

Hydrosphere

Hydrosphere comprises all the water that is present in the oceans, seas, rivers, lakes, glaciers, snow, in the soil, rocks and in the atmosphere. Earth's total water reserves are **1386 mil. km³**. **Reserves** in the particular parts of hydrosphere differ from one to another. Major part of water on the earth is sea (salt) water, the rest, **2,53% is fresh water**.

Water distribution in %:

Reservoir	Volume (million cubic km)	Percent of total	Reservoir	Average Residence Time
Oceans	1370	97.25	Glaciers	20 to 100 years
Ice Caps and Glaciers	29	2.05	Seasonal Snow Cover	2 to 6 months
Groundwater	9.5	0.68	Soil Moisture	1 to 2 months
Lakes	0.125	0.01	Groundwater: Shallow	100 to 200 years
Soil Moisture	0.065	0.005	Groundwater: Deep	10,000 years
Atmosphere	0.013	0.001	Lakes	50 to 100 years
Streams and Rivers	0.0017	0.0001	Rivers	2 to 6 months
Biosphere	0.0006	0.00004		

The water cycle

Technically known as the **hydrologic cycle** is the circulation of water within the earth's hydrosphere, involving changes in the physical state of water between liquid, solid, and gas phases. The *hydrologic* cycle refers to the continuous exchange of water between atmosphere, land, surface and subsurface waters, and organisms. In addition to storage in various compartments (the ocean is one such "compartment"), the multiple cycles that make up the earth's water cycle involve five main physical actions: evaporation, precipitation, infiltration, runoff, and subsurface flow:

Evaporation is the transfer of water from bodies of surface water into the atmosphere. This transfer entails a change in the physical nature of water from liquid to gaseous phases. Along with evaporation can be counted transpiration from plants, as well as, to a lesser degree, perspiration from land mammals. Thus, this transfer is sometimes referred to as **evapotranspiration**. 90% of atmospheric water comes from evaporation, while the remaining 10% is from transpiration.

Precipitation is atmospheric moisture that has previously condensed to form clouds (changed from the gas phases to a liquid or solid phase), falling to the surface of the earth. This mostly occurs as rainfall, but snow, hail, fog drip, and other forms participate as well.

Interception is precipitation trapped by vegetation instead of falling directly onto the soil.

Infiltration into the ground is the transition from surface water to groundwater. The infiltration rate will depend upon soil or rock permeability as well as other factors. Infiltrated water may reach another compartment known as groundwater (i.e., an aquifer). Groundwater tend to move slowly, so the water may return as surface water after storage within an aquifer for a period of time that can amount to thousands of years in some cases. Water returns to the land surface at lower elevation than where it infiltrated, under the force of gravity or gravity induced pressures.

Runoff includes the variety of ways by which land surface water moves down slope to the oceans. Water flowing in streams and rivers may be delayed for a time in lakes. Not all precipitated water returns to the sea as runoff; much of it evaporates before reaching the ocean or reaching an aquifer.

Subsurface flow incorporates movement of water within the earth. After infiltrating, subsurface water may return to the surface or eventually seep into the ocean.

World Ocean

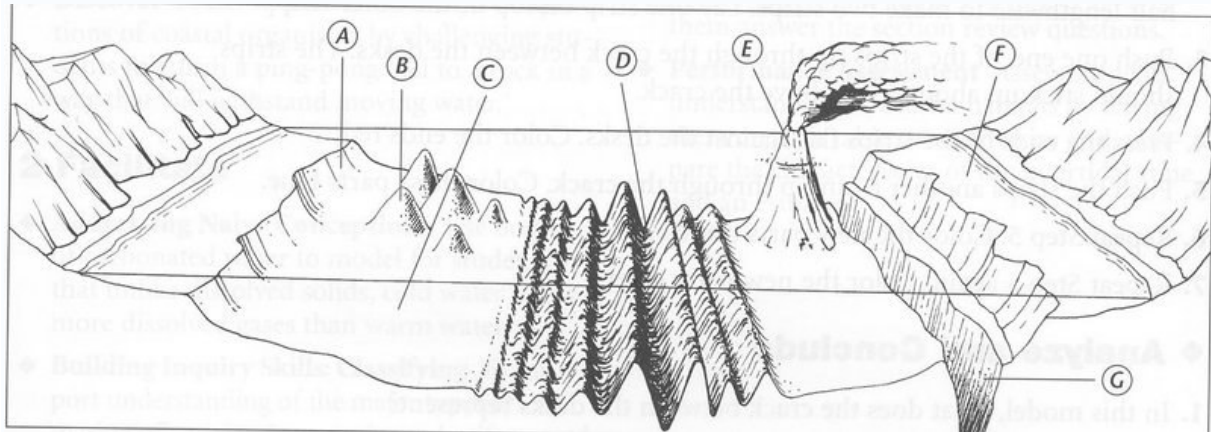
71% of earth's surface is covered by World Ocean. **Average depth is approximately 3700 m**. daily temperature fluctuations are noticeable to the depth of 30 m and those on a year basis up to 300 m. World ocean is divided by the land into **4 oceans** (Pacific, Atlantic, Indian and Arctic) and many shallow seas. Even some inland lakes with no connection with World Ocean are referred as seas. This is the case of Caspian and Dead Sea.

