GLOBE Weather Monitoring

Objectives:

Students will collect data about atmospheric weather conditions, including cloud type & cover, barometric pressure, temperature, and precipitation. This data will be submitted to GLOBE for international monitoring activities. Students will better understand how abiotic factors like weather influence living organisms.

Concept:

Students will contribute data to an international weather monitoring program. GLOBE is a unique citizen science program that encourages students and community members to participate in general observations about weather and environment. Students and scientists investigate the atmosphere through the collection of data using measurement protocols and using instruments that meet certain specifications in order to ensure that data are comparable. Learning activities aid in the understanding of important scientific concepts, the understanding of data and data collection methodologies.

Materials:

- Handout: GLOBE Weather Data Sheet
- Clipboards
- Pencils
- Thermometer
- Rain Gauge (optional)
- Board for measuring snow (optional)
- Cloud Type Poster
- Cloud & Contrail Cover Guide
- Beaufort Wind Scale

Preparation:

Visit www.globe.gov to learn more about possible parameters to measure, sign up as a GLOBE teacher, and complete relevant training modules.

Set up a weather station near your school. Try to select a site that will not be strongly affected by surrounding buildings. Your weather station may include a thermometer that includes a way to mark maximum and minimum temperatures, rain gauge, and snowboard, as well as more advanced equipment like a sling psychrometer (relative humidity) or barometer (pressure). If you cannot include all of this equipment, simple measurements like temperature, cloud cover, and cloud type are useful too.

To estimate wind speed, you can find an easy-to-read, land-based Beaufort Wind Scale chart at the Mount Washington Observatory Weather Discovery Center: http://www.mountwashington.org/education/center/arcade/wind/beaufort.html or a NOAA chart with descriptions of both land and sea can be found at http://www.spc.noaa.gov/faq/tornado/beaufort.html

This lesson includes a data sheet with many categories, but you may create your own specific to the parameters you choose to measure. Some GLOBE data should be collected as close to "local noon" as possible. However, it is better to collect data at a different time than not at all, so do not let this dissuade you.

Introduction:

Explain to students that they are going to participate in a global weather monitoring program. The data they collect will be combined with data from all over the world to help scientists understand conditions in the atmosphere and learn more about weather (day to day conditions) and climate (conditions over time).

Procedures & Activities:

Head outside with the data sheets to the weather

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station to read the instruments. You will need to demonstrate how to read each instrument on the first day of the project only.

Break students into teams, depending on the size of the class and the amount of data you are collecting. For example, if your class is small and you are collecting a lot of data, one team could be the "water team" and read and record information from the hydrometer, rain gauge, and precipitation pH tests. If your class is large and you are only collecting data for a few parameters, you could have a larger team read and record data for only one parameter, or you could have each team record all parameters you are measuring and compare results between groups, deciding on the most accurate data for each parameter.

Possible Parameters to Measure:

Cloud Type:
Look at all the clouds in the sky, look in all directions, including directly overhead. Be careful not to look directly at the sun. Identify the types of clouds that you see using a cloud type poster or GLOBE Cloud Observation Chart: http://www.globe.gov/documents/348614/351665/atmo_ds_cloudsobs.pdf.

Check the box on your Data Sheet for each and every cloud type you see. There are three types of contrails. Record the number of each type you see. This online story book can be a good resource for cloud identification, as well: http://www.globe.gov/documents/348830/350460/ElementaryGLOBE_Clouds_en.pdf

Cloud Cover & Contrails:
Look at the sky in every direction. Estimate how much of the sky is covered by clouds that are not contrails.

Using the Cloud & Contrail Cover Guide, record which cloud classification best matches what you see. Record which contrail classification best matches how much of the sky is covered by contrails.

Temperature:
Open the instrument shelter being careful not to touch or breathe on the thermometer.

If you are using a mercury thermometer, position yourself so that your eye is level with the mercury in the thermometer. Read the current temperature.

If you have a max/min thermometer, read the bottom of the indicators for maximum and minimum temperatures. Record on the data sheet. Use the magnet to gently move the maximum and minimum indicators down until they just touch the mercury.

