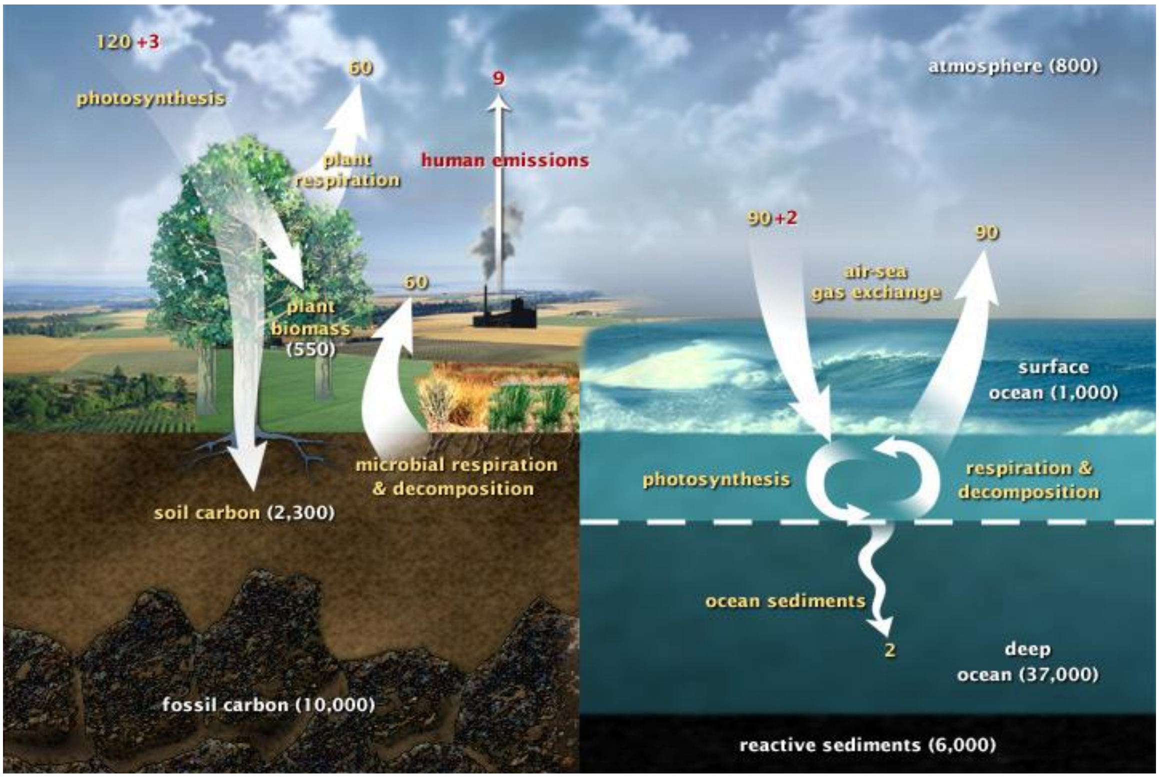
Carbon cycle

The **carbon cycle** is the biogeochemical cycle by which carbon is exchanged among the biosphere, pedosphere, geosphere, hydrosphere, and atmosphere of the Earth. Along with the nitrogen cycle and the water cycle, the carbon cycle comprises a sequence of events that are key to making the Earth capable of sustaining life; it describes the movement of carbon as it is recycled and reused throughout the biosphere.

The *global carbon budget* is the balance of the exchanges (incomes and losses) of carbon between the carbon reservoirs or between one specific loop (e.g., atmosphere ↔ biosphere) of the carbon cycle. An examination of the carbon budget of a pool or reservoir can provide information about whether the pool or reservoir is functioning as a source or sink for carbon dioxide.

The carbon cycle was initially discovered by Joseph Priestley and Antoine Lavoisier, and popularized by Humphry Davy.



This diagram of the fast carbon cycle shows the movement of carbon between land, atmosphere, and oceans in billions of tons of carbon per year. Yellow numbers are natural fluxes, red are human contributions in billions of tons of carbon per year. White numbers indicate stored carbon.

