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CLIMATE CHANGE AND ITS IMPACT ON HYDRO LOGICAL CYCLE .

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ABSTRACT:

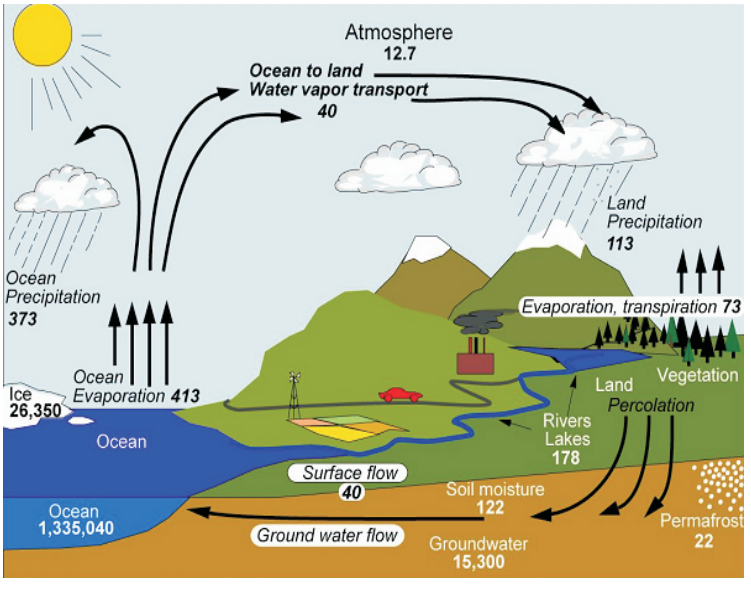
Our world is awash with water. No other planet, as far as we know has anything like a sea. Seven-tenths of earth is covered by great oceans. The water being held to the earth may occur as a gas, a liquid or a solid depending upon temperature. As a liquid, it forms hydrosphere, which covers approximately three-fourths of the earth's surface. It tends to flow downward into the lowest depressions on the surface of lithosphere, forming streams, lakes and oceans.

Key Words: *Hydrological cycle & Water Cycle, Surface Water Resources.*

INTRODUCTION

Hydrologic Cycle

Interchange of water between earth's surface and atmosphere is governed by a cycle known as hydrologic cycle. Significant amounts of water are incorporated by ecosystems in protoplasmic synthesis and there is a substantial return to the atmosphere by transpiration The relative and absolute amounts of precipitation and evaporation dictate a good deal about the structure and function of ecosystems. According to Hutchinson (1957) world precipitation amounts to about 4.46 x 1020 g annually, of this about 0.99 x 1020 g falls on land and 3.47 x io20 g on ocean surfaces. Water contents of various parts of the earth is exhibited in Table 1.



- **Limnetic zone.** This is the open water zone upto the depth of effective light penetration. The community of this zone comprises plankton, nekton and sometimes neustons. Total illuminated stratum including littoral and limnetic zones is called as euphotic zone.
- **Profundal zone.** The bottom and deep water area where light does not penetrate is called as profundal zone. This zone is often absent in ponds.

The hydrologic cycle is a complicated relationship between precipitation and runoff. The heat due to solar radiation raises the temperature of the atmosphere and the land surface, which results in evaporation and transpiration of water from the land surface, reservoirs, oceans and plants. Water in the gaseous form is transported upwards to higher altitudes, where it condenses and forms the clouds, and then precipitates. A part of this precipitation is intercepted by the plant leaves, buildings and other objects on the land surface, and the rest is lost to

infiltration. A portion of which is used by the plants for their transpiration processes and the balance either percolates downwards and joins the groundwater reservoir, or passes off as subsurface flow to the streams. The remaining portion of the precipitated water on the land surface, after the above abstractions, flows out to the streams as the surface runoff. The streams then flow down into reservoirs and oceans. This water evaporates again and the cycle thus continues.

