# Welcome To My Presentation

# water Resource

**Subject Code: 66475**

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01.

# THE HYDROLOGICAL CYCLE

As a starting point for the study of hydrology it is useful to consider the hydrological cycle. This
is a conceptual model of how water moves around between the earth and atmosphere in different
states as a gas, liquid or solid. As with any conceptual model it contains many gross simplifications; these are discussed in this section. There are different scales that the hydrological cycle can be viewed at, but it is helpful to start at the large global scale and then move to the smaller hydrological unit of a river basin or catchment.

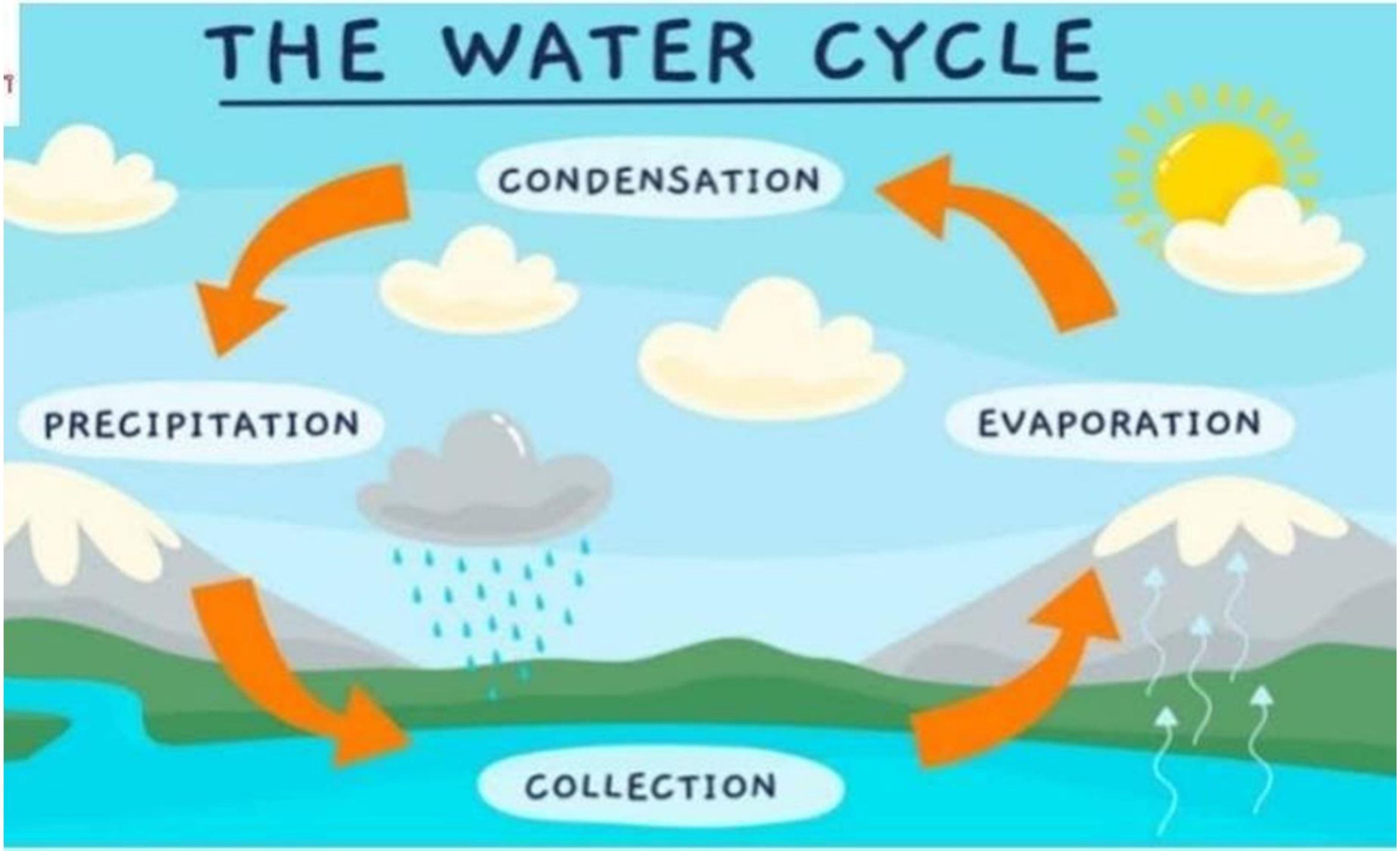
02.

# The catchment hydrological cycle

At a smaller scale it is possible to view the catchment hydrological cycle as a more in-depth conceptual model of the hydrological processes operating.

Figure 1.9 shows an adaptation of the global hydrological cycle to show the processes operating within a catchment. In Figure 1.9 there are still essentially three processes operating (evaporation, precipitation and runoff), but it is possible to subdivide each into different sub-processes. Evaporation is a mixture of open water evaporation (i.e. from rivers and lakes); evaporation from the soil; evaporation from plant surfaces; interception; and transpiration from plants. Precipitation can be in the form of snowfall, hail, rainfall or some mixture of the three (sleet).

