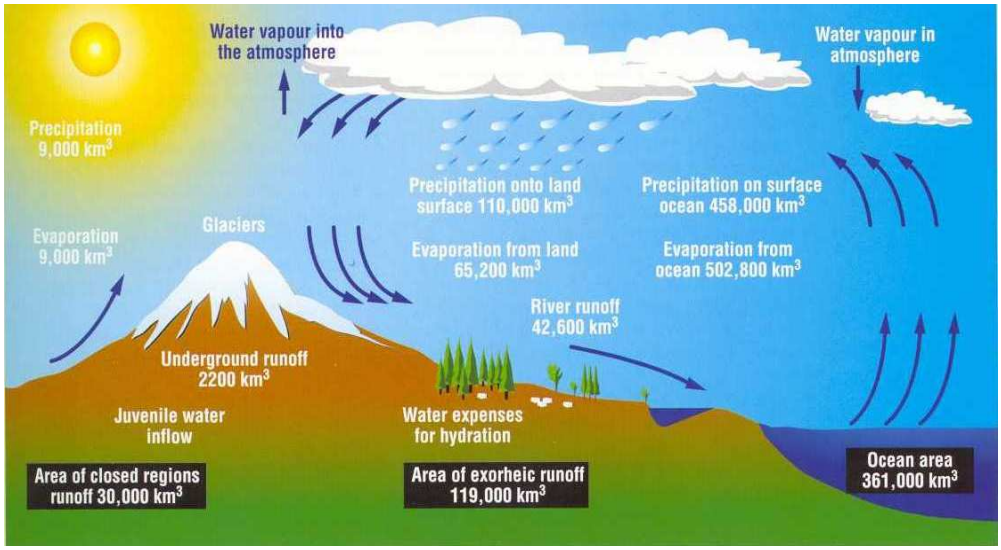
Hydrological Cycle

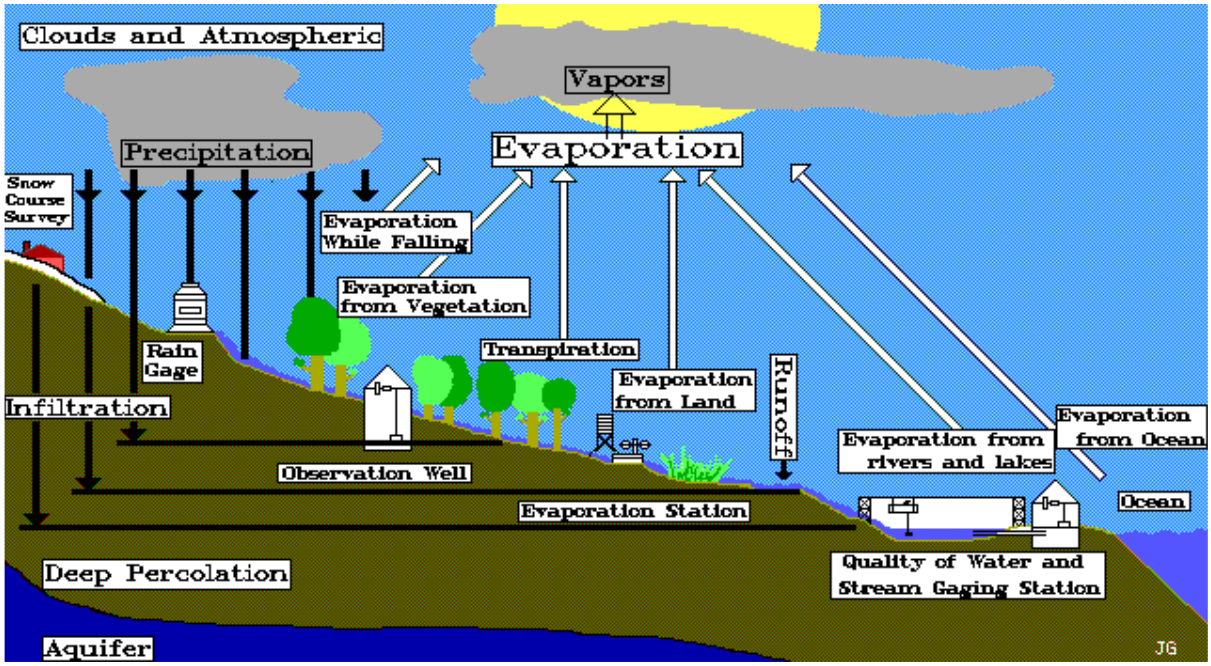
The hydrological cycle is a constant movement of water above, on, and below the earth's surface. It is a cycle that replenishes ground water supplies. It begins as water vaporizes into the atmosphere from vegetation, soil, lakes, rivers, snowfields and oceans-a process called evapotranspiration. As the water vapour rises it condenses to form clouds that return water to the land through precipitation: rain, snow, or hail. Precipitation falls on the earth and either percolates into the soil or flows across the ground. Usually it does both.

When precipitation percolates into the soil it is called infiltration when it flows across the ground it is called surface run off. The amount of precipitation that infiltrates, versus the amount that flows across the surface, varies depending on factors such as the amount of water already in the soil, soil composition, vegetation cover and degree of slope. Surface runoff eventually reaches a stream or other surface water body where it is again evaporated into the atmosphere. Infiltration, however, moves under the force of gravity through the soil. If soils are dry, water is absorbed by the soil until it is thoroughly wetted. Then excess infiltration begins to move slowly downward to the water table.

