# The Water Cycle

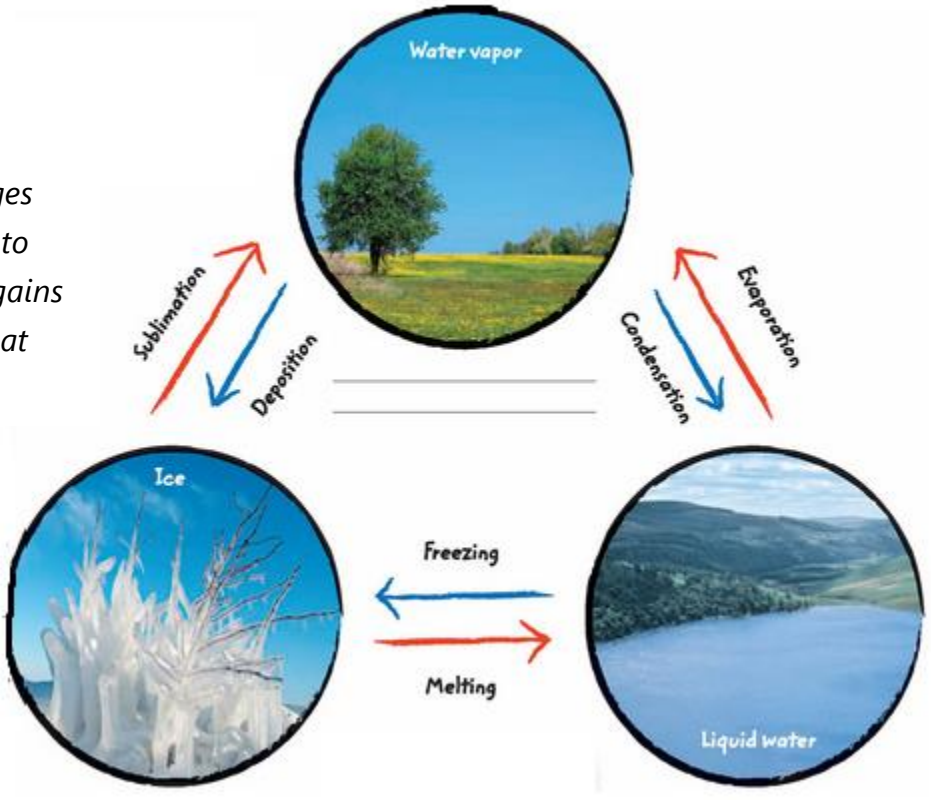
A **cycle** is a series of events that regularly repeat. Because Earth is a system, it has many processes that occur in cycles, over and over again. One very important cycle is the **water cycle.** This is how water is transferred all over the world. Water moves through the atmosphere, the hydrosphere (oceans and other bodies of water), and the lithosphere (both above and below ground). Water even moves through the biosphere - all living things need and use water. All of these different movements make up the water cycle.

You have probably already learned the steps of the water cycle: **evaporation**, **condensation**, **precipitation**, and **runoff**. It is important to realize that water does not travel through the water cycle in the same way every time. There are many different "stops" in the water cycle, and *a single drop of water can travel through the water cycle in many different ways*.

## The Sun – The Engine that Drives the Water Cycle

All cycles involve **change**. And change requires **energy**. The **Sun** provides the energy that "drives" the water cycle. Heat from the Sun can melt ice, producing liquid water. The Sun's heat also causes liquid water to evaporate. Evaporation creates water vapor, a gas that rises into the air. But just as heat from the Sun changes water, so does the absence of heat. If water loses enough heat energy (gets colder), it will freeze and turn into ice, the solid form of water. When water vapor in the atmosphere cools down, it will condense and change back into liquid water, forming clouds. Without the Sun's heat, there would be no water cycle.

*This picture shows how water changes from one form (solid, liquid, or gas) to another. This happens when water gains heat energy (gets hotter) or loses heat energy (gets colder).*

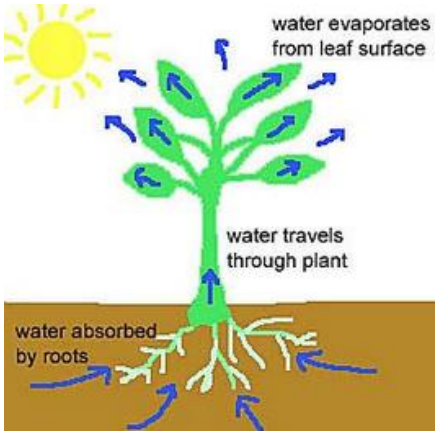


# How Does Water Reach the Atmosphere?

Water rises into the atmosphere in the form of water vapor. Water vapor is a gas, which means that solid or liquid water must receive enough heat energy from the Sun to change into gas. Water can be changed into water vapor and rise into the atmosphere in three main ways:

**Evaporation –** Evaporation happens when heat from the Sun turns liquid water into water vapor (gas). About 90% of the water in the atmosphere comes from evaporation. Most evaporation occurs in the oceans, because they cover so much of Earth's surface. However, any liquid water that receives enough heat energy will evaporate. Water can evaporate from lakes, rivers, streams, swimming pools, puddles of water, and wet soil. Even humans are an example! When we sweat, we release water from pores (holes) in our skin. The sweat evaporates into the air.


