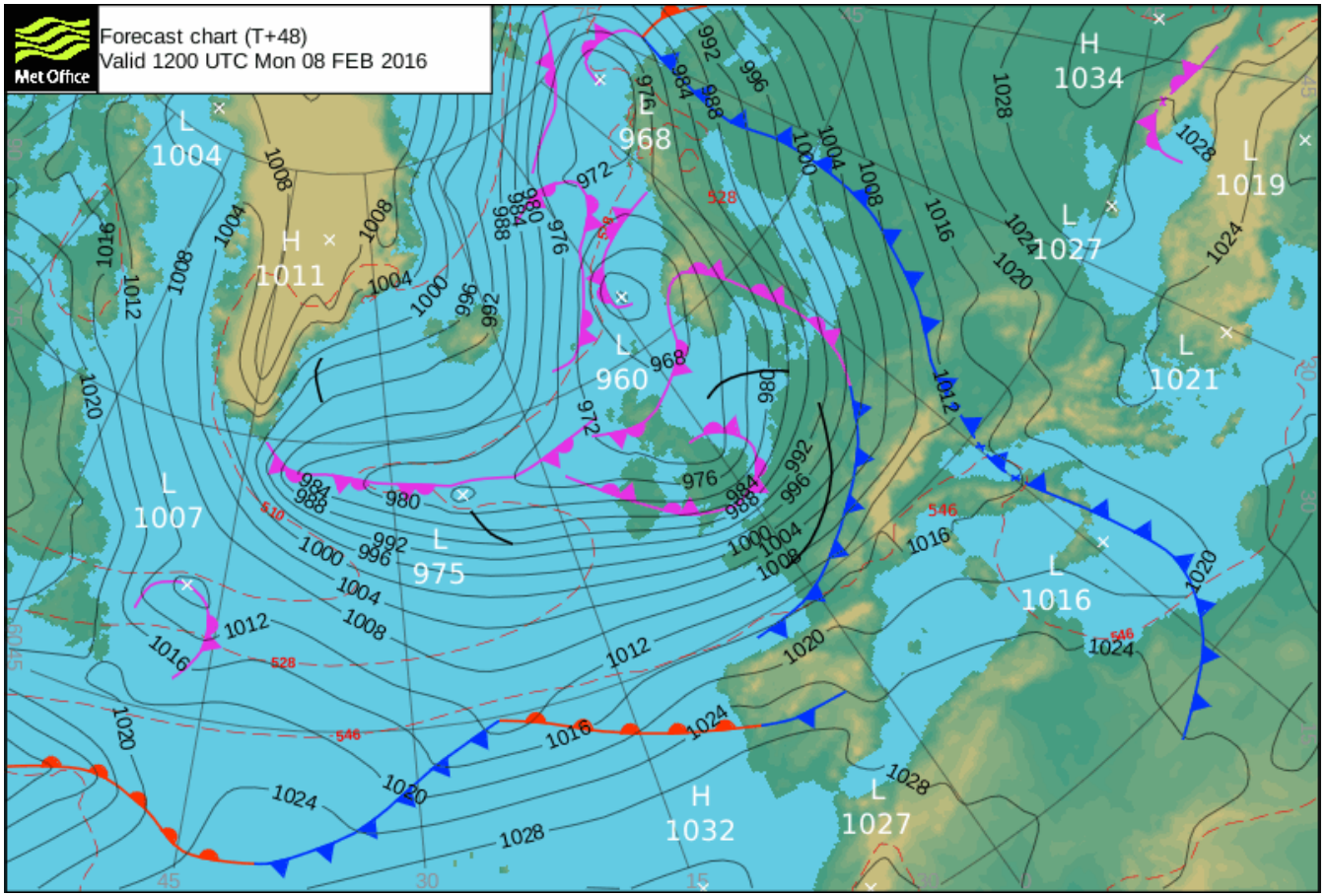
Protocol Training Slides for:
Barometric Pressure



The Atmosphere

- Extremely thin blanket of air extending about 300 miles from Earth's surface to edge of space
- Composition of molecules of nitrogen, oxygen, argon, water vapor, carbon dioxide, and other gases
- Protection from the blasts of radiation emanating from the Sun

Image: NASA

This Module

Overview

This module

- Describes how to take barometric pressure observations
- Provides instructions on how to enter your data on the GLOBE website

Learning Objectives

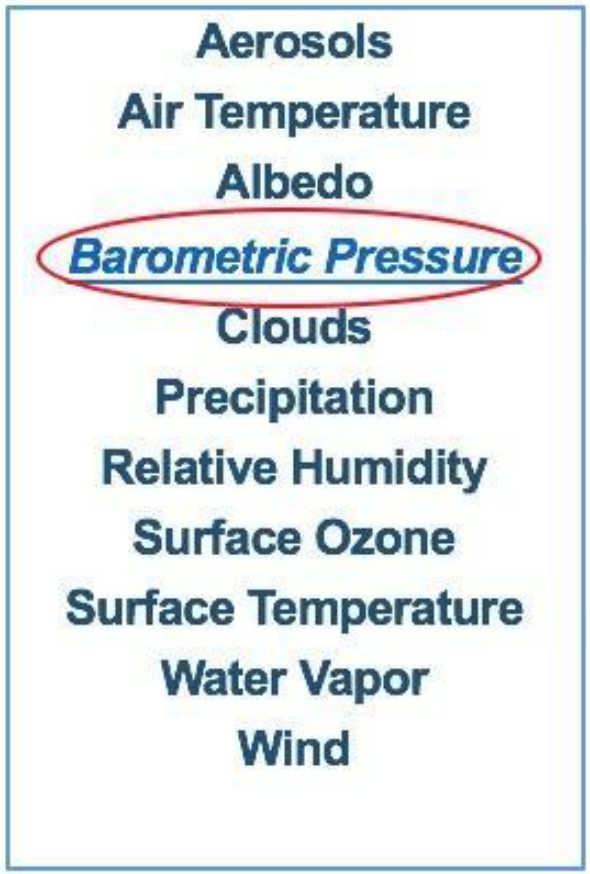
After completing this module, you will be able to

- Describe what barometric pressure is
- List reasons why it is important to collect barometric pressure data
- Determine the correct locations to take barometric pressure readings
- Upload data to GLOBE website
- Visualize data using GLOBE Visualization Site and formulate your own questions about weather

Estimated time to complete module: 1 hour

Barometric Pressure

- Measures the weight of the atmosphere per unit area
- Is the weight (force) of the air pushing on each unit of surface area on the ground
- Increase or decrease indicates upcoming weather change
- High pressure generally brings fair weather, and low pressure is associated with “bad weather”
- Link to Barometric Pressure Protocol here



Recording barometric pressure is important for many reasons:

- Used to predict the weather
- Used to interpret measurements of aerosols, ozone, and water vapor

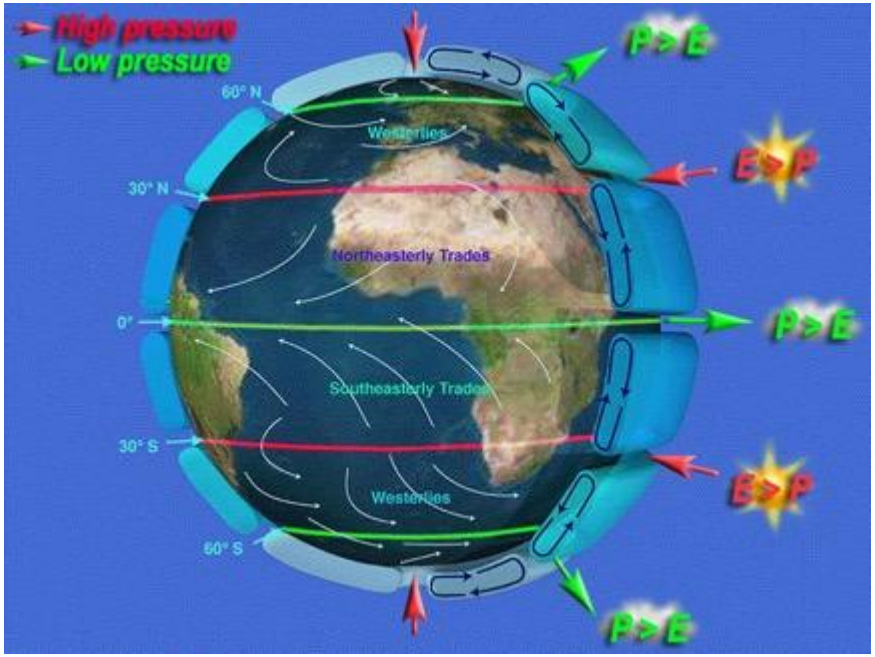
Your Impact

Your observations are valuable contributions to the scientific community and may be used by educators, students, researchers, and the general public to increase environmental awareness and STEM literacy, as well as advance Earth system science. Specifically, they can help the scientific community

