

# The Sun and Water Cycle

## Reflect

The last time you took a shower, did you think about where the water came from? Sure, it came out of the showerhead, but what about before that? The water you used to wash could have spent time in the South China Sea. Or maybe it was part of an ancient glacier at the South Pole.

The water in your shower could have come from anywhere in the world because all of Earth's water is recycled in a process called the water cycle. So just how does water from a glacier halfway around the world find its way to your bathroom?

### How does the Sun move water in the water cycle from the oceans?

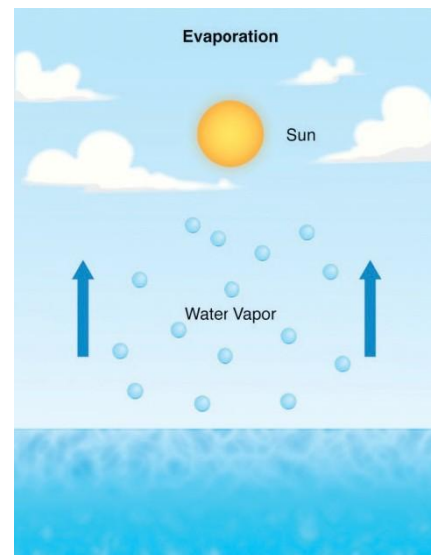
The only substance found on Earth that can exist in all three states of matter is water. Water can be solid ice, a flowing liquid, or gaseous **vapor**. When water moves through the water cycle it changes between these states of matter over and over again. The *water cycle* is the process that water moves through between the air and Earth's surface. The water cycle is powered by heat energy from the Sun.

A cycle is like a circle—it has no beginning and no end. However, we'll start looking at the water cycle in the ocean. Approximately 70% of Earth's surface is covered in ocean water. When water at the ocean's surface is heated by the Sun it gains energy. With enough energy, the molecules of liquid water change into water vapor and move into the air. This process is called evaporation. The water in the ocean is mostly *saltwater*, a mixture of salt and water. When evaporation happens only the water evaporates. The salt is left behind.



The water cycle has no beginning and no end. Water moves continuously from one stage to the next.

**vapor:** the invisible, gas form of water



Energy from the Sun causes water in the oceans to evaporate. The water vapor rises into the air. The salts remain behind.

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## Reflect

Wherever water is heated by the Sun, evaporation can occur. Water evaporates from lakes, rivers, puddles, soil, and even your body. When sweat dries on your skin, it is because the water in sweat has evaporated into the air. You may have noticed that when sweat evaporates off of you, your skin feels and tastes salty. Similar to the oceans, sweat is saltwater. The water evaporates, and the salt is left behind on your dry skin.

## Try Now

When the Sun's energy interacts with ocean water, evaporation takes place. Take a moment to model how this part of the water cycle works. For this activity, you will need:

- Plastic bowl (clear or colored, but not white)
- Salt, eight grams
- Water, 250 milliliters
- Plastic spoon

1. Add the water and the salt to the bowl. Mix them together well with the spoon so they form saltwater.
2. Set the bowl in a warm, sunny place. If possible, place the bowl outside in the Sun. If that's not possible, place it in a sunny spot inside, such as a windowsill.
3. Check the bowl after several hours or the next day. How warm the bowl of water gets will affect how long you should leave it in the sunlight. The warmer the area, the less time you will need.
4. What happened to the water in the bowl? What happened to the salt in the bowl? How does this experiment model what happens in the oceans? Is the water from your bowl part of the water cycle? Where is it now?

### What are the different components of the water cycle?

After water evaporates from the surface of the land, it enters the **atmosphere**. Warm air carries water vapor to the upper parts of the atmosphere. There it begins to cool because of the low temperatures. As water vapor cools, the water particles huddle close together. They form very small droplets of liquid water. The process in which water vapor changes back into liquid water is called *condensation*. Condensation is the opposite of evaporation. The tiny droplets of water eventually collect and form a cloud. When droplets get large enough they can fall to the ground as rain or snow.

