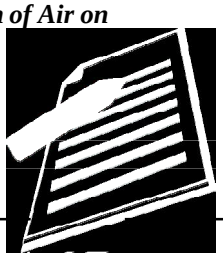

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# HUMIDITY AND PRECIPITATION

In our previous lesson while discussing the composition of the atmosphere, we noted that water vapour, though a minor component, is a very important constituent of the atmosphere. In this lesson, we will study the role of water vapour in producing day to day weather changes.

## OBJECTIVES

After studying this lesson, you will be able to :

- distinguish between absolute and relative humidity;
- establish relationship between temperature (absolute and relative humidity)
- infer conditions in which the relative humidity of a given sample of air increases or decreases;
- distinguish between saturated and unsaturated air;
- identify the factors affecting the rate of evaporation;
- explain the latent heat and its importance;
- describe the various forms of condensation;
- explain conditions conducive to precipitation;
- distinguish among the three types of precipitation (rainfall) with the help of diagrams;
- describe the salient features of distribution of precipitation in the world with reference to regional and seasonal variations;
- identify factors affecting rainfall distribution.

## 12.1 WATER VAPOUR IN THE ATMOSPHERE

Water vapour is a highly variable component of the atmosphere. Its proportion varies from zero to four percent by volume of the atmosphere. Water can exist in the air in all the three states of matter i.e. solid (ice-crystals), liquid (droplets of water) and gaseous (water vapour). Most commonly water exists in air as tasteless, colourless, transparent gas known as water vapour. The presence of water in the atmosphere has made life possible on the earth. Let us examine its significance for life on the earth.

(i) We have noted in the lesson 10, that water vapour in the atmosphere absorbs a significant portion of both incoming solar energy and outgoing earth radiation. In this way, it prevents great losses of heat from the earth's surface and helps to maintain suitable temperatures on the earth.

(ii) The amount of water vapour present in the air affects the "rate of evaporation.

(iii) The amount of water vapour present in a volume of air decides the quality of latent heat or energy stored in it for producing atmospheric changes;

(iv) The amount of water vapour present in the air of a place or in a region indicates the potential capacity of that air for precipitation.

(v) The amount of water vapour present in the air also affects standing crops favourably. On the other hand hot dry winds damage standing crops as in the case of rabi crops of North- Western India.

(vi) Air, poor in water vapour content, makes our body skin dry and rough. It is because of this fact that we use cream to protect our faces from dry air of cold winters or hot summers.

- The water vapour present in the atmosphere absorbs radiation, controls the rate of evaporation, releases latent heat for weather changes, decides the potentiality for precipitation, affects standing crops and our body skin, hence is of great significance.

## 12.2 HUMIDITY

How does water changes into water vapour? The heat energy radiated from the sun changes water into water vapour. This invisible water vapour present in gaseous form in the atmosphere at any time and place is termed as humidity. In other words, we can say that the term humidity refers to the amount of water vapour present in a given air. It indicates the degree of dampness or wetness of the air. Humidity of the air is mainly expressed in the following two ways:

(i) Absolute humidity

(ii) Relative humidity

### (i) Absolute Humidity

Absolute humidity is the ratio of the mass of water vapour actually in the air to a unit mass of air, including the water vapour. It is expressed in gram per cubic metre of air. For example, if the absolute humidity of air is 10 grams it means that one cubic metre of that air holds 10 grams of moisture in the form of water vapour. Absolute humidity is variable and changes from place to place and with change in time.

The ability of an air to hold water vapour depends entirely on its temperature. The capacity of holding water vapour of an air increases with the increase in its temperature. For example, at 10°C, one cubic metre of an air can hold 11.4 grams of water vapour. If the temperature of the same air increases to 21°C, the same volume of air can hold 22.2 grams of water vapour. The Figure 12.1 shows the relationship between temperature and the maximum amount of water vapour that an air can hold at a given temperature. A cursory glance at this figure indicates how the water holding capacity of the air increases with increase in temperature. Change in temperature and pressure conditions of an air results in the change of its volume and consequently there is change in its absolute humidity. Hence, there is a need of some more reliable measure of humidity.

