

# Global Precipitation Measurement Mission

## Water in Earth's Hydrosphere Teacher Guide

### Lesson Overview:

This is an activity that was developed to give participants an understanding of the hydrosphere. In this one-hour long activity, participants learn about the hydrosphere by making observations and taking measurements. They will go outside and use scientific equipment to investigate temperature, pH and transparency of a body of water. They will use this qualitative and quantitative data to understand why it is important to know about the condition of freshwater sources in many places in the natural environment and how these places are connected in the water cycle. The data collection is based on protocols from the GLOBE program, [www.globe.gov](http://www.globe.gov).

### Learning Objectives:

- Describe Earth's hydrosphere using qualitative (words) and quantitative (numbers) data
- Interpret data to assess the condition of water in the hydrosphere
- Explain why it is important to know about the condition of our freshwater resources

### National Standards:

#### *Core Idea ESS2.C: The Roles of Water in Earth's Surface Processes*

- Water continuously cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS-4)

#### *Core Idea ESS2.A: Earth Materials and Systems*

- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produces chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-b) (MS-ESS2-c)

### Background Information:

Water is fundamental to life on Earth. Knowing where and how much rain or snow falls globally is vital to understanding how weather and climate impact both our environment and Earth's water and energy cycles, including effects on agriculture, fresh water availability and responses to natural disasters. The Global Precipitation Measurement

# Global Precipitation Measurement Mission

(GPM) mission, launching in 2014, will help scientists to better understand how much rain and snow falls around the world.

Water is continuously cycling through all Earth systems (the water cycle). The hydrosphere includes all Earth's water. Water is found in oceans, streams, lakes glaciers, soil and air. The hydrosphere interacts with all of Earth's spheres, and water is found in all spheres.

This lesson adapts protocols from the GLOBE Program ([www.globe.gov](http://www.globe.gov)) to help students get hands-on experience collecting scientific data about our hydrosphere so they can better understand the water cycle and why it is important to know the distribution, quantity and quality of water on Earth.

Many background facts can be found in the notes on the PowerPoint slides. These websites and resources may prove useful to get more detailed information. There are additional resources at the end of this lesson plan.

The introduction to the Hydrology Guide from The GLOBE Program  
[http://www.globe.gov/documents/11865/354409/hydro\\_chapintro.pdf](http://www.globe.gov/documents/11865/354409/hydro_chapintro.pdf)

## Materials:

Copies of "Hydrosphere" Student Capture Sheet  
Stream picture (optional)  
thermometer  
pH paper  
clear collection jar

## Engage:

Divide the class into workgroups of 4 students. Give each group a picture of a stream (from a nearby stream if possible) or show the picture on the "Hydrosphere" PowerPoint. Present the scenario (Slide 2): You walk by this stream on your way home from school every day. However, today you notice something different – there are many dead fish in the water. You wonder... what could have caused this? Ask the groups to brainstorm a list of reasons the fish might be dying on their capture sheets. Share ideas as a class.

Show students the introductory slide about the hydrosphere (Slide 3). The hydrosphere is all of Earth's water – in streams, oceans, the ground, the atmosphere, and even frozen water. Water connects all parts of Earth (all spheres) and the water cycle describes this connection and how water moves (Slide 4). Discuss why water is so important (Slide 5). Unfortunately, it is rare to find completely unpolluted water. However, even water that's not completely polluted can support life. You might lead a discussion of what the students think the definition of "polluted" water might be. Lead them to understand that when people add chemicals and other pollutants to the water, it can affect the health of the watershed. You

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might point out that we can't tell if water is polluted simply by looking at it. Thus scientists run tests to gather data to help them determine the health of a body of water. Today our focus is on the condition of a local water body



# Global Precipitation Measurement Mission

on which living things rely. Our mission is to determine what condition the water is in and understand why it's important to collect this information.

