Davis Weather Station Protocol

Purpose

To log atmosphere data using a Davis weather station

Overview

A weather station is setup to measure and record atmospheric measurements at 15 minute intervals. These measurements are transferred to your school's computer and then submitted to GLOBE via email data entry.

Student Outcomes

Students can view data for their school that are continuous and show variations within a day. The data collected includes wind speed and direction and pressure thereby supporting a more complete study of meteorology using GLOBE. Students pursue a more extensive set of research investigations.

Science Concepts

Earth and Space Science

Weather can be described by quantitative measurements.
Weather changes from day to day and season to season.
Weather varies on local, regional, and global spatial scales.

Geography

The temperature of variability of a location affects the characterization of Earth's physical geographic system.

Scientific Inquiry Abilities

Scientific inquiry abilities are gained through analyzing the data collected with the weather station. Refer to the Looking at Your Data sections of the protocols that correspond to the measurements taken with your weather station for guidance on performing this data analysis. Consult the *Scientific Inquiry Abilities* listed in the gray boxes for these protocols to learn about the inquiry abilities that will be gained.

Time

2 hours for site definition and set-up

15 minutes to use spreadsheet data entry
to prepare and submit data to GLOBE periodically

Level

Middle and Secondary

Frequency

Data reporting approximately once every week

Materials and Tools

Weather station with data logger
Computer capable of running weather station software

Preparation

Set up the weather station.

Prerequisites

None

Automated Weather Stations

Using automated weather stations that record data can allow students to take environmental measurements at much shorter time intervals than collecting data by hand. The large volume of data that can be collected at uniform time intervals allows for the study of weather phenomena that can change quickly (such as wind) and so cannot be monitored through measurements taken with longer sampling periods.

The weather stations used in this protocol are manufactured by Davis Instruments (http://davisnet.com). These weather stations have a display screen that shows current weather readings, such as temperature, humidity, barometric pressure, wind speed and direction and rainfall, measured by sensors attached to the station either through cables, or wirelessly. The type of measurements taken depends on the model of weather station and the types of sensors purchased.

Besides displaying current readings on the display screen, the weather station also records data over a long period of time using a data logger. This data logger is sold in a kit that also includes software that lets you download the data onto your computer and visualize it, and is required for this protocol.

Once the data are downloaded from the weather station to your computer you can export them to a text file, ingest them to a spreadsheet program, and manipulate them to conform to the format required for GLOBE email data entry. Software is available for some models to export text files in GLOBE's email data entry format.

The following atmospheric data can be taken with this protocol and reported to GLOBE: average wind speed and direction over the 15-minute sampling interval, maximum wind speed and direction over the sampling interval, wind run integrated over the 15-minute period, temperature, relative humidity, barometric pressure, rain rate and total rainfall. Cloud, Snow, Precipitation pH, Aerosol, and Ozone measurements must still be done following the appropriate other protocols.

Measurement Logistics

1. Review background in the *Atmosphere Investigation* (*http://www.globe. gov/documents/348614/352431/ Atmosphere+Introduction/09b766fc-4dc5-410d-9626-77be6a4e1704*).
2. Setup the weather station console and connect to your computer according to manufacturer's directions.
3. Install your atmospheric weather sensors according to the *Weather Station Atmospheric Sensors Installation Field Guide*.
4. Define your measurement site as an atmosphere site with Davis Weather Station selected for thermometer type
5. Log readings at 15-minute intervals and transfer data to your computer according to the directions included with your software.
6. When you are ready to report the data to GLOBE (recommended once a week) export the data stored in your computer to a text file in the format for GLOBE email reporting following the *Logging and Reporting Weather Station Data Lab Guide*.
7. Paste the text in this file into the body of an email and send it to GLOBE following email data entry instructions available in the "Data Entry" section of the GLOBE Website.
8. Engage students in looking at the data.
9. Every year recalibrate your weather station.

Teacher Support

The instructions given in this protocol are specific to one brand of weather station. However, they may be adapted to other equipment that meets the same specifications. If you have questions or require assistance with adapting these instructions to other instruments, contact your Country Coordinator or in the US, the GLOBE Help Desk. The essential elements of this protocol, which must remain the same regardless of the equipment model, are the placement of the station, the precision and accuracy of the sensors, and the sampling interval.

When purchased, your Davis weather station is certified to be calibrated for one full year. After that there are two options for recalibration. The first option is to send it back to the manufacturer to be recalibrated for a fee (see your distributor for details). The second option is to recalibrate using the *GLOBE Recalibration Procedures* outlined in this protocol. Either option is acceptable, but one of the two must be completed so that your instrument continues to take accurate readings.