Hydroiogic Cycle format by three stages;

Evaporation or Vaporization: It is the formation of water vapor. Dissolved solids such as salts remain behind when water evaporates. Most vapours are produced by evaporation of liquid water from the surface of the oceans. Water can also vaporize through the tissues of plants. Especially from leaf surfaces. This process is called transpiration. Ice can also vaporize without melting first. This process (which is called sublimation) is slower than vaporization of liquid water.

Precipitation: It means falling from a height. Referring to water, precipitation includes all forms in which atmospheric moister descent to earth, i.e. Rain, Snow, Hail and Sheet. The water that enters the atmosphere by vaporization must first condense into liquid (Clouds & Rain) or Solid (Snow, Hail & Sheet) before it can fall. Recall that vaporization absorbs energy. (Water that evaporates from your skin absorbs heat, making you feel cold). This energy is released in the form of heat when the water vapour condenses.

Run Off: It is the flow back to the oceans of the precipitation that falls on land. In this way the land returns the water that was carried by clouds that drifted in from the ocean. Run off occurs both from the land surface (rivers) and from underground water.

Therefore

For the oceans

Evaporation (E) = Precipitation (P) + Run off (R)
(Loss) (Gain)

For the continents

E + R = Precipitation
(Loss) (Gain)
0.6 + 0.4 = 1.0

Water resources of India can be primarily classified under two heads namely, A) Surface Water Resources B) Ground Water Resources

i) Surface Water Resources

As a thorough estimate, the annual rainfall over the whole country would be equivalent to about 3700 billion cubic meters. Of this around 1250 cubic meters is lost by evapotranspiration, and another 790 billion cubic meters by seepage into the soil, thus leaving 1660 cubic meters as surface flow into the rivers. Fourteen major river system share 83 percent of the drainage basin, accounting' for 85 percent of the surface flow and serve 80 percent of the total population of the country. There are other 44 medium and 55 minor rivers which are mostly seasonal in nature. However, all the river water flow cannot be utilized because of the numerous limitations imposed by topography, climate, soil conditions etc. It has been estimated that only about 666 billion cubic meters of water can be utilized from various river without large inter basin water transfers. Moreover, because of the uneven distribution of rainfall

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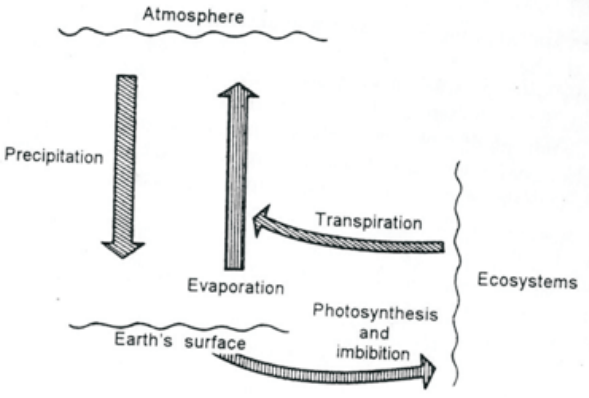
over the years, it becomes necessary to store up the flows in the monsoon period for regulated releases during the non-monsoon months.

The area and volume of surface water on Earth has increased because of the impoundments of rivers to form both medium and large reservoirs, and because of the construction of countless small farm ponds and stock tanks. By March 1981, India had constructed about 1554 major dams along with several medium and small ones, with a storage capacity of about 1,60,352 million cubic meters.



(A The general pattern of the hydrologic cycle. Note that the significance of ecosystem in the movement of water is largely by way of transpiration; some water is lost from ecosystems as respiration and perspiration and becomes a component of surface evaporation.)

