

Title: Where is water found on Earth?

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Subject / grade level: 3rd Grade Science and Math

Materials:

- Information sheets listed in resources for each group. (Exploration)
- Where is Water Found? recording sheet in resource folder (Exploration)
- Color Copies of GRACE heat map for each month (one-year set per group)- under elaboration in resources
- Graph paper
- Pencils
- Ruler
- Tape
- Assessment

Resources:

Exploration

- <http://www.sciencekids.co.nz/pictures/earth.html> (team 1)
- <http://www.sciencekids.co.nz/sciencefacts/water.html> (team 2)
- https://www.usgs.gov/special-topic/water-science-school/science/where-earths-water?qt-science_center_objects=0#qt-science_center_objects (team 3)
- <http://www.onegeology.org/extra/kids/water.html> (team 4)
- Water Cycle: From Fresh Water to Salt Water resource sheet (team 5)
- Earths Hydrosphere Video: <https://www.youtube.com/watch?v=MhMWlpLuPDI>

Elaboration

- GRACE heat maps: <https://www.jpl.nasa.gov/edu/teach/activity/tracking-water-using-nasa-satellite-data/>
- <https://grace.jpl.nasa.gov/resources/5/grace-data-over-the-united-states-2003-2012/>

Standards:

NGSS

- Disciplinary Core Ideas: 2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.
- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information.
 - Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.
 - Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question.
- Crosscutting Concepts: Patterns
 - Patterns in the natural world can be observed.

Colorado State Standards Science

- 3.ES.1. Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.

ELA

- Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (RL.3.1)

Math

- 3.MD.B. Measurement & Data: Represent and interpret data.

Lesson objective(s):

- Students will be able to collaborate as a team to locate forms of water on Earth.
- Students will be able to graph data of water mass on the earth for a specific city.

ENGAGEMENT

- Ask the following questions:
 - Earth is called the blue planet. Do you know why?
 - Are any other planets like Earth? What makes it so different? In this unit we are going to be discovering all about Earth and what makes it so unique. Today we are going to be investigating the blue part of Earth. We are going to be finding out about the forms of water.

EXPLORATION

- Divide students into 5 equal groups.
- Give each group one of the resources in the resources section under exploration. **(ELA Connection, see standard above)**
- Give each group the Where Is Water Found? recording sheet.
- Tell students: For this investigation, you are going to be working in partner teams to find out answers. You are going on a hunt to find out where water is located on Earth. You will record the information that you have found on this sheet. You need to list the forms of water that you found on this table. There are 3 categories that you need to sort your information into--fresh water (not frozen), frozen water and saltwater. I am going to give you an example to help you figure out what a form of water is to help get us started. We have the Mancos River that is a body of water that is in our town. I know that a river is a form of water. Which category would I put river in?
- Have each group read through their information and divide different water sources into three categories; salt water, fresh water (not frozen), frozen water.

EXPLANATION

- Once each team has read and talked through their different water sources have them combine with another group to talk about their results.
- Tell the students: I would like our new teams to come up and share their findings. When each group is sharing, it is going to be your responsibility to listen to what they are saying. If they tell us about a form of water that you do not have down on your paper, you need to add it. Since everyone is listening closely, I do not want to hear any repeats of something that we have heard before.
- Watch the video on the Earth's Hydrosphere found here <https://www.youtube.com/watch?v=MhMWIpLuPDI>.
- Talk about the different types of water sources in the world. Have students define different water sources in their own words. River, ocean, icecaps, groundwater, sea, lake, etc.

ELABORATION (this section attributed to GRACE lesson plan on <https://www.jpl.nasa.gov/edu/teach/activity/tracking-water-using-nasa-satellite-data/>)

