

Using GLOBE in Science and Environmental Education



The
GLOBE
Program



<http://www.globe.gov>

**The GLOBE
Acronym**

Global
Learning and
Observation to
Benefit the
Environment

What is GLOBE ?

➤ GLOBE Vision

- A worldwide community of students, teachers, scientists, and citizens working together to better understand, sustain, and improve Earth's environment on local, regional, and global scales.



The GLOBE Initiative

- a global connection



- The GLOBE initiative was announced on Earth Day 1994
- The first GLOBE training workshops were conducted in 1995
- Over 15,000 schools worldwide are involved
- All US schools were invited to participate
 - Over 10,000 US schools have registered
- All nations were invited to participate
- Over 100 countries have become GLOBE partners

Who Can Do Globe ?

- Students
- Teachers
- Citizens
- Just about anyone



What can you do with GLOBE?

➤ You will have the ability to:

- **make, record, and report** scientific **measurements** using the GLOBE Protocols
- **communicate** their data to scientists in a global database
- **make observations**
- **share and interpret data**
- **create graphs and data tables**
- **be actively engaged** in science
- **collaborate** with others
- **connect** with nature



GLOBE Can Be Used to Promote Citizen Science

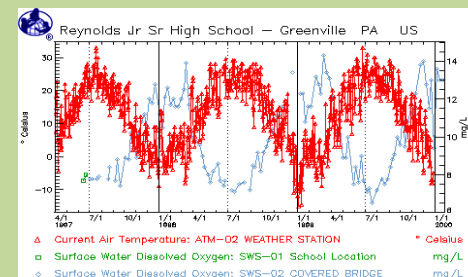
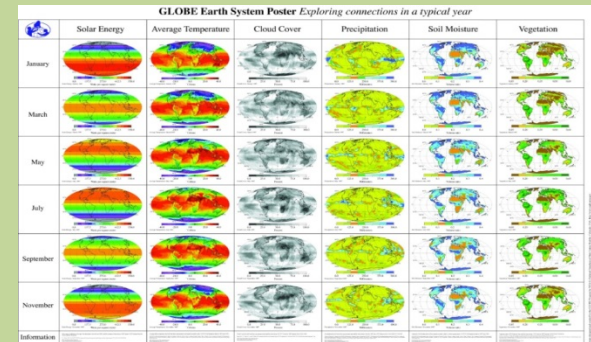


GLOBE seniors show there is no age limit to learning.

Like any GLOBE student, these seniors have been trained to read and record measurements from the instrument shelter at their site, a residential facility in Mobile, Alabama.

Protocols – What Are They?

- Measurements done by students, teachers, citizens, and organizations
 - Follows standards for accurate measuring
 - Entered into a database
 - Supported by NASA
 - Involves many countries
 - Collected data can be illustrated



GLOBE Measurements

Atmosphere

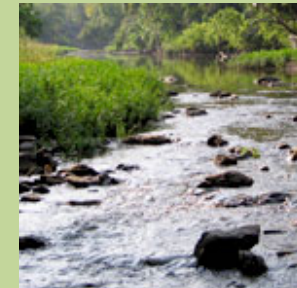
- Air temperature (Maximum, Minimum, Current)
- Precipitation (Rain, Snow, pH)
- Clouds (including contrails)
- Relative humidity
- Barometric pressure
- Surface ozone
- Surface Temperature
- Aerosols
- Water vapor



Hydrosphere

2

- Water temperature
- Transparency
- Water chemistry
 - pH, dissolved O₂, alkalinity, nitrates, salinity, conductivity
- Freshwater macroinvertebrates
- Mosquitoes



GLOBE Measurements

Pedosphere (Soil)

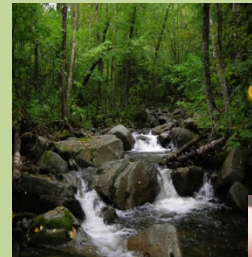
- Bulk Density
- Soil Characterization
- Soil Fertility
- Soil Infiltration
- Soil Moisture
 - Gravimetric, SMAP Block Pattern, Sensors
- Soil Particle Size Distribution
 - Structure, color, texture, consistency
- Soil Particle Density
- Soil Temperature
- Soil pH

