



# Protocol Training Slides for: **Automated Weather Stations (AWS)**

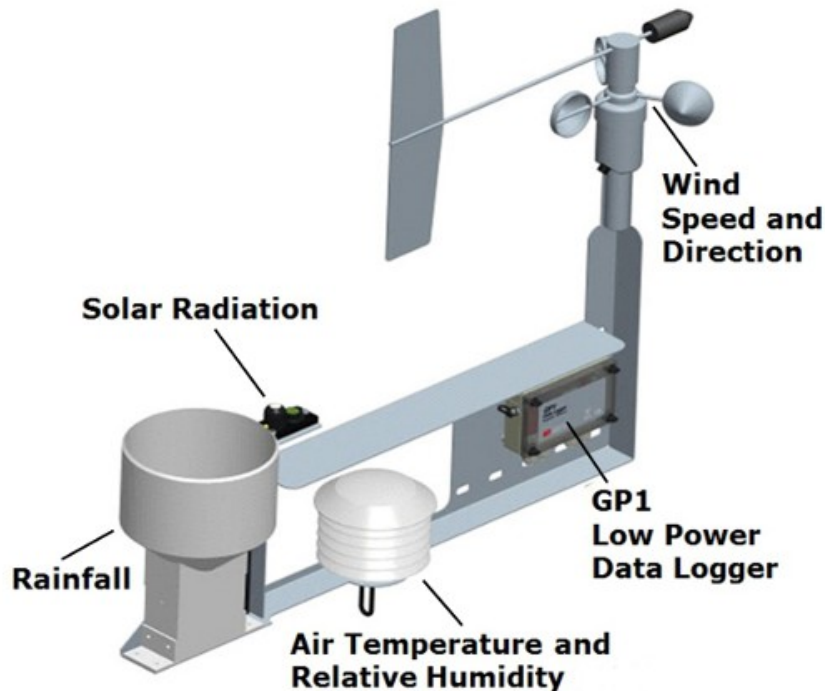


Photo credit: Daniel Miller

Automated Weather Stations (AWSs) can collect a variety of data for upload to GLOBE. They are also known as Personal Weather Stations (PWSs).