**atmosphere:** the layer of gases that surrounds Earth; commonly called "the air"

## Look Out!

Fluffy, white clouds in the sky seem like they are giant puffs of vapor floating in the air. Because they float high above the ground, many people think clouds are gas. But, clouds are actually liquid water. The gas form of water, or water vapor, is invisible. You cannot see water vapor, but you can feel it when you hold your hand above a pot of boiling water or step outside on a humid day. Because you can see clouds, you know they are not water vapor. They are made up of very small droplets of liquid water that have condensed on bits of dust floating in the atmosphere. The same is true of steam and fog.



As water vapor condenses in the atmosphere, the droplets become larger and the cloud gets heavy. When it becomes too heavy, the cloud releases the water droplets. They fall back to Earth as precipitation. There are many types of precipitation including rain, snow, hail, and sleet. Much of the water returns to the ocean and the water cycle begins again.

Water that falls onto land can take many pathways. It may run off the land and collect in lakes, rivers, and puddles. The Sun warms these bodies of water as well, and evaporation takes place. Some precipitation may soak into the ground. When this happens, there is a good chance that a living organism will use it. For example, a plant may absorb water from the soil or an animal may drink from a stream. Living things take in water and can release it as well. Plants release water into the atmosphere through their leaves. Animals release it through sweat and urination. In both cases, the Sun's energy causes the water to evaporate, and the water cycle continues.

## What Do You Think?

Evaporation, condensation, and precipitation are all parts of the water cycle. Look at the pictures of water on the next page. Which process in the water cycle will the water in each picture go through *next*?



## What Do You Think?

### How does the Sun affect weather patterns that move water and form precipitation?

The Sun's energy and the water cycle play important roles in the weather patterns seen on Earth. We have already seen how the water cycle causes weather conditions such as cloud cover, rain, and snow through evaporation, condensation, and precipitation.



When the Sun heats the ocean, it also heats the atmosphere and the land. However, different parts of Earth absorb different amounts of heat. As a result, the air is warmer in some places and cooler in others. Cold air is more dense than warm air, so it sinks closer to the surface of Earth. Warm air rises higher into the atmosphere. As it rises, the warm air cools. As it cools, it becomes more dense and sinks back to the ground. As air moves in the atmosphere, weather patterns change from storms and wind to clear and sunny skies.

Some of the water on Earth is frozen in glaciers and other forms of ice. How can frozen water move through the water cycle with the help of the Sun?

### Looking to the Future: Changes to the Water Cycle

Many scientists agree that the average temperature on Earth is increasing. What does this mean for the water cycle? Rising temperatures will cause an increase in evaporation. This leads to an increase in condensation in the atmosphere. Scientists predict that this will increase overall cloud cover, humidity, and precipitation across the globe.