Ocean is characterised by its own water regime, creation and shape of the ocean floor. It has its own water masses with characteristic properties and its own sediment system. The difference between the ocean and the sea is

that seas have salinity influenced by water from rivers, then there are sediments brought by rivers and seas have its own circulation pattern. We know few types of seas: **marginal seas** - part of ocean partially enclosed by land such as islands, archipelagos, or peninsulas. (Arabian sea) **inland sea** - shallow sea that covers central areas of continents during high stands of sea level that result in marine incursions (Dead sea). And the third one is inter-island (medziostrovné) sea. (Caribbean Sea)

Oceanic and Sea floor relief

Extending out from a continent's edge is a gently sloping, shallow area called the **continental shelf (F)**. At the edge of the shelf, the ocean floor drops off in a steep incline called the **continental slope (A)**. The continental slope marks the true edge of the continent, where the rock that makes up the continent stops and the rock of the ocean floor begins. Beyond this slope is the **abyssal plain (C)**, a smooth and nearly flat area of the ocean floor. In some places, deep, steep-sided canyons called **trenches (G)** cut into the abyssal plain (the deepest is Mariana trench - 11 034m in the Pacific ocean, Puerto Rico trench - 8 648m in the Atlantic ocean, Java Trench - 7 725 in the Indian ocean, Eurasian Basin - 5 450 m in the Arctic ocean). A continuous range of mountains called the **mid-ocean ridge (D)** winds around Earth. There are mountains on the abyssal plain, too. Some reach above the ocean surface to form **volcanic islands (E)**. Others, called **seamounts (B)**, are completely under water.



Physical and chemical properties of water in the oceans and seas

Temperature of World Ocean defines the best the relation between hydro and atmosphere. We can notice similar zonality like in the atmosphere. There is region of the highest average temperatures (over 26°C) located northwards of the equator. This is because of the influence of the Antarctica and also because of the warm oceans currents flowing from south to north hemisphere. Observable differences are also between east and west parts of the oceans also because of ocean currents. The biggest differences are in the areas of tropics and northwards of the northern latitude of 35°.

Salt water contains all known chemical elements. Composition and properties of salt water are thou influenced mainly by salts. Total amount of salts in the 1 kg of water is expressed by salinity (‰). Average salinity of World Ocean is 35‰. Salinity is influenced by evaporation, precipitation, inflow of river water, freezing and melting of water, vertical mixing and horizontal transfer of sea water.

Sea water: water – 96,5%
salinity – 3,5% :chlorine – 55%

sodium – 30%
sulphur – 7,7 %
magnesium - 3,3%
other – 4%

Salinity is rising in the areas of hot and dry climate – red sea 40‰

And is decreasing in rainy areas and in river estuaries – black sea 22‰, Baltic Sea 11‰

Movement of oceanic and sea water

Never ending movement of World Ocean is due to 3 basic types of influential forces.

Cosmic influences (gravitational forces of The Sun and The Moon) they cause low and high tide

physical and mechanical influences (solar radiation, air circulation) they cause surge (příboj) and ocean currents

Geodynamic influences (tectonic movement of ocean crust) they cause Tsunamis

Basic movements of sea water are: **low tide and high tide, waves** - free, wind based, **surge and tsunami**; and **currents** - surface, deep, ascending and descending.

Ocean currents can be divided into warm and cold according to their temperature. Warm are Gulf stream, Kuro-Shio, Brazil current. They move from the equator to the poles. Cold ones are Canary, Oja-Shio, Labrador current. They bring cold water to the equator.

Pollution of oceans and seas

The most dangerous is pollution by oil products (1 tone of oil can create impermeable layer on the surface of 10 Km²) and the deposition of nuclear waste containers at the sea floor. There are more than 100 000 containers nowadays.

Threat poses also pollution of coastal waters by sewage.

Surface water

It comprises all the water that is in the surface flows, lakes, artificial tanks, marshes, icebergs, snow and underground water.

Basin is the area from which the main stream with its tributaries carries away the water, both surface and underground. Border between basins is called **watershed**.

The Longest rivers - length in km / basin in km²

Nile - 6670 / 3 349 000

Amazon - 6570 / 6 000 000

Yangtze - 6300 / 1 808 000

Mississippi-Missouri

Yenisey-Angara

Ob-Irtysh

Lakes and artificial water tanks

Lake is a natural depression in the Earth's crust partially or fully filled by water. Lakes are divided according to their origin into Tectonic (created by the depression of Earth's crust along the faults (zlomov)). Glacial, Volcanic (in craters of the volcanoes).

largest lakes - area in km² / depth in m

Caspian sea - **386 400 / 1025**

Upper lake - **82 100 / 405**

Lake Victoria

Huron Lake

Michigan Lake

Lake Baikal is the deepest - 1620 m.

Glaciers and permanent snow cover

Glaciers are the biggest source of fresh water. Current area of glaciers is more than 16,2km² and it contains 24 mil. km³. The Largest ones are continental glaciers (Antarctica, Greenland). Smaller ones can be found in the high altitudes over the snow line (mountains).

Underground water

it is water that is present under the Earth's surface. It is created either by the infiltration of rainfall or by condensation of water vapour in the rocks. It is divided into water in soils and underground water.