**THE GLOBE PROGRAM**

A Worldwide Science and Education Program

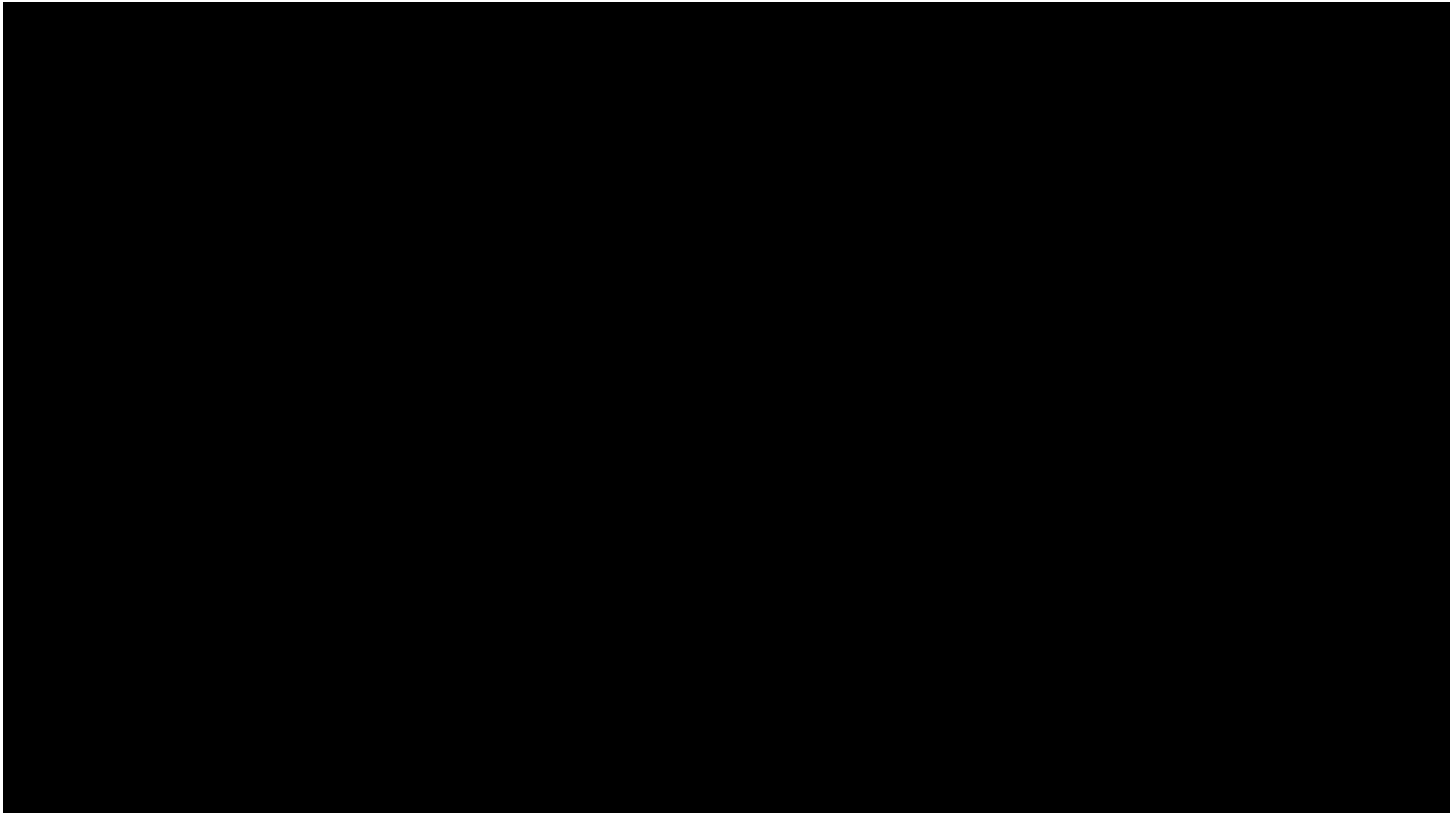


**Atmosphere**



**Automated Weather  
Stations**

## **Video: Alaska National Park Service Automated Weather Stations**



[https://www.youtube.com/watch?v=TFvoFvGHpPc&list=PLN\\_nieRfTTW57Wj-6AWXCFHfmEAzUgLLd](https://www.youtube.com/watch?v=TFvoFvGHpPc&list=PLN_nieRfTTW57Wj-6AWXCFHfmEAzUgLLd)



# The Weather

- Describes the state of the atmosphere at a given point in time and geographic location
- Caused by the interactions of solar radiation, Earth's large ocean, diverse landscapes and motion in space
- Is crucial in gaining an understanding of the Earth system



*Atmosphere Protocol*



# Automated Weather Stations

## Overview

This module

- Describes the different types of automated weather stations
- Provides an introduction to collecting and entering your data on the GLOBE website

## Learning Objectives

After completing this module, you will be able to do

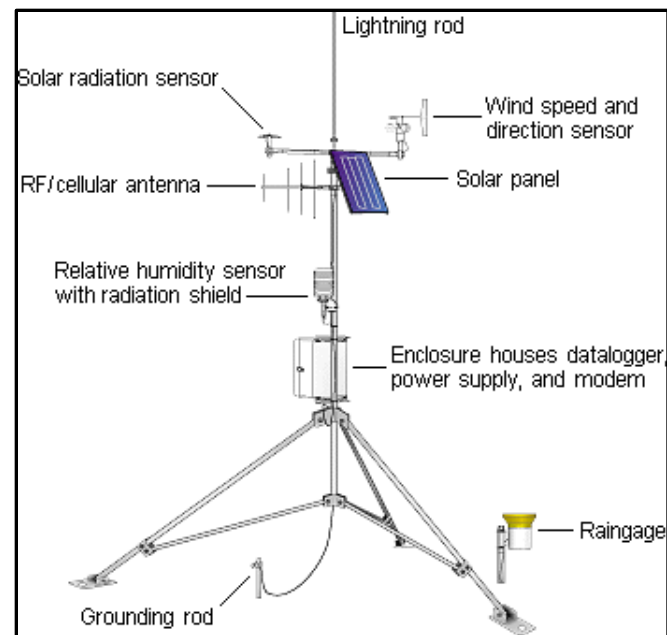
- Describe the different automated weather stations (AWS)
- List the instruments contained in AWS and the data each collects
- Determine the correct location of AWS
- Upload data to GLOBE website
- Visualize data using GLOBE Visualization Site and formulate your own questions about weather



# What is an Automated Weather Station (AWS)?

**An AWS can collect meteorological data from multiple instruments.**

Parameter	Instrument
Temperature	Thermometer
Precipitation	Rain Gauge
Humidity	Hygrometer
Atmospheric Pressure	Barometer
Wind Speed	Anemometer
Wind Direction	Wind Vane
Solar Radiation	Pyranometer
Soil Moisture	Soil Hygrometer
Soil Temperature	Soil Thermometer



- A. What is AWS?
- B. Why collect data using AWS?
- C. How your measurements can help!
- D. How to collect your data
- E. Entering your data
- F. Understanding the data
- G. Quiz Yourself
- H. Frequently Asked Questions
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# How does an AWS work?

Data collected by the AWS is contained in a **data logger** and can be emailed directly to GLOBE. AWSs are often powered by **solar panels** and accessible via **mobile phone**.





# Where are AWSs used?

A. What is AWS?

B. Why collect data using AWS?

C. How your measurements can help!

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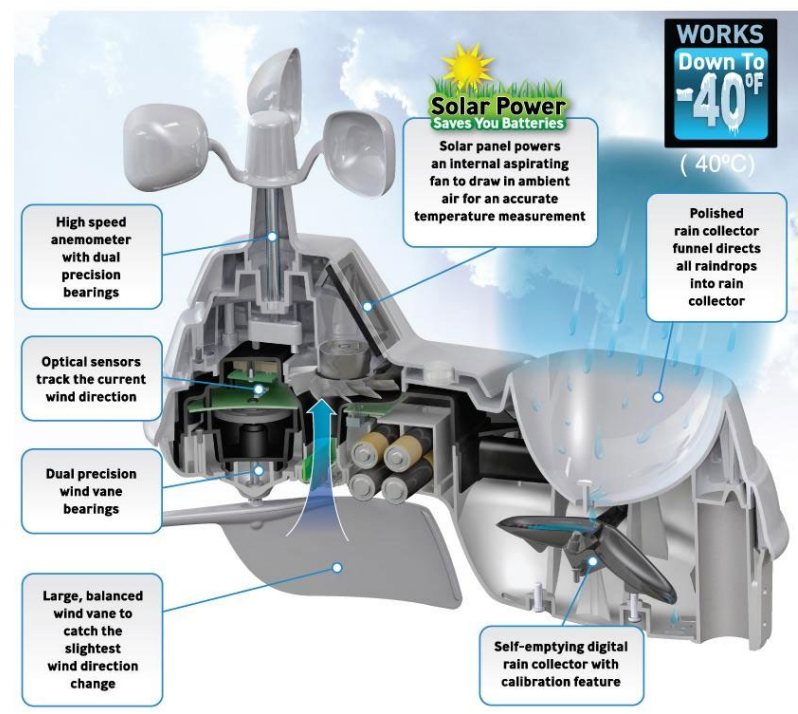
Scientists use AWSs around the world, in all types of environments!



