Observing, Describing, and Identifying Clouds

Purpose

To enable students to observe clouds, describe them in a common vocabulary, and compare their descriptions with the official cloud names

Overview

Students observe and sketch clouds, describing their forms. They will initially generate descriptions of a personal nature and then move toward building a more scientific vocabulary. They correlate their descriptions with the standard classifications using the ten cloud types identified for GLOBE. Each student develops a personal cloud booklet to be used in conjunction with the GLOBE Cloud Chart.

Student Outcomes

Students will be able to identify cloud types using standard cloud classification names.

Science Concepts

Earth and Space Science

- Weather can be described by qualitative observations.
- Weather changes from day to day and over the seasons.
- Clouds form by condensation of water vapor in the atmosphere.

Geography

- The nature and extent of cloud cover affects the characteristics of the physical geographic system.

Atmosphere Enrichment

- Clouds are identified by their shape, altitude, composition, and precipitation characteristics.
- Clouds help us to understand and predict the weather.

Scientific Inquiry Abilities

- Identify answerable questions.
- Use a Cloud Chart to classify cloud types.
- Develop descriptions using evidence.
- Communicate procedures, descriptions, and predictions.

Time

Two class periods. May be repeated on days when different kinds of clouds are present

Level

All

Materials and Tools

- GLOBE Cloud Chart
- *Observing Cloud Type Sheets* (in the Appendix)
- GLOBE Science Log
- Reference books containing cloud images
- Still or video camera to photograph clouds (optional)

Preparation

Obtain cloud reference books and mark the appropriate pages.

Prerequisites

None

Background

Accurate weather forecasting starts with careful and consistent observations. The human eye represents one of the best (and least expensive) weather instruments. Much of what we know about the weather is a result of direct human observation conducted over thousands of years. Although being able to identify clouds is useful in itself, observing clouds on a regular basis and keeping track of the weather associated with certain kinds of clouds will show students the connection between cloud types and weather. Recognizing cloud types can help you predict the kind of weather to expect in the near future. We do not describe those connections here, but there are numerous weather books that can help you and your students make them. Inviting a local meteorologist to visit your class and to talk with the students is a sure way to stimulate interest in the relationship between clouds and weather patterns.

In this activity, we ask students to look carefully at clouds, sketch them, and describe them in their own words *before* using the official names. The activity can be repeated on different days when different kinds of clouds are present. In fact, if you can be spontaneous, it would be nice to take a break and do some outdoor "cloud work" whenever a new kind of cloud appears in the sky. Over time, students can build up a considerable familiarity with cloud types. If you cannot always take the students outside when interesting clouds appear, perhaps you can observe them through a window.

Students Develop a Personal Cloud Booklet

Students should develop, either in their GLOBE Science Logs or in separate cloud booklets, an individual, personal set of notes on clouds and cloud types. They should devote one page of their GLOBE Science Logs to each individual cloud type they identify. They can include not only their own observations and descriptions but also photographs of clouds that they take or that they clip from other sources. On any given day students may observe several kinds of clouds in the sky at the same time. If several types of clouds are present, they should record each of the types on a separate page of their GLOBE Science Logs.

Identifying and Classifying Clouds

The GLOBE protocol asks you to identify ten common types of clouds. The names used for the clouds are based on three factors: their *shape,* the *altitude* at which they occur, and whether they are *producing precipitation.*

1. Clouds come in three basic shapes:
   cumulus clouds (heaped and puffy)
   stratus clouds (layered)
   cirrus clouds (wispy)
2. Clouds occur in three altitude ranges (specifically, the altitude of the cloud base):
   High clouds (above 6,000 m), designated by "cirrus or cirro-"
   - Cirrus
   - Cirrocumulus
   - Cirrostratus

   Middle clouds (2,000 - 6,000 m), designated by "alto-"
   - Altocumulus
   - Altostratus

   Low clouds (below 2,000 m), no prefix
   - Stratus
   - Nimbostratus
   - Cumulus
   - Stratocumulus
   - Cumulonimbus

Note: While both cumulus and cumulonimbus clouds may have their bases starting below 2,000 m, they often grow thick enough to extend into the middle or even high range. Thus, they are often referred to as "clouds of vertical development." Only high clouds are wispy and so the term cirrus has become synonymous with wispy as well as referring to high clouds.

3. Clouds whose names incorporate the word "nimbus" or the prefix "nimbo-" are clouds from which precipitation is falling.
4. Contrails are linear clouds formed around small particles in jet aircraft exhaust.

These are indeed clouds, caused directly by human activity, and are of great interest to researchers. We distinguish three subtypes:

1. *Short-lived contrails:* obvious tail behind a plane; Do not remain after plane passes;
2. *Persistent, non-spreading contrails:* obvious contrails (linear, narrow features) that do not appear to dissipate significantly, or to show signs of spreading, and that remain long after the airplanes that created them have left the area; Each contrail subtends a narrow angle in the sky;
3. *Persistent, spreading contrails:* obvious linear cirrus-type clouds with a diffuse appearance; Each contrail subtends a wider angle in the sky.

Cloud Identification Tips

Several things are useful to know in identifying and naming clouds according to the official classifications:

Clouds that are wispy and high in the sky are always cirrus of one type or another. If the cirrus clouds contain waves or puffs, then they are cirrocumulus. If they form continuous layers that seem to cover the sky high up, they are cirrostratus. Contrails occur at high levels too, and are very linear cloud features.

Clouds at middle altitudes are designated by the prefix "alto-." If in layers, they are altostratus; if in heaps and puffy, they are altocumulus.