Interception of precipitation by plants makes the water available for evaporation again before it even reaches the soil surface. The broad term „runoff" incorporates the movement of liquid water above and below the surface of the earth. The movement of water below the surface necessitates an understanding of infiltration into the soil and how the water moves in the unsaturated zone (throughflow) and in the saturated zone (groundwater flow). All of these processes and sub-processes are dealt with in detail in later chapters; what is important to realise at this stage is that it is part of one continuous cycle that moves water around the globe and that they may all be operating at different times within a river


THE WATER CYCLE
CONDENSATION
PRECIPITATION
EVAPORATION
COLLECTION

03.

# THE WATER BALANCE EQUATION

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THE WATER BALANCE EQUATION

In the previous section it was stated that the hydrological cycle is a conceptual model representing our understanding of which processes are operating within an overall earth–atmosphere system. It is also possible to represent this in the form of an equation, which is normally termed the water balance equation. The water balance equation is a mathematical description of the hydrological processes operating within a given timeframe and incorporates principles of mass and energy continuity. In this way the hydrological cycle is defined as a closed system whereby there is no mass or energy created or lost within it. The mass of concern in this case is water.

There are numerous ways of representing the water balance equation but equation 1.1 shows it in its most fundamental form.

$P \pm E \pm \_S \pm Q = 0$ (1.1)

where P is precipitation; E is evaporation; _S is the change in storage and Q is runoff. Runoff is normally given the notation of Q to distinguish it from rainfall which is often given the symbol R and frequently forms the major component of precipitation.

The ± terminology in equation 1.1 represents the fact that each term can be either positive or negative depending on which way you view it – for example, precipitation is a gain (positive) to the earth but a loss (negative) to the atmosphere.

As most hydrology is concerned with water on or about the earth‟s surface it is customary to consider the terms as positive when they represent a gain to the earth.

Two of the more common ways of expressing the water balance are shown in equations 1.2 and 1.3

P – Q – E – _S = 0 (1.2)

Q = P – E – _S (1.3)

In equations 1.2 and 1.3 the change in storage term can be either positive or negative, as water can be released from storage (negative) or absorbed into storage (positive).

The terms in the water balance equation can be recognised as a series of fluxes and stores. A flux is a rate of flow of some quantity (Goudie et al., 1994): in the case of hydrology the quantity is water. The water balance equation assesses the relative flux of water to and from the surface with a storage term also incorporated. A large part of hydrology is involved in measuring or estimating the amount of water involved in this flux transfer and storage of water

04

# Water droplet growth

Water or ice droplets formed around condensation nuclei are normally too small to fall directly to the ground; that is, the forces from the upward draught within a cloud are greater than the gravitational forces pulling the microscopic droplet downwards.

In order to overcome the upward draughts it is necessary for the droplets to grow from an initial size of 1 micron to around 3,000 microns (3 mm).

The vapour pressure difference between a droplet and the surrounding air will cause it to grow through condensation, albeit rather slowly. When the water droplet is ice the vapour pressure difference with the surrounding air becomes greater and the water vapour sublimates onto the ice droplet. This will create a precipitation droplet faster than condensation onto a water droplet, but is still a slow process. The min mechanism by which raindrops grow within a cloud is through collision and coalescence. Two raindrops collide and join together (coalesce) to form a larger he amount of precipitation falling over a location varies both spatially and temporally (with time).

The different influences on the precipitation can be divided into static and dynamic influences.

Static influences are those such as altitude, aspect and slope; they do not vary between storm events.

Dynamic influences are those that do change and are by and large caused by variations in the weather. At the global scale the influences on precipitation distribution are mainly dynamic being caused by differing weather patterns, but there are static factors such as topography that can also cause major variations through a rain shadow effect (see case study on pp. 18–19). At the continental scale large differences in rainfall can be attributed to a mixture of static and dynamic factors. In Figure 2.1 the rainfall distribution across the USA shows marked variations.

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# Dewfall

The same process of condensation occurs in dewfall, only in this case the water vapour condenses into liquid water after coming into contact with a cold surface. In humid-temperate countries dew is a common occurrence in autumn when the air at night is still warm but vegetation and other surfaces have cooled to the point where water vapour coming into contact with them condenses onto the leaves and forms dew. Dew is not normally a major part of the hydrological cycle but is another form of precipitation.

# PRECIPITATION DISTRIBUTION

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Dynamic influences are those that do change and are by and large caused by variations in the weather. At the global scale the influences on precipitation distribution are mainly dynamic being caused by differing weather patterns, but there are static factors such as topography that can also cause major variations through a rain shadow effect (see case study on pp. 18–19). At the continental scale large differences in rainfall can be attributed to a mixture of static and dynamic factors. In Figure 2.1 the rainfall distribution across the USA shows marked variations. Although mountainous areas have a higher rainfall, and also act as a block to rainfall reaching the drier centre of the country, they do not provide the only explanation for the variations evident in Figure 2.1. The higher rainfall in the north-west states (Oregon and Washington) is linked to wetter cyclonic weather systems from the northern Pacific that do not reach down to southern California. Higher rainfall in Florida and other southern states is linked to the warm waters of the Caribbean sea. These are examples of dynamic influences as they vary between rainfall events.
At smaller scales the static factors are often more dominant, although it is not uncommon for quite large variations in rainfall across a small area caused by individual storm clouds to exist.
As an example: on 3 July 2000 an intense rainfall event caused flooding in the village of Epping Green, Essex, UK

Thanks At All