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# What's inside of the AWS?

Inside the AWS are some delicate instruments that are protected from the elements by a protective casing. Batteries are also stored inside. Many AWS have solar panels for power in addition to batteries.







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## Your data can also assist with NASA's GPM Program!

- Earth based measurements of precipitation assist the Global Precipitation Measurement Mission by providing *in situ* data.
- GPM aids in understanding water-borne diseases, weather forecasting, and freshwater availability.
- Knowing how much precipitation falls and where it falls helps to understand weather and climate impacts.
- GLOBE students have taken precipitation observations for a GPM field campaign.



**NASA'S GLOBAL PRECIPITATION MEASUREMENT MISSION (GPM)**



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# YOUR measurements can help NASA scientists answer questions

- How do urban areas affect the temperature around them?
- How does daily weather change seasonal and yearly averages?
- How do local factors such as elevation and water bodies affect the weather?
- How does El Nino affect your weather?





# What I Need to Collect Data

<i>Instruments</i>	Your eyes, GPS unit, Automated Weather Station
<i>References</i>	<a href="#"><u>GLOBE cloud chart</u></a>
<i>When</i>	AWS take weather observations continuously (typically every 15 minutes)
<i>Where</i>	A good observation site (See <a href="#"><u>Documenting your atmosphere study site</u></a> )
<i>Form</i>	<a href="#"><u>Atmosphere Investigation Data Sheet</u></a>

A. What is AWS?

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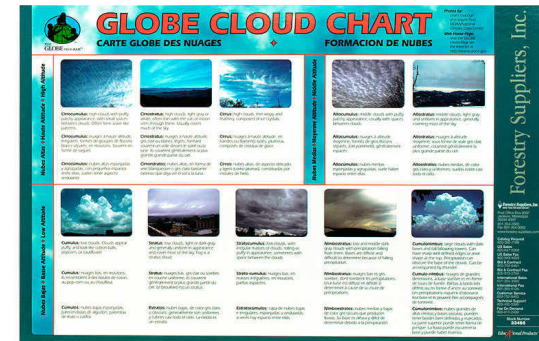
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# What Type of AWS Should I Get?

- There are many different types of AWSs:
- \$ Very simple ones with only two or three instruments
- \$\$\$ Very expensive ones with lots of instruments
- Which one you get depends on your interests and budget
- An AWS can be permanently installed or set up temporarily



Photo Credit: Daniel Miller



# Where can I get an AWS?

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B. Why collect data using AWS?

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- You can purchase an AWS from many different vendors, including Amazon.

- You can use this link to comparison shop: at the [Weather Underground.com](http://WeatherUnderground.com)



RainWise PWS Direct to Weather Underground

Discounted price for WU users!

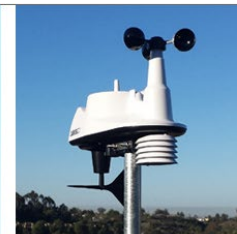
Buy Now

Great for...

Gardeners & Farmers

Included Instruments

- Temp [indoor & outdoor]
- Relative Humidity [indoor & outdoor]
- Wind Speed & Direction
- Pressure
- Rainfall



Davis VantageVue Package

Buy Now from Amazon

Great for...

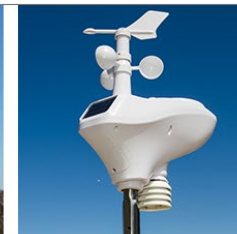
Tech Savvy Weather Enthusiast

Included Instruments

- Temp [indoor & outdoor]
- Relative Humidity [indoor & outdoor]
- Wind Speed & Direction
- Pressure
- Rainfall

Package includes:

- Ambient Weather AirBridge to communicate directly with the VantageVue™.
- Ambient Weather WeatherBridge to push data to the internet through your



Ambient Weather 1001

Buy Now from Amazon

Great for...

The not-so tech savvy

Included Instruments

- Temp [indoor & outdoor]
- Relative Humidity[indoor & outdoor]
- Wind Speed & Direction
- Pressure
- Rainfall
- Solar radiation
- UV
- Display console



Bloomsky

\$50 off with the promo code "bloomsky2015"

Buy Now

Great for...

Weather Photographers

Included Instruments

- Temp [outdoor]
- Relative Humidity [outdoor]
- Pressure
- UV
- Rain Sensor
- Camera



**You can start with a simple version and then add sensors and instruments as you like!**



THE **GLOBE** PROGRAM

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Atmosphere



Automated Weather  
Stations

# Video: Comparing Automated Weather Stations





# Assembling your AWS

A. What is AWS?

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Once you receive your AWS, it will take approximately one hour to assemble using the manufacturer's instructions.





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# Where should I install my AWS?

