Climate Change
Why do the Poles Matter?...Water, Water, Water

The goal of this activity is to demonstrate how much water is stored in the large ice sheets by looking at how global sea level would change if they melted.

SUMMARY OF BASIC CONCEPTS:

• There are 3 big ice sheets on Earth: Greenland, West Antarctica, East Antarctica.

• Each ice sheet contains large volumes of water. If they melted entirely sea level everywhere would rise. Each ice sheet holds the following amounts of sea level rise trapped in ice:

Greenland	24 feet
West Antarctic	19 feet
East Antarctica	170 feet
Total	**213 feet**

GENERAL BACKGROUND INFORMATION

The Polar regions are fascinating areas that have been the focus of intense study during the last decade. During the Ice Ages ice covered both North America and Europe. A mile thick blanket of ice reached as far as New York City! The last remaining ice sheets on Earth exist in the Arctic and the Antarctic. These remnants of previous Ice Ages are reminders of widespread glaciation, many millions of years ago. The stability and shifting of the ice in these areas is a major focus for ongoing research.

The water that is captured and held in these ice sheets represents the largest store of freshwater on Earth. When ice sheets melt, or slip into the ocean, the level of the global oceans rises, just as if you drop ice cubes in your glass of water, the level of water rises.

So how big are the polar ice cubes? What will happen when the polar regions warm up? Greenland holds 2.85 million km³! Antarctica holds a reservoir 25 million km³ of freshwater! Hmm millions of cubic kilometers? but what does this really mean? If the entire ice sheet covering Greenland were to melt, sea level would rise ~24 feet. Do you know someone who is 6 feet tall? That is 4 of these people standing on top of each other, or taller than a two-story building! BUT this is just Greenland. What about Antarctica? Antarctica holds a lot MORE ice.

Antarctica is separated into two sections of ice sheet…West Antarctica and East Antarctica. West Antarctica is smaller, and if all the ice there melted sea level would rise ~18 feet…this is 3 of your 6 foot tall friends standing on top of each other. East Antarctica is MUCH larger! If East Antarctica were to melt sea level would rise ~170 feet! That is too many people standing on top of each other to even think about! What if we think about something else instead…like the statue of liberty. If Lady Liberty were to step off her pedestal and stand on the shoreline of New York City she would be 151 feet tall. What would happen to her? Turn the page and try this experiment to see!

MATERIALS NEEDED:

• Fish tank (standard 10 gallon with 10' by 20' base)
• Water to fill tank 3.5 inches
• 20 personal size water bottles (500 ml size) – have students bring old bottles!
• (3) gallon jugs of water
• Food coloring – red, green and blue
• Print the backdrop images from this sheet and cut out: **2 story house; Lady Liberty**
• A Globe

ACTIVITIES

1. Use a globe to orient the students to the locations of Greenland and Antarctica. Discuss the size of ice sheets
2. Discuss why ice sheets affect sea level. Demonstrate by filling 2 glasses of water - glass one with ice cubes and glass two without. Mark the water level in both glasses. Add ice into the glass of water without ice and watch the water level rise, marking the new height. Wait until the ice in the second glass melts to see if that water level changes. Compare.
3. Test the impact of sea level rise - Greenland and West Antarctic Ice Sheets (WAIS)
   a. Fill tank 3.5 inches with water
   b. Tape **2 story house image** on the outside back of the fish tank so that the front edge of the house is at water level– beach front height (try to keep image dry so ink doesn't run). Remind students this house represents a 24 ft. high 2 story house.
   c. Add food coloring to bottles of water as noted below
   d. Add 9 - (500ml) type - bottles of water (colored blue)– this is the sea level rise for WAIS. What happens to the house? Note results, and record. Remove bottles.
   e. Add 11 - (500ml) - bottles of water (colored green)– this is sea level rise for Greenland. What happens to the house? Note results and record. Remove bottles.
4. Change backdrop to **Lady Liberty** graphic. Remind students she is 151 feet tall 6 times the size of the 2 story house!
   a. Add (3) 1 gallon jugs (colored red) - this is sea level rise for East Antarctic Ice Sheet, What happened to Lady Liberty? Note results and record. If desired you can add the other ice sheets (be sure to use the adjusted ratios below for this new graphic scale.)
   b. WAIS – (2) 500 ml bottles & Greenland – (3) 500 ml bottles
5. Add a local landmark - Look around the community & pick a tall landmark to test 15-20 stories tall or 150-200 feet is best.
   The scale is 50'= 1inch so a 10 story building would be 2 inches tall.

QUESTIONS TO THINK ABOUT:

1. Does it matter if the ice sheets melt or slip into the ocean? Explain.
2. How fast do scientists feel sea level is rising?
   • First ask your parents or grandparents if they have noticed a change in sea level in their lifetime?
   • But things are 'heating up' and we are seeing changes occur more quickly. In the next 100 years scientists estimate sea level could rise 31 inches. (Pfeffer et al., *Science*, 5 September 2008: Vol. 321. no. 5894, pp. 1340 - 1343 DOI: 10.1126/science.1159099)
3. What are some things that you can think of that you can do to help slow Climate Change?