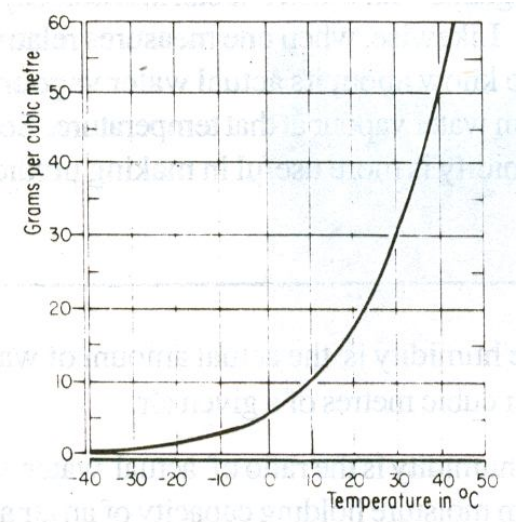



*Fig 12.1 Maximum Absolute Humidity for a Wide Range of Temperature*

### (ii) Relative Humidity

Relative humidity is the most important and reliable measure of atmospheric moisture. It is the ratio of the amount of water vapor actually in a volume occupied by air to the amount the space could contain at saturation.

$$\text{Relative humidity} = \frac{\text{Vapour pressure in the air}}{\text{Saturation vapour pressure}}.$$

From Figure 12.1, it is quite clear that air can hold a definite maximum quantity of water vapour at a given temperature. When this situation is attained, we say the air is fully saturated. The temperature at which a given sample of air becomes fully saturated is called the dew point or saturation point The relative humidity of an air at saturation point is hundred percent. Since the concept of relative humidity is very important in understanding this lesson let us illustrate it with the help of an example. It is clear in Fig 12.1 that an air can hold 22.2 grams of water vapour at $21^0$C temperature. If this air is holding 11.1 grams of water vapour at the same temperature i.e. $21^0$C, the relative humidity of the air will be 11.1/22.2x100 or 50 percent. And, if the same air is actually holding 22.2 grams of water vapour at $21^0$C, the relative humidity of air will be 22.2/22.2x100 or 100 percent. The air become saturated when its relative humidity is cent percent. If the relative humidity of air is less than 100 percent, the air is said to be unsaturated.

The relative humidity increases when the temperature of the air goes down or when more moist air is added to it. The relative humidity decreases when the temperature of the air increases or when less moist air is added to it

In order to make it clear that relative humidity is a better measurement of water vapour in atmosphere than absolute humidity, yet another example can be cited. Suppose, there is a tumbler containing 250 grams of water, one cannot tell how much portion of the tumbler is filled with water till one knows its maximum water containing capacity. When one comes to know that the tumbler can contain maximum of 500 grams of water, one can immediately tell that the tumbler is half filled with water. Likewise, when one measures relative humidity of an air, one not only needs to know about its actual water vapour content but also its total capacity to contain water vapour at that temperature. So, now you can understand why relative humidity is more useful in making predictions about atmospheric conditions.

- Absolute humidity is the actual amount of water vapour present in grams per cubic metres of a given air.
- Relative humidity is the ratio of actual water vapour content to the maximum moisture holding capacity of an air at a given temperature and it is expressed in percentage (RH.=A.H/Max. capacity X 100)
- The temperature at which a given sample of air becomes fully saturated is called dew point or saturation point.

## INTEXTQUESTIONS 12.1

1. Name the three forms in which water can exist in the atmosphere.

   (a)_____ (b)_____ and (c)_____

2. Give a geographical term for each of the following:

   (a) The amount of water vapour present in the atmosphere.

   _____

   (b) The weight of actual water vapour present per volume of air.

   _____

   (c) The ratio of the amount of the water vapour actually is a volume occupied by air to the amount the space could contain of saturation.

   _____

   (d) The air that contains moisture to its full capacity is called

   _____

   (e) The temperature at which a sample of air becomes saturated.

   _____

## 12.3 EVAPORATION

Evaporation is the process of which water changes from its liquid state to gaseous form. This process takes place at all places, at all times and at all temperatures except at dew point or when the air is saturated. The rate of evaporation is affected by several factors. Important among them are as under:

**(i) Accessibility of water bodies**

The rate of evaporation is higher over the oceans than on the continents.

**(ii) Temperature**

We know that hot air holds more moisture than cold air. So, when the temperature of an air is high, it is capable of holding more moisture in its body than at a low temperature. It is because of this that the rate of evaporation is more in summers than in winters. That is why wet clothes dry faster in summers than in winters.

