

Grade: 5 th grade	Topic: The Hydrosphere	Number of lessons: 7-9
Brief Lesson Description:		
<p>This series of lessons and investigations will be part of a 5th grade Earth and Space Science unit exploring Earth's Hydrosphere. The phenomenon used to introduce and engage students will be the changing patterns in global ocean levels. Students will have already explored the importance of water on earth and the presence of water in all 3 major states. Students will be challenged to use comparative models to test different ideas about the patterns of change in global sea levels. Through a series of exploration labs, students should gain an understanding of how vast the Earth's hydrosphere is yet how little of it is in an accessible form of freshwater. Students will be asked to think about how they use water daily (drinking, hygiene, cooking, playing) and why it's important to conserve and protect this precious resource. Students will also be challenged to discuss how authentic satellite data can be used as evidence to support claims, such as how melting land ice can impact the global sea levels.</p>		
Performance Expectations and Goals:		
<p>Students should develop an understanding of the following:</p> <ol style="list-style-type: none"> 1. The hydrosphere is made up of the water on and under the surface of the earth. 2. Most of the water on earth is found in the oceans. 3. Most of the freshwater on earth is frozen and not accessible to us. 4. Ground water provides accessible fresh water sources. 5. Changes in frozen water on earth can lead to changes in the level of seawater. 6. Data collected from satellites and probes can provide invaluable data and understanding about short- and long-term changes in the hydrosphere and can be used to predict these patterns of change. 		
<p>Disciplinary Core Ideas: 5-ESS2-2 Nearly all of Earth's available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. 5-ESS2-1 Earth's major systems are the geosphere, the hydrosphere, the atmosphere, and the biosphere. These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate.</p>	<p>Science & Engineering Practices: Ask questions about what would happen if a variable is changed. Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon. Conduct an investigation collaboratively to produce data to serve as the basis for evidence.</p>	<p>Cross Cutting Concepts: <u>Stability and Change</u> Some systems appear stable, but over long periods of time will eventually change. Change is measured in terms of differences over time and may occur at different rates. <u>Patterns</u> Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and designed products. Patterns of change can be used to make predictions. Patterns can be used as evidence to support an</p>

		<p>explanation. <u>Cause and Effect</u> <u>Mechanisms and Prediction</u> Cause and effect relationships are routinely identified, tested, and used to explain change. Events that occur together with regularity might or might not be a cause-and-effect relationship.</p>
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Background Information and skills already introduced:

Students have spent time talking about and exploring scientific patterns and using observable data from patterns to support claims. Students have worked collaboratively to collect data and share observations. Students have been introduced to CER and qualitative vs. quantitative observations.

Resources Used:

NASA:
My NASA data: <https://mynasadata.larc.nasa.gov/>
Earth Systems Data Explorer: <https://mynasadata.larc.nasa.gov/EarthSystemLAS/UI.vm>

Other:
Mystery Science: mysteryscience.com

Ocean Literacy Network. (n.d.). *Ocean Literacy - College of Exploration*.
<http://oceanliteracy.wp2.coexploration.org/>. Retrieved March 26, 2023, from
<https://www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf>

Lesson Plan:

ENGAGE: 1-2 class periods

Objective: To introduce students to the changing levels of the ocean through a NASA modified activity. The original activity can be found [here](#).

1. Ask students what sea level is and what tides are. Explain the difference - tides are an expected rise and fall of ocean water in an area on a daily basis, while sea level is an overall measurement of the average height of the ocean.
2. Ask students if they think sea level is rising, falling or remaining steady. Remind students that we are looking at average global sea-level height not sea level in specific areas. Students should provide an explanation of their thinking.
3. Students will observe [actual data](#) collected by NASA over a 29 year period. Students will be given a [simplified version of the data](#). The data will be cut into strips and each

team of 2 will be given data for one year only. Teams will be asked to graph (line graph) the data on the provided blank graph. The teacher should highlight that the GSLH is a comparative height - it is compared to the average level in 1990 so a negative height would be a lower level than 1990 where a positive height would mean a higher level than 1990. Stop and ask students why a comparative height and not an absolute height is used.