- You should install your AWS in a place that is easily accessible to you.
- However, it should not be installed between buildings or under trees.
- A location near your home or school in an open area that is grassy is best.



Go here for a good installation guide:

<http://www.wunderground.com/weatherstation/installationguide.asp>





# What are some things that can interfere with the AWS?

- Obstructions to wind (ex. buildings)
- Things that give off humidity (ex. trees)
- Things that give off heat (ex. pavement and rooftops)

Therefore, place your AWS in an area that is away from trees, pavement and rooftops and that has open access to wind flow.



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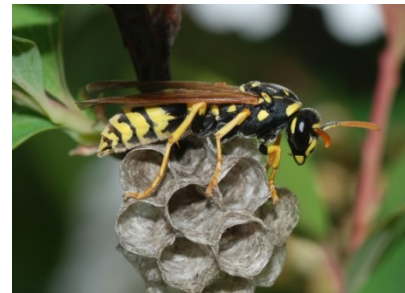
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# CAUTIONS!

Wasps or spiders may try to set up a home inside of the protective casing of your AWS!



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# CAUTIONS!

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Check the operating temperatures of your AWS in the manufacturer's instructions. Some AWS will not operate in extremely cold environments!



# Protecting Your AWS

You can protect your AWS from people and animals by placing fencing around it.

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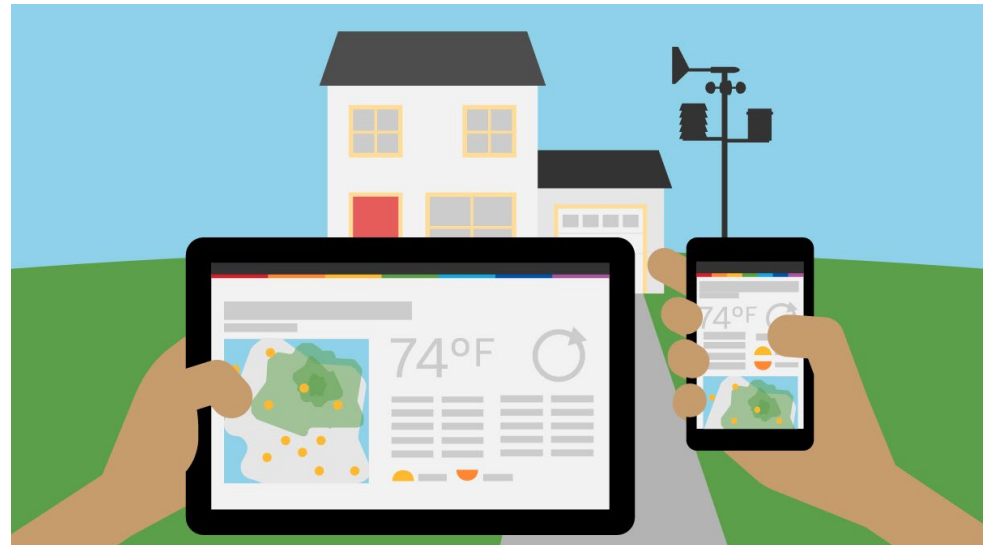
I. Further Resources





# Data from your AWS

You can view data from your AWS directly on your smart phone or tablet; however, you should also share it with the GLOBE community.



For your AWS data to be available to teachers and students around the world, you will need to upload your data to the GLOBE website or use the email approach to send the data to the GLOBE database.

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# Entering Data

***Click on the AWS name below to go to the GLOBE Protocols***

<a href="#"><u>Davis</u></a>	<a href="#"><u>Earth Networks</u></a>
<a href="#"><u>RainWise</u></a>	<a href="#"><u>WeatherHawk</u></a>

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# Collecting Data

- 1) Choose and purchase an AWS according to your budget and predicted use.
- 2) Set up your AWS in an open area following the manufacturer's instructions. Install each of the sensors you purchased.
- 3) Collect GPS data for the **center** of the site (latitude, longitude and elevation).
- 4) Record your site data on an Atmosphere Investigation [data sheet](#).
- 5) Use the [Cloud Protocol](#) to record cloud observations.
- 6) Set up your AWS to log readings in 15-minute intervals. Transfer the data to your computer using the directions included with the AWS data software.

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- 10) Log into the GLOBE website.
- 11) Set up an Atmosphere Site
- 12) Under Thermometer Type choose the type of AWS you have: Davis, AWS Earth Networks Station, Rainwise, and WeatherHawk.
- 13) For Earth Networks, set up and connect your AWS through <https://earthnetworks.com/>
- 14) Get a Earth Networks ID
- 15) Enter the Station ID that you got from Earth Networks.
- 16) Add other descriptions of your site including pictures.

Everything should be ready for GLOBE to pull your data from your AWS to the GLOBE website.