Once it reaches the water table, it is called ground water. Ground water continues to move downward and laterally through the subsurface. Eventually it discharges through hillside springs or seeps into streams, lakes, and the ocean where it is again evaporated to perpetuate the cycle.

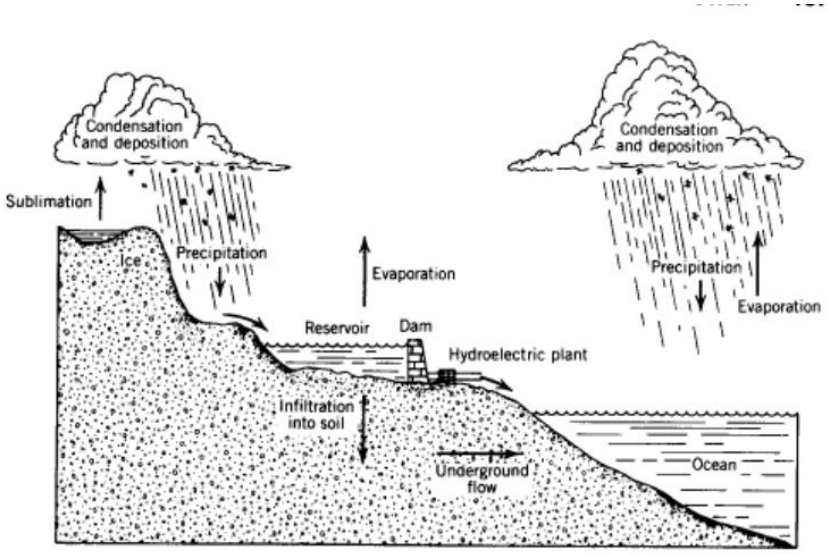
GROUND WATER AND SUBSURFACE WATER most rock or soil near the earth's surface is composed of solids and voids. The voids are spaces between grains of sand, or cracks in dense rock. All water beneath the land surface occurs within such void space sand is referred to as underground or subsurface water. Subsurface water occurs in two different zones. One zone, located immediately beneath the land surface in most areas, contains both water and air in the voids. This zone is referred to as the unsaturated zone. Other names for the unsaturated zone are zone of aeration and vadose zone. The unsaturated zone is almost always underlain by a second zone in which all voids are full of water.



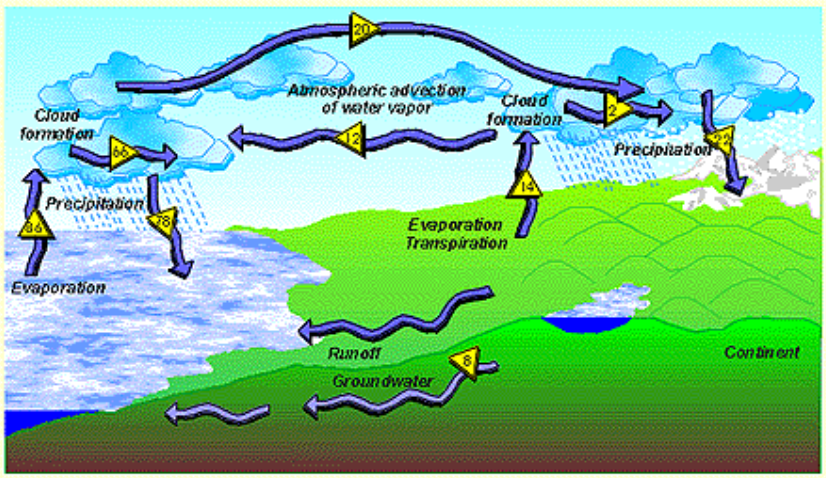


This zone is defined as the saturated zone. Water in the saturated zone is referred to as ground water and is the only subsurface water available to supply wells and springs. Water table is often misused as a synonym for ground water. However, the water table is actually the boundary between the unsaturated and saturated zones. It represents the upper surface of the ground water. Technically speaking, it is the level at which the hydraulic pressure is equal to atmospheric pressure. The water level found in unused wells is often the same level as the water table.

AQUIFERS an aquifer is a saturated geologic formation that will yield a usable quantity of water to a well or spring. Ground water occurs in aquifers under two conditions: confined and unconfined. A confined aquifer is overlain by a confining bed, such as an impermeable layer of clay or rock. An unconfined aquifer has no confining bed above it and is usually open to infiltration from the surface. Unconfined aquifers are often shallow and frequently overlie one or more confined aquifers. They are recharged through permeable soils and subsurface materials above the aquifer. Because they are usually the upper most aquifer, unconfined aquifers are also called water table aquifers.



Confined aquifers usually occur at considerable depth and may over lie other confined aquifers. They are often recharged through cracks or opening sin impermeable layers above or below them. Confined aquifers in complex geological formations may be exposed at the land surface and can be directly recharged from infiltrating precipitation. Confined aquifers can also receive recharge from an adjacent highland area such as a mountain range. Water in filtrating fractured rock in the mountains may flow downward and then move laterally into confined aquifers.



The hydrological cycle model.
The hydrological cycle model with percentages and directional arrows denoting flow paths. Global average values are shown as percentages.

WATER SUPPLY WELLS When water is withdrawn from a well, its water level drops. When the water level falls below the water level of the surrounding groundwater flows into the well. The rate of inflow increases until it equals the rate of withdrawal. The movement of water from an aquifer into a well alters the surface of the aquifer around the well. It forms what is called a cone of depression. A cone of depression is a funnel-shaped drop in the aquifer's surface. The well itself penetrates the bottom of the cone. Within a cone of depression, all ground water flows to the well. The outer limits of the cone define the well's area of influence.