

**Hydrology** is the study of the movement, distribution, and quality of water throughout the Earth, and thus addresses both the hydrologic cycle and water resources.

Domains of hydrology: hydrometeorology, surface hydrology, hydrogeology, watershed management and water quality.

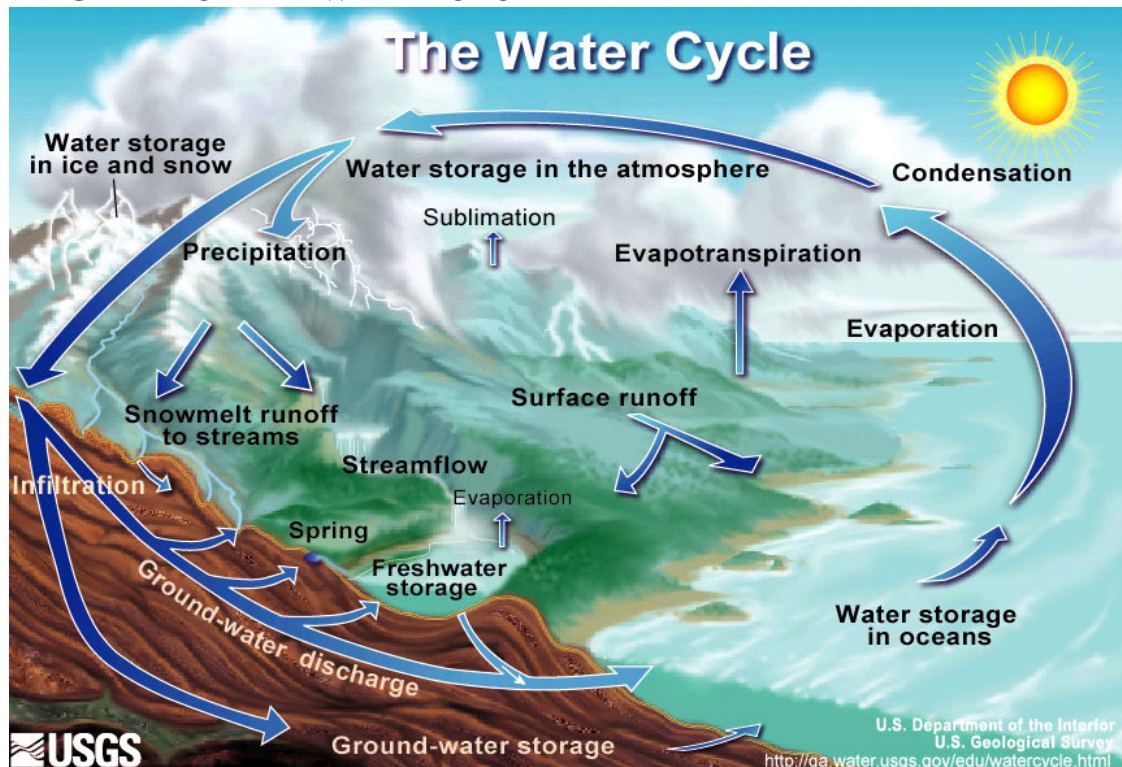
### **Hydrological cycle**

The central theme of hydrology is that water moves throughout the Earth in different ways and at different rates. The most vivid image of this is in the evaporation of water from the ocean, which forms clouds. These clouds drift over the land and produce rain. The rainwater flows into lakes, rivers, or aquifers. The water in lakes, rivers, and aquifers then either evaporates back to the atmosphere or eventually flows back to the ocean, completing a cycle.

Terms used in the cycle:

- **Condensation** is the accumulation of water vapor in the air to form clouds that will do precipitation.
- **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. ( similar to plant transpiration from plants and perspiration from living things)
- **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). Groundwaters 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, either within the vadose zone or aquifers. After infiltrating, subsurface water may return to the surface or eventually seep into the ocean.

## DIAGRAM FOR THE WATER CYCLE



### Basin hydrological cycle

The basin hydrological cycle is used when studying rivers. It is an **open system**. The main input is precipitation which is regulated by various means of storage. Outputs include channel run off, evotranspiration and groundwater outflow.