**(iii) Air moisture**

If the relative humidity of a sample of air is high, it is capable of holding

less moisture. On the other hand if the relative humidity is less, it can take more moisture. Hence, the rate of evaporation will be high. Aridity or dryness of the air also increases the rate of evaporation. During rainy days, wet clothes take more time to dry owing to the high percentage of moisture content in the air, than on dry days.

**(iv) Wind**

Wind also affects the rate of evaporation. If there is no wind, the air which overlies a water surface will get saturated through evaporation. This evaporation will cease once saturation point is reached. However, if there is wind, it will blow that saturated or nearly saturated air away from the evaporating surface and replace it with air of lower humidity. This allows evaporation to continue as long as the wind keep blowing saturated air away and bring drier air.

**(v) Cloud cover**

The cloud cover prevents solar radiation and thus influences the air temperatures at a place. This way, it indirectly controls the process of evaporation.

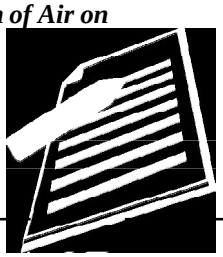
It is interesting to note that about 600 calories of heat is used for converting each gram of water into water vapour. A calorie is unit of heat energy spent in raising temperature of one gram of water by $10^0$C. The heat energy used for changing the state of water or a body from liquid to gaseous state or from solid (ice) to liquid (water) state without changing its temperature is called latent heat. It is a sort of hidden heat. The effect of which is not seen on the thermometer. The latent heat consumed in changing water into gaseous form is released when water vapour changes into water or ice. The release of latent heat in the air is an important source of energy for causing changes in weather.

A special case of evaporation is transpiration, which entails a loss of water from leaf and stem tissues of growing vegetation. The combined losses of moisture by evaporation and transpiration from a given areas are termed evapo-transpiration.

- The evaporation is the process of changing water into water vapour.
- The rate of evaporation is affected by the accessibility of water, temperature, aridity of air, wind and cloud cover.
- The heat energy used for changing the state of water, or a body from liquid to gaseous state or from solid to liquid state without changing its temperature is called latent heat.

## 12.4 CONDENSATION

Condensation is the process by which atmospheric water vapour changes



into water or ice crystals. It is just reverse of the process of evaporation. When the temperature of saturated air falls below dew point, the air cannot hold the amount of humidity which it was holding earlier at a higher temperature. This extra amount of humidity changes into water droplets or crystals of ice depending upon the temperature at which condensation takes place.

**(a) Process of condensation**

The temperature of the air falls in two ways. Firstly, cooling occurs around very small particles of freely floating air when it comes in contact with some colder object. Secondly, loss in air temperature takes place on a massive scale due to rising of air to higher altitudes. The condensation takes place around the smoke, salt and dust particles which attract water vapour to condense around them. They are called hygroscopic nuclei. When the relative humidity of an air is high, a slight cooling is required to bring the temperature down below dew point. But when the relative humidity is low and the temperature of the air is high, a lot of cooling of the air will be necessary to bring the temperature down below dew point. Thus, condensation is directly related to the relative humidity and the rate of cooling.

- Condensation is a process of changing water vapour into tiny droplets of water or ice cystals.
- Condensation takes place when temperature of air falls below dew point and is controlled by relative humidity of the air and rate of cooling.

**(b) Forms of condensation**

Condensation takes place in two situations, firstly, when dew point is below freezing point or below 0° C and secondly, when it is above freezing point. In this way, the forms of condensation may be classified into two groups:

(i) Frost, snow and some clouds are formed when dew point is below freezing point.

(ii) Dew, mist, fog, smog and some clouds are formed when dew point is above freezing point.

The forms of condensation may also be classified on the basis of place where it is occurring, for example, on the ground or natural objects such as grass blades and leaves of the plants or trees, in the air close to the earth's surface or at some height in the troposphere.

**(i) Dew:** When the atmospheric moisture is condensed and deposited in the form of water droplets on cooler surface of solid objects such as grass

blades, leaves of plants and trees and stones, it is termed as dew. Condensation in dew form occurs when there is clear sky, little or no wind, high relative humidity and cold long nights. These conditions lead to greater terrestrial radiation and the solid objects become cold enough to bring the temperature of air down below dew point. In this process the extra moisture of the air gets deposited on these objects. Dew is formed when dew point is above freezing point. Dew formation can be seen if the water is poured into a glass from the bottle kept in a refrigerator. The outer cold surface of the glass brings the temperature of the air in contact with the surface down below dew point and extra moisture gets deposited on the outer wall of the glass.