Clouds that form at low altitudes (below 2,000 m) are either of the cumulus or stratus family. Clouds in the cumulus family are puffy and heaped. Clouds in the stratus family form in layers or sheets that cover broad expanses of sky.

Low clouds that are dark, threatening and *actually producing rain* receive the designation "nimbus." Nimbostratus clouds cover the entire sky with broad sheets and produce steady rain. Nimbostratus clouds are larger horizontally than vertically. The rainfall associated with nimbostratus typically is low to moderate in intensity, but falls over a large area for an extended period of time. Cumulonimbus have dark bases and puffy tops, often anvil-shaped, and are sometimes called "thunderheads." They tend to produce heavy precipitation, typically accompanied by lightning and thunder.

Using Photography

It should not be hard to find photographs of clouds in books, charts, and magazines. However, the students will enjoy taking their own photographs of clouds. Introduce this as an activity after they have sketched and described clouds in their own words. Video photography of clouds in motion also presents a new perspective on cloud formation and behavior, particularly if you can use a tripod and time-lapse photography.

Part 1: Describing Clouds In Your Own Words

What To Do and How To Do It

1. Organize the students into two-person teams. Send them outside with their GLOBE Science Logs to an open location to observe the clouds. Each student should draw a detailed sketch of the clouds in the sky. If there are several different kinds of clouds present, they should sketch each specific kind on a separate page of their notebooks.
2. Each student should record the date and time of day and describe the appearance of the clouds next to the sketch. They should use as many words as necessary to describe the appearance of the clouds. Emphasize that there are no right or wrong answers and that they should use whatever words seem appropriate to them. Some possible student responses:
   Size: small, large, heavy, light, dense, thick
   Shape: fluffy, stringy, cottony, lumpy, torn, smooth, patchy, sheets, ragged, looks like a...
   Color: gray, black, white, silvery, milky
   Description: thunderclouds, menacing, threatening, gloomy, enveloping, beautiful, streaked, foggy, bubbly, scattered, moving, swirling
3. Upon returning to the class, pairs should join together to share descriptions. Ask each group of four to compile a "group list" of all the words they used to describe each cloud type they observed. They should select the words they think are the best ones for describing the clouds they saw.
4. Using the GLOBE Cloud Chart, students should match their sketches with one of the photographs and record the scientific name of the cloud type next to their sketch.

Part 2: Comparing Your Descriptions to the Official Descriptions

What To Do and How To Do It

1. (You may choose to postpone this discussion until the class has accumulated descriptions of several different kinds of clouds.)
   Initiate a class discussion. Ask one four-person group to draw a cloud sketch on the board and record the words their group used to describe the cloud. If several different clouds have been observed, have a different group do each type. Ask other groups to contribute additional words they used to describe these clouds.
   Ask the students to group the words they used into clusters that seem to go together. Ask them to name the specific features of the clouds (such as size, shape, color, altitude, or other features) to which these clusters refer. Do these clusters represent the main cloud features to which they think an observer should pay attention? Are there any cloud features that have not been included? What would they say is the basis of their system, that is, what features of clouds does it pay attention to?
2. Ask the students to indicate the "official" names for the clouds pictured on the board. Explain that the official system used to classify clouds relies upon three features of clouds: shape, altitude, and precipitation. Compare the official system to the classification system they developed on their own. What cloud features does each include and omit?
   Ask students which of their words they would use to describe each of these cloud families:
   stratus clouds
   cumulus clouds
   cirrus clouds
   nimbus clouds

3. Repeat the observation, sketching, and description of different cloud types on subsequent days as new clouds appear in your sky. Have students develop a separate page of their GLOBE Science Logs for each new cloud type they observe. Have them record both the official name of the cloud and their own preferred descriptions of it. Continue to discuss the basis for the official classification system.

Adaptations for Younger and Older Students

Younger students can describe clouds in terms of their basic family type: cirrus, cumulus, and stratus. They can also describe the height of the clouds: low, medium, or high; their shape: large or small; and their color: white, gray, or black.

Older students can correlate cloud types with the appearance of certain types of weather. See the *Cloud Watch Learning Activity.* Students also can pay attention to the sequence of cloud types over the course of several days and can investigate the factors that cause clouds to form.

This activity can present interesting possibilities for collaboration with an art teacher or a literature teacher, each of whom can contribute a different, perhaps nonscientific, perspective on the description of clouds.

Further Investigations

Examine the correlation between wind and clouds. Chart the wind direction and speed for each observable cloud type.

Explain the connection between the hydrologic cycle and atmospheric conditions.

Satellite and shuttle photos allow observations of the dynamics of our atmosphere and the examination of large-scale phenomena that are not possible from land. Use space-based imagery to predict weather or to track storms. Consider the merits and disadvantages of space images versus local meteorological information and data.

Track storms and clouds from a distance to aid in understanding local weather conditions. Use binoculars to study clouds and their formations from a distance. Use local maps to help identify the distance of landmarks and the speed at which clouds are moving.

Create cloud games to practice identification skills and concepts:

Cloud Game #1: Have each student create a set of 3" x 5" index cards that includes names of the ten cloud types. A second set of cards includes illustrations of each of the ten types. Pairs of students combine cards, turning them face down. Partners alternate turning over two cards at a time, attempting to locate a match. A successful match results in another turn. Play continues until all cards have been matched. The winner is the partner with the most matched pairs.

Cloud Game #2: Groups of students can generate questions about clouds: appearance, shape, altitude, and percentage of dominant cover. On a 3" x 5" index card write the statement as an answer. For example: "Scattered Clouds" is the answer to the question, "What is the cloud cover when between a tenth and a half of the sky is covered with clouds?" Divide the class into teams to play. Players respond to the answer cards in the form of a question (see above).