

4.1 Water Cycle (6.3.1)

Explore This Phenomena



Every school has drinking fountains. You need water. Think about the water that you drink. Where did the water come from before you drank it? Where will it go when you are done with it? How long has the water been here on Earth?

Where do you think the water you are drinking today has been? Draw a model that shows where your water has been.

6.3.1 Water Cycle

Develop a model to describe how the cycling of water through Earth's systems is driven by energy from the Sun, gravitational forces, and density.



In this section, focus on energy. Think about how the transfer of energy drives the motion and cycling of water throughout the water cycle.

The Water Cycle

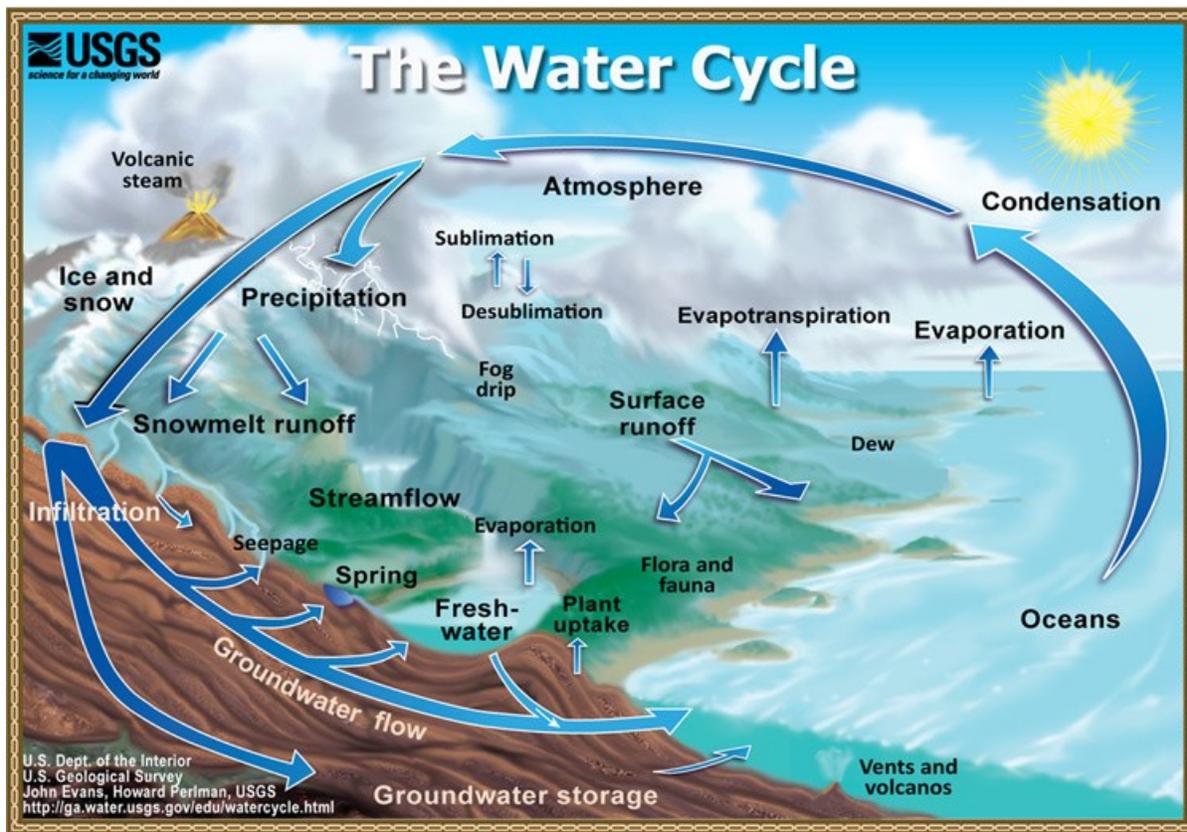
The water molecule found in your glass of water today could have erupted from a volcano early in Earth's history. In the intervening billions of years, the molecule probably spent time in a glacier or far below the ground. The molecule surely was high up in the atmosphere and maybe deep in the belly of a dinosaur. Because of the unique properties of water, water molecules can cycle through almost anywhere on Earth. Where will that water molecule go next?

Water continuously moves between living organisms, such as plants, and non-living things, such as clouds, rivers, and oceans. The water cycle does not have a starting or ending point. It is an endless recycling process that involves oceans, lakes and other bodies of water, as well as the land surfaces and the atmosphere. One possible pathway water could follow is:

- Water evaporates from the surface of the ocean. As the water vapor rises, it collects and is stored in clouds.
- As water cools in the atmosphere it condenses to form clouds. Condensation is when water vapor turns into liquid water.
- Water leaves the atmosphere as precipitation. Precipitation includes rain, snow, hail, and sleet. Precipitation returns the water to the Earth's surface.
- When precipitation falls to the surface, the water can sink into the ground to become part of the underground water reservoir, also known as groundwater. Much of this underground water is stored in aquifers, which are porous layers of rock that can hold water.