**(ii)** **Frost:** When the dew point is below freezing point, under above mentioned conditions, the condensation of extra moisture takes place in the form of very minute particles of ice crystals. It is called frost. In this process, the air moisture condenses directly in the form of tiny crystal of ice. This form of condensation is disastrous for standing crops such as potato, peas, pulses, grams, etc. It also creates problems for road transport system.

**(iii)** **Mist and Fog:** When condensation takes place in the air near the earth's surface in the form of tiny droplets of water hanging and floating in the air, it is called mist. In mist the visibility is more than one kilometer and less than two kilometers. But when the visibility is reduced to less than one kilometer, it is called fog. Ideal conditions for the formation of mist and fog are clear sky, calm and cold winter nights.

**(iv)** **Smog:** Smog is a fog that has been polluted and discoloured by smoke, dust, carbon monoxide, sulphur dioxide and other fumes. Smog frequently occurs in large cities and industrial centres. It causes respiratory illness.

**(v)** **Cloud:** Clouds are visible aggregates of water droplets, ice particles, or a mixture of both along with varying amounts of dust particles. A typical cloud contains billions of droplets having diameters on the order 060.01 to 0.02 mm; yet liquid or solid water accounts for less than 10 parts per million of the cloud volume. Clouds are generally classified on the basis of their general form or appearance and altitude. Combining both these characteristics, clouds may be grouped as under.

**Low clouds:** The base level of low clouds varies from very near the ground to about 2000m. The basic type of this family is the status, a low, uniform layer resembling fog but not resting on the ground.

Stratocumulus clouds form a low, gray layer composed of globular masses or rolls which are usually arranged in groups, lines, or waves.

Clouds with vertical development fall into two principal. **Categories:** cumulus and cumulonimbus. Cumulus clouds are dense, dome-shaped and have flat bases. They may grow to become cumulonimbus, the extent of vertical development depending upon the force of vertical currents below the clouds as well as upon the amount of latent heat of condensation liberated in the clouds as

they form.

To an observer directly beneath, a cumulonimbus cloud may cover the whole sky and have the appearance of Nimbostratus, The word nimbus (or prefix nimbo) applies to a cloud from which rain is falling. It derives from the Latin for "violent rain".

**Medium clouds:** These clouds are formed at altitudes between 2000 to 6000 metres. This group of clouds include altocumulus and altostratus.

**High clouds:** These clouds are formed above the altitude of 6000 metres and include cirrus, cirrostratus and cirrocumulus (see fig. 12.2).

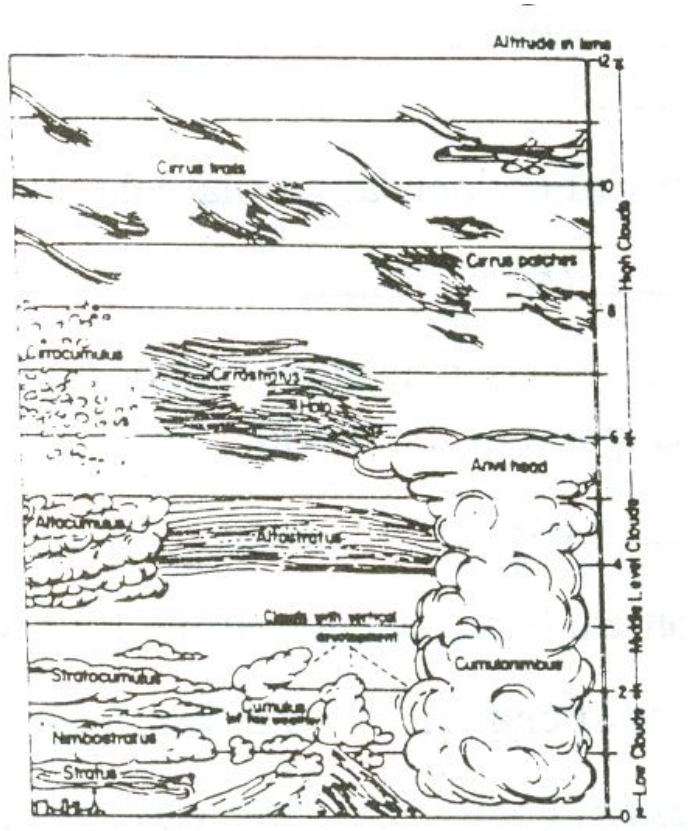



*Fig. 12.2 : Cloud types are grouped into families according to height and form*

- Forms of condensation include dew, frost, mist, fog, smog and clouds.
- Frost and some clouds are formed when condensation takes place below freezing point.
- Clouds are grouped into three types on the basis of appearance and altitude.

