UNIT 3 : PRECIPITATION

PRECIPITATION

Definition

-Water in liquid or solid forms falling to the earth.

-It includes – rain, snow, hail, sleet.

-It does not include- fog, dew, frost.

Precipitation process

-The first step in precipitation is condensation

-The process of condensation involves a change from water vapour to liquid.

-Not all the condensation ends in precipitation

-Though all clouds contain water, some produce precipitation while others not.

-Sometimes the rain drops get evaporated before reaching the earth.

-Only when the droplets is larger sized, it will result in a precipitation.

Facts- PRECIPITATION

Droplets- very small size. Less than 10 micrometers in diameter. (The human hair is 75 micrometers in diameter)

-Drizzle- 500 microns, seem to float in air. They fall at a slower rate.

-Raindrops- 200-7000 microns.

-Millions of droplets make a raindrop

-To get a good sized raindrop, about 3 millimeters in diameter, it would take 27 millions of the 10 micron droplets.

Forms of PRECIPITATION

1.RAIN

-It is “precipitation of liquid water particles, more than 0.5 mm in diameter.

-It is larger than a drizzle

-Whenever rain drops fall from A high altitude clouds, some of them evaporate while passing through A layer of dry air.

-Sometimes, falling rain drops completely evaporate before reaching the ground. Such streaks of rainfall is called as virgae.

2. Drizzle

-Its diameter is less than 5mm and placed close to each other.

-When the drops of falling precipitation is very small and of uniform size, that float in the air is called drizzle.

-This gives very small amount of rainfall.

-Being small in size, the numbers are numerous

-Drizzle if connected with fog and poor visibility

-If the droplets in drizzle completely evaporate before reaching the ground, then it is called as mist.

Forms of PRECIPITATION

3. SNOW

-It is precipitation of white and opaque grains of ice.

-It is the precipitation of solid water.

-It may fall from pure cloud that has super cooled water droplets.

-Heaviest snowfall is reported to occur when the temperature of air from which snow is falling is below 0^0c

4.SLEET

-It is the form of precipitation with A mixture of rain and snow.

-It is 5mm or less in diameter.

-It is formed when ice particles and super cooled water droplets are found close to each other.

-Sometimes sleet may grow into hailstorms.

Forms of PRECIPITATION

5.HAILSTORMS

-It is precipitation of small balls or pieces of ice with A diameter ranging from 5 to 50 mm or more, falling either separately or agglomerated into irregular lumps.

-It is the most destructive form of precipitation

-Its structure resembles an onion.

-It consists of concentric layers of ice alternating with layers of snow.

-The onion structure is due to the variations in the rate at which the super coloed droplets accumulate and freeze.

-It is usually pea sized or even smaller, rarely in baseball size.

-The largest hailstone is noticed in kansas, 3rd september 1970, weighted 766 grams, 14 cm in diameter.

-Has different shapes- conical or ellipsoidal.

Forms of PRECIPITATION

5.HAILSTORMS

-Every hailstone is made of clear ice and milky ice.

-The opaqueness is due to the trapped air bubbles.

-In both hemispheres, area lying between 300 and 600, north and south latitudes, have maximum number of these hailstorms.

-In india, the period march to may, is the ideal condition for hailstorm occurrence.

-It destructs the crops in few seconds, creating heavy economic loss.

-It affects air crafts.

-It is very difficult to forecast the time and occurrence of a hailstorm.

