
My NASA Data - Lesson Plans

What Will Happen if Climate Variability and Change Cause Glacier and Polar Ice Cap Melting

Grade Band

- 3-5

Time

- 50 minutes

Overview

This activity is one of a series in the collection, The Potential Consequences of Climate Variability and Change activities.

It engages students in modeling how increased temperatures hasten the melting of ice in the environment, contributing to a rise in sea level and subsequent flooding of coastal areas.

Credit: Institute for Global Environmental Strategies

Materials Required

- Two small aquarium tanks, a glass cover (a plastic cover or plastic food-wrap will work, but should not come in direct contact with the lamp)
- Two clamp lamps with 60-watt bulbs
- Tinted plastic wrap or transparency paper
- Water
- Blue food coloring (optional)
- “Icebergs” and “glaciers” (freeze water in paper cups or milk cartons; peel off paper)
- Rulers
- Pencils

- Crayons
- Grease pencil or marker (optional)
- Graph paper
- Student Activity Three lab sheet

Procedure

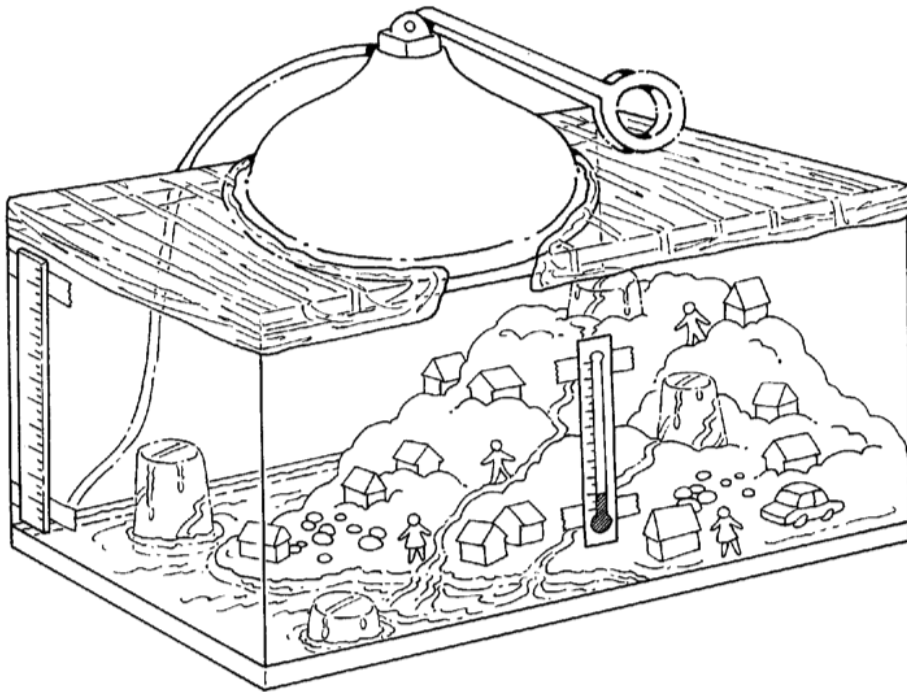


Figure 3. Tank Set-up with

“Icebergs” and “Glaciers”

Step 1

Set up Tank 1 and Tank 2 as in Activity One. Add blue food coloring to the water (optional) and carefully pour into the tank. Take a baseline temperature. Measure the water level in the tank. (You may wish to tape a ruler to the front of the tank and mark the water level on the tank glass with a grease pencil or marker.) Record data on the *Student Activity Three Lab Sheets for Tanks 1 and 2*.

Step 2

Explain the difference between glaciers and icebergs to the students. Then place one or more “icebergs” and “glaciers” in your tanks (see Figure 3). Note the rise in the water level with the introduction of the ice. Draw a diagram of the tank and measure and record the new temperature and water height on the *Student Activity Three Lab Sheets for Tanks 1 and 2*.

Step 3

Place a lamp over Tank 1. Place a glass cover, plastic wrap, and a lamp over Tank 2. (NOTE: Place the plastic wrap material around the lamp bell, not under it. CAUTION: Material in direct contact with the bare bulb may catch fire. Explain to the students this is only being done to prevent the plastic

wrap from catching on fire. In the “real” atmosphere, the sun’s rays pass directly through the atmosphere.) Record the temperature and water level changes in the tanks at 1, 5, 10, 30, and 60-minute intervals on the lab sheets.