## INTEXT QUESTIONS 12.2

(1) List five factors which affect the rate of evaporation.

(a) _____ (b) _____

(c) _____ (d) _____

(e) _____

(2) Name the forms of condensation that take place on the solid objects.

(a) _____ (b) _____

(3) Name two forms of condensation that occur in the air just above the ground in most parts of the world.

(a) _____ (b) _____

(4) Give geographical term for each of the following:

(a) The process of change of water into water vapour_____

(b) The process of change of water vapour into liquid or solid state

_____

(c) A mass of tiny droplets of water or ice crystals hanging in the air at some height_____

(d) Type of clouds formed due to convection and look like wool pack

_____

(e) Type of clouds which are chief rain producer_____

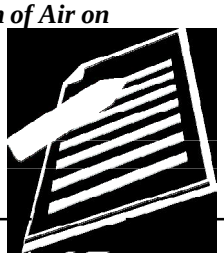
## 12.5 PRECIPITATION

Precipitation is defined as water in liquid or solid forms falling to the earth. It happens when continuous condensation in the body of air helps the water droplets or ice crystals to grow in size and weight that the air cannot hold them and as a result these starts falling on the ground under the force of gravity.

**Forms of precipitation**

The precipitation falls on the earth in various forms of droplets of water, ice flakes and solid ice balls or hail and at times droplets of water and hail together. The form that precipitation takes is largely dependent upon the method of formation and temperature during the formation. The forms of precipitation are as follows:

**(i) Drizzle and Rainfall :** Drizzle is a fairly uniform precipitation composed exclusively of fine drops of water with diameter less than 0.5 mm. Only when droplets of this size are widely spaced are called rain.



**(ii)** **Snowfall:** When condensation takes place below freezing point (-0° C), the water vapour changes into tiny ice crystals. These tiny ice crystals grow in size and form ice flakes which become big and heavy and start falling on the ground. This form of precipitation is called snowfall. Snowfall is very common in Western Himalaya and mid and high latitude regions in winter.

**(iii)** **Sleet:** Sleet is frozen rain, formed when rain before falling on the earth, passes through a cold layer of air and freezes. The result is the creation of solid particles of clear ice. It's usually a combination of small ice balls and rime.

**(iv)** **Hail :** Hail is precipitation of small balls or pieces of ice (hail stones) with diameters ranging from 5 to 50mm, falling either separately or agglomerated into irregular lumps. Hailstones are comprised of a series of alternating layers of transparent and translucent ice.

- Falling down of atmospheric moisture on the earth's surface is called precipitation.
- The precipitation in the form of tiny droplets of water and bigger water droplets are known as drizzle and rainfall respectively.
- When the precipitation is in the form of big ice balls, it is called Snow fall.

## 12.6 TYPES OF RAINFALL

We know, when a mass of moist air ascends to high altitudes it cools down to lower temperatures. In doing so it attains dew point which leads to condensation and precipitation. Thus the cooling of air occurs mainly when it rises. There are three important ways in which a mass of air can be forced to rise and each of these ways produces its own characteristic precipitation or rainfall.

**(a)** **Convectional Rainfall**

Excessive heating of the earth's surface in tropical region results in the vertical air currents. These currents, lift the warm moist air to higher strata of atmosphere. When-the temperature of such a humid air starts falling below dew point continuously, clouds are formed. These clouds cause heavy rainfall which is associated with lightning and thunder. This type of rainfall is called conventional rainfall. It is very common in equatorial region where it is a daily phenomenon in the afternoon (see fig. 12.3)