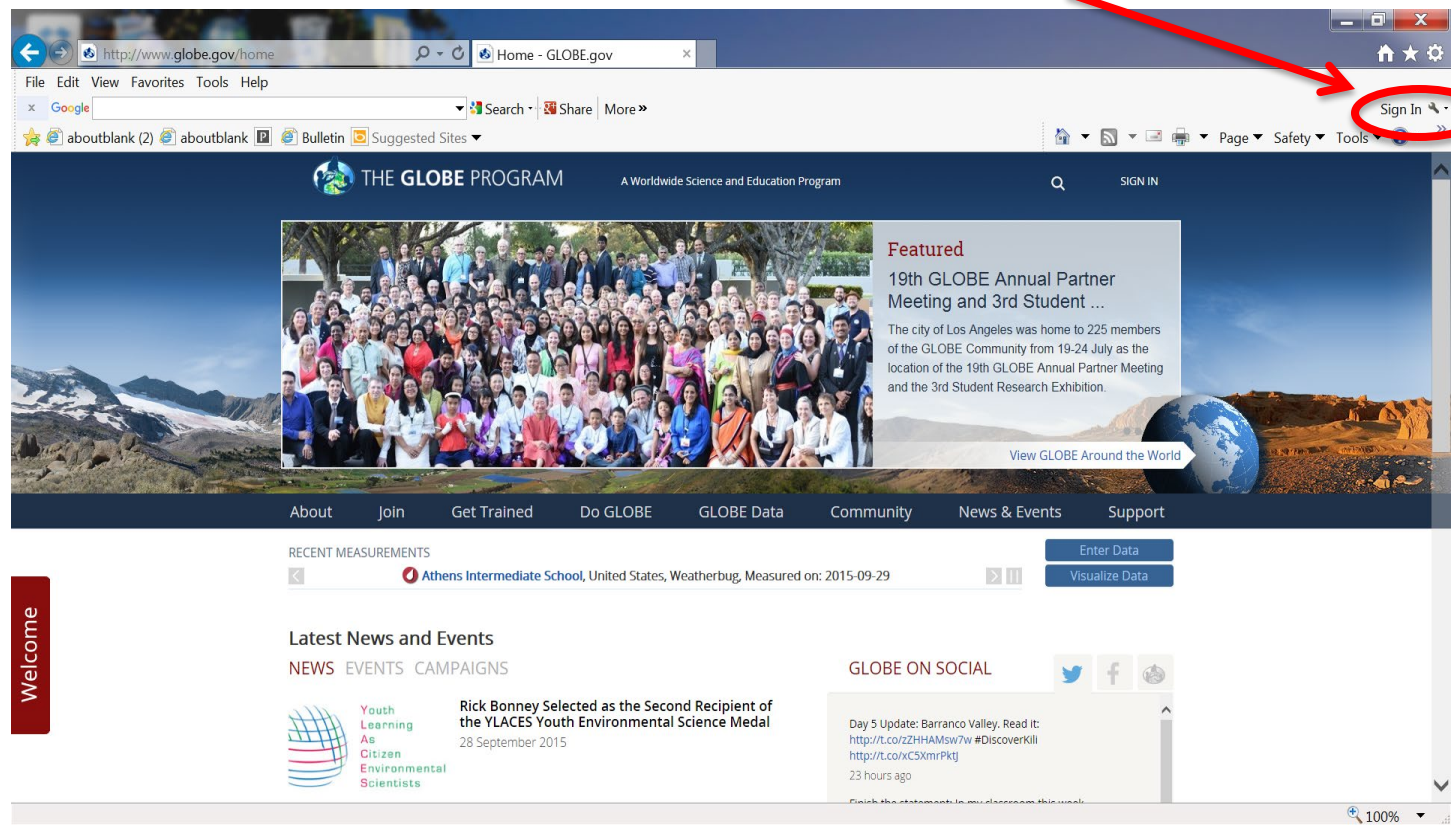




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# Entering Data

Go to [www.globe.gov](http://www.globe.gov) and click sign in.



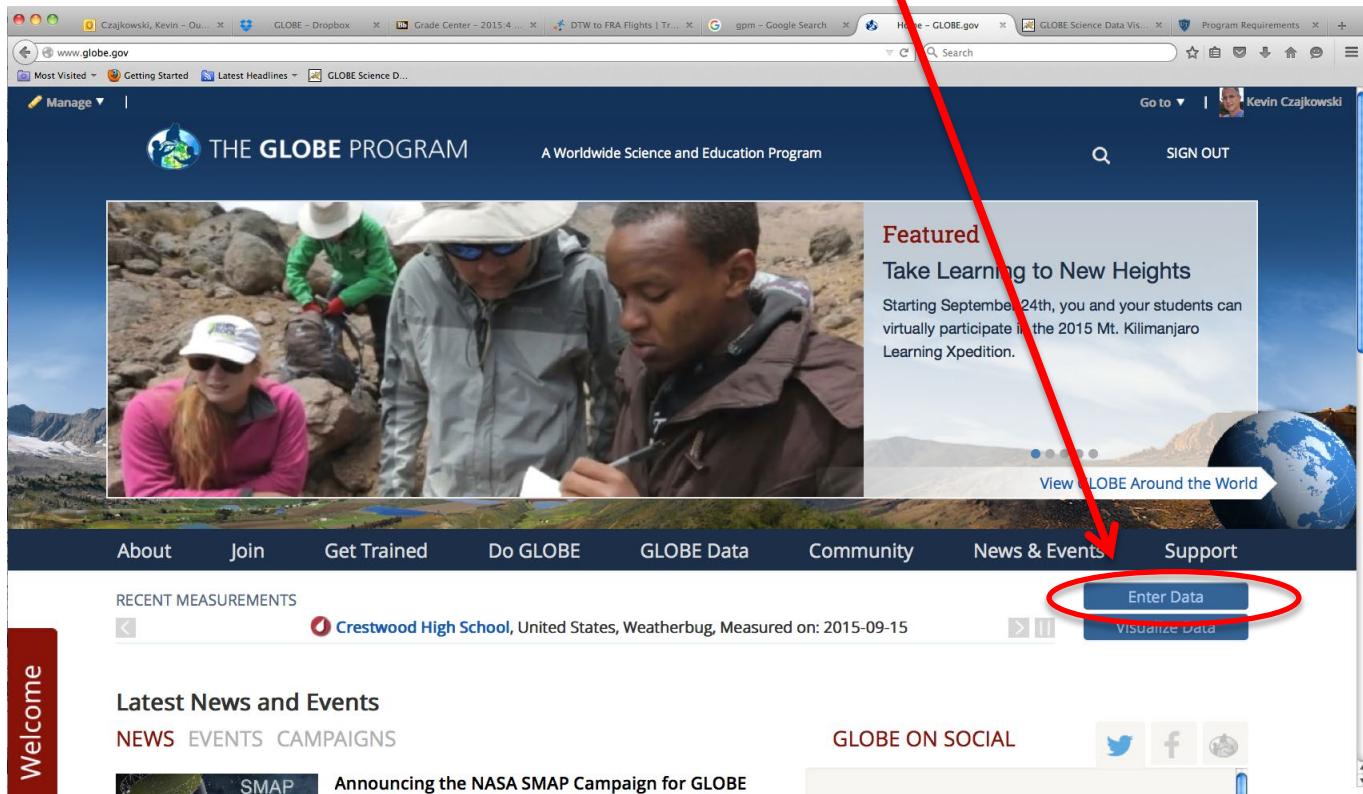
The screenshot shows the homepage of the GLOBE Program website. At the top right, there is a 'SIGN IN' link. A red arrow points from the text 'click sign in.' to this 'Sign In' button, which is also circled in red. The website features a navigation menu with links like 'About', 'Join', 'Get Trained', 'Do GLOBE', 'GLOBE Data', 'Community', 'News & Events', and 'Support'. There is also a 'RECENT MEASUREMENTS' section showing data from Athens Intermediate School and a 'Latest News and Events' section with a news item about Rick Bonney.