Before starting students on the installation of your weather station, review the material provided in the *Site Selection and Setup Protocol* for information on important considerations in selecting an area to take atmospheric measurements.

Data Recording

The GLOBE database requires weather station data logged at 15-minute intervals, so make sure that the sampling interval in your weather station is set to 15 minutes. Also, the read-out should happen on the quarter-hour (e.g., 10:00, 10:15, 10:30, 10:45, etc.) Ensure that measurements are being displayed and reported in the appropriate units (i.e., millimeters for rain, degrees Celsius for temperatures, percent for relative humidity, meters/second for wind speed, and kilometers for wind run).

The time associated with each data point reported to GLOBE needs to be in Universal Time (UT). If you choose to have your weather station set to local time you will need to make sure that you adjust the times reported to GLOBE.

Due to the quantity of data, weather station data is reported to GLOBE only via email data entry. Software provided by Davis may allow data to be exported directly into the correct GLOBE email data entry format (see *Frequently Asked Questions* for information on the availability of this software), using the *"Export Records (GLOBE Format)"* option from the Browse menu option in the export data pull-down menu. This software can automatically adjust the times to UT. If you have an older version of the software that does not have this option, export your data to a text file, import the text file into your spreadsheet program, manipulate the columns to match the requirements for email data entry, and cut and paste the resulting values into an email data entry message.

Helpful Hints

- During set-up, be sure to choose the right value for the volume of your tipping bucket or all rain data will be in error.

Questions for Further Investigations

Are the patterns of weather variables over a day the same every day? What causes this?

Which season has the greatest range of temperatures? Why?

What are the latitudes and elevations of other GLOBE schools with annual precipitation and temperature patterns similar to yours?

Is your local environment affected more by average temperature or temperature extremes?

How do changes in wind speed and direction and pressure relate to changes in temperature and relative humidity and to the occurrence of rain?

Weather Station Atmospheric Sensors Installation
Field Guide

Task

Install the atmospheric sensors for your weather station.

What You Need

❑ The sensors that you are going to install

❑ The tools necessary to make the installation

❑ *GLOBE Site Definition Sheet*

❑ Manufacturer's instructions

❑ Compass

Note: Actual installation may vary significantly depending on which sensors you are using and the location where you are installing them.

In the Field

1. Scout for a location(s) for the placement of your instrument shelter. If you are using an anemometer (to measure wind) that can be mounted separately from the rest of the sensor suite, consider mounting it in a different location. If the anemometer is attached to the rest of the sensors, then preferably mount them in a location most appropriate for the thermometer (step 4). If you are using wireless sensors, make sure that they are mounted close enough to your station console to allow for proper communication.

2. If possible, mount your sensor suite so that the temperature sensor is at a height of 1.5 meters above the ground (or 60 cm above average maximum snow depth), preferably in a flat open area with a natural surface (grassy in most places). Try to avoid having buildings within 10 meters.

3. If possible, mount the anemometer where it is above the height of nearby trees and buildings. If you mount it on top of a building, try to keep it at least 1.2 meters above the roofline.

4. Report your site definition data to the GLOBE Website as an atmosphere site with Davis Weather Station selected for thermometer type.

Logging and Reporting Weather Station Data

Lab Guide

Task

Log and report data collected with your weather station.

What You Need

❑ A setup and operating weather station ❑ A suitable computer with email access

In the Field

1. Set your weather station to log data at 15 minute intervals on the quarter hour (e.g., 15:15).

2. Download your weather station data to your computer following the instructions for your weather station. Note: some weather stations can be set-up to transfer these data automatically.

3. Export a text file of your data. Save this file on your computer. (If your software has the ability to export a text file in the GLOBE email data entry format, skip to step 5).

4. Use spreadsheet or other software to edit the exported file into the GLOBE email data entry format. Save this spreadsheet file on your computer.

5. Copy and paste your data in GLOBE email data entry format into the body of a GLOBE email data entry message.

Frequently Asked Questions

1. What should I do if there is frozen precipitation that my weather station registers as rain?

Frozen precipitation and melting snow can cause the tipping bucket of your weather station to tip, and may therefore register as rainfall on your station. The tipping bucket is calibrated exclusively for rainfall so any measurements caused by frozen precipitation are erroneous. Please report any frozen precipitation in your metadata and if possible edit your data record to remove any rainfall readings that were caused by frozen precipitation before reporting data to GLOBE.

2. I am using a Davis weather station, but my software does not include the option to export GLOBE data. What can I do?

Davis is making the option to export GLOBE data available in updated versions of the software for their weather stations. These updated versions are available for download from the Davis Website (http://davisnet.com). You can contact Davis to see if a version of the software that includes the export GLOBE function is available for your model weather station.