Biosphere

- Arctic Bird Migration
- Biometry (canopy and ground cover, tree and shrub height and diameter, grass biomass, species id)
- Fire Fuel
- Green-up and Green-down, Budburst

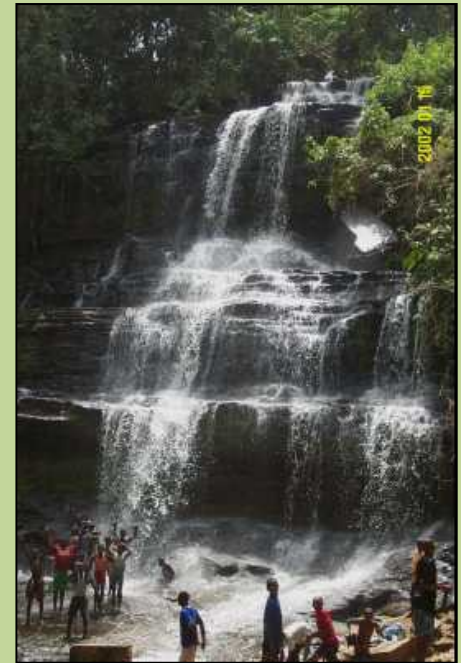
- Land Cover Classification (manual and computer-aided)
- Lilac Phenology
- Phenological Gardens
- Ruby-Throated Hummingbirds
- Seaweed Reproductive Phenology
- Standing Carbon (coming soon)

Earth as a System



Why do GLOBE scientists research water temperature?

- To track the mixing of waters in estuaries and along coasts
- To help determine the evaporation rates
- To help determine what can live in water
- To determine the overturning of lakes



Water Temperature: Inquiry Context



- How does water temperature compare to air temperature?
- How does a rain event or snow melt affect water temperature?
- How does the water temperature vary across seasons?
- How does water temperature relate to other water quality measurements?

Water Temperature & Science Content

Processes **Affecting** Water Temperature:

- Sunlight or Shade
- Discharges of warmer or cooler water
- Reflected heat from land cover

Processes **Affected by an Increase** in Water Temperature:

- Increase in rates of chemical reactions
- Increase in respiration rates in organisms
- Increase in growth rates
- Decrease in solubility of gases

The Measurements

- **Thermometer Calibration**
 - GLOBE protocols recommend calibration every three months
- **Water Temperature**
 - Three separate measurements



Collecting Data: Protocol

- Lower thermometer 10 cm into water for 3-5 minutes
- Read temperature at eye level, keeping bulb in water
- Thermometer should be in water for 1 minute
- Take two more measurements
- Average the three temperatures
- Check for accuracy



Berks Nature is a GLOBE Partner

- Berks Nature is a GLOBE partner and a certified training center.
- Training is done at our facility, “The Nature Place”, in Reading, PA.
- Check our Website, www.berksnature.org for scheduled training seminars or call us at 610-372-4992 for information or to schedule a training session with us.



In Summary

- **GLOBE :**
 - Offers many different avenues to develop and/or enhance programming
 - Provides an avenue for students, teachers, seniors, and other community organizations to get involved and connect to their environment while doing science
 - Provides training, resources, and activities
 - Offers to make science and learning significant to each individual
 - Becomes a resource for data, past and present