FORMS OF PRECIPITATION

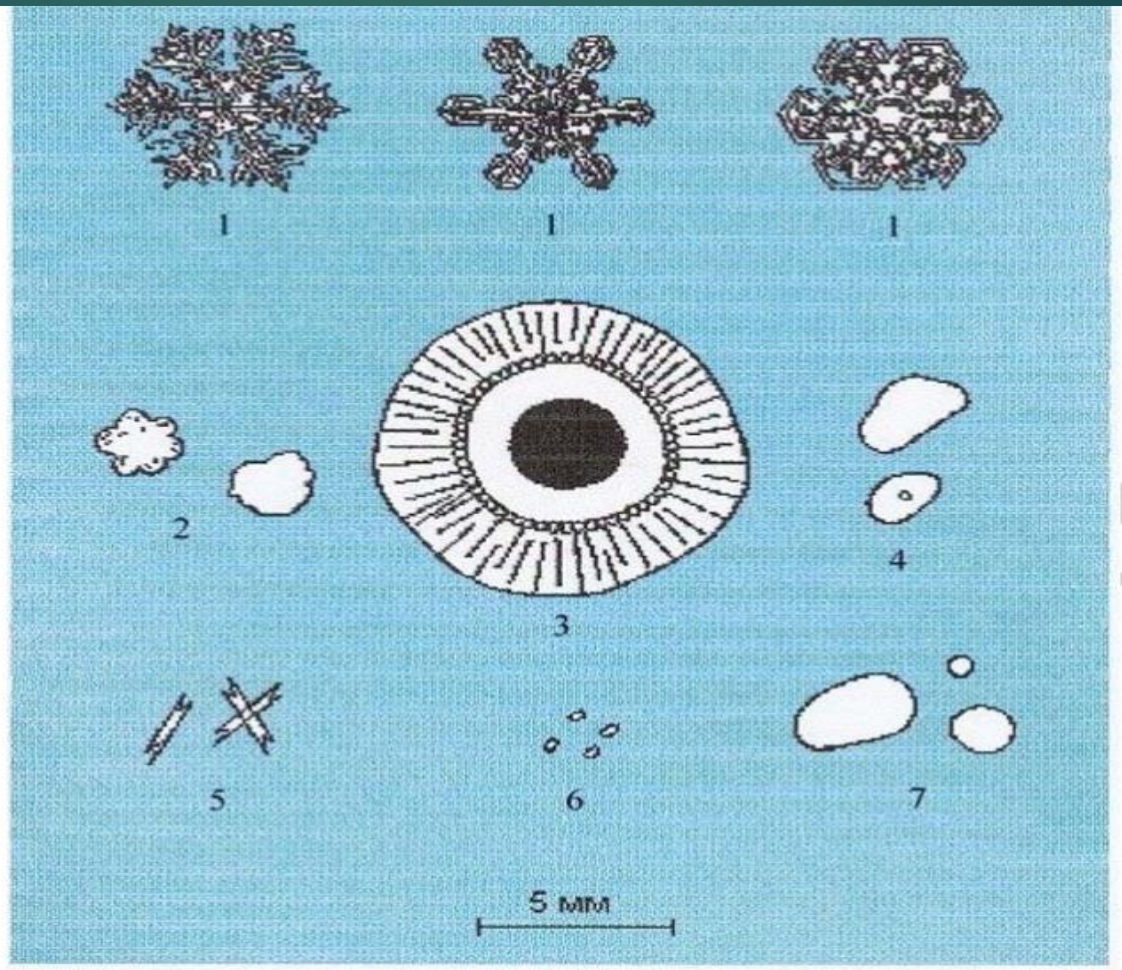


Figure 1. The main types of the precipitation. 1 - snow; 2 - small hail; 3 - large hail; 4 - ice pellets (graupel); 5 - snow pellets (ice needles, ice crystals); 6 - droplets of drizzle; 7 - rain drops.

Types of precipitation based on types of ascent & precipitation characteristics

Cyclonic Precipitation

- A cyclone is a region in the atmosphere with large low pressure having circular wind motion. The cyclonic precipitation is caused by the movement of moist air mass to this region due to the difference in pressure. Cyclones can be of two types frontal and non-frontal precipitation.

