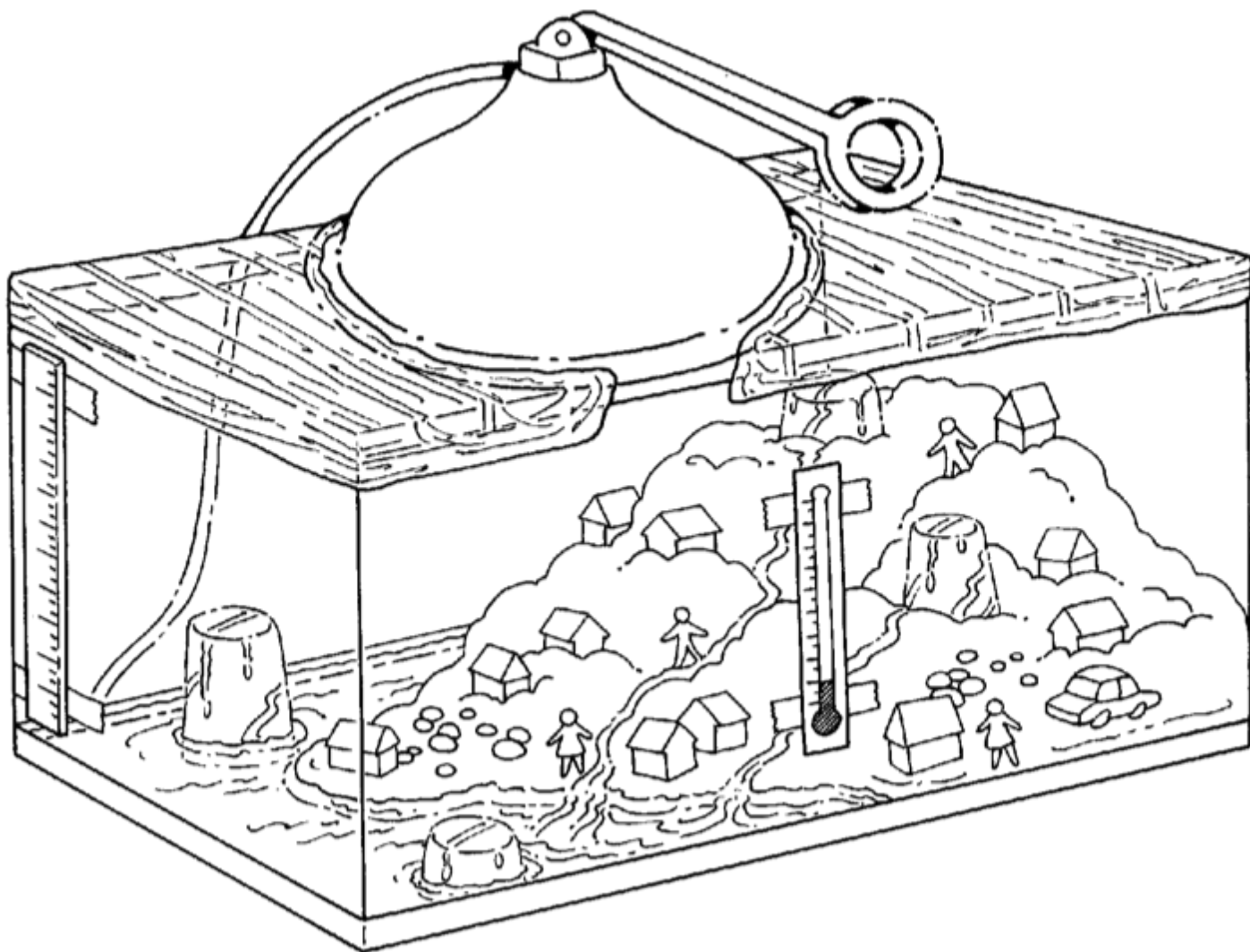

My NASA Data - Lesson Plans

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



Overview

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

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

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](#)

Video

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.

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?

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

Prerequisites Student Knowledge

Students must have the following skills and knowledge to complete this activity:

- The sun’s heat creates our weather. It drives the water cycle and wind patterns. Students need to understand the basics of the water cycle, especially the concepts of evaporation and precipitation.
- “Air is there. “It consists of gas molecules and has mass. A simple way to demonstrate this idea is to show your students an “empty” paper lunch bag. When you ask them what is inside, most students will answer, “Nothing.” Next, face each student with the opening of the bag about 18 inches from his or her face. Then, clap the bag between your hands. This forces air out of the bag and “squirts “the student with “nothing. “Now if you ask what was in the bag, your students will answer, “Air.”
- The atmosphere consists of a mixture of molecules. It acts like a blanket to keep the Earth warm enough for us to live. Most of the components of our atmosphere are there naturally, but the activities of people living and working on the Earth have changed the mixture of gases and particles, increasing the amount of heat-trapping gases in the atmosphere. It is much like adding more blankets to your bed at night. The more blankets you add, the warmer you become. The more heat-trapping gases there are in the atmosphere, the more of the sun’s energy it traps and the higher the temperatures rise.
- Weather is what happens outdoors every- day, whereas climate is the average weather in a particular place over the seasons of the year. Your students should be able to show which zones of the Earth are tropical, subtropical, temperate, and polar.

Procedure

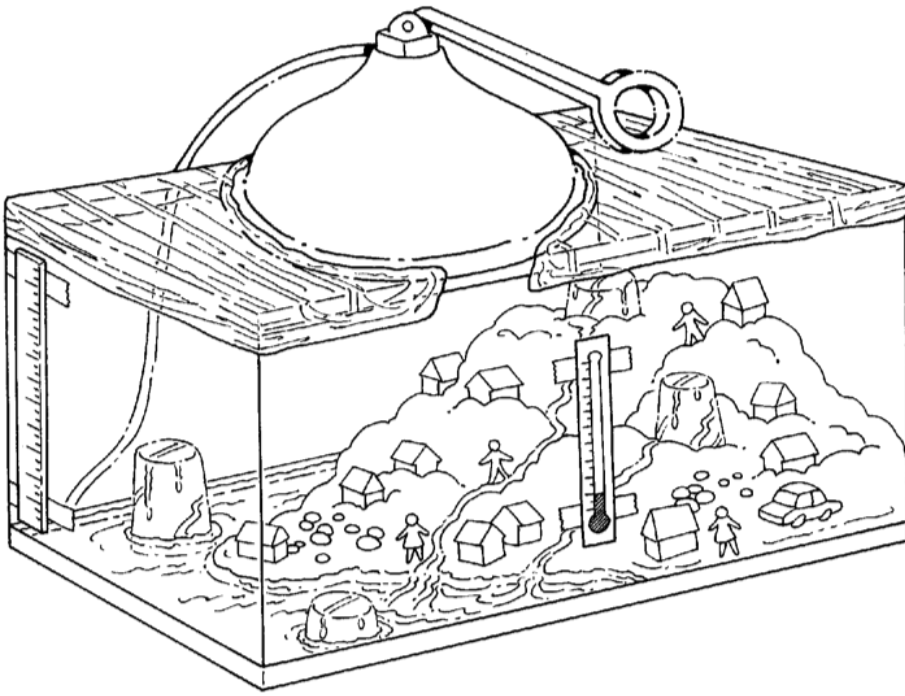


Figure 3. Tank Set-up with

“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.

Extensions

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1. Research and discuss how and where glaciers form. How would these conditions and regions be affected by climate variability and change?
 2. Have the students compare the glaciers with the icebergs from their activity. What makes them different? Where do icebergs come from? Ask the students to predict what would happen to an iceberg as it floats in the ocean.