Step 4

Complete lab sheets.

NGSS Three Dimensional Learning

NGSS Disciplinary Core Ideas

- ESS2A: Earth Materials and Systems
- ESS3D: Global Climate Change

NGSS Crosscutting Concepts

- Cause and Effect
- Scale, Proportion, and Quantity

NGSS Science and Engineering Practices

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying out Investigations
- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence

Supported Common Core Math

- CCSS.Math.Content.3.MD.A.1
- CCSS.Math.Content.3.MD.B.4
- CCSS.Math.Content.4.MD.B.4
- CCSS.Math.Content.5.MD.B.2

Learning Objectives

- Observe and describe changes of the Cryosphere model as variables are changed;
- Explain the relationship between the models and the real world
- Make predictions about future climate changes and some of their potential impacts on Earth

Essential Questions

- How do I recognize a change in the Cryosphere?
- How does change in the Cryosphere affect changes in other parts of the Earth System?

Why Does NASA Study This Phenomenon?

Located in the Arctic near the North Pole, Greenland is covered by a massive ice sheet three times the size of Texas and a mile deep on average. Greenland is warming almost twice as fast as Antarctica, which is causing the ice to melt and raise global sea levels. NASA is monitoring Greenland's ice sheet from high up in space to the ocean floor below to provide data for scientists studying the global impact of all its melting ice.

The creation of ICESat-2 is allowing NASA's scientists to make accurate maps of polar ice sheets. These maps help them make informed predictions about weather patterns, climate change, and the effects of changing ice structures. The maps are so accurate they can measure to within 3 centimeters of an ice sheet's actual thickness from a huge distance!

[Video: Launchpad: ICESat-2 - Next Generation Technology](#)

Launchpad: ICESat-2 - Next Generation Technology | https://www.youtube.com/watch?v=g3qmgopJt_8 | Source: NASAeClips

Learn how the second generation of the Ice, Cloud, and Land Elevation Satellite, better known as ICESat-2, is being used to map the ice structures in the world's polar regions. Manipulating the distribution of photons by lasers to create accurate images of these frozen structures allows scientists to study their changes and impact on Earth's climate.

Teacher Background Information

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- To effectively teach about the effects of climate variability and change, teachers should have a solid understanding of the following concepts:
 - The sun provides the heat and light energy that sustains life on Earth. It creates the weather we experience daily (for example, the cycle of precipitation and wind patterns) and the climate characteristics of the place where we live (tropical, sub-tropical, temperate, and polar regions).
 - The atmosphere, which is virtually transparent to incoming sunlight, surrounds the Earth and helps trap heat near the Earth's surface, much as the glass over a greenhouse traps heat. Without our atmospheric "blanket," the Earth would be about 60 degrees F cooler in every season.
 - The atmosphere consists of many kinds of molecules (nitrogen, oxygen, carbon dioxide, aerosols including water vapor, and others). These molecules absorb, emit, transmit, and reflect heat and light energy.
 - Combustion, exhaust, and other by-products of human activities (aerosols) are contributing to the changing mix of molecules in the atmosphere. This change is causing our atmosphere to hold in more heat energy and has raised temperatures in every climate zone.
 - A glacier is a large mass of ice formed on land. An iceberg is a large piece of ice that has broken off from a glacier and dropped into a large body of water. About 4/5 to 8/9 of an iceberg is below the water.
 - Keep in mind that melting icebergs will not cause a rise in sea level since they are already in the ocean. Melting glaciers, on the other hand, will cause a sea level rise, since they are land-based.
 - Rising temperatures may cause changes in the Earth's climate. Effects might include drought, torrential rains, flooding, rising sea levels, and depletion of groundwater. More positive effects could be increased plant production or warmer winters in northern cities.
 - IMPORTANT: The enclosed lab sheets are to be used by Grade 3–4 students, and by 1–2 teachers to help organize their own observations and guide their discussions with students who have limited reading and calculating skills.
 - NOTE: These activities deal only with the effects of aerosols and gases on the Earth's temperature. The effect of albedo, due to cloud cover, is not discussed.

Student Resources

- [Student - What will Happen if Climate Variability & Change Cause Glacier & Polar Ice Cap Melting](#)

Teacher Resources

- [What will Happen if Climate Variability & Change Cause Glacier & Polar Ice Cap Melting](#)