- Understand and predict the weather (air temperature, rain, relative humidity, cloud conditions, atmospheric pressure)
- Understand Atmospheric Composition (trace gases and particles in the air)
- Interpret aerosols, ozone, and water vapor measurements

Example: NASA's Aquarius Mission

- Studying the relationship of ocean salinity and atmospheric pressures which vary on Earth.
- Image illustrates the pattern of atmospheric pressures on Earth. Atmospheric pressure highs are at the poles, 30°N and 30°S. Atmospheric lows are along the equator, 60°N and 60°S.
- Cloudiness and precipitation (P) dominate bands of low pressure. At these latitudes, world's rainforests are located. Dryness and evaporation (E) dominate bands of high pressure. At these latitudes, deserts are located.
- Read more here



E – Evaporation; **P** – Precipitation'

Image: University of Maine, Aquarius

Protocol at a Glance

Instruments	Aneroid Barometer or Altimeter
Data Sheet	*Integrated 1-day Data Sheet*
When	Preferably, within one hour of *local solar noon*
Where	Classroom Wall at eye level
Other	Log book for data collection; Computer with internet connection to enter data

Aneroid Barometer

Altimeter

Use in higher elevations greater than 500 m

Calibrating your Instrument: Aneroid Barometer

Calibration of Aneroid Barometer

1) Inspect your barometer; it will most likely have two different scales, one in millibars (or hectopascals) and one in millimeters (or centimeters) of mercury. All of your measurements for GLOBE should be taken in millibars or hectopascals (remember, these are equivalent).
2) Find a local reliable weather information source, which provides measurements of pressure. Compare to see if the readings are the same. Once you have obtained an accurate sea level pressure reading in millibars or hectopascals, reset your barometer to this pressure reading using a small set screw on the back of the barometer (this should only be done by the teacher!).
3) There is a needle that can be set to the current reading each day – you should do this each day after you take your pressure reading.
4) When you take tomorrow's reading, your barometer's set needle will read yesterday's value, and you can instantly compare to see whether pressure is higher or lower now than the day before!
5) Calibrate every 6 months.

Calibrating your Instrument: Altimeter

Calibrating the Altimeter

- Most likely already calibrated by the factory.
- Pick a location where you know the altitude from a reliable source and check the setting. If different, set the altitude.

Collecting Data-1

Read the barometer to the 0.1 millibar using the black arm. This barometer reads 1006.2 mb.

For this location, the pressure has dropped over the last 24 hours.

Collecting Data-2

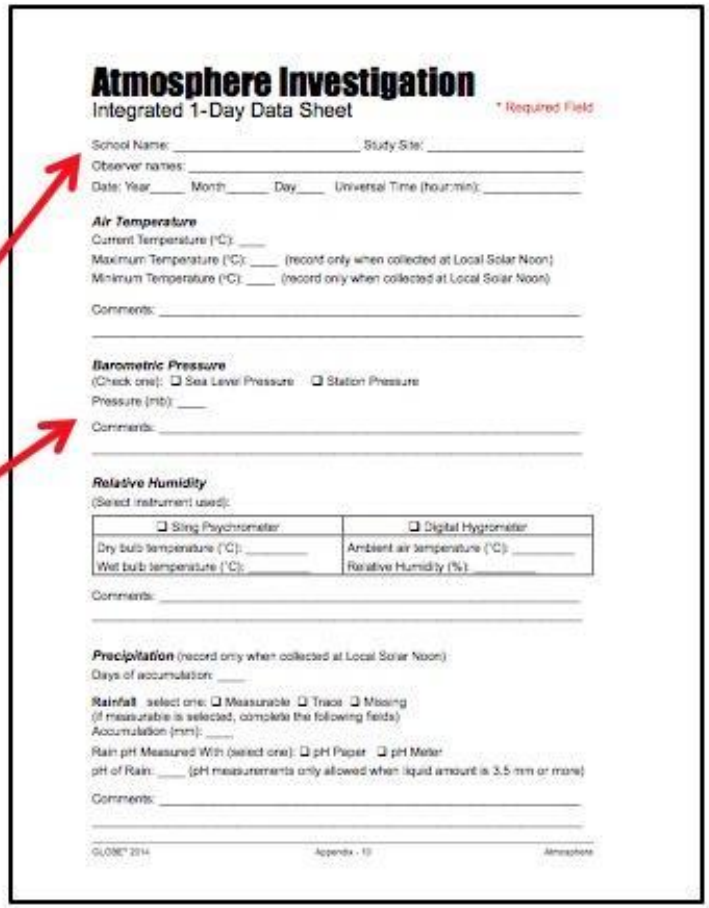
1) Collect data daily, preferably within one hour of local *solar noon*. Record the time (local or UTC) and date on the *Integrated 1-day Data Sheet*.
2) Tap gently on the glass cover of the aneroid barometer to stabilize the needle.
3) Read the barometer to the nearest 0.1 millibar (or hectopascal).
4) Record this reading as the current pressure.
5) Set the "set needle" to the current pressure.