Main components

The global carbon cycle is now usually divided into the following major reservoirs of carbon interconnected by pathways of exchange:

- The atmosphere
- The terrestrial biosphere
- The oceans, including dissolved inorganic carbon and living and non-living marine biota
- The sediments, including fossil fuels, fresh water systems and non-living organic material, such as soil carbon
- The Earth's interior, carbon from the Earth's mantle and crust. These carbon stores interact with the other components through geological processes

Carbon pools in the major reservoirs on earth.[2]

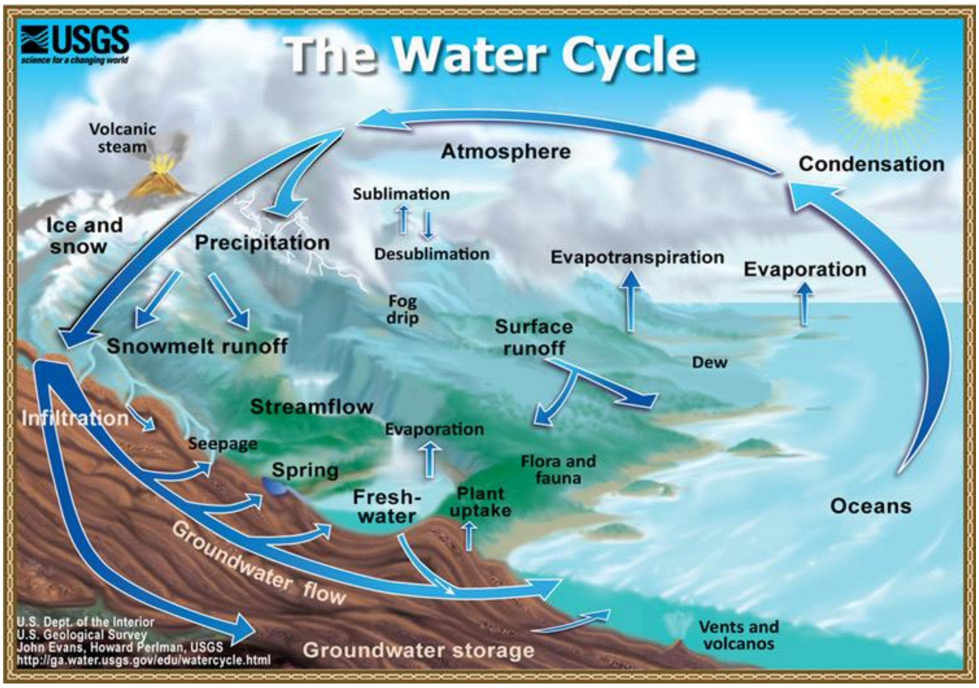
Pool	Quantity (gigatons)
Atmosphere	720
Oceans (total)	38,400
Total inorganic	*37,400*
Total organic	1,000
Surface layer	670
Deep layer	36,730
Lithosphere	
Sedimentary carbonates	> 60,000,000
Kerogens	15,000,000
Terrestrial biosphere (total)	2,000
Living biomass	600 - 1,000
Dead biomass	1,200
Aquatic biosphere	1 - 2
Fossil fuels (total)	4,130
Coal	3,510
Oil	230
Gas	140
Other (peat)	250

The carbon exchanges between reservoirs occur as the result of various chemical, physical, geological, and biological processes. The ocean contains the largest active pool of carbon near the surface of the Earth. The natural flows of carbon between the atmosphere, ocean, and sediments is fairly balanced, so that carbon levels would be roughly stable without human influence.

Water cycle

The **water cycle**, also known as the **hydrologic cycle** or the **H_2O cycle**, describes the continuous movement of water on, above and below the surface of the Earth. The mass water on Earth remains fairly constant over time but the partitioning of the water into the major reservoirs of ice, fresh water, saline water and atmospheric water is variable depending on a wide range of climatic variables. The water moves from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere, by the physical processes of evaporation, condensation, precipitation, infiltration, runoff, and subsurface flow. In so doing, the water goes through different phases: liquid, solid (ice), and gas (vapor).