If you are using a digital thermometer, use the buttons to toggle through current, maximum, and minimum temperature. Record on the data sheet. Reset by holding the button down for one second.

Close the instrument shelter.

Rain Gauge:
Read the level of the water in your rain gauge; be sure your eyes are level with the water in the measuring tube. Read the level at the bottom of the meniscus.

Record the rainfall amount to the nearest one-tenth of a millimeter.

Pour the water into the sampling jar and cover it for the pH measurement, if you will be testing that.

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Record the number of days rain has accumulated in the gauge. (The number of days since the rain gauge was last checked and emptied.) Dry the rain gauge and remount it on its post.

Snow:
Insert the measuring stick vertically into the snow until it rests on the ground. Be careful not to mistake an ice layer or crusted snow for the ground.

Read and record the depth of the snowpack.

Repeat the measurement in at least two more places where the snow is least affected by drifting. Report all three of these numbers as the total snowfall.

After a new snow has fallen on earlier snow, gently insert the measuring stick vertically into the snow until it touches the snowboard. Read and record the depth of new snow. If there is new snow, take at least two more measurements at different spots on the snowboard. Report these numbers as the depth of new snow.

Record the number of days since the last reading of snow on the snowboard.

Wind Speed and Direction:
GLOBE does not actually collect data on wind speed and direction, but it is an important component of understanding and predicting weather and the movement of currents, marine debris, and pollution.

To measure wind direction, use a wind direction instrument such as a wind sail or slowly rotate your body until you feel the most wind. Winds are identified by the direction from which they are coming. So if your wind sail is pointed south, the wind is a north wind because it is coming from the north, blowing to the south. Use the Beaufort Wind Scale to calculate speed.

Other measurements:
Other parameters include precipitation pH, aerosols, barometric pressure, relative humidity, surface temperature, soil temperature, ozone, and water vapor. Check the GLOBE Astmospheric Conditions webpage for more information on how to measure these parameters: http://www.globe.gov/web/atmosphere-climate/overview.

Wrap-up:

Use the daily weather data to remind students what they might need to wear for recess or field trips. Discuss how the weather might affect various organisms in the surrounding ecosystems.

Extensions & Lesson Connections:

Weather observations can be used along with readings from the homemade barometers to make and test daily weather predictions as outlined in the "Pressure & Storms" Lesson.

Have students graph weather conditions throughout the monitoring project. Visit the GLOBE data portal (http://vis.globe.gov/GLOBE/) to compare your weather to other areas of the world.

Use the data you have collected to make predictions in other activities, such as “Popcorn Spill” or “Plastics in Motion.”

Evaluation:

Observe student participation and cooperation in data collection. Review data sheets for accuracy, completeness, and neatness.

Cloud & Contrail Cover Guide

Cloud Cover Classifications	Contrail Cover Classifications
No Clouds The sky is cloudless; there are no clouds visible	**None** There are no contrails visible.
Clear Clouds are present but cover less than one-tenth (or 10%) of the sky.	**0-10%** Contrails are present but cover less than one-tenth (or 10%) of the sky.
Isolated Clouds Clouds cover between one-tenth (10%) and one-fourth (25%) of the sky.	**10-25 %** Contrails cover between one-tenth (10%) and one-fourth (25%) of the sky.
Scattered Clouds Clouds cover between one-fourth (25%) and one-half (50%) of the sky.	**25-50%** Contrails cover between one-fourth (25%) and one-half (50%) of the sky.
Broken Clouds Clouds cover between one-half (50%) and nine-tenths (90%) of the sky.	**> 50%** Contrails cover more than one-half (50%) of the sky.
Obscured Clouds cannot be observed because more than one-fourth (25%) of the sky cannot be seen clearly. Record what is blocking your view of the sky: • Fog • Smoke • Haze • Volcanic Ash • Dust • Sand • Spray • Heavy Rain • Heavy Snow • Blowing Snow	**Obscured** Contrails cannot be observed because more than one-fourth (25%) of the sky cannot be seen clearly. Record what is blocking your view of the sky: • Fog • Smoke • Haze • Volcanic Ash • Dust • Sand • Spray • Heavy Snow • Blowing Snow