**Transpiration** – During the process of photosynthesis, plants release water directly into the atmosphere. The surface of the plant has tiny openings, called stomata. Water leaves the plant through the stomata and rises into the air as water vapor.




**Sublimation** – Sublimation is a rare process in which solid water (ice) can change directly into water vapor (gas). It does NOT have to melt into liquid first. Sublimation can happen when very dry air blows over snow or ice. This causes friction that heats up the ice and turns it directly into water vapor. Glaciers are one example of solid water (ice) that sublimates into water vapor and rises into the atmosphere.

# How Does Water Return to Earth?

How does water leave the atmosphere and return to Earth? There are two steps: **condensation** and **precipitation**.

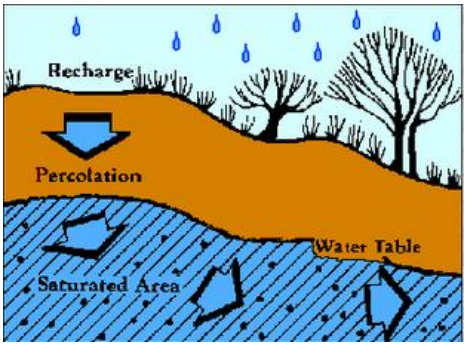
**Condensation -** First, the water vapor **condenses**. **Condensation** is the change of water from gas form to liquid form. When water vapor in the atmosphere loses heat and cools down, condensation happens. As the water vapor cools down and condenses, it attaches to small particles of dust floating in the atmosphere, forming tiny liquid water droplets. These liquid water droplets are so small that they can float in the atmosphere. This is what forms **clouds**! (It is important to understand that clouds are made of liquid water and dust – NOT water vapor!) When condensation occurs on the ground, it forms **dew**. You can see dew on grass early in the morning when temperatures are cool.

**Precipitation -** Up in the clouds, the tiny liquid water droplets collide with other droplets, forming larger and larger drops. Eventually, the drops will become so heavy that they can no longer float in the air. **Gravity** pulls them down, and they fall to the ground as precipitation. **Precipitation** is any form of water that falls to Earth from clouds. Precipitation can occur as liquid rain, or as solid (frozen) snow, sleet, or hail.

# How Does Water Move around Earth's Surface?

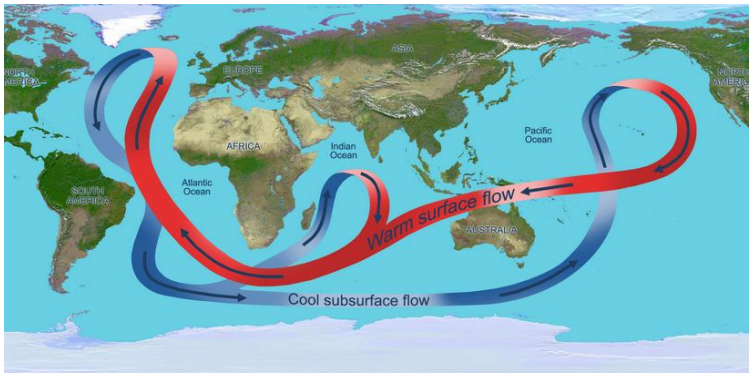
Once water falls back to Earth as precipitation, it moves all around Earth's surface. Because of the downward pull of **gravity**, water always flows downhill. And because Earth's surface is uneven, water is always moving around. There are four main ways that water moves around Earth:

**Runoff** and **Surface Water** – Moving water that flows around Earth's surface is called **runoff**. Streams and rivers are examples of runoff. Runoff will always flow downhill (pulled by **gravity**), until it eventually reaches an ocean, lake, or other large body of water. Runoff is the reason that oceans don't run out of water. Any water that is found on Earth's surface is called **surface water.**




**Infiltration** and **Groundwater**– Some water stays on Earth's surface as surface water. But water can also soak into the ground as it is pulled by **gravity**. This is called **infiltration**. Once water is beneath Earth's surface, it is called **groundwater**. Groundwater can seep through tiny openings in soil and rocks. Large amounts of groundwater can be found in underground rock aquifers. Aquifers are like natural water storage containers underground.

**Iceflow** – Much of Earth's ice is stored in large ice caps at the North and South poles. Other ice is stored in **glaciers** found high up in mountains all over Earth. Glaciers cover about 10% of Earth's surface. Just like liquid water, ice gets pulled downhill by **gravity**. Glaciers are often called "rivers" of ice, because they move slowly downhill as they are pulled by gravity. Some glaciers reach the ocean, where they break off into the water and become icebergs.




**Ocean Currents** – Ocean currents move large amounts of water around Earth. Some ocean currents are caused by **wind** that pushes along the surface of the water. Other ocean currents are formed by **convection currents**, which are caused by temperature differences in the water. Water is always moving in ocean currents.