



Overview:

Students will learn about global climate change, what causes global warming, and scientific projections about climate change in the near future.

Objectives:

The student will:

- make a hypothesis about the cause of Greenland's melting ice sheet;
- use a globe to make analogies between Greenland and Alaska;
- determine how quickly sea levels may rise; and
- write about the cause of global warming and the effect of rising sea levels on Alaska communities.

Materials:

- STUDENT WORKSHEET: "Greenland Melting"
- OVERHEAD: "Taking Earth's Temperature"
(Download from the Level V+ Classroom Lessons page of <http://www.ArcticClimateModeling.org>)

GLEs Addressed:

Science

- [9] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [10-11] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
- [10-11] SD3.1 The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by describing causes, effects, preventions, and mitigations on human impact on climate.

Activity Procedure:

1. Share the following information with students:

Throughout the world, scientists and National Weather Services measure and record air temperature readings, the amount of rainfall and snowfall, the size and thickness of glaciers and ice sheets, and corresponding changes in ocean levels. The resulting data paints a picture of Earth's climate and how that climate changes over time.

Climatology is the study of climate, and climatologists are the scientists who study climate. Most climatologists agree that Earth's climate is warming up. The term they use is global warming.

2. Global warming is caused by rising levels of carbon dioxide and other atmospheric gases such as methane water vapor. An increase in these gases reduces heat lost to space, and increases heat trapped near Earth's surface. Global warming is like adding an extra blanket around the planet, and results in an increase in the average global temperature. This increase in carbon dioxide and other gases is the result of clearing forests, and burning coal, oil and gas to heat homes and power automobiles. These heat-trapping gases are normally present in Earth's atmosphere and in fact allow life as we know it on Earth, but they are now being produced faster than plants and oceans can absorb them.
3. Display the OVERHEAD: "Taking Earth's Temperature" on the projector.

At the time of publication, 2006 was the warmest year on record in the contiguous United States (since recording began in 1895) have all occurred within the last 14 years. According to NOAA, global temperatures could increase by 6-10 degrees over the next 100 years.

4. Ask students to discuss what happens when global temperatures rise. (*Glaciers and ice sheets melt, causing sea levels to rise; permafrost melts; coastlines crumble; and weather patterns change, causing more rain and snow in some areas and less in others.*)

Extension Idea: Ask students to read the September 2004 issue of National Geographic, which provides a thorough overview of global warming. "When temperatures rise and ice melts, more water flows to the seas from glaciers and ice caps...Ocean levels have raised between 4 and 8 inches in the past 100 years," according to the Intergovernmental Panel on Climate Change.

5. Ask students to complete the STUDENT WORKSHEET: "Greenland Melting."

Answers:

1. Hypothesis: Greenland's ice sheet is melting because of warmer global temperatures (Answers will vary).
2. 59° - 61°
3. Anchorage
4. Answers will vary, but should be Alaska coastal communities.
5. Answers will vary, but should be global (outside the United States) coastal communities.
6. the rate of global warming
7. $20' \times 12" = 240" \div 1,000 \text{ years} = .24" \text{ per year}$
8. Answers will vary
9. Answers will vary

Name: _____

Greenland Melting

Student Worksheet (page 1 of 2)

Levels V-VI



Directions: Read the following information and answer the questions below:

Greenland, at 840,000 square miles, is the world's largest island. Eighty-five percent of the island is covered in ice up to 2-miles thick. Studying this ice sheet is one of the best ways to study climate change in the Northern Hemisphere. Ice cores taken from Greenland show that during the last warm period (the Eemian interglacial period from 130,000 to 110,000 years ago) much of Greenland's ice sheet melted, accounting for a rise in sea levels throughout the world.

Greenland's ice sheet has begun to melt again, losing more mass each summer than it replaces through winter snowfall. In 2001, Greenland's ice sheet was losing about 50 cubic km of ice per year. By 2005 the melting had increased to 220 cubic km per year. (By comparison, the city of Los Angeles uses about one cubic km of water per year.) In all, Greenland's ice sheet contains 2.85 million cubic km of ice.

The Greenland ice sheet contains 10 percent of all the fresh water on Earth. If the Greenland ice sheet melts completely, sea levels around the world will rise 6 meters (20 feet) or more. Cities and villages built on low lands near the world's oceans will be covered in water. For example, the southern half of Florida and all of London will be inundated. Scientists who study the Greenland ice sheet believe that if the rate of global warming continues to increase, the ice sheet will be gone within 1,000 years.