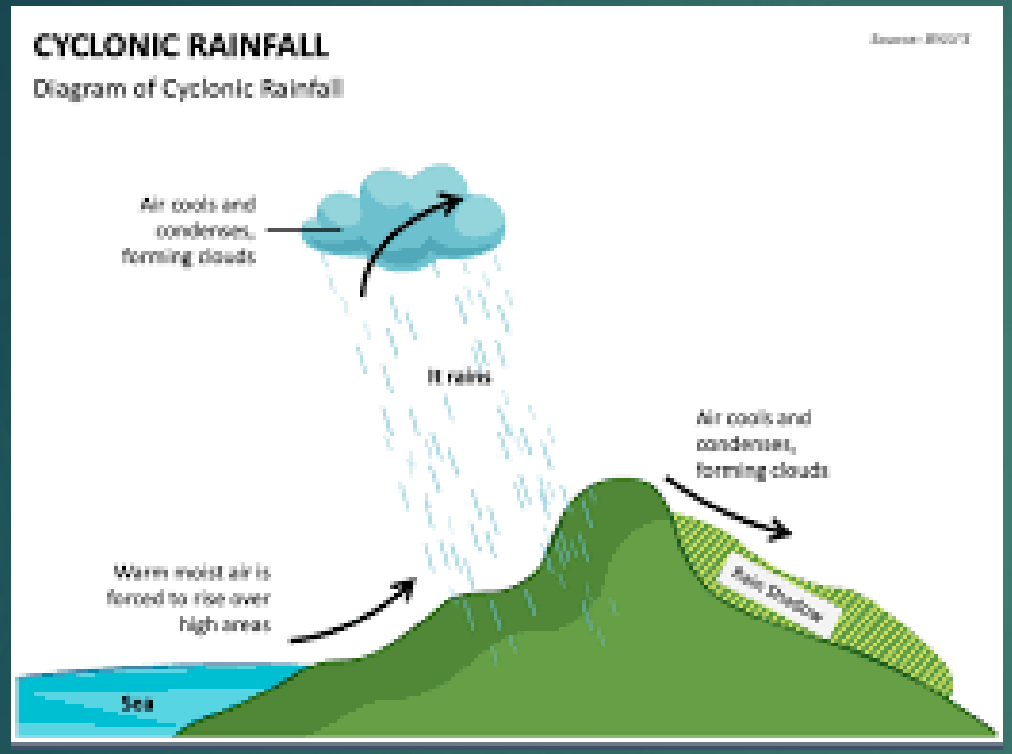
Frontal Precipitation

- A frontal is called as the hot moist air mass boundary. This precipitation is caused by the expansion of air near the frontal surface.

Non-Frontal Precipitation

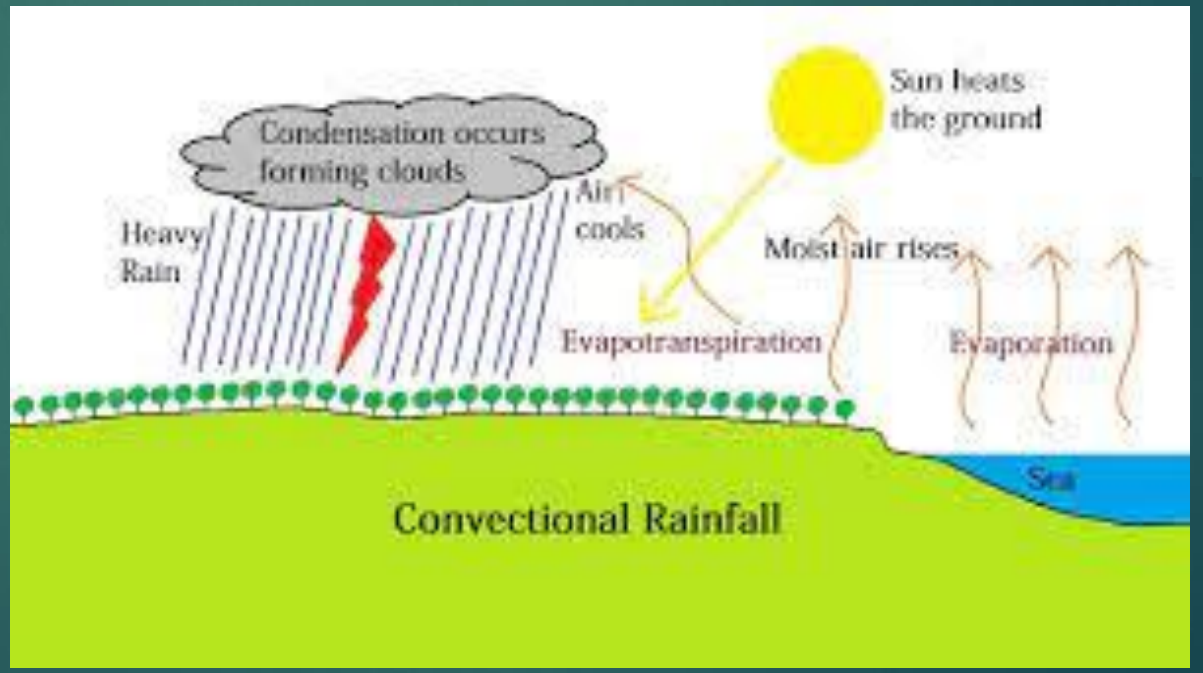
- This is a cold moist air mass boundary that moves and results in precipitation.