Data Sheet

Enter the data on the Integrated 1-Day Data Sheet

Be sure to fill out the top: School Name, Study Site, Observer Names, Date and Time (local or UTC)

Atmosphere Data Sheet



Atmosphere Investigation
Integrated 1-Day Data Sheet
* Required Field

School Name: _____ Study Site: _____
Observer names: _____
Date: Year____ Month____ Day____ Universal Time (hour:min): _____

Air Temperature
Current Temperature (°C): ____
Maximum Temperature (°C): ____ (record only when collected at Local Solar Noon)
Minimum Temperature (°C): ____ (record only when collected at Local Solar Noon)

Comments: _____

Barometric Pressure
(Check one): ❑ Sea Level Pressure ❑ Station Pressure
Pressure (mb): ____

Comments: _____

Relative Humidity
(Select instrument used):

❑ Sling Psychrometer	❑ Digital Hygrometer
Dry bulb temperature (°C): _____	Ambient air temperature (°C): _____
Wet bulb temperature (°C): _____	Relative Humidity (%): _____

Comments: _____

Precipitation (record only when collected at Local Solar Noon)
Days of accumulation: ____

Rainfall select one: ❑ Measurable ❑ Trace ❑ Missing
(if measurable is selected, complete the following fields)
Accumulation (mm): ____
Rain pH Measured With (select one): ❑ pH Paper ❑ pH Meter
pH of Rain: ____ (pH measurements only allowed when liquid amount is 3.5 mm or more)

Comments: _____

Entering Barometric Pressure in the GLOBE Observer Data Entry System

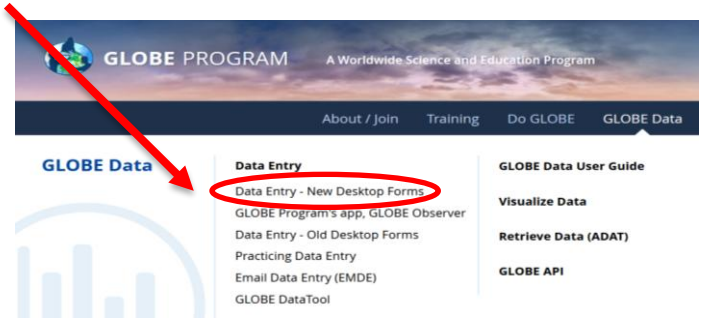
Two Options for Uploading Data:

These methods all allow users to submit environmental data – collected at defined sites, according to protocol, and using approved instrumentation – for entry into the official GLOBE science database.

1. Download the GLOBE Observer mobile app from the App Store.
2. Data Entry: Visit globe.gov, click on the "GLOBE Data" tab, then underneath "Data Entry" click on "Data Entry – New Desktop Forms".

Note 1: You will need a GLOBE teacher, trainer, or scientist account to submit GLOBE data.

Note 2: It may take some time after you enter your data for it to appear in the GLOBE data visualization system.



