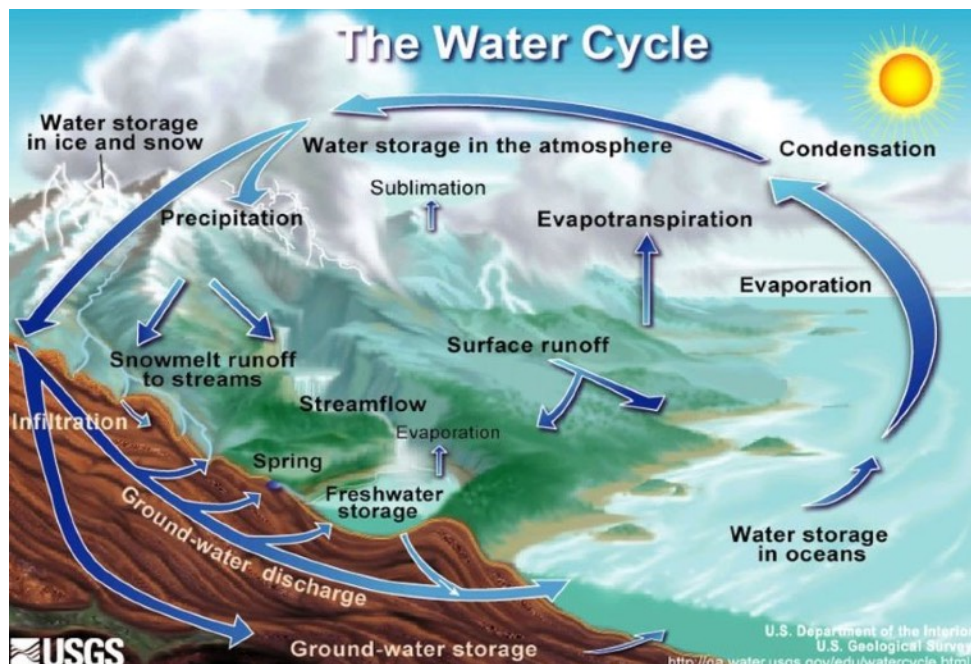


The Water Cycle and How Climate Change Affects It

Introduction

The water cycle describes how water vapour evaporates from the surface of the earth, rises into the atmosphere, cools and condenses in clouds, and then precipitates as rain or snow. The evaporation phase purifies water because it causes salts and other solids picked up during the cycle to be left behind. Transpiration, a vital part of the water cycle, is the process where plants release water vapour into the atmosphere. The precipitation phase replenishes the land with freshwater. The flow of liquid water and ice on the Earth's surface transports minerals across the globe. It also reshapes the geological features of the Earth through processes like erosion and sedimentation. The water cycle is essential for the maintenance of most life and ecosystems on the planet.



The Water Cycle

(From the United States Dept. of Interior – USGS)

Water Storage

Oceans store 96% of all water on Earth. Ocean water is saline; on land, there are some saline lakes. The rest of the Earth's water is fresh. Fresh water is stored in liquid form in lakes, artificial reservoirs, rivers, and wetlands. Water is also stored in solid, frozen form in ice sheets, glaciers, and snow packs at high elevations or near Earth's poles. Water vapour is a gas and is stored in the Earth's atmosphere. In the soil, frozen water is stored as permafrost and liquid water is stored as soil moisture. Deeper below ground, liquid water is stored as groundwater in aquifers. Water in groundwater aquifers is found within cracks and pores in the rock.

The Effects of Climate Change on the Water Cycle

Evaporation

Warmer air can hold more moisture than cool air. As a result, in a warmer world, the air takes up more water from oceans, lakes, soil, and plants. The drier conditions this air leaves behind could negatively affect drinking water supplies and agriculture. On the other hand, the warmer, wetter air could also endanger human lives. A study from Columbia University's Lamont-Doherty Earth Observatory found that higher humidity will make future higher temperatures unbearable in some places, by blocking the cooling effects of our sweat.