The groundwater zone is normally divided into a **zone of saturation** in which the underground water fills all the spaces in the rock, and a **zone of aeration** above it, in which the water does not fully saturate the pores. The **water table** divides one zone from the other. **Aquifers** are rocks that hold water. They provide the most important store of water and regulate hydrological cycle.

Water can flow through a basin in a number of ways. **Overland flow** occurs in two main ways: when precipitation exceeds the infiltration rate, and when the soil is **saturated**. But **Throughflow** refers to water flowing through the soil in natural pipes and **percolines** (lines of concentrated water flow between soil horizons). **Baseflow** and **interflow** refer to the movement of water within the zone of aeration and within the zone of saturation.

### Rivers

A **river** is a large natural waterway. The source of a river may be a lake, a spring, or a collection of small streams, known as headwaters. From their source, all rivers flow

downhill, typically terminating in the ocean. The mouth, or lower end of a river is known as its base level. A river's water is normally confined to a channel, made up of a stream bed between banks. Most rainfall on land passes through a river on its way to the ocean. Smaller side streams that join a river are tributaries. The scientific term for any flowing natural waterway is a stream; so in technical language, the term river is just a shorthand way to refer to a large stream.

River has three main roles: - to erode the river channel – to transport material – to create new erosional and depositional landforms. The speed of the river water depends on the slope and basin characteristics ( increased or decreased friction)

### ***Drainage basins***

A drainage basin is an area within which water supplied by precipitation is transferred to ocean, a lake or a larger stream. It includes all the area that is drained by a river and its tributaries. Drainage basins are divided by a **watershed** - an imaginary line that separates adjacent basins.

(Drainage patterns are explained with pictures in the book Advanced Geography, p.86)

This is an average measurement.( world's ten longest rivers)

1. Nile (6,690 km)
2. Amazon (6,452km)
3. Yangtze (Chang Jiang) (6,380 km)
4. Mississippi-Missouri (6,270 km)
5. Ob-Irtysh (5,570 km)
6. Huang He (Yellow) (5,464 km)
7. Amur (4,410 km)
8. Congo (4,380 km or 4,670 km). (The source of this river is disputed.)
9. Lena (4,260 km)
10. Mackenzie (4,240 km)

### **River regime**

Groundwater regulates the flow of a river and supplies water to it between periods of rain. The river regime depends on four factors:

- amount and intensity of rain
- infiltration capacity of soil and rock
- morphology of the basin
- vegetation

The river regime can be influenced by further more factors as deforestation or dam building is.

Effect of deforestation on hydrology in bullet points:

- organic material is decomposed at faster rate
- rain drop impact increases
- evapotranspiration rates decrease
- overland run-off increases

Advantages of building a dam:

1. flood and drought control (also in Slovakia, Nile, Huang He)

2. irrigation ( Aswan, fertile crescent locality)
3. hydro-electric power production
4. recreation and tourism

Disadvantages of building a dam:

1. water losses – the dam provides less water than expected
2. ground water changes
3. displacement of population or flooding of unique locality ( e.g. Aswan)
4. seismic stress – build up by the mass pressure of water onto the dam basin
5. deposition of sediments – within the dam millions of tones of sediments are deposited annually

... and many other differed from the locality the dam is build in.

## **Lakes**

Lake is a natural water reservoir, that occur in crust lower lands. Basins as the beds for lakes can be of various types. Tectonic (Baikal, Tanganyika), glacial (plesa), volcanic – the craters of inactive volcanoes ( Ukerewe), or mixed type.

Lakes are water reservoirs and no salt lakes are concentrated to the three main regions of North America ( 25%), East African lakes ( 22%) and lake Baikal (18%)

Salt lakes are mainly in hot climatic zones when evaporation exceeds precipitation. These lakes often change their area during the annum. Biggest lake is Caspian Sea, the most salty is Dead Sea with salinity of 24.5 %.

## **Ice**

Water in the form of ice is accumulated in two types of ice forms: glaciers and icebergs. (1.7% of total hydrosphere account)

Glaciers can be further divided into mountain and continental glaciers. Icebergs are huge ice pieces floating in the sea mainly around the polar caps.

Continental glaciers: Antarctica, Greenland

Mountain glaciers: occur above the snow lane ( Alps, Himalayas, Andes)