**This presentation used
materials and illustrations from
the GLOBE program website.**



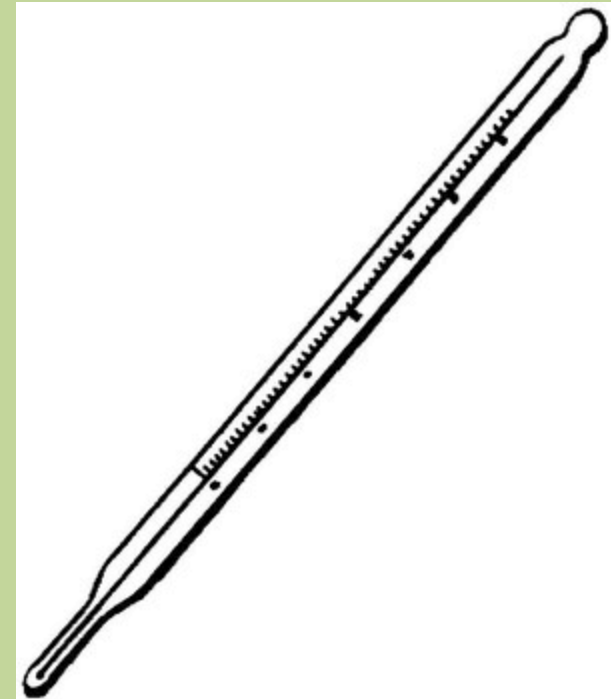
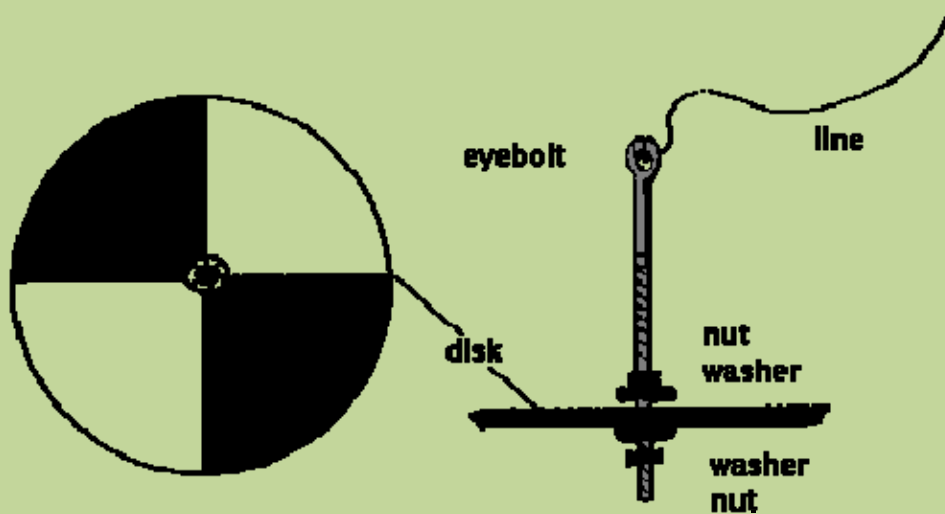
To Learn More About GLOBE

Go to:

www.globe.gov

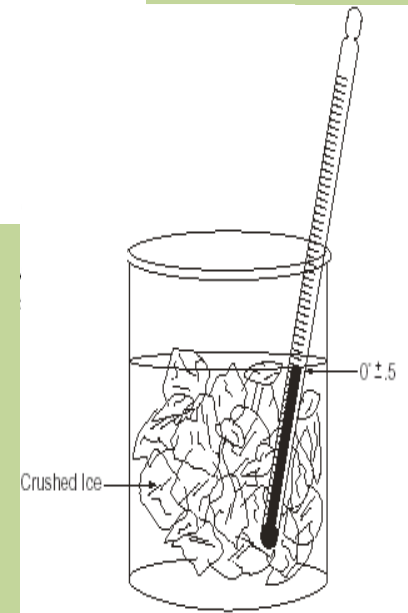
ACTIVITY TIME

- Thermometer Calibration
- SECCI Disk and Tube



Collecting Data: Calibrating the Thermometer

- Stir together distilled water and crushed ice
- Let sit for 10-15 minutes
- Submerge thermometer in ice-water bath for three minutes, stir occasionally
- Thermometer should read between -0.5°C and $+0.5^{\circ}\text{C}$



Calibrating an Alcohol-filled Thermometer

Lab Guide

Task

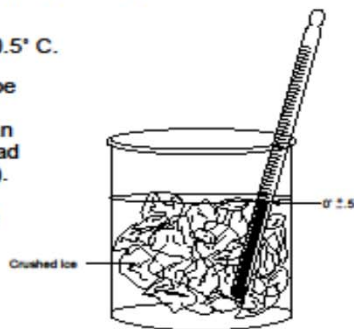
Calibrate the alcohol-filled thermometer or temperature probe.