Most precipitation that occurs over land is not absorbed by the soil. This water remains on the surface and is called runoff. Runoff collects in streams and rivers and eventually flows back into the ocean.

Water also moves through the living organisms. Plants soak up large amounts of water through their roots. The water then moves up the plant and evaporates from the leaves in a process called transpiration. Another name for transpiration is evapotranspiration. The process of transpiration, like evaporation, returns water back into the atmosphere.



Forces that Drive the Water Cycle

Solar Energy

The Sun provides the energy that drives the water cycle. For water to evaporate it requires an input of energy. The Sun directly impacts the water cycle by supplying the energy needed for evaporation.

Density

As clouds accumulate more water they become more dense. Water will fall from the clouds as precipitation to the surface of the Earth.

Gravity

Clouds will move water from the ocean to the tops of the mountains. Water evaporated from the ocean will be deposited on land as precipitation. Gravity pulls the water down to the oceans where the process continues.

Earth's Water Reservoirs

Water can be found in many different locations on the Earth. It can be found in oceans, clouds, puddles or living things. Each of these locations is called a reservoir.

Oceans

Most of Earth's water is stored in the oceans. In fact, 97% of the Earth's water is in this reservoir. Water can remain in the ocean for hundreds or thousands of years. Or it can evaporate in days or hours.

Atmosphere

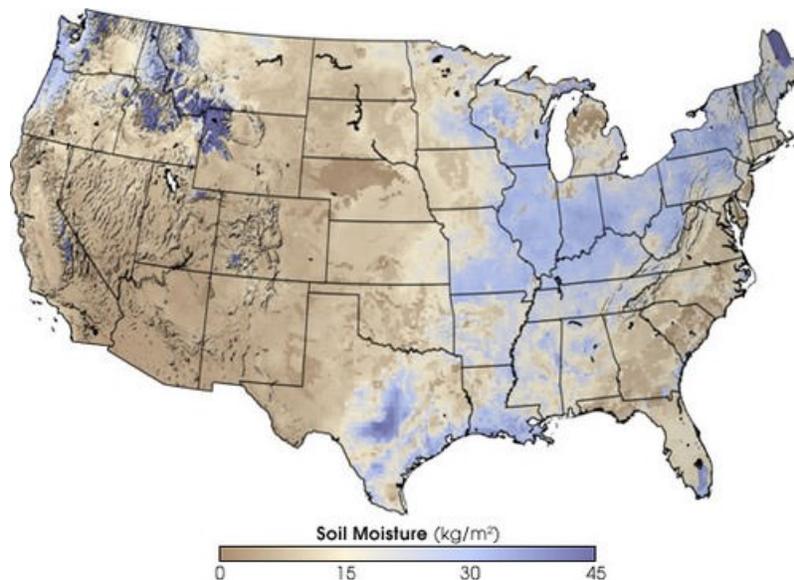
When water absorbs energy it will change from a liquid to water vapor. The Sun's energy can evaporate water from the ocean surface or from lakes, streams, or puddles on land. The water vapor remains in the atmosphere until it condenses to become tiny droplets of liquid. The droplets gather in clouds, which are blown about the globe by wind. As the water droplets in the clouds collide and grow, they fall from the sky as precipitation. Precipitation can be rain, sleet, hail, or snow. Sometimes precipitation falls back into the ocean and sometimes it falls onto the land surface.

Streams and Lakes

When water falls from the sky as rain it may enter streams and rivers that flow downward to lakes and oceans. Water that falls as snow may sit on a mountain for several months. Snow may become ice in a glacier, where it will remain for hundreds or thousands of years. Snow and ice slowly melt over time to become liquid water, which provides a steady flow of fresh water to streams, rivers, and lakes. A water droplet falling as rain could also become part of a stream or a lake. At the surface, the water will eventually evaporate and reenter the atmosphere.

Soil

A significant amount of water seeps into the ground. Soil moisture is an important reservoir for water (Figure below). Water trapped in soil is important for plants to grow.



The moisture content of soil in the United States varies greatly. (From ck12)

Groundwater

Water may seep through dirt and rock below the soil and then through pores infiltrating the ground to go into Earth's groundwater system. Groundwater enters aquifers that may store fresh water for centuries. Alternatively, the water may come to the surface through springs or find its way back to the oceans. Water can remain in this reservoir for hundreds or even thousands of years.

Biosphere

Plants and animals depend on water to live. Plants and animals are another place water is stored. Plants take up water from the soil and release large amounts of water vapor into the air through their leaves in transpiration. Water will move quickly through this reservoir.

Focus Questions:

1. Explain how energy from the Sun affects the movement of water through the water cycle.
2. What is a water reservoir? List 3 examples of water reservoirs.
3. Describe how water can change states as it moves through the water cycle?

Putting It Together



Where do you think the water you are drinking today has been?

Review your initial model, now draw a revised model that shows where your water has been based on what you have learned.