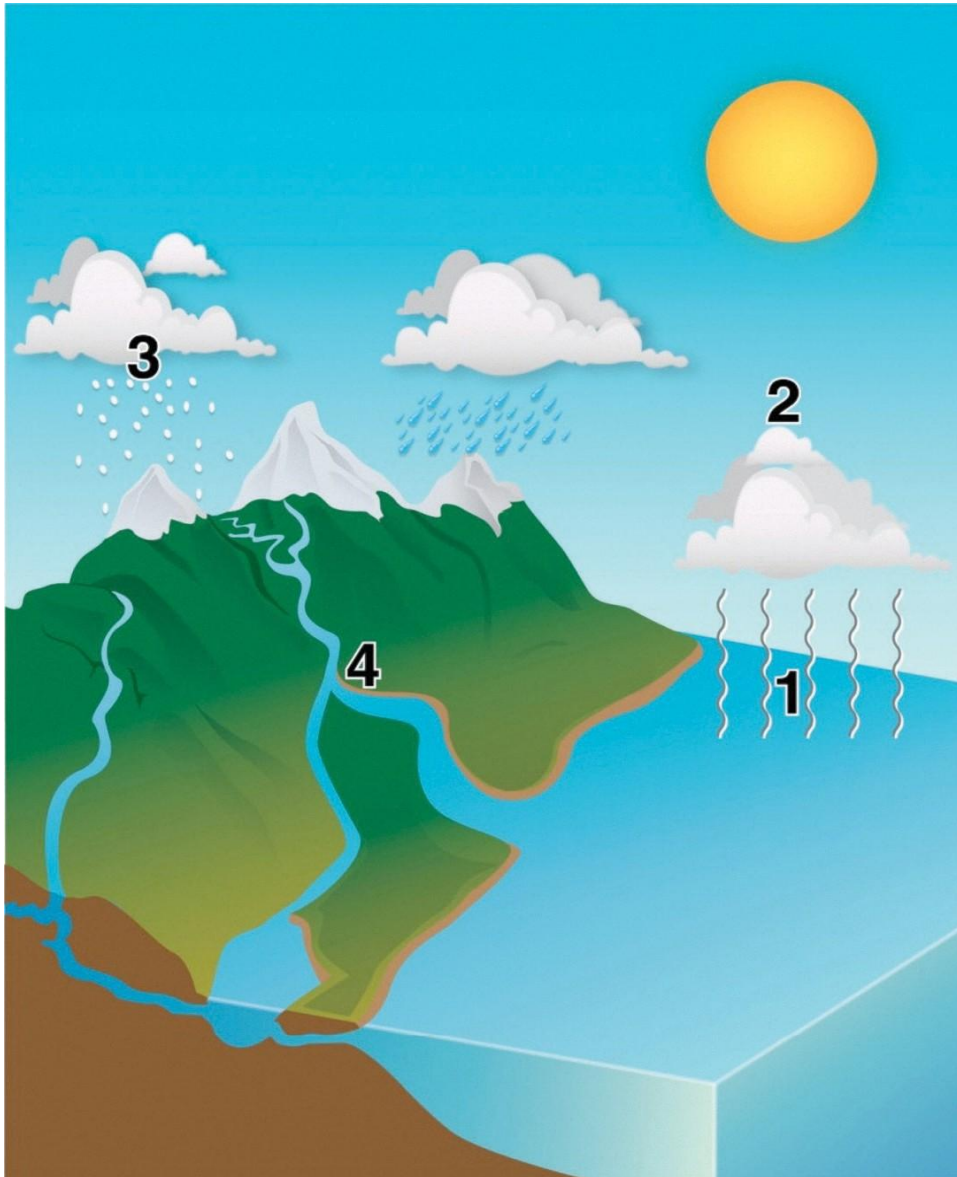
Higher air temperatures also will cause more precipitation to fall as rain. Snow, sleet, and hail result from low air temperatures. Increases in rainfall can cause rivers to overflow and put areas in greater danger of flooding. How else could rising global temperatures affect the water cycle?

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## What Do You Think?

### What do you know?

The Sun's energy powers the water cycle. Water changes state—its temperature increases and decreases as it moves through different stages of the water cycle. Look at the scene from nature shown below. The numbers represent different parts of the water cycle. For each number, describe what is happening in the water cycle. Then draw arrows showing how water moves in a continuous cycle through each process.



### Living in the Water Cycle

To help your child learn more about the water cycle and the Sun, experience it together in nature. Take your child outside with a digital camera or other device that can take pictures. Have your child take a wide variety of pictures from nature that are related to the water cycle. Suggestions include puddles, streams, the ocean, clouds, raindrops, snow banks, sunlight, and the sky. Encourage your child to be creative and to take pictures of unique examples of the water cycle such as soil, leaves, small animals, ice cubes, and people. If possible, have your child take multiple pictures of the same object to form a collage that exemplifies the variety found in nature. You can also have your child find examples of the water cycle inside the home. Suggestions include a steamy mirror, a glass of water, or a pot of boiling water. (Take precaution when children are around hot objects.)

After returning home, print out the pictures. Gather poster board, glue or tape, and some markers. Using the pictures, have your child create a personal poster of the water cycle from your own backyard. Arrange the pictures according to the different stages of the water cycle that they represent. For example, all the cloud pictures could represent condensation. Use the markers to label and describe the parts of the water cycle. Then, have your child present the project to other family members, explaining what he or she learned about the Sun and the water cycle.

Here are some questions to discuss with your child:

- How do you interact with the water cycle every day?
- How does the amount of sunlight affect the water cycle? Does more evaporation take place at night or during the day? Why?
- How does air temperature affect the precipitation stage of the water cycle?