

HOW DOES CLIMATE CHANGE AFFECT SEA LEVELS?

GRADES 6-8

MATERIALS

3 clear 2 quart tubs (rectangular food containers are ideal)
2 cups of medium-sized rocks (1-3 inches in size)
3 yogurt or similar-sized plastic containers
Water
Wet erase marker

BACKGROUND

Scientists are concerned that climate change is affecting sea levels. According to the EPA, sea surface temperatures have risen 1.3°F per decade since 1901. In the past three decades, water temperatures have been higher than any other period since 1880. This rise has been attributed to the excess greenhouse gases in the atmosphere caused by the burning of fossil fuels. As water warms it increases in volume, contributing to higher water levels.

Higher atmospheric temperatures and warmer seas cause glaciers to melt at an increased rate. Glaciers contain 69% of the world's freshwater. This water flows into rivers, lakes and the ocean. In the past, winter snows balanced out this water loss. However, melting is beginning earlier in the spring and snowfall is starting later in the fall, and the majority of glaciers worldwide are retreating at rates never before recorded.

Warmer water and warmer air is also causing glacial calving events that are larger in scope than in any previous times. Calving occurs when large chunks of ice break away from the edge of a glacier. Calving adds huge volumes of water to the oceans. The melting of icebergs and ice sheets also add volume to the oceans, although this is a smaller volume due to the differences in density between the saltwater of the ocean and the mostly freshwater composition of the icebergs.

DEFINITIONS

Density-The degree of compactness of a substance, calculated by mass/volume

Volume-The amount of space that a substance or object occupies

Glacier-A slowly moving body or river of ice formed by the accumulation of snow on mountains or near the poles

Glacial melt-Water released by a glacier due to warm air and/or warm water flowing underneath the glacier

Glacier calving-The breaking off of chunks of ice at the edge of a glacier

Iceberg-A large floating mass of ice detached from a glacier or an ice sheet that is carried out to sea

Ice sheet-A permanent layer of ice covering an extensive tract of land, esp. a polar region

TEACHER PREPARATION

Fill yogurt containers $\frac{3}{4}$ full of water and freeze.

INSTRUCTIONS

1. Label clear tubs A, B, and C.
2. Pile rocks on one end of container A.
3. Pour 2 cups water into each container.
4. Remove ice from yogurt containers.
5. Arrange and/or add rocks to container A so that part of the pile is above the water and can hold the ice.
6. Mark the water level on the outside of container A. Arrange ice on top of rocks. This represents a glacier.
7. Add 1 tablespoon salt to container B and stir until dissolved. Add a piece of ice into the water and mark the water level. This will represent an iceberg.
8. Mark the water level of container C. Explain to students that this will represent a glacier calving. Ask students what they think will happen when you add a piece of ice. Add a piece of ice into the water and mark the new water level.
9. After the ice has melted in all three tubs, measure the water level.

DISCUSSION QUESTIONS

Which container represents a glacier? (A)

Which container represents an iceberg? (B)

Which container represents glacial calving? (C)

Which container(s) show higher water levels after melting? (A)

Which events add significant amounts to the volume of the ocean? (glacial melt and calving)

Why are accumulative sea levels of concern? Who or what could be affected? Encourage students to think about the cumulative effect of more and more ice melting - while each melting glacier or iceberg leads to a relatively small change in sea level, these small changes add up over time!

ADDITIONAL RESOURCES

For Teachers:

<http://ocean.nationalgeographic.com/ocean/critical-issues-sea-level-rise/>
(Explains different components of sea level rise)

http://aquarius.nasa.gov/pdfs/prop_fresh_sea.pdf
(Downloadable lesson on the properties of salt and fresh water)

<http://sealevel.climatecentral.org>
(Interactive map of U.S. coastal cities likely to be affected by rising sea levels)

<http://environment.nationalgeographic.com/environment/global-warming/big-thaw/>
(National Geographic article about receding glaciers)

<http://www.pbs.org/newshour/rundown/2012/03/will-you-be-underwater-theres-a-map-for-that.html>
(Interactive map with information about coastal areas that could be affected by rising sea levels)

http://climate.nasa.gov/climate_reel/MeltingIceRisingSeas640360
(NASA video-good overview of the topic from the forming of glaciers to the effects of melting glaciers and ice sheets-appropriate for students as well)

<http://www.businessinsider.com/islands-threatened-by-climate-change-2012-10?op=1>
(List of islands that will disappear if sea levels continue to rise)

<http://ncse.com/climate>
(National Center for Science Education - Initiative for Climate Change website with rationale, support and resources for teaching climate change)

For Students:

<http://epa.gov/climatestudents/impacts/signs/sea-level.html>
(EPA student guide to climate change, includes graphs and charts related to rising sea levels)