Entering Barometric Pressure Data – Step 1&2

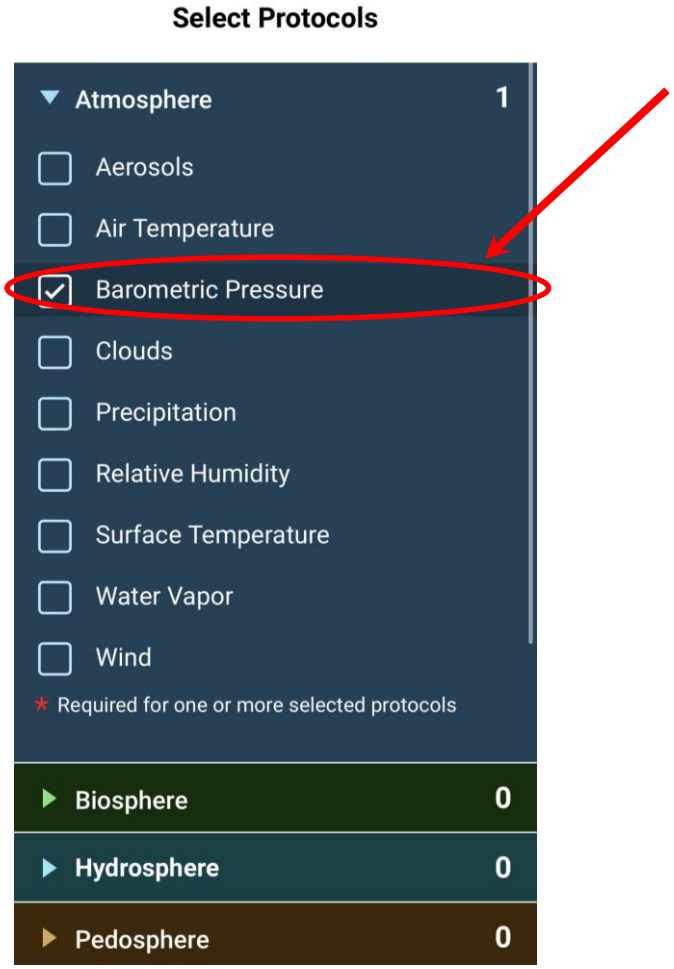
The steps below will walk you through entering your Atmosphere Study Site Information in the GLOBE Observer App, which you can access using your GLOBE or GLOBE Observer login.

1. Click “Data Entry”

2. Click "Create/Edit My Sites"

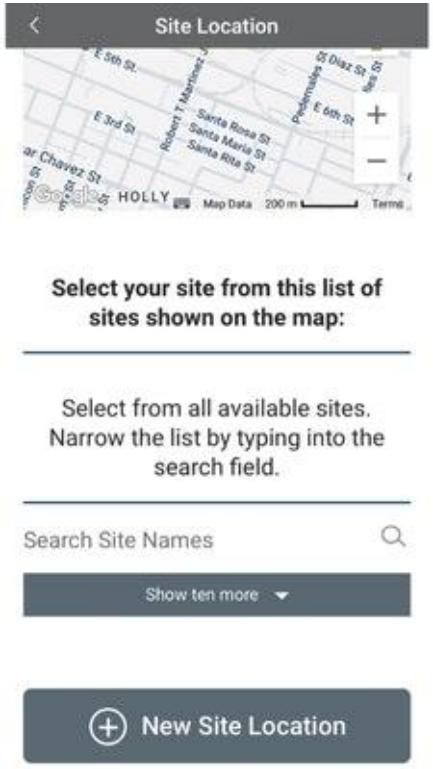
Entering Barometric Pressure Data – Step 3

3. Click on the arrow next to "*Atmosphere*" and select "*Barometric Pressure*". The other necessary protocols will be automatically selected.

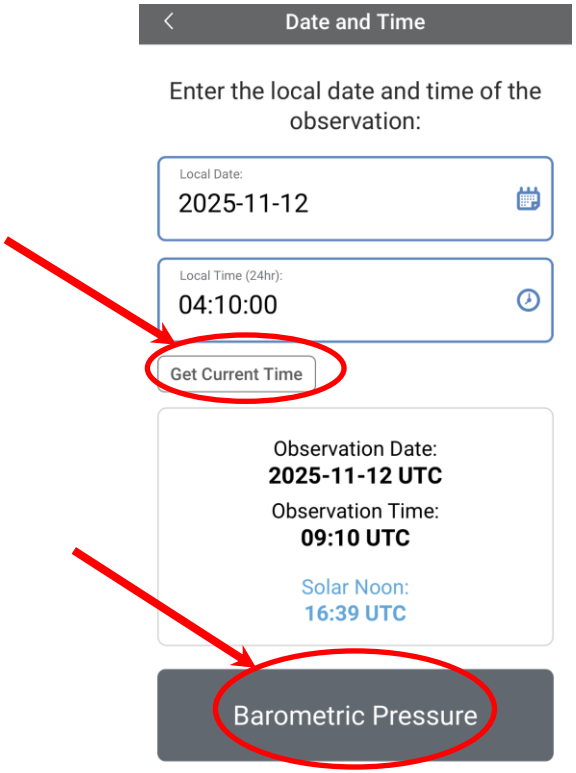


Entering Barometric Pressure Data – Step 4&5

4. At the bottom of the screen, click "*Continue*". When prompted, enter site location details (latitude, longitude, and elevation). Choose an existing site or identify a new site by clicking "*+ New Site Location*"

