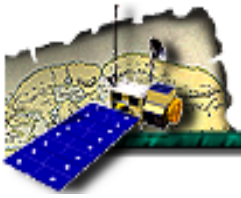

Visit to an Ocean Planet

Earth's Hydrologic Cycle

Overview

The ocean is the key element in Earth's *hydrologic cycle* (water cycle). Students will construct a simple model of the hydrologic cycle to help them visualize and understand the movement of liquid water and heat.

Concepts

- The hydrologic cycle is the continual movement of water from one place to another and from one state of matter to another.
- The hydrologic cycle plays a major role in distributing water and heat around the planet.

Materials

- Glass aquarium
- 3 Thermometers
- Large, shallow bowl
- Permanent marker
- Absorbent paper (paper towels, for example)
- Bright light source
- 4 or 5 Ziplock bags
- Ice
- Water
- Food coloring
- Diagram of the hydrologic cycle

Preparation

This activity can be set up as a demonstration by the teacher or as a small group activity. Final interpretation should be done by the whole class. The effects of this demonstration are more dramatic if a larger aquarium is used.

You might wish to set up the aquariums on one day and begin the observations on the next day. If so, you can leave the light shining overnight.

Procedure

Engagement

Rain and snow bring water to Earth's surface. Where does the water go from there? How does water move around the planet? Will Earth ever run out of water? Write a hypothesis that explains the movement of water between the ocean and the atmosphere.

Activity

Day 1:

1. Draw an indicator line around the top of the bowl (you will fill the bowl with water to this line). If you plan to leave the experiment set up for several days, the indicator line will help you see the amount of evaporation.
2. Spread out the absorbent paper over an area just larger than the size of the aquarium.
3. Fill the bowl with water to the indicator line, and add a drop of food coloring to the water so that it is easier to see the water as it moves through the aquarium. Put the bowl at one end of the paper.
4. Place three thermometers on the paper, one near each end and one in the center. Turn the empty aquarium upside down over the paper. Make sure the aquarium covers the bowl and three thermometers.
5. Shine a bright light down through the glass directly over the bowl of water. Brighter bulbs lead to better results. The light bulb end represents the equator end and the opposite end represents Earth's pole.
6. Leave the light shining over the water bowl overnight.

Day 2:

7. Cover the roof of the aquarium evenly with zip-lock bags of ice. Make sure that the bags are well sealed so that there are no leaks. Wait a few minutes. Add more ice bags if necessary.
8. Check the aquarium every ten minutes. Where do you see water? Is the water moving in the aquarium. Note the water level in the bowl. How much water is in the bowl? Diagram the aquarium and the *condensation* patterns.
9. Record temperatures at each end and in the middle of the aquarium. Note the *evaporation* of water from the bowl, the movement of the water in the aquarium and each thermometer's temperature. Does the temperature *gradient* correlate with the movement of water?

Explanation

What you have observed in your aquarium is a very simple version of Earth's hydrologic cycle. Through the process of *evaporation*, the liquid water became *water vapor*. Water vapor is invisible. As the water vapor cooled at the top of the container, it formed tiny water droplets. This process is called *condensation*, the process of water vapor changing into liquid.

The hydrologic cycle is one mechanism for distributing water and heat on Earth. The oceans play an important role in the cycle. Water evaporates from the ocean and, in some instances, the winds carry the water vapor inland. Eventually, the water vapor cools in the atmosphere and forms tiny water droplets that combine into larger raindrops. Note: This is a very simplified explanation for an extremely complex process.

Extension

The atmosphere interacts with the ocean, which in turn, interacts with the atmosphere. Winds in the atmosphere create ocean waves, and the heat supplied from the ocean warms the atmosphere. Atmospheric patterns determine the oceanic flows, which influences where—and how much—heat is released to the atmosphere. Moreover, atmospheric cloud cover determines by how much—and where—the ocean will be heated.

Atmospheric water vapor is important because heat released by rain fuels atmospheric circulation. Water vapor is also related to sea surface humidity, which controls the transfer of latent heat (heat required for evaporation) from the oceans to the atmosphere. In addition, water vapor is a *greenhouse gas* which affects how the earth retains heat. Monitoring the global water vapor content is thus an important task for understanding the role of the oceans in weather and climate change.

The TOPEX/Poseidon satellite measures atmospheric water vapor with an onboard microwave radiometer. Have your students watch a color-coded data animation showing how atmospheric water vapor changes over time. What factors might cause such changes? They can also see updates to these data on the world wide web: http://topex-www.jpl.nasa.gov.

Links to Related CD Activities, Images, and Movies

Image of *Hydrologic cycle*

Movie of *TOPEX/Poseidon atmospheric water vapor*

Activity *Coastal verses Inland Temperatures*

Vocabulary

condensation	*evaporation*	*gradient*
greenhouse gas	*hydrologic cycle*	*water vapor*

Source

Adapted from the Orange County Marine Institute Curriculum Series.