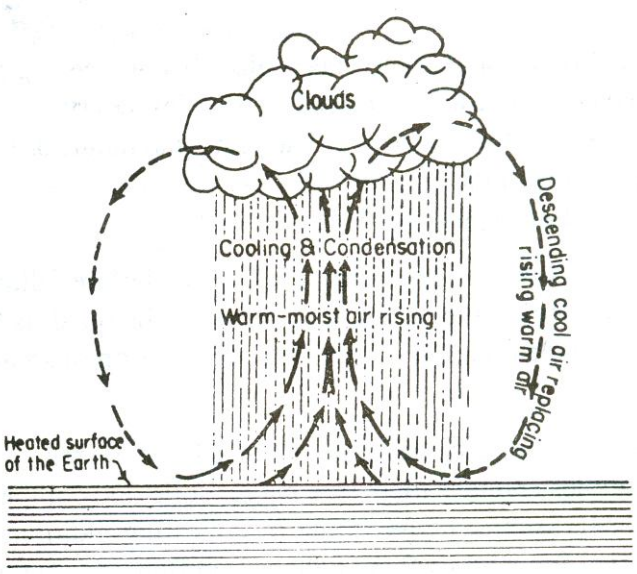



*Fig. 12.3 Conventional Rainfall*

### (b) Orographic or Relief Rainfall

Orographic rainfall on formed where air rises and cools because of a topographic barrier. When their temperature fall below dew point, clouds are formed. These clouds cause widespread rain on the windward slopes of the mountain range. This type of rain is called orographic rainfall. However when these winds cross over the mountain range and descend along the leeward slopes, they get warm and cause little rain. Region lying on the leeward side of the mountain receiving little rain is called rainshadow area (see figure 12.4). A famous example of orographic rainfall is Cherrapunji on the southern margin of the Khasi Hills in Meghalaya India.

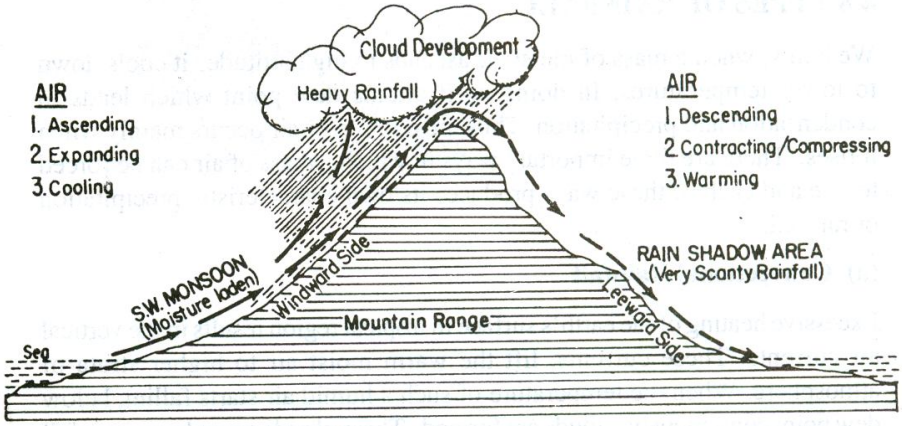
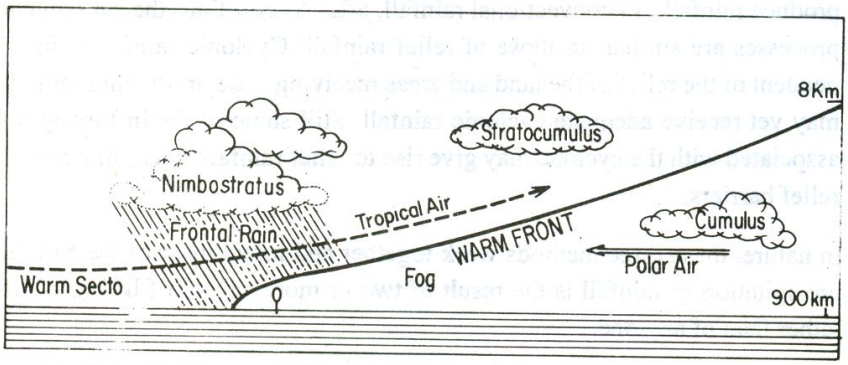