- Tell students we are now going to talk about how NASA tracks water mass on the Earth.
- 1. Define GRACE: The Gravity Research And Climate Experiment is an Earth science mission that's a collaborative effort between the U.S. and Germany.
- 2. Define GRACE's mission: To orbit Earth (16 times a day!) and measure small variations in Earth's gravitational field to track how and where water mass is moving across the planet.
- 3. Explain that multi-colored maps like the ones shown in the animation are called "heat maps," but don't track temperature as the name might imply. Instead, heat maps show the amount of something at a particular location. In this case, we are tracking variations in Earth's gravity field which indicate water mass changes.
- 4. Show students this animation: <https://grace.jpl.nasa.gov/resources/5/grace-data-over-the-united-states-2003-2012/>
- 5. Ask students what the animation is showing. Answer: The highs and lows of combined land-water storage (snow, soil moisture and surface water) represented as millimeters of equivalent water over time (January 2003-February 2013).
- 6. Ask students why it might be important to track water.
- 7. Replay the heat map animation, pausing at the beginning of the data set, January 2003. Ask students to identify their location on the map. Use a copy of a U.S. map.
- 8. Continue playing the animation while students watch changes in their region.
- 9. Pause several times and ask students to use the color bar below the map to state the numerical value of millimeters of water (mm-H₂O) for the given month.
- 10. Ask students to explain how they know what is happening. Answer: The color bar below the map indicates the amount of equivalent water. Changing colors on the map indicate changing water amounts at that location.
- 11. Divide the class into groups and have each group mark their city with a dot on each of their monthly maps. Project a U.S. map on a screen and mark the exact location so students can reference it. Be sure all groups have the same location pinpointed on their maps.
- 12. Explain to students that they will be making a giant line graph of data for 2003-2012 as a class, with each group graphing all the months of one year.
- 13. Provide each group with a sheet of graph paper, on which they will graph their points. (**math connection- see standard listed under standards**)
- 14. Have each group label the months across the horizontal (x) axis at distance intervals agreed upon by the class. All groups should use the same scale so graphs can be easily combined. Agree on whether the paper should be oriented "landscape" or "portrait" so combining them at the end of the activity will be easier.
- 15. Have each group label the vertical (y) axis at intervals appropriate for the task. Discuss that the y-axis should be labeled with a range that will accommodate the measurement of mm-H₂O as indicated by the color bar at the bottom of the heat maps. All groups should use the same scale so graphs can be easily combined.
- 16. Have students title their graphs appropriately. The title should include what is being represented by the graph (amount of equivalent water), the year and the location.
- 17. Have groups plot their data and connect the dots with a straight line.
- 18. Have groups present each year's data and trends to the class. Ask: What months does the gravity (water storage) increase or decrease?
- 19. Discuss seasonal differences and variation.
- 20. Have the students tape their graphs together on a wall or whiteboard, lining up the years in sequential order. Or, create a new, larger class graph and have each group plot their data, connecting sequential points with a line. Use colored pencils to differentiate years.
- 21. As a class, examine the overall trends. Ask: What is happening at the location over the 10-year time span? Why is this happening?

EVALUATION- assessment page included

- List 3 sources of water found on Earth and define them in your own words.
- Where can you find frozen water, salt water, and fresh water (not frozen) on Earth? List one source for each.
- What does a heat map show?
- How can we use heat maps to predict what is happening to Earth's water?

References:

Earth Pictures. (2018). Retrieved June 16, 2019, from <http://www.sciencekids.co.nz/pictures/earth.html>

Pawlik, L. (n.d.) *Tracking Water Using Nasa Satellite Data.* Retrieved June 16, 2019, from <https://www.jpl.nasa.gov/edu/teach/activity/tracking-water-using-nasa-satellite-data/>