Cyclonic rainfall

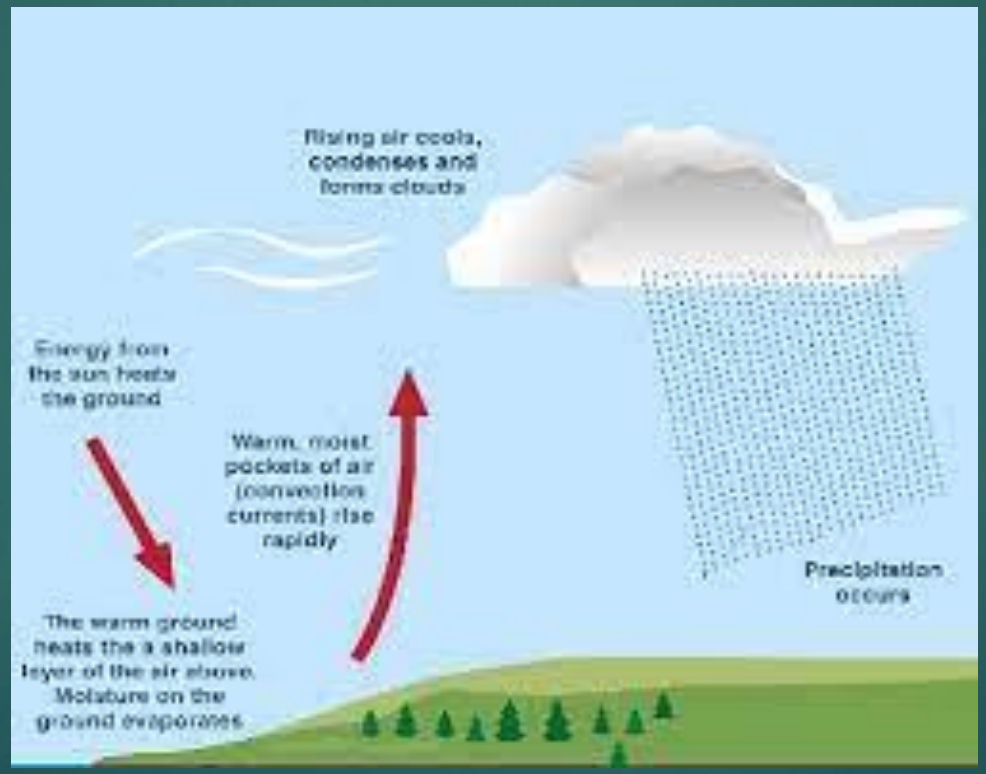


Convectional Precipitation

- The air above the land area gets heated up by some cause. The most warmer air rises up and cools and precipitates. Convective precipitation is showery in nature. This type of precipitation happens in varying intensities. The areal extent of convective precipitation is small in the range of less than 10km in diameter.

