

WATER IN ATMOSPHERE

INTRODUCTION

- Our atmosphere contains gases, dust particles and water vapours.
- Water is present in three states i.e solid(ice),liquid(water) and gaseous(water vapour)

WATER VAPOUR

- It is the gaseous form of water.
- It accounts for 4 percent in air by volume.
- Its **Significance/Importance:**
 - 1.It plays a vital role in determining weather conditions.
 - 2.It is source of precipitation as condensation of water vapour result in forming clouds.
 - 3.It is good absorber of heat radiated by sun and thus act as a blanket allowing Earth neither too hot or cold.
- **Source of Water vapour:**
 - Oceans, Rivers, Lakes, Ice pellets and glaciers are water sources.
 - 75% of evaporation come from this source.

HUMIDITY

- The amount of water vapour present in the air is called Humidity.
- The weight of water vapour expressed in terms gcm^3 .
- The quantity of moisture that air can hold is called saturated point and air is called saturated.
- Humidity is of following two types:
 - **1. Absolute Humidity:** It is the actual amount of water vapour present in the air. It is calculated in gcm^3 .
 - **2. Relative Humidity:** It is calculated by following formula:
$$\text{R.H} = \frac{\text{Amount of water vapour present in the air}}{\text{Amount of water vapor required to saturate the same amount of air at a particular temperature}} * 100$$
- It is calculated in percentages.

EVAPORATION

- The process by which water is transferred from liquid to gas is called Evaporation.
- Water vapour is added in the atmosphere by Evaporation.
- Factors which affect Evaporation are:
- **1. Temperature:** More the temperature, more will be water vapour in the air.
- More water vapour is present near the equator and very less is present near polar areas.
- Water vapour is higher during day and less during night.
- The temperature at which water starts evaporating is called latent heat of vaporisation.
- **2. Dryness of Air:** Dry air has larger capacity to absorb water vapour as compared to wet air.
- **3. Size of water body:** Greater the size of water body, greater is the evaporation.
- **4. Movement of air:** Greater the movement of air, greater the evaporation.
- **5. Clouds:** Clouds obstruct the solar radiation as they scatter the radiation, so clear sky is required for the evaporation process.

CONDENSATION

- The process of change of state from gaseous(water vapour) to solid(ice) is called Condensation.
- The temperature at which saturation occurs i.e. relative humidity is 100 % and water vapour began to change its state is called dew point.
- **Condensation depend on the following factors:**
- 1. If Relative Humidity is higher(more water vapors) then the condensation is also high.
- 2. Greater the amount of cooling of air, greater the condensation.
- 3. Greater the volume of water vapour greater the condensation and greater the formation of clouds.

Forms of Condensation

- **1. Dew:**

- Earth surface is heated during day and cooled during night time.

- Sometimes the cooling becomes so much that temperature of the air touching the Earth surface falls below dew point.

- Water vapor present in the air condenses in the form of water droplets called as dew

- **Conditions favorable for formation of dew:**

- **1. Long nights:** Long nights will help in providing more time for cooling of earth surface and air touching it.

- **2. Warm days:** More warmer are the days, more water vapour will be added through evaporation and more will be the condensation.

- **3. Clouds:** Clouds scatter the solar radiation. So if no clouds will be there, no obstruction to solar radiation will be there. More the surface is heated, more the evaporation, more will be the water vapour, more will be the condensation.

- **4. Calm air:** if the air is calm, it will remain with the earth for longer period of time and more dew will be formed.

- **5. More relative humidity,** more water vapour and more the formation of dew.



- **2. Frost:** It is formed when dew point falls below freezing point and water vapour is deposited in form of minute ice crystals called as frost.
- When the temperature of the air falls suddenly, the water vapour converts directly into solid(ice) instead of converting into liquid. The process is called Sublimation and the minute ice crystals is called frost.
- **Conditions favorable for the formation of Frost:**
 - 1. Long nights: More longer the nights, more cooler the air, more the formation of thick frost.
 - 2. Clear Sky
 - 3. Calm Air
 - 4. Warm days
 - 5. Dewpoint falls below the freezing point.



- **3. Fog and Mist**
- When the temperature of the air mass containing large number of water vapour falls all of a sudden, condensation of water vapour takes place and cloud of water vapour seems to be present near ground which is called FOG.
- Mist is type of Fog but its different in the following ways:



FOG	MIST
It has thinner layer of moisture	it is thicker layer of moisture.
It is present more in plain areas.	It is present more on mountains.
They are drier than mist.	They are not as drier than fog.