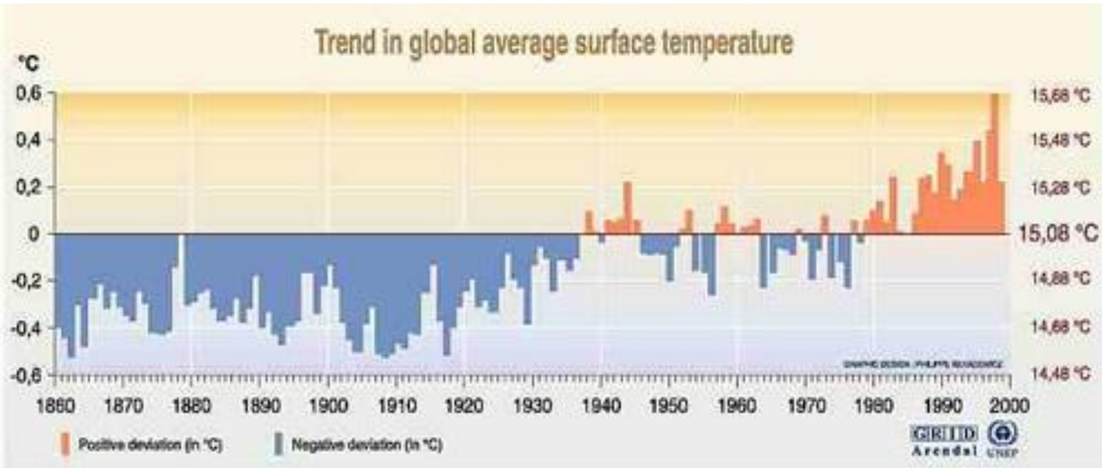
The water cycle involves the exchange of energy, which leads to temperature changes. For instance, when water evaporates, it takes up energy from its surroundings and cools the environment. When it condenses, it releases energy and warms the environment. These heat exchanges influence climate. The evaporative phase of the cycle purifies water which then replenishes the land with freshwater. The flow of liquid water and ice transports minerals across the globe. It is also involved in reshaping the geological features of the Earth, through processes including erosion and sedimentation. The water cycle is also essential for the maintenance of most life and ecosystems on the planet.



Weather & Climate Change

What Is Climate and Climate Change?

Our weather is always changing and now scientists are discovering that our climate does not stay the same either. Climate, the average weather over a period of many years, differs in regions of the world that receive different amounts of sunlight and have different geographic factors, such as proximity to oceans and altitude.



This graph shows the amount of difference between each year's global average temperature and the overall average (15.08°C) since 1860. The upward trend since the early 1990s indicates global warming.

Courtesy GRIDA/UNEP

Climates will change if the factors that influence them fluctuate. To change climate on a global scale, either the amount of heat that is let into the system changes, or the amount of heat that is let out of the system changes. For instance, warming climates are either due to increased heat let into the Earth or a decrease in the amount of heat that is let out of the atmosphere.

The heat that enters into the Earth system comes from the Sun. Sunlight travels through space and our atmosphere, heating up the land surface and the oceans. The warmed Earth then releases heat back into the atmosphere. However, the amount of sunlight let into the system is not always the same. Changes in Earth's orbit over thousands of years and changes in the Sun's intensity affect the amount of solar energy that reaches the Earth.

Heat exits the Earth system as the Earth's surface, warmed by solar energy, radiates heat away. However, certain gases in our atmosphere, called greenhouse gases, allow the lower atmosphere to absorb the heat radiated from the Earth's surface, trapping heat within the Earth system. Greenhouse gases, such as water vapor, carbon dioxide, methane and nitrous oxide, are an important part of our atmosphere because they keep Earth from becoming an icy sphere with surface temperatures of about 0°F. However, over the past century or so the amounts of greenhouse gases within our atmosphere have been increasing rapidly, mainly due to the burning of fossil fuels, which releases carbon dioxide into the atmosphere. Consequently, in the past one hundred years global temperatures have been increasing more rapidly than the historic record shows. Scientists believe this accelerated heating of the atmosphere is because increasing amounts of these greenhouse gases trap more and more heat.

Complicating Factors

There are many different factors that complicate this system, including clouds, volcanic eruptions, oceans, and people. Additionally, there are likely factors that affect climate which we have yet to identify. Factors interact, resulting in global cooling, global warming, or even contributing to both. Find out more about some of these processes by clicking on the link above.