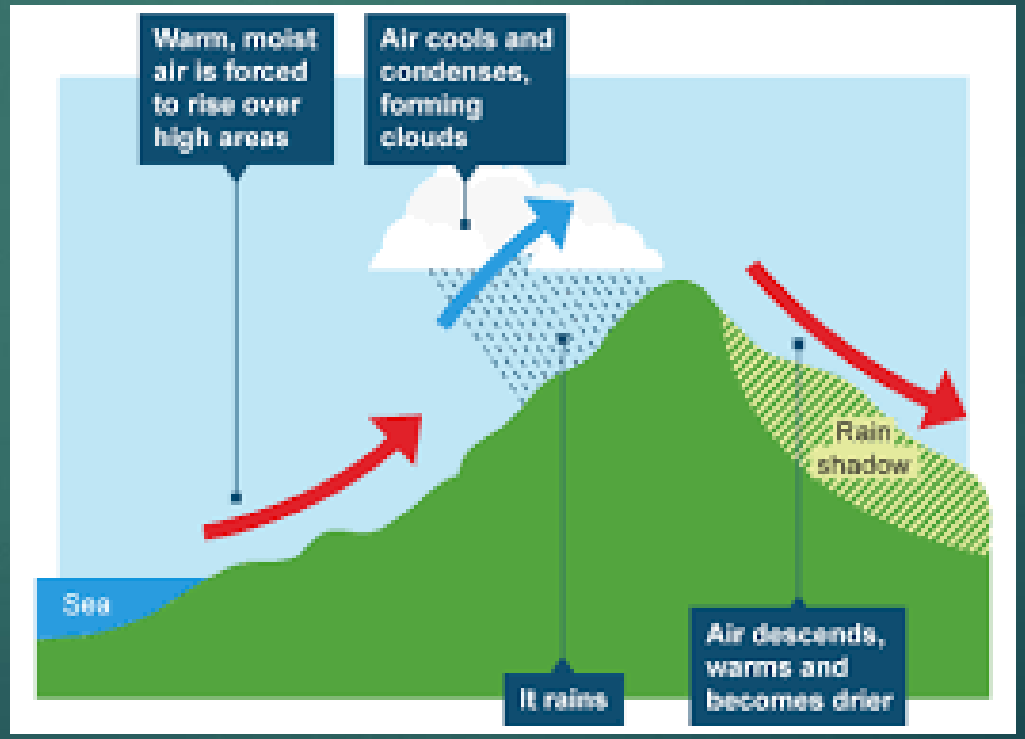


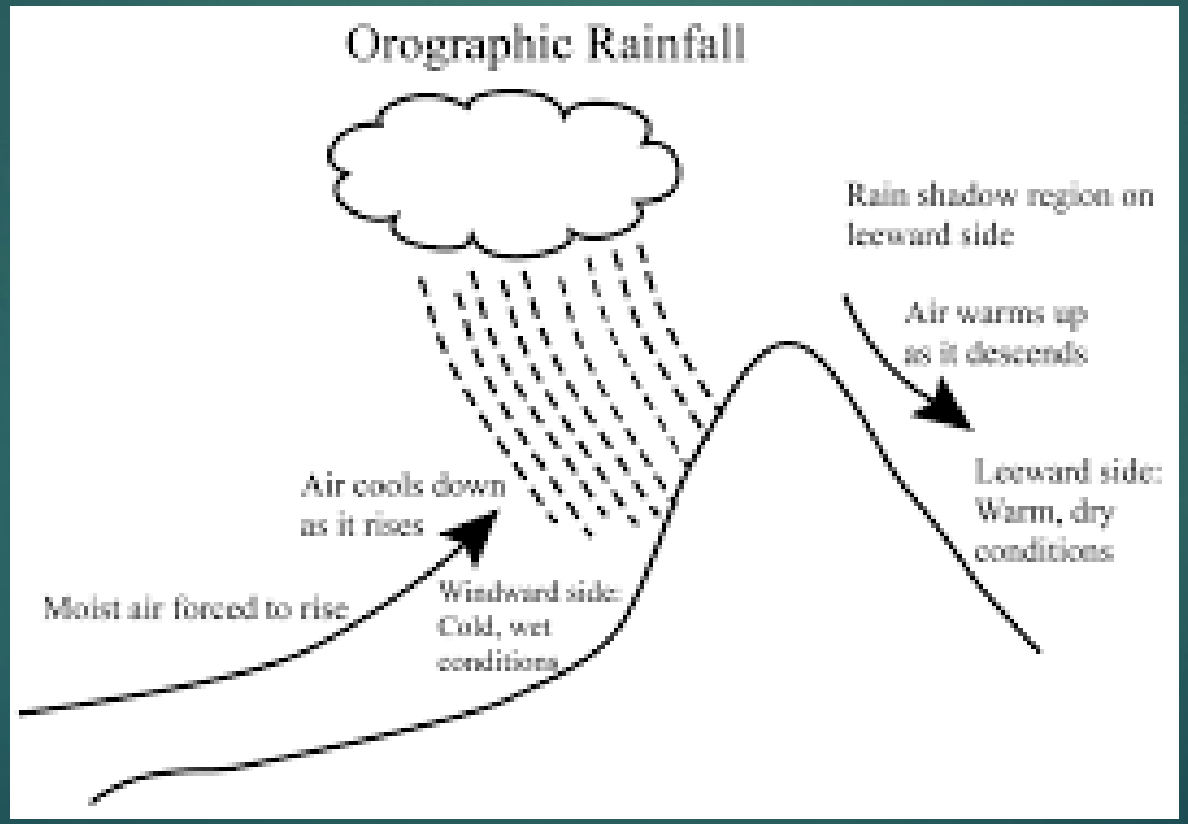
Convectional rainfall

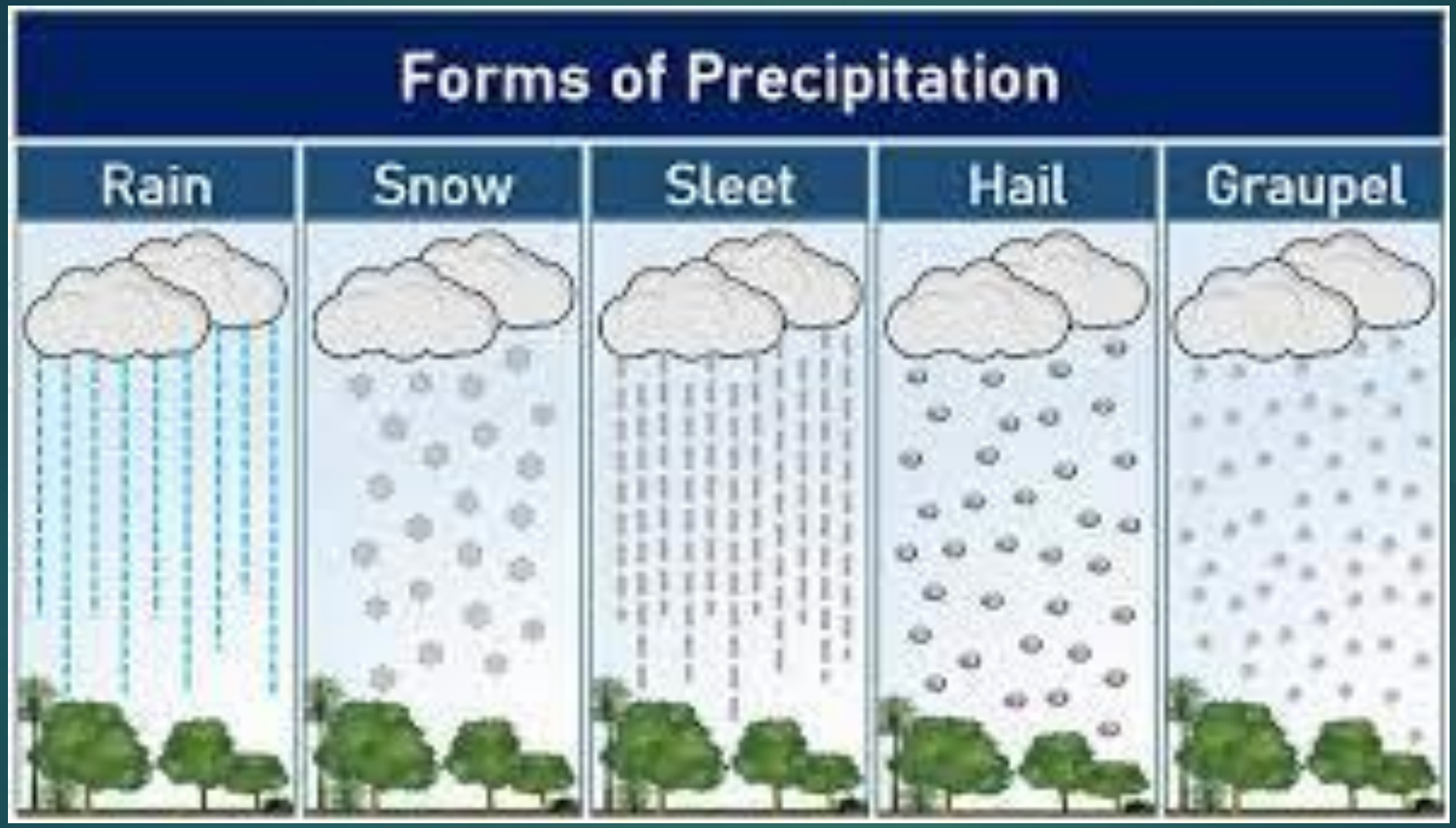


Orographic Precipitation

- Moving air masses have chances to strike barriers like mountains. Once they strike, they rise up which causes condensation and precipitation. The precipitation is greater in the windward side of the barrier compared to the leeward side of the barrier.