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# Entering Data

Now click on **Enter Data**.



The screenshot shows the GLOBE Program website interface. At the top, there is a navigation bar with the GLOBE logo and the text 'THE GLOBE PROGRAM A Worldwide Science and Education Program'. Below this is a main banner area with a photo of students in a field and a 'Featured' section titled 'Take Learning to New Heights'. A red arrow points from the top of the page down to the 'Enter Data' button in the 'RECENT MEASUREMENTS' section. The 'Enter Data' button is circled in red. Other visible elements include a 'SIGN OUT' button, a search bar, and a 'GLOBE ON SOCIAL' section at the bottom.



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# Entering Data

## Choose Live Data Entry.

The screenshot shows the GLOBE Data Entry website. At the top, there is a navigation bar with 'Manage', 'Toggle Edit Controls', 'Go to', and 'Mikell Lynne Hedley'. Below this is a banner image of a landscape with mountains and a lake, with 'THE GLOBE PROGRAM' and 'A Worldwide Science and Education Program' text. A search bar and 'SIGN OUT' link are also present. The main navigation menu includes 'About', 'Join', 'Get Trained', 'Do GLOBE', 'GLOBE Data', 'Community', 'News & Events', and 'Support'. The 'GLOBE Data > Data Entry' breadcrumb is visible. On the left sidebar, under 'GLOBE Data', there are links for 'Data Entry', 'Live Data Entry' (circled in red with a red arrow pointing to it), 'Training Data Entry', 'Email Data Entry (EMDE)', and 'Data Entry Mobile App'. The main content area is titled 'Data Entry' and contains an 'Important Information' section with text about liquid-filled thermometers. Below that, it states 'GLOBE Data Entry consists of several options:' and includes a small image of people working at a computer with a link to 'Live Data Entry'.



# Entering Data

If you have not already done so, add a new site.

The screenshot shows a web browser window with the URL <https://data.globe.gov/#/entry>. The page title is "THE GLOBE PROGRAM SCIENCE Data Entry" and it says "Welcome Kevin Czajkowski". There is a blue notification bar that says "Welcome to the GLOBE data entry site." Below this is a "My Bookmarks" section for "The University Of Toledo" with several bookmarked items like "Dr.C's alfalfa field:ATM-10 / Integrated 1-Day" and "Ottawa River Soil site / Soil Moisture Gravimetric and Volumetric - SMAP Block Pattern". Below that is a "My Organizations and Sites" section with two entries: "+ The University Of Toledo" and "+ Surface Temp". In the bottom right of the "My Organizations and Sites" section, there is a red circle around an "Add Site" button, which is pointed to by a red arrow.

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# Entering Data

Enter an Atmosphere Site name, and latitude and longitude for the center of your site, and click on **Create Site**.

Outlook Web App | Home - GLOBE.gov | The GLOBE Program | Visualize and Retri... | GLOBE Science Dat... | Monroe, Michigan... | Verizon Wireless P... | Checkout Order Su... | +

https://data.globe.gov/#/sites/new?orgid=394556

Most Visited | Getting Started | Latest Headlines | GLOBE Science D...

