The Cooperative Institute for Research in Environmental Sciences

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Introduction

The Cooperative Institute for Research in Environmental Sciences (CIRES) Education Outreach group works with educators, scientists and students. We provide materials, courses, workshops, digital resource collections and online communities in climate education.

Water is at the core of many issues in environmental change from local to global scales, and learning about the water cycle offers students an opportunity to explore core scientific concepts and their local environment.

Students working on water cycle dioramas

In climate research, there are significant uncertainties in the way the water cycle will act to enhance (positive feedback) or mitigate (negative feedback) global warming. Water also acts as a central theme that provides opportunities for experiential science education at all levels. The "Water Spotters" program underway at University of Colorado exploits the synergy between needs for enrichment of middle-school science education and the needs for water sample collection to provide primary data for for research investigating water and energy cycles in a semi-arid environment.

Experiential Education Science Projects

The program takes advantage of the prominent agricultural landscape of the region in eastern Colorado, which is a poignant example of how society influences the climate through irrigation, evaporation/ transpiration and run-off and whose productivity is influenced by the climate system. Both natural grasslands and alpine ecosystems in the surrounding regions serve as examples of the native landscape. In coordination with the St. Vrain Valley School District MESA (Math Engineering Science Achievement) program, middle-school students collect rain water samples whose chemistry is analyzed and used as a core component of investigating water and energy cycles in a semi-arid environment. We highlight the value of citizen science in obtaining needed research quality data while also meeting national needs to improve science education.

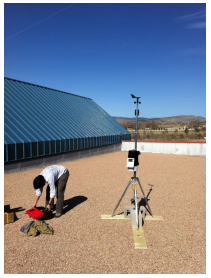
Citizen Science and Weather Data

To help investigate water and energy cycles in Colorado's Front Range, students from 11 St. Vrain Valley schools...

- will participate in the precipitation collection and have weather stations mounted at their schools.
- Have the opportunity to track the weather data throughout their school careers, from elementary school to high school.
- Be able to compare weather data among schools
- As a fun STEM activity, students will design their own precipitation collectors and compare them with the Noone Group's design.

Students discuss the data from the school weather station

Teachers need high quality learning resources and a supportive community to teach climate topics with confidence. Water Spotters provides an unique opportunity for students and teachers to interact with university scientists and graduate students.



Dr. Noone's Team install the school weather stations at St Vrain schools

Water Spotters Curriculum

MESA WATER SPOTTERS

The Water Spotters curriculum was developed by teachers and scientists. It includes new lessons that have been developed in coordination with science teachers that emphasize both core scientific standards and application learning about the water cycle. The modules include original lessons and lessons with expanded original material to teach about water and water isotopes. Curriculum packages that include media resources are increasingly important to teachers. The Water Spotters program uses video to teach collection protocols and give background on the project. Weather station data from schools are disseminated online alongside the rainwater collection protocols.

Check Out Dr. Noone's Water Spotters video! He provides students and their teachers with a great overview to the study and the precipitation collection protocol. Scan the QR cade! Or visit http://vimeo.com/40322110

Journey Through the Water Cycle

SAMPLE ACTIVITY: Instructions: Choose to travel as a light water molecule (H_2O) or as a heavy water molecule (HDO or $H_2{}^{18}O$) You are about to cycle amongst the ocean (liquid), the atmosphere (vapor), and clouds (liquid). You will evaporate, condense, re-evaporate, or precipitate as you move from one reservoir to another. Your journey will be determined by rolling a die and following the directions below. Your goal is to keep track of your journey by drawing arrows and circling reservoirs.

LIGHT WATER

If you roll...	If you are at OCEAN...	If you are at AIR...	If you are at CLOUD...
1	Draw an arrow ocean->air	Draw an arrow air->cloud	Draw an arrow cloud->ocean
2	Draw an arrow ocean->air	Draw an arrow air->cloud	Draw an arrow cloud->ocean
3	Draw an arrow ocean->air	Draw an arrow air->cloud	Draw an arrow cloud->ocean
4	Draw an arrow ocean->air	Circle air	Draw an arrow air<-cloud
5	Draw an arrow ocean->air	Circle air	Draw an arrow air<-cloud
6	Circle ocean	Circle air	Draw an arrow air<-cloud

Air Cloud

Ocean

HEAVY WATER

If you roll...	If you are at OCEAN...	If you are at AIR...	If you are at CLOUD...
1	Draw an arrow ocean->air	Draw an arrow air->cloud	Draw an arrow cloud->ocean
2	Draw an arrow ocean->air	Draw an arrow air->cloud	Draw an arrow cloud->ocean
3	Draw an arrow ocean->air	Draw an arrow air->cloud	Draw an arrow cloud->ocean
4	Circle ocean	Draw an arrow air->cloud	Draw an arrow cloud->ocean
5	Circle ocean	Draw an arrow air->cloud	Draw an arrow cloud->ocean
6	Circle ocean	Circle air	Draw an arrow air<-cloud

Air Cloud

Ocean