1. Make a hypothesis to explain what is causing Greenland's ice sheet to melt.

2. Study a world globe. What is the southernmost latitude of Greenland? _____

3. What major city in Alaska is closest to this same latitude? _____

4. Look at a map of Alaska. List 3 Alaska villages or cities that will be affected by increasing sea levels.

5. Look at a map of Alaska. List 3 cities outside the United States that will be affected by increasing sea levels.

6. Scientists predict that the ice sheet will melt in just 1,000 years if what continues?

Name: _____

Greenland Melting

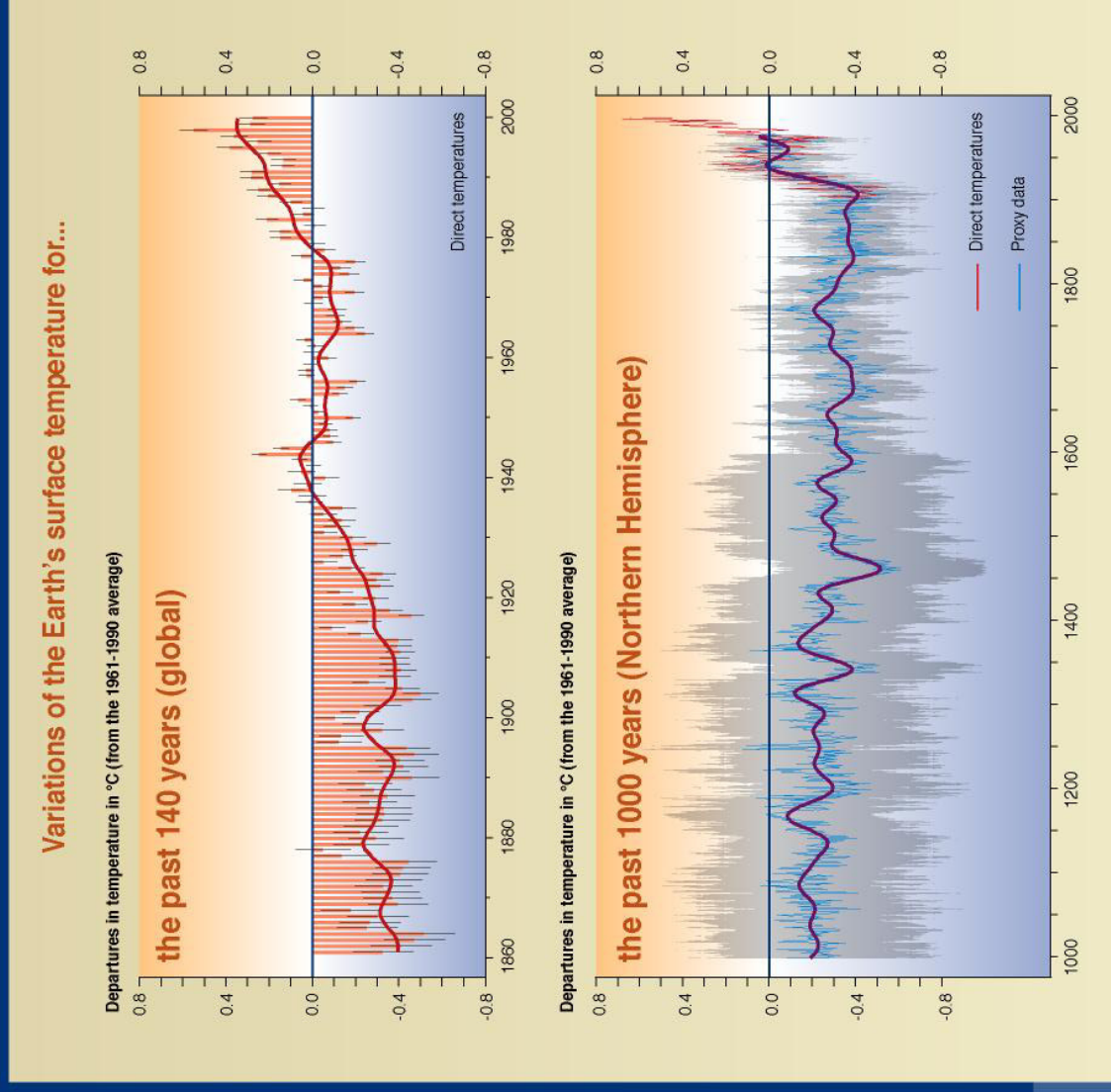
Student Worksheet (page 1 of 2)

7. If Greenland's ice sheet melts in 1,000 years, and raises ocean levels by 20 feet, how many inches would that be each year if the rise were steady over time? Show all work. Remember to convert from feet to inches.

8. List and explain three causes of global warming.

9. List and explain three effects of raising sea levels on communities in Alaska.

Taking Earth's Temperature Overhead



Source—Climate Change 2007:
The Scientific Basis, Synthesis
Report, Intergovernmental Panel
on Climate Change
SYR - FIGURE 2-3



IPCC

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE