Weather and Climate

Overview

Ice Cores: Unlocking Past Climates Module 1: Climate and Ice

Part I of this lesson begins with a video that explains the difference between weather and climate, describes glacier formation, and identifies the types of information that can be found in the glacial record. The video is followed by an exploration of current weather conditions at various locations around the world. The locations represent a variety of climate types and each is located near a glacier or ice sheet. Students then differentiate between weather and climate and examine climate data for their location. In Part II students visit websites to learn what glaciers are and how they are formed. Students conduct additional internet research in Part III to discover what types of substances can be trapped in glaciers. In the final activity students locate a glacier or ice sheet closest to the city they collected weather data for and create a model that tells the story of several years in the life of their glacier. The story includes weather information and information about any natural or human-induced events that contributed materials to the glacier's record.

Content Objectives

Students will

- Differentiate between weather and climate
- Investigate how glaciers are formed and where they are found
- Build a glacier model that illustrates several years of the glacial record

Grade Level: 5-8

Suggested Time: 2-3 class periods

Multimedia Resources

- http://www.wunderground.com/
- http://www.weatherbase.com
- The Life Cycle of a Glacier, http://www.pbs.org/wgbh/nova/vinson/glac-flash.html
- How Glaciers Work, http://science.howstuffworks.com/glacier.htm
- Glacier Formation, http://science.howstuffworks.com/glacier1.htm.
- Glaciers and Icecaps: Storehouses of Freshwater,

  http://ga.water.usgs.gov/edu/earthglacier.html

- Stories in Ice, http://www.pbs.org/wgbh/nova/warnings/stories/
- Ice Core Timeline, http://www.pbs.org/wgbh/nova/warnings/stories/icecore.html

- Paleoclimatology: The Ice Core Record, http://earthobservatory.nasa.gov/Features/Paleoclimatology_IceCores/

- Why Study Ice Cores?, http://nicl.usgs.gov/why.htm
- Ice Cores Reveal Fluctuations In Earth's Greenhouse Gases,

  http://www.sciencedaily.com/releases/2008/05/080514131131.htm

- Deep ice tells long climate story,
  http://news.bbc.co.uk/2/hi/science/nature/5314592.stm
- Glaciers, Ice Sheets, and Climate Change, http://www.waterencyclopedia.com/Ge-Hy/Glaciers-

  Ice-Sheets-and-Climate-Change.html

Materials

- Clear, colorless container for glacier models, e.g. plastic food containers, large disposable plastic cups
- Various materials to represent snow and ice in the glacier model, e.g. shredded paper, rice, marshmallows, shredded foam rubber
- Various materials to represent dust, pollen, volcanic ash, etc., e.g. coffee grounds, colored sugar, confetti

Suggested locations:
These locations have been selected due to their proximity to a major glacier or ice sheet and the variety of climates they represent.

Location	**Nearest Glacier/Ice Sheet**	**Climate Type**
Santa Barbara, CA	Palisade Glacier is the largest glacier in the Sierra Nevada	coastal climate
Idaho Falls, ID	Fremont Glacier, Wyoming	semiarid alpine climate
La Paz, Bolivia	Quelccaya Ice Cap, Andes Mountains	subtropical highland
Lhasa, Tibet	Tibet plateau	arid alpine
Mombasa, Kenya	Kilimanjaro Glacier	warm tropical
Danmark Havn (Danmarkshavn), Greenland	Greenland ice sheet	tundra

Procedures

Part I: What's the difference between weather and climate?
1. Engage students in the topic by showing the *Climate and Ice* video

a. Before showing the video engage students in a conversation about the weather. This could be as simple as asking them how they like today's weather to something more expansive like asking them about dramatic weather events they remember, how they could find out what the

weather was like on the day they were born, or asking them to describe the weather on a perfect day.

2. During the video ask students to note things they would like to learn more about.
3. After showing the video ask students what topics from the video they would like to

   learn more about. Develop a class list as students are sharing. Highlight topics that will be addressed throughout this lesson. Follow up and transition to the next step by asking students to share their current understanding of the difference between weather and climate. This sharing could be done as a journal entry, a Think-Pair-Share, or any other strategy that requires students to clearly express their current thinking about weather and climate.

2. Discuss the following questions with the whole class.
    1. Where would you go to find out what tomorrow's weather will be?
    2. What does a weather forecast tell us? (temperature, precipitation, barometric pressure,

       wind speed)

    3. How far into the future can we typically predict the weather? (5-7 days)
    4. Where would you go if you wanted to find out what the weather was like last year at

       this time? What about 100 years ago? Or 1000 years ago?

3. Transition to the next step by telling students that together you are going to explore the current weather around the world, global climate, glaciers, and how glaciers help us understand what the climate was like long ago.
4. Organize students into groups. Assign each group one of the suggested locations. Each group will go to http://www.wunderground.com/ or similar sites to find the following information for their assigned location:
    1. Current weather
       i. Temperature

       ii. Precipitation

       iii. Barometric pressure
       iv. Wind speed
    2. Next day's predicted weather
    3. Record high and low temperature, and when the record was set
    4. Locate the site on a world map.
5. Ask each group to report to the class. They should indicate where their location is on a world map and share their findings. As a class, discuss the similarities and differences in the weather for each site. Identify the longest held record and ask students to think about ways scientists can learn about environmental conditions that happened before this record began.

6. Define climate and differentiate between weather and climate. Replay the portion of the video that distinguishes between weather and climate.
7. Ask each group to go to www.weatherbase.com and search for their location. After finding the data for their location, each group should examine the average high and low temperatures and average precipitation for their location. Groups should then describe the climate of their location and explain how the current weather makes sense within the larger view of climate.

a. Guiding Questions

i. How many years on record were used in determining the averages for your site?
ii. What is the average high temperature? In what month did it occur?

iii. What is the average low temperature? In what month did it occur?
iv. What is the average annual precipitation?
v. Describe the pattern of the precipitation. Is there a wet and dry season, or is the precipitation fairly constant throughout the year?
vi. Describe the climate for your location.
vii. Does the current weather for your location make sense based on your climate

description?

8. Ask the students to think about ways we can find out about weather conditions and climate prior to human record keeping. Refer back to the *Climate and Ice* video. If necessary guide them to glaciers as a source of long ago climate data.

Part II: What is a glacier?

1. Begin by asking students to share their current thinking about glaciers, how they form, and

   where they might be found. This can be done through discussion, journaling, wiki entries, etc.

2. Have groups of students investigate the following sites to learn some fundamentals about glaciers.
   1. The Life Cycle of a Glacier, http://www.pbs.org/wgbh/nova/vinson/glac-flash.html
   2. How Glaciers Work, http://science.howstuffworks.com/glacier.htm, and the next page,

      Glacier Formation, http://science.howstuffworks.com/glacier1.htm.

   3. Glaciers and Icecaps: Storehouses of Freshwater,

      http://ga.water.usgs.gov/edu/earthglacier.html

3. Ask each group to share what they have learned. As a class, develop a description of how glaciers form, what happens to glaciers during warm weather, and where they are found in the world.

Part III: What do glaciers record?

1. Conduct a webquest to determine what types of substances can be trapped in glaciers. Include

   the following sites in the webquest:

   1. Stories in Ice, http://www.pbs.org/wgbh/nova/warnings/stories/
   2. Ice Core Timeline, http://www.pbs.org/wgbh/nova/warnings/stories/icecore.html
   3. Paleoclimatology: The Ice Core Record,

      http://earthobservatory.nasa.gov/Features/Paleoclimatology_IceCores/

   4. Why Study Ice Cores?, http://nicl.usgs.gov/why.htm
   5. Ice Cores Reveal Fluctuations In Earth's Greenhouse Gases,

      http://www.sciencedaily.com/releases/2008/05/080514131131.htm

   6. Deep ice tells long climate story,

      http://news.bbc.co.uk/2/hi/science/nature/5314592.stm

   7. Glaciers, Ice Sheets, and Climate Change, http://www.waterencyclopedia.com/Ge-

      Hy/Glaciers-Ice-Sheets-and-Climate-Change.html

2. Create a class list of substances that can be trapped in glaciers.
3. Ask each team to locate the glacier or ice sheet nearest the location they used for their weather

   data. After locating the nearest glacier, students should write a hypothetical story that might be revealed by examining a few layers of their glacier. The story should reflect the surrounding area and events that might logically have happened.

a. Guiding Questions:

i. Was each year wet or dry?
ii. Did any natural events occur (e.g. volcanic eruption, forest fire) that might have resulted in substances being trapped in the glacier?
iii. Did any human-generated events occur (e.g. industrial accident, nuclear testing) that might have resulted in substances being trapped in the glacier?

4. Ask each group to use the materials available to them to construct a model of their glacier for the years they have described in their hypothetical story.
5. Ask each group to explore the models constructed by their classmates. As they explore the models, they should try to determine what conditions the model represents.
6. Wrap up by having each group present their models and stories to the entire class.

Additional content support for teachers:
Ice-core evidence of abrupt climate changes, http://www.pnas.org/content/97/4/1331.full