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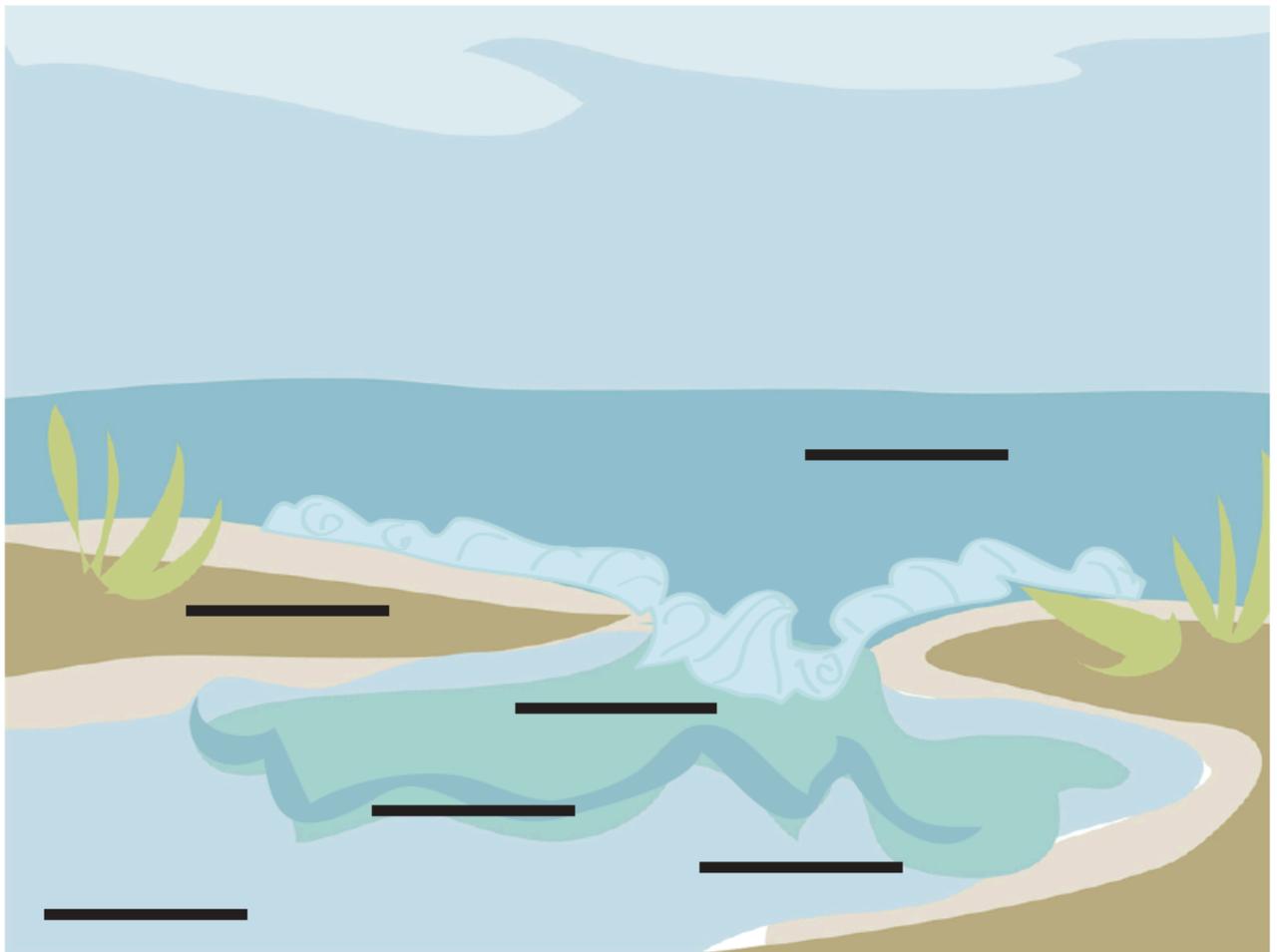
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Water Cycle: From Fresh to Salt Water

Follow the path of the water. Read the paragraph and fill in the blanks in the image.

Just under the land surface is where the water table of a river meets with the sea. As freshwater from rivers collides with the ocean, the water tries to mix. However, the ocean is made up of saltwater -- which is much denser than fresh water -- so instead of mixing, it will stratify, creating layers. The buoyant fresh water floats to the top while the denser saltwater sinks to the bottom. However, a small portion of fresh water and salt water will mix. This water is called dispersion. Tidal waves are often responsible for mixing waters due to the massive turbulence they cause. Even wind can encourage mixing.



Where can you find fresh water and salt water collide? Visit your nearest beach and try to identify the water table, dispersion, and more!

Where is Water Found on Earth?

1. List 3 sources of water found on Earth and define them in your own words.

Lakes/ponds- a large body of freshwater surrounded by land

Rivers- a large stream of freshwater that usually empties into a lake or sea.

Glacier- a slowly moving mass or river of ice formed by the accumulation and compaction of snow on mountains or near the poles usually containing freshwater.

Oceans/Seas- the whole body of salt water.

Groundwater- water held underground in the soil or in pores and crevices in rock that can either be salt or freshwater.

2. Where can you find frozen water, salt water, and fresh water (not frozen) on Earth?
List one source for each.

Frozen water- North Pole, South Pole, Mountains during winter, Alaska

Saltwater- Atlantic Ocean, Great Salt Lake, Mediterranean Sea, Pacific Ocean, Indian Ocean, Arctic Ocean, Southern Ocean

Freshwater (not frozen)- Mississippi River, Snake River, The Great Lakes

3. What does a heat map show?

The amount of something at a particular location, in this case water on Earth.

4. How can we use heat maps to predict what is happening to Earth's water?

A heat map can show us trends. We can tell how much water was on the earth during a certain year or time of year. It can show us if we are having an impact on the Earth's water.