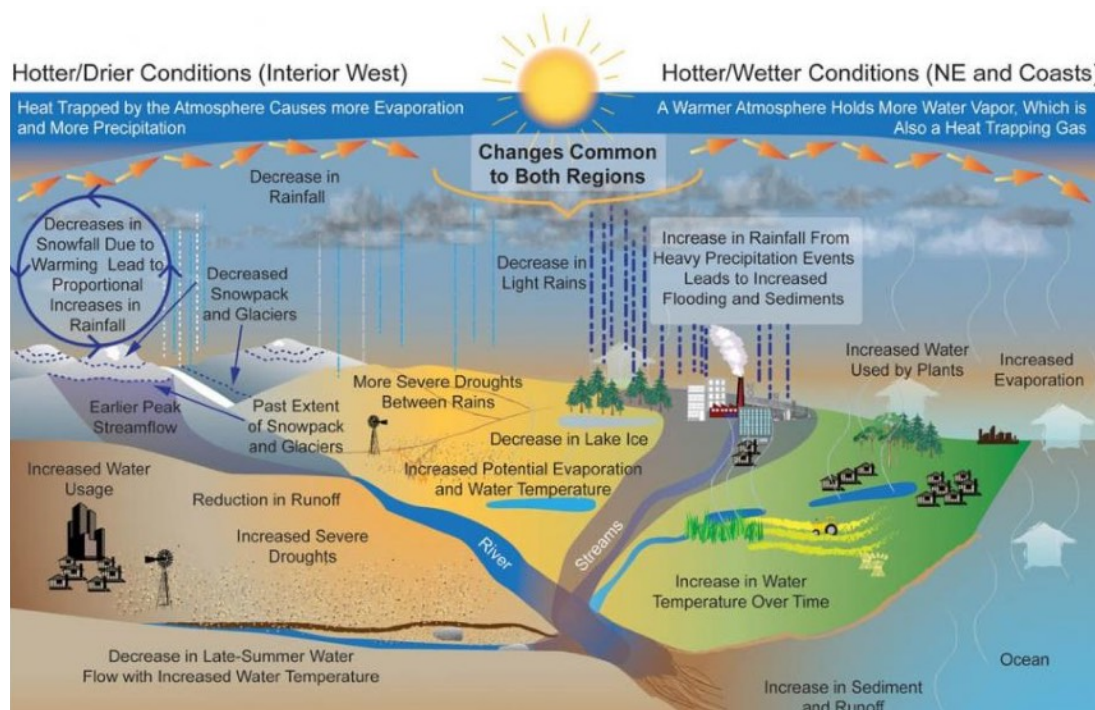
Precipitation

When extra warm, extra wet air cools, it drops additional rain or snow to the ground. Thus, a warmer world means heavier rain and snowstorms. By changing air temperatures and circulation patterns, climate change will also change where precipitation falls. Some areas have and will receive more rainfall and other areas less.

Researchers at the Earth Institute have found that climate change may already have exacerbated past and present droughts, and that drier conditions are contributing to more frequent and more severe wildfires.

Other Effects

- Water quality: Increased runoff of pollutants and sediment, and saltwater intrusion can decrease water quality.
- Sea level rise: Rising sea levels can contaminate freshwater aquifers and estuaries with saltwater, making them unfit for consumption and agriculture.
- Floods and droughts: Climate change can increase the frequency and intensity of floods, and increase drought in areas that receive less rain and snow.
- Ocean currents: Warming of the ocean can make the water less likely to sink, which could alter ocean currents.
- Water availability: Combined, the above effects can decrease water availability. As a result, droughts occur, causing food scarcity and undernourishment.



Global Strategies to Protect Water

- Healthy aquatic ecosystems and improved water management can lower greenhouse gas emissions and provide protection against climate hazards (Water and Climate Coalition).
- Wetlands such as mangroves, seagrasses, marshes, and swamps are highly effective carbon sinks that absorb and store CO₂, helping to reduce greenhouse gas emissions (UNEP).
- Wetlands also serve as a buffer against extreme weather events (UNEP). They provide a natural shield against storm surges and absorb excess water and precipitation. Through the plants and microorganisms that they house, wetlands also provide water storage and purification.
- Early warning systems for floods, droughts and other water-related hazards provide a more than tenfold return on investment and can significantly reduce disaster risk: a 24-hour warning of a coming storm can cut the ensuing damage by 30 per cent (WMO).
- Water supply and sanitation systems that can withstand climate change could save the lives of more than 360,000 infants every year (New Climate Economy report).
- Climate-smart agriculture using drip irrigation and other means of using water more efficiently can help reduce demand on freshwater supplies.
- Unconventional water resources, such as regulated treated wastewater, can be used for irrigation and industrial and municipal purposes. Safely managed wastewater is an affordable and sustainable source of water, energy, nutrients and other recoverable materials.
- In many places, groundwater is over-used and polluted; in other places, it is an unknown quantity. Exploring, protecting and sustainably using groundwater is central to adapting to climate change and meeting the needs of a growing population.

