected with the DOW to familiarize students with characteristics of the DOW and scan strategies for different meteorological events we may observe. The term project will include construction and interpretation of unique datasets the students themselves have collected. Students will be expected to produce publication-quality figures and describe their experiment and observations in a 10-page paper. Term projects will be due at the date of their final exam. In addition to student assessment through homework and the term project, questions related to the DOW will appear on their in-class exams.

Students in *Radar and Satellite Meteorology* will also complete a survey before and after their experience with the DOW. This will enable documentation of their expectations going into this project and the perceived benefits or disadvantages of the project. Student responses to the survey will be analyzed and used internally to improve the structure and goals of the project and future DOW Educational Requests. This report will be included in the summary report to NSF.

Meteorological computational facilities at UNC feature a Linux cluster and a meteorology lab with dual-boot Windows/Linux machines, which have the NCAR SOLOiii radar software application installed. Additional data analysis and visualization with IDV and Python will be explored.

### 3. Outreach Activities

The focus of outreach activities is to introduce non-meteorology majors at UNC to an exciting, high-profile facility used in atmospheric research that they would most likely only see on specialty weather documentaries or television series. Two introductory-level courses in meteorology are being offered in the 2014 Fall Semester that would benefit from a tour of the DOW: *Our Violent Atmosphere* (MET 110; 104 students), and *General Meteorology* (MET 205; 58 students). A homework assignment featuring the DOW with reflectivity and velocity imagery will be created for *General Meteorology*, and attendance will be required. MET 110 fulfills a science liberal arts elective for non-meteorology undergraduate students. These students will be offered class credit for attending the DOW tour, in hopes of sparking greater interest in students when it comes to appreciating science, and in particular, the field of meteorology.

### 4. Facility Request Form for Educational Activities

#### Part I: General Information

Requestor Name	Wendilyn J. Flynn
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Faculty Advisor Name (if student requestor)	---

#### Part II: Project Description

Project Title	FR-DOW
Project Location	Greeley, CO and surrounding areas
Start and End Dates of Field Deployment	Oct 12 - Nov 15 (flexible; plan to operate on ad-hoc basis)
NSF Facilities requested (type and # of systems)	One Doppler on Wheels (DOW) radar, polarimetric if available
Number of Expendables requested (if applicable)	None

#### Part III: Educational Activities Description

Number of students actively involved	Graduate: 1 Undergraduate: ~8 Tours: Undergraduate >100
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Desired training activities conducted by Facility Staff including time in the field	SOLOiii software Basic training for data collection
Desired teaching activities conducted by Facility Staff including time in the field	Not required
Additional special requirements that pertain to Facility support	None
Ancillary/Oppportunistic Outreach Activities	University Students: One day of DOW tours for courses at UNC K-12: None Public: None

#### Part IV: Operational Requirements

Please specify data access needs (e.g., real time)	Real-time data displays during deployments and recorded data for analysis. All available parameters including reflectivity, Doppler velocity, and depending on availability of polarimetric DOW, polarimetric variables and moments are requested.
Please specify data analysis needs	Data processing to provide DORADE sweep files and netCDF files
Please specify communications needs	None

#### 5. Budget

Due to the proximity of the CSWR hangar and UNC, single-day DOW deployments are expected to occur on an as-needed basis. Up to five deployments are expected. Therefore, the anticipated costs will be due to fuel consumption to transport the DOW between Boulder, CO and Greeley, CO, and likely would not exceed \$1,000.