The Hydrology

It is the science that deals with global water, its appearance, circulation & distribution, its chemical & physical characteristics, and its relation with the environment & living beings, and it's a branch of geology science so it deals with streams rivers……., and it related with other sciences like chemistry physical and fluid.

1- Some branches of hydrology

1-1-Limnology (the science that studies the lakes)

1-2-Cryology (the science that studies the snow and ice)

1-3-Geohydrology (the science that deals with groundwater)

1-4-Potamology (the science that studies the overground or the rivers that run on the ground, or the surface water)

1-5-Hydrometeorology (the science that deals with hydrology &climate to gather)

1-6-Chemical hydrology is the study of the chemical characteristics of water

2-Some purposes for studying hydrology

2-1-Design the water resources plants such as irrigation, water supply, water energy, wastewater plants, and bridges.

2-2-Estimating the capacity of water reservoirs and dams.

2-3-Quantity and capacity of floods to control them.

2-4-Minimum and maximum flow from the resource.

2-5-Determination of probable maximum precipitation for channel and spillways, and also to design water and rainwater pipes. Analyzing the impacts of antecedent moisture on sanitary sewer systems.

2-6-Determining the water balance of a region.

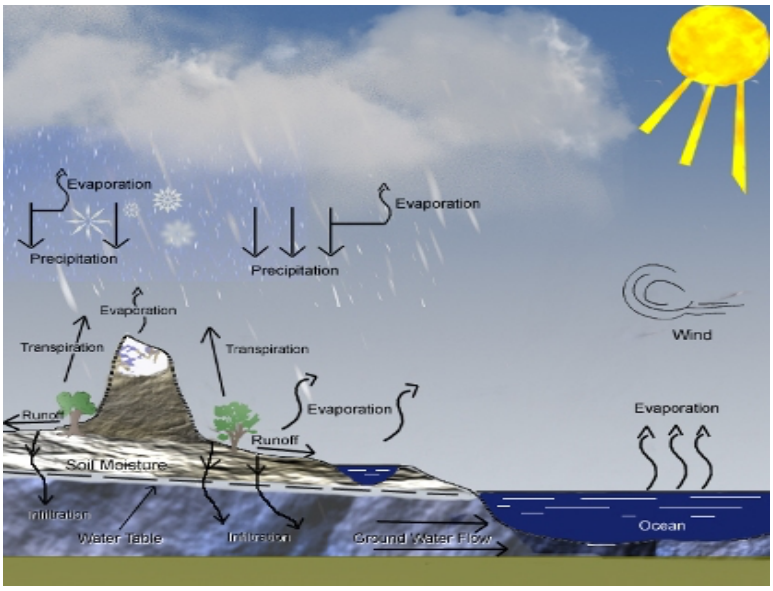
3-Units you need

1 Doname	2500 m^2
1 Hectare(ha.)	10^4 m^2
1 Acre	0.4047 ha.
1 Acre	4047 ~4000 m^2
1 Acre	43560 ft^2
Acre-ft	43560 ft^3
1ft	0.3048 m
1 ft	12 inches
1 m	3.28 ft
1 ft^3	$23*10^{-6}$ acre-ft
1 acre-ft	1234 m^3

Note: Units of rainfall (P), and runoff(R) may be by m or m^3 or m^3/s or acre-ft. The area from which the calculations are named Watershed, catchment area, and basin area.(مساحة الجابية)

Hydrology

4-Water budget (balance equation)



The water recirculation in nature yields the water budget equation and takes this formula:

$$\boldsymbol{I - O = \Delta S}$$

Where:

I : inflow , O: outflow,ΔS: change in storage

Each income to the watershed takes the plus sign and each outcome takes the minus sign

P :precipitation or rainfall (+) , R:direct runoff (+) , F:infiltration (-)

E:evaporation (-) ,Qin (+) , Qout(-) and so on

So the equation may take another shape

P+ R+ Qin- E- F- Q out= Δs

If there is no change in storage then Δs=0

5-Definitions

5-1. Overflow : the flow of water over surface*المياه الجارية فوق سطح الارض*

5-2.Interflow: the lateral flow of water on the surface of the soil.

المياه الجارية تحت سطح الأرض والقريبة منها

5-3.Direct flow: the summation of overland flow and interflow.

مجموع المياه الجارية فوق سطح الارض وتحتها مباشرة

5-4.Runoff : water leaving the land surface to the stream.

مياه السيح او التي تجري على الأرض باتجاه أي منفذ مائي

5-5.Base flow : inter flow +ground flow.

مجموع المياه التي تجري تحت سطح الأرض العميقة والقريبة

5-6.Total flow :direct runoff+ + base flow.

مجموع المياه الجارية فوق وتحت الأرض كلها

Examples

Ex1

Over a period, a catchment area is expected to have precipitation, evaporation, and groundwater, Write the budget equation.

$P-E-F=\Delta S$

Ex.2

During two months, a catchment area (65 km^2) is expected to have 254 mm of precipitation, calculate the P amount by m^3?

$(254/1000) \times 65 \times 10^6 = 16510 * 10^3\ m^3$

Ex.3

During a month, a catchment area (50 km^2) is expected to have 85 mm of evaporation, calculate the E amount by m^3 / s?

$(85/1000) \times 50 \times 10^6 * 30 * 24 * 3600 = 11016 * 10^9\ m^3/s$

Ex.4

Estimate the constant rate of (withdrawal ما تم سحبه من الخزان) (during a month) from a 2 ha. Reservoir in 30 days during which the reservoir level dropped by 0.75 m despite an average inflow into the reservoir of 2.5 m^3/day. During the month the average seepage loss from the reservoir was 0.25 cm? (by m^3)

In- F- with.= ΔS

$In = 2.5 \times 30 = 75\ m^3$

$Out\ (F) = 0.25/100 \times 2 \times 10^4 = 50\ m^3$

$S = 0.75 \times 2 \times 10^4 = 15000\ m^3$

Withdrawal - 1475 m^3

Ex.5

Average runoff into a 670 km^2 catchment area was measured as 65 m^3/s for a 2-hr period, what is the runoff volume (R) by mm?

R=(65 *1000 *2*3600) / 670 * 10^6 = 0.698 mm\

Ex. 6

What is the infiltration rate from a lake with an area of 1000 ha., if the annual infiltration = 40 inches? (acre-ft)

40 /12 = 3.34 ft.

1000 ha. / 0.4047 = 2470.9 acre

2470.9* 3.34 = 8253.02 acre. Ft.