What You Need

- Alcohol-filled thermometer or temperature probe
- 100-mL distilled water
- 500 mL beaker
- 400-mL crushed ice

What to Do

1. Stir together 100 mL of water and 400 mL of crushed ice in the beaker to make an ice-water bath.
2. Let the ice-water bath sit for 10 to 15 minutes so that it reaches its lowest temperature.
3. Put the bulb of the thermometer into the bath. Gently move the thermometer around in the ice-water bath.
4. Leave the thermometer in the water for three minutes.
5. Read the temperature without removing the bulb of the thermometer from the water.
6. Let the thermometer stay in the water sample for one more minute.
7. Read the temperature again. If the temperature has not changed, go to Step 8. If the temperature has changed since the last reading, repeat Step 6 until the temperature stays the same.
8. The thermometer should read between -0.5° and 0.5° C.
9. If the alcohol-filled thermometer or meter with probe does not read the proper temperature, notify your teacher. Alcohol-filled thermometers do not have an adjustment and must be replaced if they do not read temperature with the expected accuracy ($\pm 0.5^{\circ}$ C). Some temperature meters and probes may have adjustments for calibration. Follow the instructions that came with your probe to calibrate. If your probe cannot be calibrated, it must be replaced.



Water Temperature Protocol for Thermometers

Field Guide

Task

Measure the temperature of your water using an alcohol-filled thermometer.

What You Need

- [Hydrosphere Investigation Data Sheet](#)
- Alcohol-filled thermometer (with string and rubber band attached)
- Clock or watch
- Latex gloves
- Pen or pencil

In the Field

1. Fill out the top portion of your *Hydrosphere Investigation Data Sheet*.
2. Put on the gloves.
3. Slip the rubber band around your wrist so that the thermometer is not accidentally lost or dropped into the water.
4. Check the alcohol column on your thermometer to make sure there are no air bubbles trapped in the liquid. If the liquid line is separated, notify your teacher.
5. Put the bulb end of the thermometer into the sample water to a depth of 10 cm.
6. Leave the thermometer in the water for three minutes.
7. Read the temperature without removing the bulb of the thermometer from the water.
8. Let the thermometer stay in the water sample for one more minute.
9. Read the temperature again. If the temperature has not changed, go to Step 10. If the temperature has changed since the last reading, repeat Step 8 until the temperature stays the same.
10. Record the temperature on the *Hydrosphere Investigation Data Sheet*.
11. Have two other students repeat the measurement with new water samples.
12. Calculate the average of the three measurements.
13. All temperatures should be within 1.0° C of the average. If they are not, repeat the measurement.

Instrument Construction: Transparency

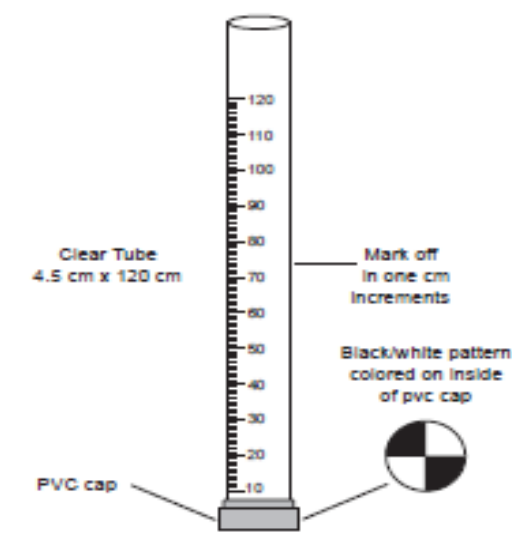
Instructions for Making a Transparency Tube to Measure Water Transparency