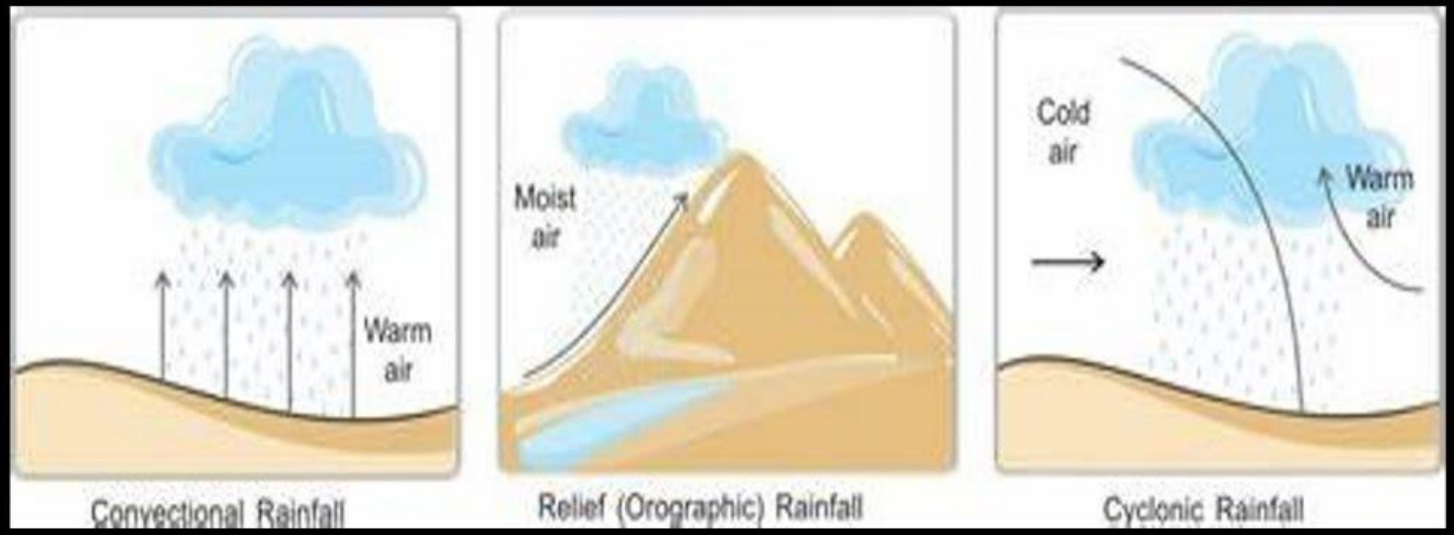



Orographic Rainfall
Rain shadow region on leeward side
Air warms up as it descends
Leeward side: Warm, dry conditions
Air cools down as it rises
Moist air forced to rise
Windward side: Cold, wet conditions



Graupel means Snow Pellets or Soft Hail

Cyclonic Precipitation, Convective Precipitation and Orographic Precipitation



Dew Point vs. Humidity

The dew point is the temperature the air needs to be cooled to (at constant pressure) in order to achieve a relative humidity (RH) of 100%. At this point the air cannot hold more water in the gas form. If the air were to be cooled even more, water vapor would have to come out of the atmosphere in the liquid form, usually as fog or precipitation.

The higher the dew point rises, the greater the amount of moisture in the air. This directly affects how "comfortable" it will feel outside. Many times, relative humidity can be misleading. For example, a temperature of 30 and a dew point of 30 will give you a relative humidity of 100%, but a temperature of 80 and a dew point of 60 produces a relative humidity of 50%. It would feel much more "humid" on the 80 degree day with 50% relative humidity than on the 30 degree day with a 100% relative humidity. This is because of the higher dew point.

So if you want a real judge of just how "dry" or "humid" it will feel outside, look at the dew point instead of the RH. The higher the dew point, the muggier it will feel.

General comfort levels USING DEW POINT that can be expected during the summer months:

- less than or equal to 55: dry and comfortable
- between 55 and 65: becoming "sticky" with muggy evenings
- greater than or equal to 65: lots of moisture in the air, becoming oppressive

- The **dew point** of a given body of air is the temperature to which it must be cooled to become saturated with water vapor. This temperature depends on the pressure and water content of the air. When the air is cooled below the dew point, its moisture capacity is reduced and airborne water vapor will condense to form liquid water known as dew.[1] When this occurs through the air's contact with a colder surface, dew will form on that surface.

- The dew point is affected by the air's humidity. The more moisture the air contains, the higher its dew point.

- When the temperature is below the freezing point of water, the dew point is called the **frost point**, as frost is formed via deposition rather than condensation. In liquids, the analog to the dew point is the cloud point.

- The dew point is the temperature the air must reach before it can be cooled, at constant pressure, to achieve a relative humidity of 100%, according to the Weather Service.

In other words, the air will not be able to hold more water in its gas form. If the air were to cool even more, water vapor would release into the atmosphere in its liquid form, such as via fog, dew or precipitation.