4. When all groups have finished their individual graphs they will be attached to make one graph showing all of the data. Students will be asked to look for patterns in the data.
5. Students will discuss and then complete our [notice/wonder lab sheet](#) with a partner. Students are encouraged to list 5 things that they notice and 3 things that they wonder. The graph will be hung in the classroom and students will be encouraged to go up to it and make observations.
6. The teacher will monitor discussions to make sure that students do not confuse tides with global sea level changes. There may also be some confusion about what causes this rise in global sea levels - the teacher will help guide the discussions but there will be 2 activities later that will help clarify for students. Useful background information can be found [here](#).

EXPLORE: 4-6 class periods

Leading questions:

- How is sea level changing? What evidence do we have about sea level change?
- How is sea ice related to sea levels?
- How much water is on earth? How much is salt water vs. fresh water?
- Why is it important for NASA to be collecting real time data about the oceans?

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1. Watch [NASA | Arctic Sea Ice 101](#) to get students thinking about why the sea level is rising?
2. Leading questions will be posted around the room.
3. After discussing the leading questions and providing time for small and large group discussions, students will focus on the question of how sea level is changing.
4. Students will work in teams of 3-4 to complete [When Floating Ice Melts](#).
5. Students will engage in small group discussions about whether their claim was supported with evidence. Groups will take turns sharing what they discovered and if they were surprised by their discoveries. CER lab sheets will be completed collaboratively with teacher guidance. We will share ideas of new questions that we have about sea level rise. This will lead us to our next activity.
6. Students will work in teams of 3-4 to complete [When Land Ice Melts](#).
7. After completing the first two labs in this section, students should feel a connection to why this data collection is important and how important the hydrosphere is. The last activity in this section looks at how massive the amount of ocean water is on earth and why even slight changes in global sea levels are important.
8. Students will complete [How much water is in the world?](#) from Mysteryscience.com. In this lesson, students use estimation and graphing to discover the surprising difference

in the amounts of fresh and saltwater on Earth. In the activity, Map the World's Water, students [count squares on maps](#) and record the amount of fresh, frozen, and salt water found in their assigned area of the world. Then students [calculate and graph](#) how much of each type of water is present on the planet. Students will use stickers to represent squares of water - a [class bar graph](#) using stickers will be created.

EXPLAIN: 1 class period

-All of the content presented in the explain section should be a review of the information students discovered through their investigations.

-Students will be given the images from [the slides](#) and will glue them into their lab books then they will write in the facts/notes as we move through the discussion.

ELABORATE:

Authentic real data can be used to explain and predict patterns on earth like the rise in global sea levels. What else can this data help us to understand about the hydrosphere?

Students will use the [NASA data cubes](#), in teams of 2-3, to do some exploring about [other factors](#) that influence the hydrosphere:

-Precipitation rate using [graph cube level 1 questions](#)

-Sea surface temperature using [map cube level 1 questions](#)

-Sea surface salinity using [graph cube level 1 questions](#)

Multiple sets of each will be prepared. Students will be able to choose which data set to work with.

EVALUATE:

Students will be evaluated throughout the lessons on:

- Class/small group discussion participation
- Completion of line graph (GSL) and bar graph (water distribution)
- Completion of [CER rubric](#) for NASA land/water ice labs - [lab #1](#) and [lab #2](#) - these will be completed collaboratively as a team
- [Mystery Science lesson assessment](#) - completed individually

Common Core Mathematics Standards - 5th grade

Measurement and Data

Represent and interpret data.

Geometry

Graph points on the coordinate plane to solve real-world problems.

Mathematical Practices

Make sense of problems and persevere in solving them.

Reason abstractly and quantitatively.

Construct viable arguments and critique the reasoning of others.

Look for and express regularity in repeated reasoning and patterns.

Essential Principles of Ocean Literacy

Principle 1: The Earth has one big ocean with many features

1a. The ocean is the defining feature on our planet Earth – covering approximately 70% of the planet's surface

1d. Sea level of the average height of the ocean relative to the land and the factors that cause sea level to change.

1e. Most of Earth's water (97%) is in the ocean.

Principle 6: The ocean and humans are inextricably interconnected

6a. The ocean affects every human life. It supplies freshwater and nearly all Earth's oxygen.