4. **Clouds:** Clouds are hanging oceans of water vapor and dust particles.
- They are formed by condensation of water vapor and dust particles at a particular temperature and a particular height.
 - They are of following types:
 - **1. CIRRUS:**
 - Formed at high altitudes i.e. 8000-12000m
 - They are thin and detached.
 - They have a feathery appearance.
 - They are white in colour.
 - **2. CUMULUS:**
 - They look like cotton wool.
 - They are found at height of 4000m - 7000m
 - They are seen scattered here and there.



- **3. STRATUS:**
- They are covering maximum portion of sky.
- They are of lower height as compared to other clouds.
- They are spread equally in sky.
- **4. NIMBUS:**
- They are black coloured clouds.
- They are formed at middle level or near the surface.
- They are shapeless clouds.



PRECIPITATION

- Condensation of water vapor result in forming clouds.
- Clouds cannot hold these condensed water vapor for long and they fall on Earth in different forms like Rainfall, Sleet, Snowfall and Hailstones.
- 1. **Snowfall**: When the condensation of water vapor occurs below freezing point, water vapour turns into solid state without passing into liquid state. This condensed water vapours in the form of snow flakes is called as Snowfall. 2. **Sleet**: It is frozen raindrops.
- The raindrops which leave a warm air and founds cold air lying near to ground.
- the particles solidifies and reach ground in form of small ice pellets bigger than raindrops called as sleet.
- 3. **Hailstones**: When precipitation occurs in the form of hard rounded pellets is known as hail.

4. Rainfall

- The warm air rises and carries the water vapour to a certain height.
- Water vapour combines with dust particle and on reaching a particular height, they result in forming clouds.
- When the cloud is not able to hold this condensed water vapours, they fall on the surface of Earth in the form of water droplets.
- When the condensed water vapour fall on the surface of earth in form of water droplets, it is called as rain.

TYPES OF RAINFALL

- **1. Convective rainfall:**
- During day, the surface of Earth is warm as a result of which air which comes in its contact becomes warm, light and rises.
- To balance the low pressure conditions there, cold air comes from surrounding areas.
- The cold moist air reaches a particular height where condensation of water vapor occurs which in turn causing rain.
- This rainfall is observed near the Equator and is followed by thunder and lightning.
- It occurs during afternoon and does not last long.

- **2. Orographic Rainfall:**

- The word 'orographic' means mountains.
- Rainfall caused by rising of humid air along the slope of the mountain is called as orographic rainfall.
- Humid air rises along the slope of mountain and on reaching a particular height, condensation of water vapor takes place and result in forming clouds and causing rain.
- The side of the mountain from where air rises and cause rainfall is called Windward side.
- The side of the mountain which does not receive any rainfall is called leeward side.
- This type of rainfall is observed in mountain areas like Western Ghats, Bengaluru etc.

Cyclonic or Frontal Rainfall

- When a warm airmass converges with cold airmass, it rises along the slope of front.
- Saturation and Condensation of water vapour takes place and cause rainfall.
- Winter rainfall in north western part of India is received because of this type of rainfall.

Distribution Of Rainfall

- Different places on Earth surface receive different of rainfall. Rainfall is near equator and decreased as we towards poles.
- The various factors for distribution of rainfall are:
- **1. Distribution of Oceans/Landmasses:**
- Eastern margin of continents receive more presence of landmasses as compared to western margins where most of deserts are located.
- **2. Direction of Winds:**
- Winds coming from sea causes rainfall, therefore eastern margins receive more rainfall as compared to western margins.

- The major rainfall zones are:
- **1. Areas of high rainfall(above 200 cm per annum)**
- Equatorial areas like Amazon basin in South America, Parts of Western Africa, North eastern parts of India(Mawnsynram).
- **2. Areas of moderate rainfall(100-200 cm per annum)**
- Coastal areas of North-South America, Southern Parts of Africa receive more rainfall.
- **3. Areas of Low rainfall(less than 50 cm per annum)**
- Areas like upper parts of North America and Russia Northern parts of Africa(Sahara desert), South Western part of Australia(Great Sandy Desert) etc receive low rainfall.