Table 1 Water Content of the Various Parts of the Earth (Hutchinson, 1957)

	Content (g)
Primary Lithosphere	$250{,}000 \times 10^{20}$
Ocean	$13{,}800 \times 10^{20}$
Sedimentary rocks	$2{,}100 \times 10^{20}$
Polar caps & other ice	167×10^{20}
Circulating ground water	2.5×10^{20}
Inland waters	0.25×10^{20}
Atmospheric water vapour	0.13×10^{20}
Total -	$266{,}069.88 \times 10^{20}$

The surface water availability in India as per Central Ate Commission has been shown in Table 2

Table 2: Surface water estimate for India (Mahajan, 1986)

River	Average Annual flow (M.ha.m)	Utilizable flow (M.ha.m)
Ganga basin	51.01	25.0
Brahmaputra basin	54.00	02.4
West flowing rivers (South of Tapti)	21.50	03.1
N armada and Tapti	06.20	04.9
Indus basin	07.70	04.6
Mahanad Land East		
flowing rivers	12.30	09.1
Godavari, Krishna and		
East flowing rivers	22.50	19.1
West flowing rivers (North of Narmada)	02.50	02.0
Total	178.04	70.2

It has been estimated that out of the total annual flows of 178.04 million-hectare meter only 70.2 m. ha. is available for effective use. Our country has adopted a big water storage plan. We have now about 600 huge and medium size storage dams, with a total capacity of about 160,352 million cubic meter water. This looks meager when compared with that of United States of America which has roughly the same quantum of total surface runoff, but has built dams with a capacity nearly five times higher than we have.

B. Ground Water Resource

It has been estimated that out of about 790 billion cubic meters of water that seeps into the soil, about 430 billion cubic meters remain in the top soil layers and produces soil moisture which is essential for growth of vegetation. The remaining 360 billion cubic meters percolates into the porous strata and represents the actual enrichment of underground water. Out of this, the water that can be extracted economically is only about 225 billion cubic meters (Murthy, 1975).

Uses of Water:

1) Human settlements have been near the source of water, because water is needed for drinking cooking, washing etc.
2) Agriculture and pastoral activities also needed plenty and reliable sources of water.
3) Industries do require plenty of water. Some industries like sugar, paper, jute and iron and steel industries require more water so, water is one of the factors of it's location. It is essential for cooling of machinery or as a raw material.
4) Water is a source of power. It can be used to generate hydel power, tidal energy and wave energy.
5) Water is very essential for aquatic plants and animals. Protein rich food can be obtained from fish,
6) Water provides cheap means of transport development.
7) Water provides a means of recreation and sports.
8) Water is essential in the process of photosynthesis through which green plants prepare their food
9) Large water bodies determine the hydrologic cycle. Thus water influence weather and climate of any region and thus its flora and fauna.
10) Water has various applications as solvent, chemical reactant, coolant and cleaning agent.
11) Water is used for liquid and solid waste disposal.

12) Water is significantly linked with social, economic, political and ecological factors.

SIGNIFICANCE -

Hydrologic cycle encompasses the movement of water from the ocean to the atmosphere and back to the ocean again by way of evaporation, runoff in streams and rivers and groundwater flow. Only a small amount of water in the ocean is active in the hydrologic cycle at any one time, and yet this small amount of water is very important in the movement and sorting of chemical elements (biogeochemical cycles), shaping the landscapes, weathering the rocks, transporting and depositing sediments and providing us with water resources.

The hydrologic cycle is important for limnology. It forms freshwater bodies like ponds and lakes. The South face of Himalayas receives 1200 cm of rain annually. However, the entire fresh water on land surface of the earth is 0.25 x 1020 gm. Himalayas is the mam rain bringing barrier in North India and the Eastern and Western Ghats of South India. In the absence of barriers, there is little precipitation, viz. deserts of Gobi, Sahara and Rajasthan where annual rainfall is less than 25 cm.

CONCLUSION

The Hydrologic Cycle is constantly happening all around us each and every day and is an essential part of life. It is necessary so that we have shade from clouds, to water our plants with the falling rain, and for fish to swim in. I hope you found this unit interesting and enjoyable, and appreciate water even more! To learn more about water and the Hydrologic Cycle refer to the links on the websites given, look in your school library, or ask your teacher to direct you to other resources.

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