## Explore:

Present our scientific question: "How much water is present in the hydrosphere today?" Ask the students if they can identify which components of the water cycle involve the hydrosphere. Let them discuss ideas or share as a class. Then show the animation of the water cycle and narrate the animation as needed to describe the geosphere connection.

Prepare the students to go outside and test the water (Slide 6). Give them the testing equipment and review how to use and care for it. Also, review how and where to collect data (see capture sheet and data collection instructions). Finally, inform the students about how to find their study site and give them a time---keeping device. If they finish early, they could test another site with a different land use.

## Explain:

Gather the groups together (Slide 7) to share and analyze their results. Based on the data collected, have them answer the scientific question, "What is the condition of the water in the hydrosphere today?" using both qualitative and quantitative data. Students should discuss with their group and record their thoughts on the capture sheet. Use the "did you know" sections on the data collection instruction sheet to help interpret data. Remind the students that this data is just for today. They would need to collect this data over many days to get a complete idea of the condition of the water.

## Evaluate:

Discuss the following with the students: list factors that would make a pond in healthy to support fish (Slide 8). Ask the students why it is important to study bodies of water (Slide 9). All the water on Earth is connected though the water cycle. We need to understand our natural waters and have data about how conditions change over time to make better decisions about how we use, manage, and enjoy water resources. Also, water is a limited resource, and we can't simply make more water. The water we have now is the same water that has been on Earth for several billion years, and it is continuously recycled through the water cycle. Therefore, it is vital that we know where and how much rain and snow falls to Earth all over the globe.

Wrap up by sharing a little about NASA's GPM Mission and satellite (Slide 10). Also share the video "Water, Water Everywhere" (Slide 11).

# Global Precipitation Measurement Mission

## Elaborate/Extend:

- Show students the video “Water, Water Everywhere.”  
<http://pmm.nasa.gov/education/videos/water-water-everywhere>
- Compare hydrosphere data in several different bodies of water or locations along the same body of water.
- Conduct other water quality tests from the GLOBE hydrology protocol, like nitrates, phosphates, salinity, dissolved oxygen, etc.  
[http://www.globe.gov/documents/11865/354448/hydro\\_ds\\_invest.pdf](http://www.globe.gov/documents/11865/354448/hydro_ds_invest.pdf)
- Conduct a macroinvertebrate study in your water body.  
<http://www.iwla.org/index.php?ht=a/GetDocumentAction/i/1182>
- Make a secchi disk to test transparency in a more scientific way.  
<http://des.nh.gov/organization/divisions/water/wmb/vlap/documents/secchi.pdf>
- Use a map to discover how your local stream or water body is connected to others in your local watershed.

## Teacher Notes:

This lesson provides students with background information about the hydrosphere, and allows students to go outside and take actual measurements to learn about the condition of the water. The data collection can happen with or without the background information

Choose locations for groups to visit where they can easily access a body of water, preferably freshwater. Groups can all test in the same area, or you can send groups to different locations and compare data.

The data collection is based on GLOBE Program protocols. The GLOBE Program has many training opportunities and offers a wide variety of different opportunities for students to collect authentic data and share it with other students around the world! Go to <http://www.globe.gov> and click “join” to learn more.

## Additional Resources:

- Helpful information, background, and resources about the GPM mission and Precipitation Education <http://pmm.nasa.gov/education/>  
[http://www.nasa.gov/mission\\_pages/GPM/overview/index.html](http://www.nasa.gov/mission_pages/GPM/overview/index.html)
- Background information about the hydrosphere and water cycle  
<http://www.sciencelearn.org.nz/Contexts/H2O-On-the-Go/Science-Ideas-and-Concepts/The-water-cycle>  
<http://www4.uwsp.edu/geo/faculty/ritter/geog101/textbook/hydrosphere/hydrosphere.html>  
[http://www.geography4kids.com/files/water\\_intro.html](http://www.geography4kids.com/files/water_intro.html)