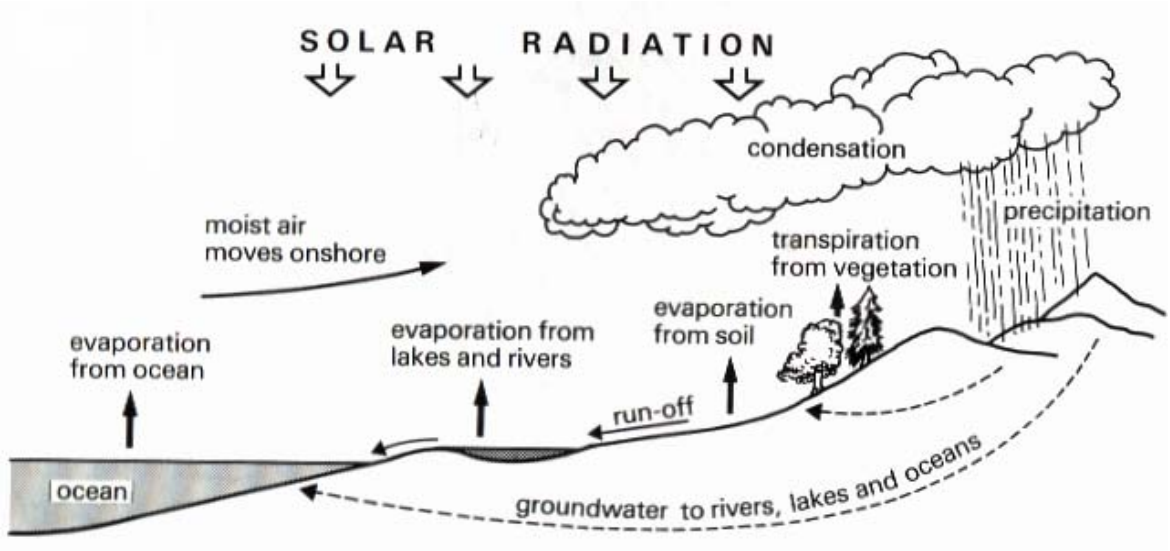
AS Geography 1.2 Fluvial Environments *Student Notes*

1. The Hydrological Cycle is a System

- **The global hydrological cycle (inputs, outputs, stores and flows) and the drainage basin cycle to include evapotranspiration, condensation, precipitation, surface runoff, groundwater flow, evaporation, transpiration, infiltration and percolation.**

You need to be familiar with the hydrological cycle as a closed system. In a closed system only energy (not matter) can be an input or an output and is exchanged between the system and is environment. The matter (in this case water) is re-circulated within the system.



The stores are where matter (water) and energy are retained. In the hydrological cycle these include oceans, the air (where water can be stored as vapour or clouds of water droplets and ice), **snow fields and glaciers**, the **interception store**, **river channel store** and **lakes**, the **surface store** (puddles) **soil water**, **groundwater** and the **water stored in the living tissues** of plants and animals.

You need to be aware that the stores and flows vary temporally (over time). This includes long term changes such as between the balance of seawater and glacial ice, which increases in a glacial period and decreases in an interglacial. It also includes the short-term changes associated with changing patterns of weather, vegetation, land use, soil water, ground water and river discharge.

The main flows (or processes) are:

- **Evaporation:** the physical process in which a liquid changes to a vapour. Evaporation rates will depend on the amount of solar energy (insolation), temperature, humidity, wind and the nature of the ground surface. Rates are higher if insolation levels are high, temperatures are high, humidity is low, wind speeds are high and the ground surface is bare. Some evaporation takes place from water that has fallen onto the surface of leaves (the interception store).

- **Transpiration:** the process by which plants lose water vapour through the stomata (pores) on their leaves. This, in turn, extracts soil moisture and returns it to the atmosphere as vapour.

- **Evapotranspiration:** the loss of moisture from the Earth's surface by means of both direct evaporation and transpiration from vegetation.

- **Condensation:** the process by which water changes from a vapour to a liquid (usually fine cloud or mist droplets) or solid (ice crystals). This usually results from either cooling the air below its dew point or by adding water vapour until the air becomes saturated.

- **Precipitation:** the deposition of water in a solid or liquid form on the Earth's surface from atmospheric sources. It includes dew, drizzle, rain, hail, sleet and snow. It forms as a result of either coalescence or the incremental growth of ice crystals within a cloud (Bergeron-Feindeison theory), or both.

- **Leaf drip and stem flow:** the processes by which water flows off plants to the ground surface.

- **Infiltration:** the movement of water from the surface into the soil. The rate will depend on the permeability of the soil and its level of saturation.

- **Percolation:** the movement of water from the soil into the bedrock or parent material. Percolation will only take place if the parent material is permeable.

- **Surface runoff:** the water leaving a drainage basin area in stream or river channels. It is derived from direct precipitation into the channel, throughflow, base flow (or groundwater flow) and overland flow.

- **Throughflow**: the downslope movement of water through the soil or regolith (weathered bed-rock).

- **Groundwater flow (or base flow):** the movement of water through the parent material or bedrock. The rate of flow is largely determined by the nature of the rock. Clay has a very low level of base-flow, whereas chalk and sandstone may have high rates of baseflow. Some of the highest rates of base flow occur in limestone areas where whole rivers flow through cavern systems. Ground water will re-enter a river or stream channel via a spring.