5E Lesson Plan: The Rising Seas

Adapted from NASA JPL Lesson: https://www.jpl.nasa.gov/edu/teach/activity/whats-causing-sea-level-rise-land-ice-vs-sea-ice/

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Subject / grade level: 2nd Grade

Materials: Clay, Ice, Trays, blow dryers, Student Science Notebooks, Projector, Websites from NASA JPL on climate change

NC SCOS Essential Standards and Clarifying Objectives:

2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be a solid or liquid.
2-ESS2-2 Patterns in the natural world can be observed
2-ESS2-1 Things may change slowly or rapidly
W.2.8 Recall information from experiences or gather information from provided sources to answer a question
2.MD.A.1 Measure the length of an object by selecting and using the appropriate tools

***For third grade**

ESS3.B A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impact.
MP.4 Model with mathematics

Lesson objective(s):

Students will look at a data set for rising sea levels, as seen from NASA satellites. They will analyze the data to see how much the sea levels have risen since 1993, and will answer the question: what is causing the sea levels to rise?

Differentiation strategies to meet diverse learner needs:

Students will work in groups to analyze five-year increments of the data. The experiment will be modeled whole-group. During the extension reading, students will read aloud and answer questions in partnerships. In order to help students understand buoyancy, ice will be placed in a water bottle with measurements on the sides so students can see how ice dropping in makes the water level rise, but ice melting does not.

ENGAGEMENT

Students will look at photographs from the NASA climate time machine https://climate.nasa.gov/interactives/climate-time-machine as well as Greenland sea ice Sept. 1987 vs. Sept. 2017 https://climate.nasa.gov/images-of-change?id=644#644-greenlands-tracy-and-heilprin-glaciers-melt and the Pine Island Glacier Calving in Antarctica https://climate.nasa.gov/images-of-change?id=496#496-pine-island-glacier-calving-antarctica

Students will look at pictures of icebergs and glaciers and will be asked which is which. Looking at a globe, they will be told where glaciers we looked at exist (Greenland, as well as Antarctica), and where icebergs, or the sea ice we looked at exists (North Pole). We will discuss that glaciers exist on every continent but Australia, and will discuss that icebergs exist in different parts of earth, but the sea ice we looked at was in the arctic, or North Pole of our planet.

Students will discuss the following: Water around the globe is rising, but what is the cause? Is it the glaciers on land causing water to rise, or is it icebergs in the sea? *Thermal expansion will be explained at the conclusion of the lesson. (Adaptation for 2nd) https://climate.nasa.gov/images-of-change?id=496#496-pine-island-glacier-calving-antarctica

Driving Question: During our lesson today, we are going to discover what is causing the seas to rise. We will be able to answer the question, is it more the ice that is melting on land (glaciers), like Greenland and Antarctica, or is it more the ice that is melting in the sea (icebergs), like in the arctic North Pole that is causing sea levels to rise?

EXPLORATION

As a class, discuss sea-level rise and climate change. Students will conduct an experiment to learn how melting ice contributes to sea-level rise.

Remind students where there is a lot of ice on Earth. Ask them to specify if the ice is on land or at sea. (The Greenland and Antarctic ice sheets, along with smaller mountain glaciers, are considered land ice. The ice in

the Arctic is frozen seawater and therefore considered sea ice.)
Ask students which type of ice, if any, contributes more to sea-level rise. Ask students to explain their thinking.
On the student data sheet, have students record their prediction about which type of ice will contribute more to sea-level rise.
Provide each group with the required materials and directions to conduct the experiment. *2nd grade adaptation: do this as a demonstration. Prepare clay ahead of time.
Press equal amounts of clay into one side of each plastic tub, making a smooth, flat surface representing land rising out of the ocean.
In one tub, place as many ice cubes as possible on the flat clay surface (I put 8). This represents land ice.
In the other tub, place the same number of ice cubes on the bottom of the tub, next to the clay. This represents sea ice.
Pour water into the sea-ice container until the ice floats. Be sure no ice is resting on the bottom of the tub. The water shouldn't be higher than the land level.
Without disturbing the ice cubes, pour water into the land-ice container until the water level is about equal to the water level in the sea-ice container.
Using the ruler, measure the water level (in millimeters or inches for 2nd grade) in each tub and record the data on the student data sheet.
You can mark the water level with a marker on the outside of the tub, but if the containers are reused, they will have the marks from the previous group. Another way to mark the water level is to mark a line in the clay using a pencil or other object. *Or put masking tape ahead as a mark where the first water level stops.
At regular intervals, measure the water level and record it on the data sheet. Compare the water level with the marked line in the clay. Allow the ice in both tubs to melt completely.
Use the measurements recorded on the data sheet to create a line graph representing the water level in each tub. (Skip this step with 2nd grade)

While students are waiting for the ice to melt, guide students in reading the data from the sea level satellite data from 1993-present.
Students will convert data from the line graph into a bar graph.
Graph Data: 1993-1995: 12mm rise; 1996-2000: 10 mm; 2001-2005: 15 mm; 2006-2010: 17 mm; 2011-2016: 18 mm

EXPLANATION

- In which container did the water level rise more?
- How does this compare with your prediction?
- Why do you think it rose more in the container it did?
- Does the melting of Earth's glaciers contribute to the rising sea level? Why?
- Do the melting icebergs contribute to the rising sea level? Why?

ELABORATION

Vocabulary: Iceberg, Glacier, Thermal Expansion, climate change
Students will get a more sophisticated understanding of the concept by reading and responding to the following articles:
https://climatekids.nasa.gov/polar-temperatures/
https://climatekids.nasa.gov/10-things-glaciers/
Questions for responses are on attached worksheets.
Extension: Watch and discuss TED Talk on Polar Ice Warming https://www.youtube.com/watch?v=ofaoiHYKtlc
Watch and discuss TED Talk on Global Warming and Rising Seas: https://www.youtube.com/watch?v=f7sEhuSbQo8

EVALUATION

- Students should make a prediction and provide reasoning for their prediction. The accuracy of their prediction is not as important as the fact that they made one and can communicate their reasoning.
- Students should compare their results to their predictions and provide a reasonable explanation for what they

observed.
- Students should be able to connect the model to the global events of ice melting and associated sea-level rise.
- Students should demonstrate further understanding of polar temperatures and glaciers after reading the climate kids articles.