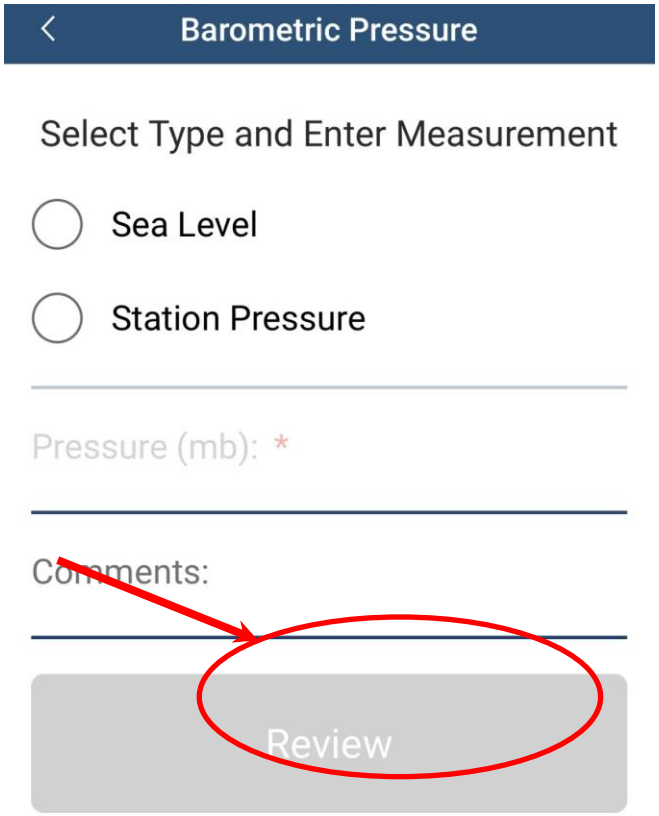


5. Check to see if the "*Date and Time*" are correct, if it is not, click "*Get Current Time*" to update it. Then click "*Barometric Pressure*" to move on



Entering Barometric Pressure Data – Step 6

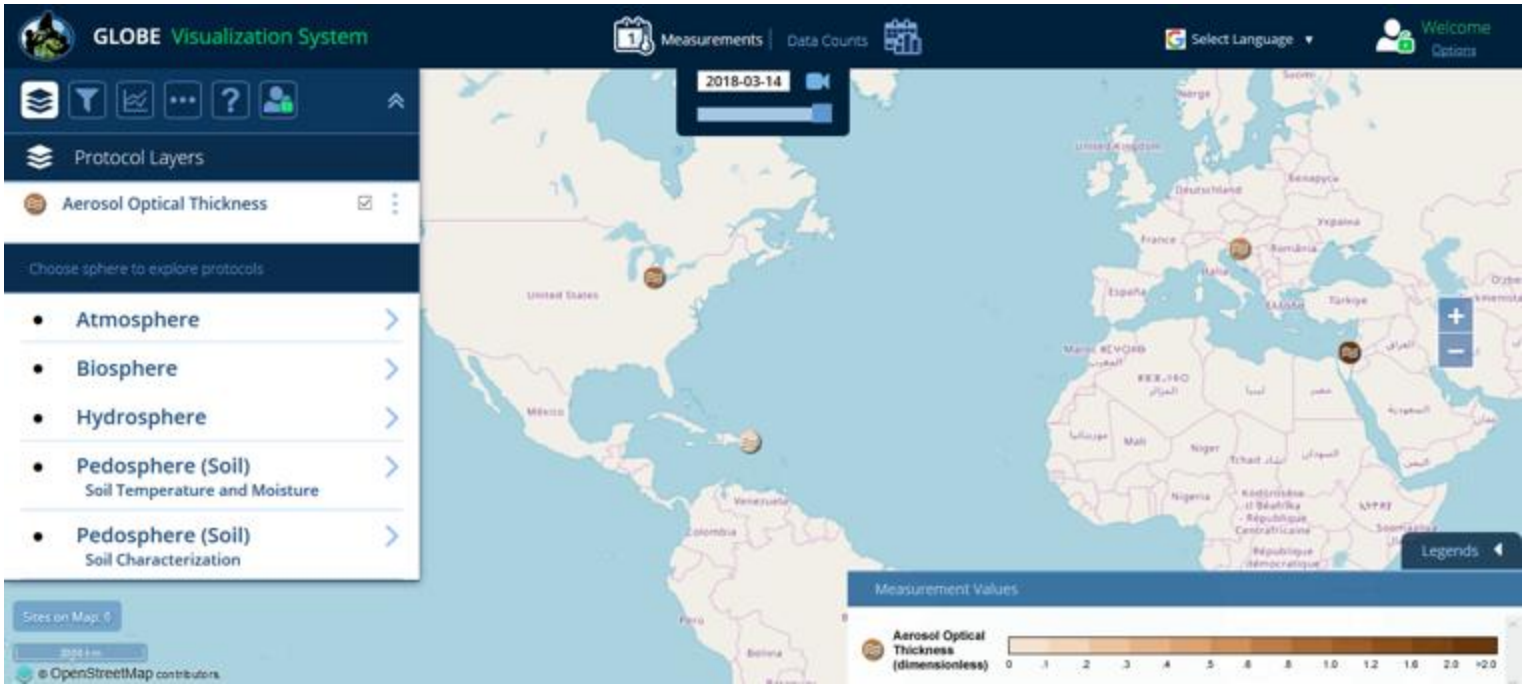
6) Enter Barometric Pressure type and measurement details. Then click "*Review*" to view your observation summary, and then click "*Finish*" to submit the observation