Materials

- ☐ Clear tube (approximately 4.5 cm x 120 cm)
- ☐ Permanent, waterproof black marker
- ☐ PVC cap (to fit snugly over one end of tube)
- ☐ Meter stick (or meter tape)

Directions for Construction

1. On the bottom of the inside of the PVC cap, draw a Secchi disk pattern (alternating black and white quadrants) with the black permanent marker.
2. Put the PVC cap over one end of the tube. Cap should fit tightly so water cannot leak out.
3. Use the marker and meter stick to draw a scale on the side of the tube. The bottom of the inside of the PVC cap where the Secchi disk pattern is drawn is 0 cm. Mark every cm up from that point.
4. A shutoff valve can be installed near the bottom of the tube to allow water to escape in a controlled manner; this would resemble commercially-available transparency tubes.



Instrument Construction: Transparency

Instructions for Making a Secchi Disk to Measure Water Transparency

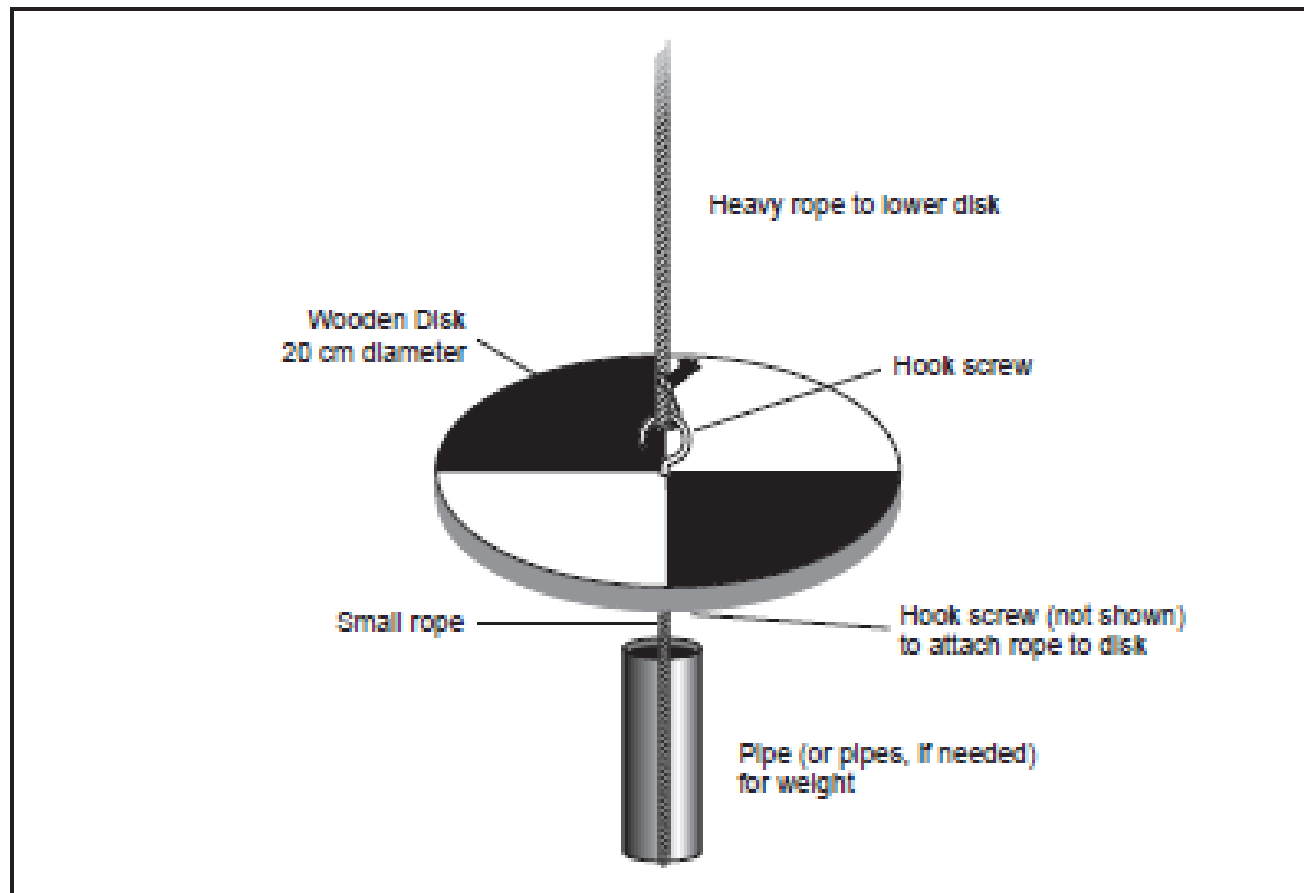
Materials

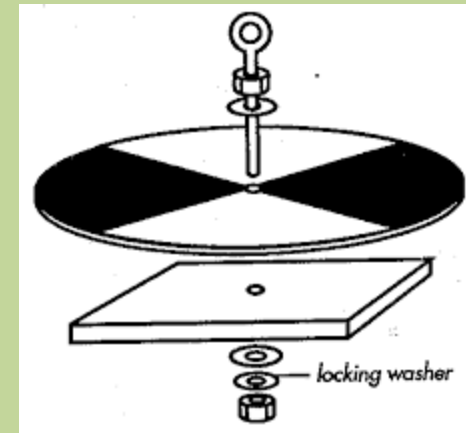
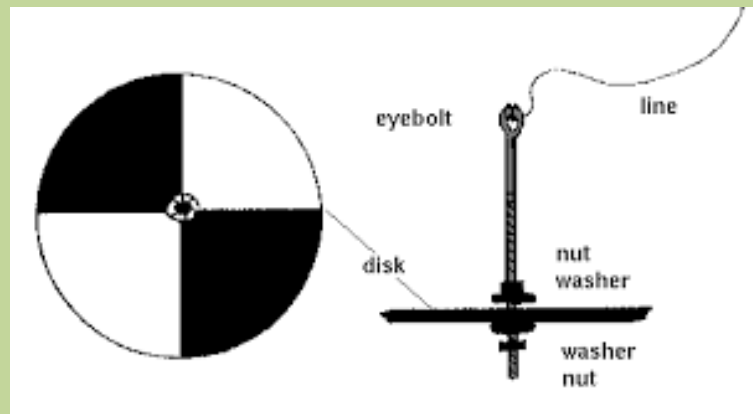
- Wooden disk (20 cm diameter)
- Paint (black and white)
- 2 hook screws (2-3 cm)
- Pipe(s) for weight
- 5 meters rope (or more, depending on depth of water)
- Meter stick
- Permanent, waterproof markers (black, red, blue)
- Short piece of rope (approximately 50 cm - 1 m)

Directions for Construction

1. Divide top of wooden disk into four equal quadrants. Draw lightly in pencil 2 lines crossing at a 90 degree angle to identify the quadrants.
2. Paint two opposite quadrants in black and the other two in white.
3. Screw a hook screw into the top center and bottom center of the disk. Tie the 5-m (or longer) rope through the screw in the top of the disk.
4. Tie the short piece of rope through the screw on the bottom of the disk. String the rope through the pipe. Tie a large knot at the bottom of the pipe so that it does not fall off when hanging vertically underneath the disk.
5. Measure and mark the rope above the top part of the disk with a black marker every 10 cm.
6. Measure and mark every 50 cm up from the disk with a blue marker and every meter with a red marker.

SECCHI DISK





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Lower disk into water.	Continue lowering disk...	...and lower...	...until it can no longer be seen. Record this level.	Raise and record level you see disk again.
USING A SECCHI DISK				