THEGLOBEPROGRAM SCIENCE Data Entry

Welcome Kevin Czajkowski

Data Entry Home / The University Of Toledo /

**Add site type**

**Atmosphere**

Atmosphere

Surface Temperature

**Hydrology**

Hydrology

**Land Cover/Biology**

Land Cover

**Earth as a System**

Greening

Phenological Gardens

**Soil**

Soil Characteristics

Soil Moisture and Temperature

**Photos** →

**Site Name \*** \* indicates a field is required

**Coordinates**

**Latitude \***

North  South

**Longitude \***

East

**Elevation \***

**Source of Coordinates Data \***

GPS  Other

**Comments**

Optional

**Create Site** **Reset**

**NOTE: If you enter the data correctly, you get a smiley face!**

😊

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# Entering Data

## Choose the AWS that you have in the Thermometer Type

THE GLOBE PROGRAM SCIENCE Data Entry Welcome Kevin Czajkowski

Data Entry Home / The University Of Toledo /

**Add site type**

**Atmosphere**

Atmosphere

Surface Temperature

**Hydrology**

Hydrology

**Land Cover/Biology**

Land Cover

**Earth as a System**

Greening

Phenological Gardens

**Soil**

Soil Characterization

Soil Moisture and Temperature

**Photos** →

Buildings (within 10 meters of the instrument shelter)

Slope Angle

Rain Gauge Height  cm

Ozone Clip Height  cm

Thermometer Height  cm

**Thermometers**

Liquid-filled Maximum/Minimum Thermometers - GLOBE no longer recommends the U tube thermometer for recording maximum and minimum air temperatures. The thermometer magnet for resetting the floats becomes demagnetized and/or the floats stick in the tube. GLOBE encourages the use of a digital maximum/minimum thermometer for these air temperature measurements. If you are currently using a U-tube thermometer please consider replacing it with a digital model.

Thermometer Type:

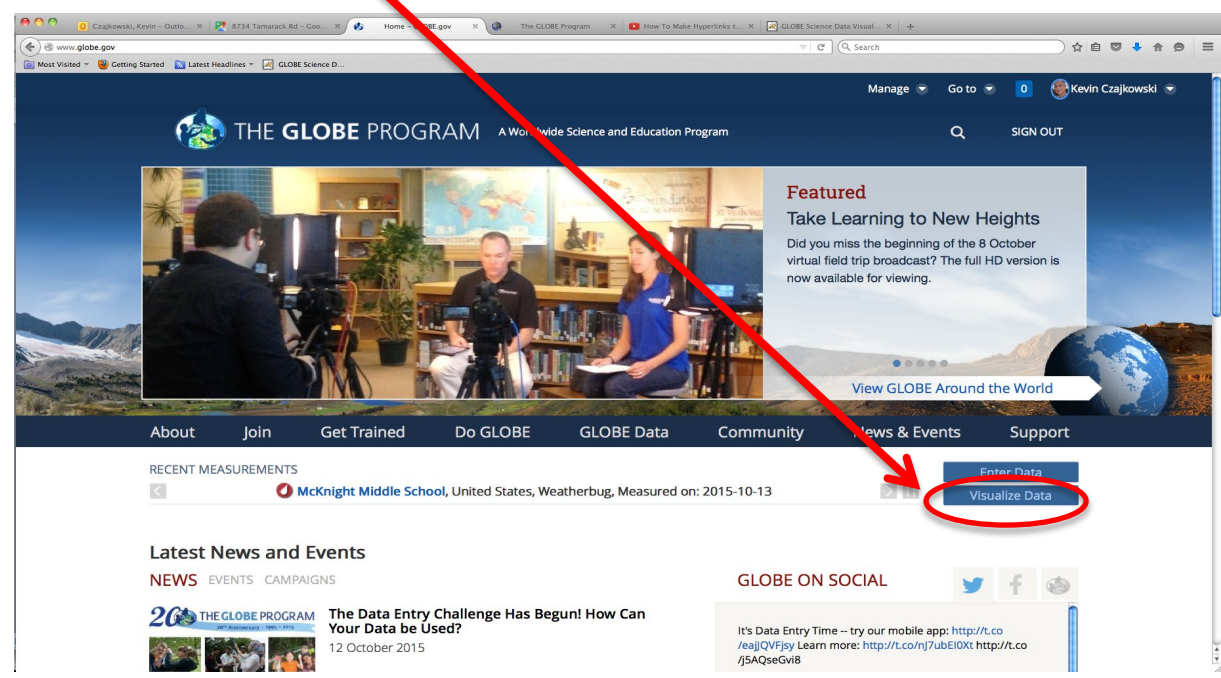
- Other, Soil or Air
- Liquid-Filled Max/Min (U-tube)
- Liquid-Filled, Current Temp Only
- Digital Single-Day Max/Min
- Digital Multi-Day Max/Min
- AWS WeatherBug Station**
- Davis Instrument
- Data Logger (HOBO)
- Rainwise
- Weatherhawk
- No Thermometer

Surface Cover Description

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# Retrieving Data from the GLOBE Visualization

## Click on Visualize Data



[E-training](#) is available to explore the full power of the visualization system.



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# Retrieving Data from the GLOBE Visualization

Close the **Welcome** box and click on **Add +** to add a layer

The screenshot shows the GLOBE Visualization System interface. A red arrow points to the 'Add +' button in the 'Data Layers' menu. A 'Welcome' dialog box is open in the center of the map, providing instructions on how to use the system.

**Welcome to the GLOBE Visualization System**

**Getting Started:**

To begin visualizing your GLOBE data, first determine if you are interested in viewing measurements or data counts by selecting one of the map types at the top left. Next, select a measurement type or data counts date range using the date selector below the map type.

Next, add a data layer. All sites that have data of the selected measurement layer type on the date or dates selected, will display. Click on a site icon on the map to view data and site information about the selected site.