Visualize and Retrieve Data

GLOBE provides the ability to view and interact with data measured across the world. Select our *visualization tool* to map, graph, filter and export data that have been measured across GLOBE protocols since 1995.

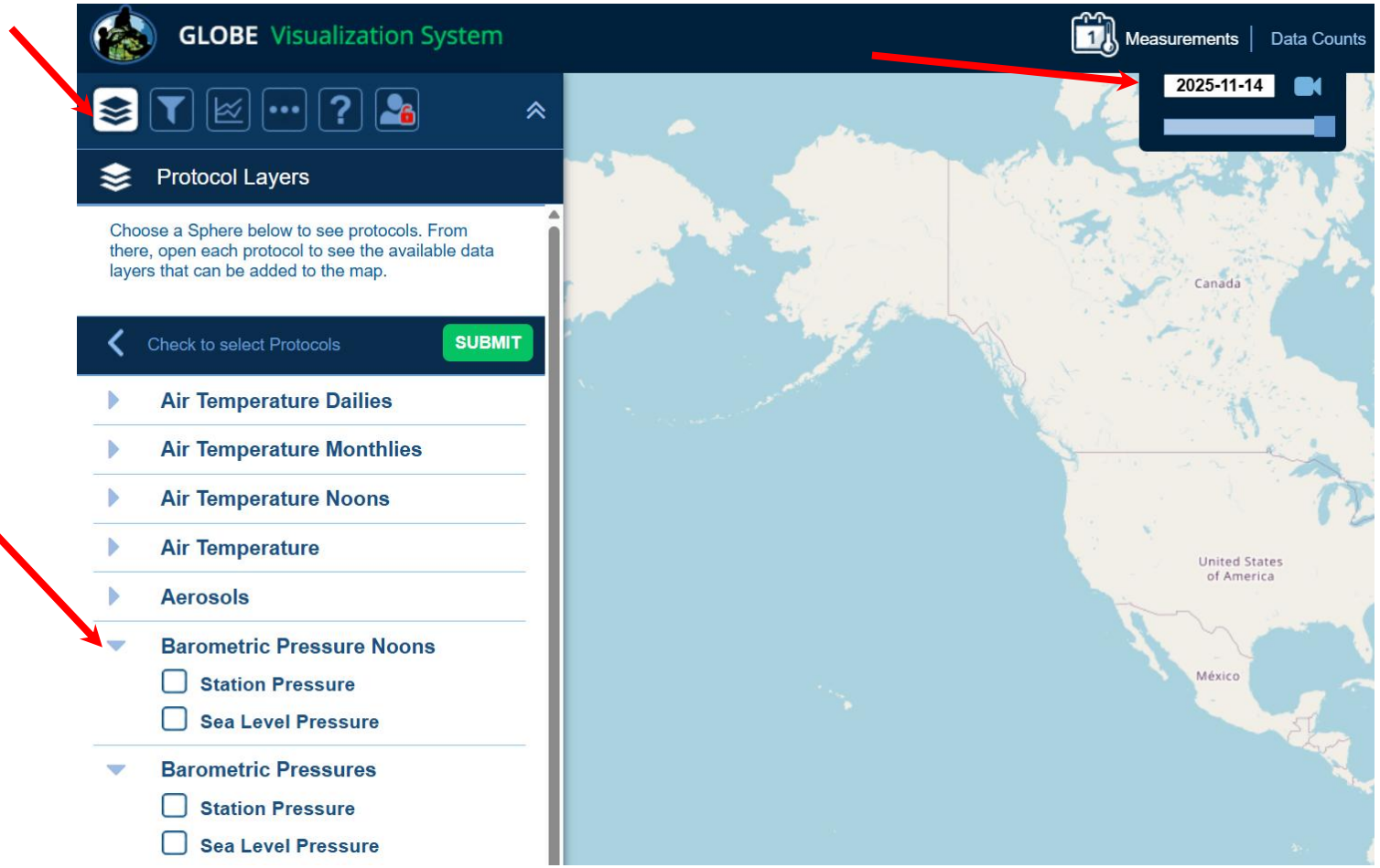
These step-by-step tutorials on using the visualization system will assist you in finding and analyzing data: *PDF version* *PowerPoint version*