- The higher the dew point, the greater amount of moisture present in the air, says the Weather Service.
- When considering dew point levels, these conditions can be expected during the warmer months:

•Less than or equal to 55: "dry and comfortable"
•Between 55 and 65: "becoming 'sticky' with muggy evenings"
•Greater than or equal to 65: "lots of moisture in the air, becoming oppressive"

Dew Point Weather Records :

•**Highest dew point temperature:** A dew point of 35 °C (95 °F) — while the temperature was 42 °C (108 °F) — was observed at Dhahran, Saudi Arabia, at 3:00 p.m. on 8 July 2003.

•**Highest temperature with 100% of relative humidity**: A temperature of 34 °C (93 °F) with 100% of relative humidity in Jask, Iran, on 21 July 2012.

Measurement
(Hygrometer is used to measure)

Dew point		Relative humidity at 32 °C (90 °F)
Over 27 °C	Over 80 °F	73% and higher
24–26 °C	75–79 °F	62–72%
21–24 °C	70–74 °F	52–61%
18–21 °C	65–69 °F	44–51%
16–18 °C	60–64 °F	37–43%
13–16 °C	55–59 °F	31–36%
10–12 °C	50–54 °F	26–30%
Under 10 °C	Under 50 °F	25% and lower

What is Evapotranspiration?

The total quantity of water utilized by the plants for transpiration and evaporation taking place from the nearby soils at any given moment is known as evapotranspiration.
Evapotranspiration is this the sum total of transpiration and evaporation from the earth’s surface. The term "consumptive use" also refers to evapotranspiration.
Evapotranspiration is measured in millimeters (mm).

Evapotranspiration Process :

Evapotranspiration is a kind of process in which water is transferred from the Earth's surface to the atmosphere through the combined processes of plant transpiration and evaporation. Evaporation happens when liquid water converts to vapor, while transpiration refers to water loss from plant leaves. This process plays a important role in the Earth's water cycle, influencing climate, energy balance, and ecosystem dynamics

Types of Evapotranspiration :

Potential Evapotranspiration (PET)

Propounded by Thornthwaite (1948), PET is characterized as the evapotranspiration from a sizable vegetated land surface with constant access to sufficient moisture. As there are no restrictions on moisture availability, PET relies on the available energy. It is the maximum allowable Evapotranspiration occurring for a crop in a particular climate or the maximum allowable Evapotranspiration that would occur in a well-watered agricultural area.

Actual Evapotranspiration (AET)

AET refers to the actual evapotranspiration that takes place in a specific situation.
If the plant has an appropriate water supply, the ratio of AET to PET shall be equal to 1 and soil moisture will be at field capacity.
If the plant's water supply is insufficient, the AET to PET ratio will be less than 1.
In clayey soils, AET/PET is almost equal to 1 up to a 50% decrease in moisture availability
AET tends to be 0 when the soil moisture reaches the threshold of irreversible wilting.

What are the factors affecting evapotranspiration?

The various factors that affect evapotranspiration include
Meteorological Factor
Density of vegetation
Soil Moisture
Stage of plant growth
Adjoining Land
Surface area of leaves

1. Meteorological factors
The intensity of solar radiation
Day length
Air temperature
Wind speed
Humidity
Cloudiness
Precipitation
Visibility of atmosphere – eg: fog

2. Geographical factors
Altitude
Latitude
Slope
Distinguish land and water bodies
Topography

3. Crop factors

Nature of crop
Age or growth stage
Method of cultivation
Nature of leaf
Nature of root system
Nature of canopy
Nature of stomata
Duration of growth
Growing season
Crop density
Crop variety

4. Soil factors

Availability of soil moisture
Soil texture
Soil structure
Soil temperature
Bulk density
Presence of plow pan
Soluble salt content
Water holding capacity
Nature of pore space
Depth of water table
Organic matter content etc.

5. Cultural and management practices

Tillage
Method of cultivation – Broad casting and Line sowing
Weeding
Mulching
Irrigation
Drainage
Application of fertilizer and pesticides etc.

Precipitation

https://www.youtube.com/watch?v=1wreQRWF1FM
(Types of Precipitation)

https://www.youtube.com/watch?v=3KoiQ5Iw6Ug
(Forms of Precipitation)

https://www.youtube.com/watch?v=9knozomoMUU
(Forms of Precipitation)