To further refine your site search, select the Filters menu located in the Layers/Filters menu bar. You can filter by school, site, city, data range (for data counts) and more.

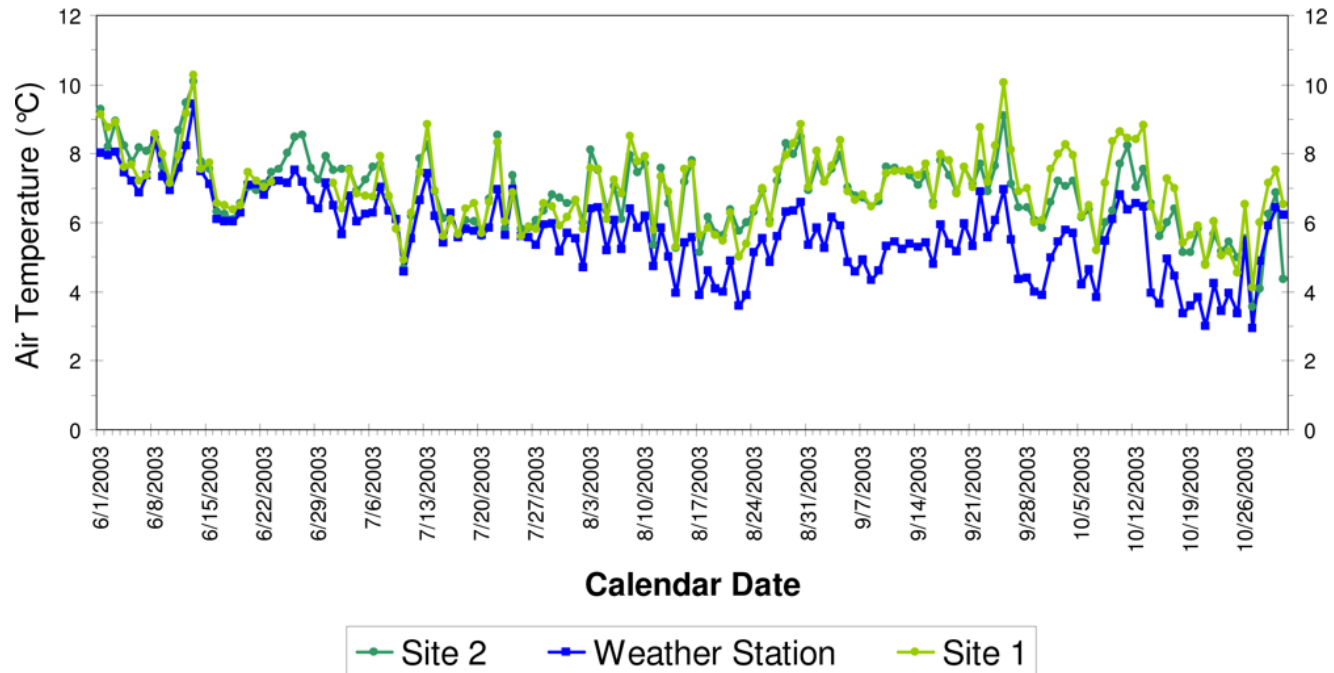




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# Once you've entered your data, you can view it.

### Daily Averages



# GLOBE allows you to analyze your data.



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# What Have I Learned?

- What is an automated weather station (AWS)?
- What instruments does an AWS contain?
- What data is collected by each instrument in AWS?
- Why it is it important to collect weather data?
- Where can I purchase an AWS?
- Where should I place my AWS?
- What do I need to collect data?
- How do I submit data to GLOBE?
- What can I do with the data submitted to GLOBE?



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# FAQs

***Is there additional help on the GLOBE website on how to set up an automated weather station?***

Yes. Here are some additional links: [Davis AWS](#)

[Installing the weather station](#)

[Here is a tutorial about how to connect the station to GLOBE](#)

[Weather Station Manual](#)



# Further Resources

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- For GLOBE E-training go to: <https://www.globe.gov/get-trained/protocol-e-training/modules>
- For information on purchasing GLOBE supplies go to: <http://www.globe.gov/web/north-america/resources/globe-equipment-suppliers>
- What is a Personal Weather Station?  
<http://www.wunderground.com/weatherstation/whatispws.asp>
- Personal Weather Station Buying Guide:  
<http://www.wunderground.com/weatherstation/buyingguide.asp>
- Hydrometeorological Networks in the U.S.: <http://www.eol.ucar.edu/projects/hydrometnet/>
- Davis Weather Stations videos: <https://www.youtube.com/user/davisinstruments/videos>
- Earth Networks Weather Stations: <https://www.earthnetworks.com/products/weather-station/>
- Ambient Weather GLOBE Program Products:  
<http://www.ambientweather.com/globeprogram.html>
- Ambient Weather GLOBE Compatible Weather Station Software:  
<http://www.ambientweather.com/glcwestso.html>
- Scientific Sales, Inc. Weather Stations: <http://www.scientificsales.com/>
- WeatherHawk Weather Stations: <http://www.weatherhawk.com/weather-stations>
- How WeatherHawk Stations work: <http://www.weatherhawk.com/education-more>
- WeatherHawk Lesson Plans for K-12 Teachers: <http://www.weatherhawk.com/lesson-plans>
- Simple Homemade Weather Station for Kids:  
<http://celebrating200years.noaa.gov/edufun/book/BuildyourownWeatherStation.pdf>