http://vis.globe.gov/GLOBE/

Visualize and Retrieve Data – Step 2

Select the date for which you need data, add the protocol layers, and you can see where data is available.



Questions for YOU to Investigate

- After recording your pressure readings for a month, make a graph of your pressure observations and also plot the daily precipitation. Do you see a relationship between these observations?
- Is there any relationship between your data from the *Cloud Protocols* and barometric pressure?
- Use pressure data from several GLOBE schools adjusted to sea level pressure to see if you can locate where high and low pressure areas are for a given day. How well do your findings compare with weather maps from your local newspaper or any other source?

What have YOU learned?

- What is barometric pressure?
- Why is it important to collect barometric pressure data?
- What instrument(s) is/are needed to collect barometric pressure data?
- Where can I purchase the instrument(s)?
- Where should I take my barometric pressure measurements?
- What data do I need to collect?
- How do I submit my data to GLOBE?
- What can I do with the data submitted to GLOBE?

FAQs 1

1. **If we missed reading the barometric pressure for a day or more (over the weekend, holiday, vacation, etc.), can we still report the pressure today?** Yes, you are only reporting today's pressure, so please report it as often as possible.

2. **I really don't understand the difference between barometric station pressure and sea level pressure.**
   Since weather stations are spread all over the world at many elevations, and since pressure decreases rapidly with elevation, meteorologists need a way to map horizontal pressure patterns using a constant reference altitude. The easiest way to do this is to convert all observed pressure values to sea level pressure. In GLOBE, barometric pressures are reported as sea level pressures but can be accessed and visualized as either sea level or station pressures, as the database is capable of making corrections to compensate for elevation changes.

3. **Why do we have to reset the "set needle" each day?**
   The set needle is used to identify the previous pressure reading. Using it, you can instantly compare the current pressure reading to the previous one. For example, if the pressure is lower today than yesterday, you might ask yourself if the weather is stormier?

FAQs 2

6. How accurate are these pressure readings, compared to those that might be taken with mercury barometers? Today's aneroid barometers are not as accurate, in general, as well-made mercury barometers. There are some electronic barometers that have very accurate measurements, but the relatively inexpensive instruments that meet GLOBE specifications have all the necessary accuracy for our pressure measurements (about 3 to 4 mbar).

7. Why does pressure always decrease with height in the atmosphere? Because pressure is a measure of the mass of the atmosphere above you (air does have mass!), as your elevation increases, there is less air above you, so pressure is less.

8. Why do high altitude GLOBE schools have to use an altimeter? Most aneroid barometers are designed to be used near sea level. Altimeters are special aneroid barometers designed to be used at higher altitudes (including aircraft). At an altitude of 500 m above sea level, we would expect atmospheric pressure to be no greater than 1000 mbar and down to as low as 900 mbar for intense storms. Most aneroid barometers, however, have 950 mbar as the lowest possible measurement.

Further Resources

GLOBE Learning Activities

My NASA Data

Information on purchasing GLOBE supplies

We want your feedback!

Please provide us with feedback about this module. This is a community project and we welcome your comments, suggestions and edits!

Comment here: eTraining Feedback

Do you have questions? help@nasaglobe.org

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