

eCLEAR Rising Sea Levels Activity

Name: _____

Date: _____

Why is climate change affecting global sea levels?

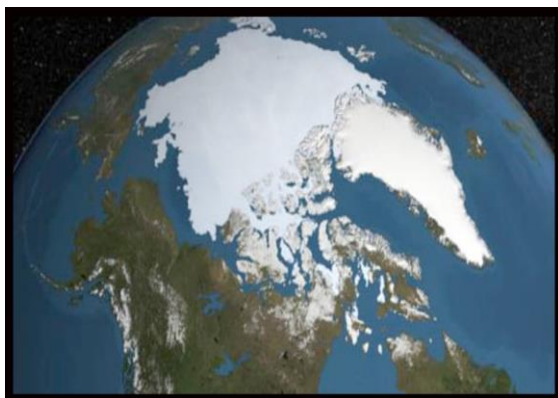
One of the well known effects of human induced climate change is sea level rise. According to the weather folks (**NOAA**-National Oceanic and Atmospheric Association) and the space folks (**NASA**) and other global scientists the data shows that global sea levels have already risen 4-8 inches (10-20 cm) in the past 100 years. ([National Geographic 2017](#)). But more troubling is that based on the satellite data (as well as other scientific measurements) there is an *accelerated rate of sea level rising in the past 20 years that is approximately 2X the speed of sea level rise in the past 80 year!* ([NASA 2018](#)). What specifically is causing this rise in the ocean levels? Melting ice on the Earth's surface is the answer to this question. But is all melting ice contributing equally to ocean level rise? (Note: as ocean temperature rises, there is something called "thermal expansion" of the ocean water which also contributes to sea level rise. Make a prediction about what the term "thermal expansion of water" means)

There are 2 main categories of ice on the Earth - **land ice** (like snow pack and ice on top of land and glaciers) and **sea ice** (ice that is formed on the ocean surfaces and icebergs). Which type of ice is mainly contributing to sea level rise and where would you find it?

Pre lab questions:

1. Look at a globe or map of the world. What is the main difference between the North Pole and the South Pole? _____
2. Find Greenland on your map. Would the Greenland ice be land ice or sea ice?

3. Find at least one glacier on your world map. Where is it? _____ What ocean do you think melting waters from your glacier would end up in? _____
4. Look at a map of the world that shows cities. Name 5 major cities that are on the coast of an ocean. Estimate the number of people that live in your 5 cities _____



[NASA photos 2015](#) - Label the north pole and south pole "land ice" and "sea ice". Put a * on Greenland and a checkmark on the continent of Antarctica

Activity - Can you measure the change in water levels from melting land ice and sea ice?

1. Your teacher will provide you with a set up something similar to the one pictured below. Notice the 2 big “ice cubes” and 2 large containers. One container has a plastic “ramp” on the top of it with something to keep the ice from sliding. We used the top of a plastic container with holes poked at the end.
2. Set up your experiment. Your teacher will tell you the mL of water used to make the big “ice cubes” (we used 400 mL of water for these). Then put approximately 1600 mL of water in each of your containers. One will be a model of melting “land ice” and the one with the plastic “ramp” will be a model of melting sea ice.



3. What variable will you be measuring in this experiment? _____ How will you measure it? _____

4. After you put 1600 mL of water in both containers, put one big ice cube INSIDE the container on the left and put the other big ice cube on the plastic ramp on the right (see picture below).

Draw a line where the water levels start out in both containers and record your start time! (*Note your teacher may have you leave this activity going until the next day or check it at the end of the period if enough time)



5. After both big ice cubes have melted, what can you conclude about your water levels? Explain how this activity models the different effects of land ice and sea ice on global ocean levels.

Research Questions

Go to this website below and answer the following questions:

[National Snow and Ice Data Center fact sheet on ice sheets](https://nsidc.org/cryosphere/quickfacts/icesheets.html)

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- A. If all of the ice in the Greenland ice sheets melted, how much would the sea level rise?
- B. If all of the ice in the Antarctic ice sheets melted, how much would the sea level rise?
- C. One of the things that scientists think is happening is that as the ice sheets are melting and getting smaller pieces of ice that it accelerates more melting. This is happening in the Greenland ice sheets right now. This is an example of positive feedback. How could you model this positive feedback of melting in the activity above?
- D. Look back at your map of major cities that are on the ocean (at sea level). Approximately how many people worldwide would you estimate will be displaced by maximum ocean level rise?
- E. The Earth's ancient history has had natural cycles of warm and cold (this is not human caused climate change but was affected by different solar activity of our sun, variations in the Earth's orbit, and gigantic volcanic eruptions (that naturally belch out atmospheric CO₂ among other gases). Do a little research and see if there was ever a time in geologic history when ocean levels varied a lot. Explain.

Thinking Questions

F. Do you think melting icebergs will contribute to sea level rise? Why or why not? Explain

G. When land ice forms, it is made of freshwater. As it flows into the oceans, do you think it will affect the salinity (saltiness) of the oceans? What effects do you think this might have on ocean systems? (hint: salt water is more dense that freshwater)

H. Draw a model below of how land ice and sea ice affect sea level rise in different ways. Make sure you label your models.