*Fig 12.4 Orographic Rainfall*

### (c) Convergence or Cyclonic Rainfall

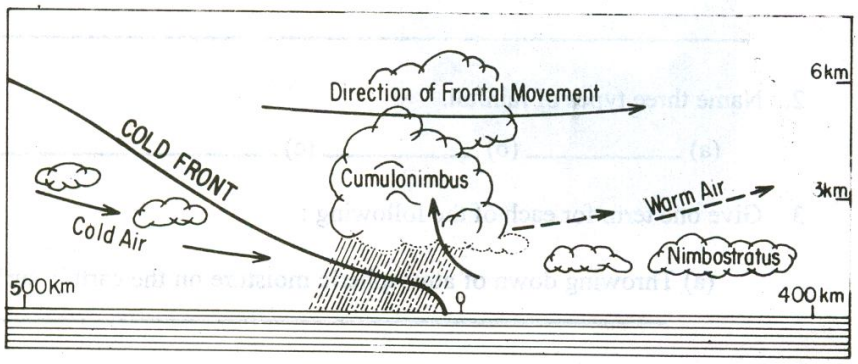
Convergence rainfall, produced where air currents converge and rise. In tropical regions where opposing air currents have comparable temperatures, the lifting is more or less vertical and is usually accompanied by convention. Convectioned activity frequently occurs along fronts where the temperature of the air masses concerned are quite different. Mixing of air along the front also probably contributes to condensation and therefore to the frontal rainfall. When two large air masses of different densities and temperature meet, the warmer moist air mass is lifted above the colder one. When this happens, the rising warm air mass condenses to form clouds which cause extensive down pour. This rainfall is associated with thunder and lightning. 'This type of rainfall is also called frontal rainfall. This type of rainfall is associated with both warm and cold fronts, (fig. 12.5) It is generally steady and may persist for a whole day or even longer.

*(a) Rainfall Associated with a warm Front*




*(b) Rainfall Associated with a Cold Front*

*Fig. 12.5 Cyclonic Rainfall*




In all these types, the cooling of large masses of humid air is essential to produce rainfall. In conventional rainfall, after rising of air, the subsequent processes are similar, to those of relief rainfall

In nature, these three methods work together and infact most of the

earth's precipitation or rainfall is the result of two or more causes of lifting of air rather than of anyone.

- On the mode of occurrence, the rainfall is classified into conventional, orographic and convergence.

## INTEXT QUESTIONS 12.3

1. List the various forms of precipitation.

   _____

2. Name three types of rainfall.
   (a)_____(b)_____(c)_____
3. Give one term for each of the following:
   (a) Throwing down of atmospheric moisture on the earth's surface

   _____

   (b) Frozen raindrops and melted snow falling on the earth's surface

   _____

   (c) The plane of contact between two air masses of varying characteristics

   _____

   (d) Precipitation in the form of ice balls

   _____

   (e) Rainfall caused by uplift of the air due to excessive heating

   _____
4. Below are given true and false statements. Mark 'T' if the statement is true and 'F' if it is false:
   (a) Precipitation is the process of converting water vapour into liquid or solid state_____
   (b) Precipitation in the form of ice flakes is called snowfall _____
   (c) Area lying on the leeward side of a mountain range receive scanty rainfall_____
   (d) Orographic rainfall is caused by ascend of warm moist air due to excessive heating_____

## 12.7 DISTRIBUTION OF PRECIPITATION

The spatial distribution of precipitation is not uniform all over the world. The average annual precipitation for the world as a whole is about 97.5 centimeters but the land receives lesser amount or rainfall than the oceans. The annual precipitation shows marked difference on the land. Different places of the earth's surface receive different amount of annual precipitation and that too in different seasons.

The main features of the distribution of precipitation can be explained with

the help of global pressure and wind belts. distribution of land and water bodies and the nature of relief features. Before arriving at any conclusion regarding the causes for regional and seasonal variation, let us first see regional and seasonal distribution patterns of precipitation.

### (a) Regional Variations

On the basis of average amount of annual precipitation. We can recognize the following precipitation regions in the world. (see fig. 12.6)

**(i)** **Regions of Heavy Precipitation:** The regions which receive over 200 centimeters of annual precipitation are included in this category. These regions include equatorial coastal areas of tropical zone and west-coastal regions of temperate zone.

**(ii)** **Regions of Moderate Precipitation:** The regions which receive 100 to 200 centimeters of annual precipitation are included in this category. These regions lie adjacent to the regions of heavy precipitation. Eastern coastal regions of subtropical zone and coastal regions of the warm temperate zone are included in this category.

**(iii)** **Regions of Less Precipitation :** This category includes regions which receive precipitation between 50 to 100 centimeters. These regions lie in the interior parts of tropical zone and eastern interior parts of temperate zone.

**(iv)** **Regions of Scanty Precipitation:** The areas lying in the rain shadows (leeward) side of the mountain ranges, the interior parts of continents, the western margins of continents along tropics and high latitudes receive precipitation less than 50 centimeters. These regions include tropical, temperate and cold deserts of the world.

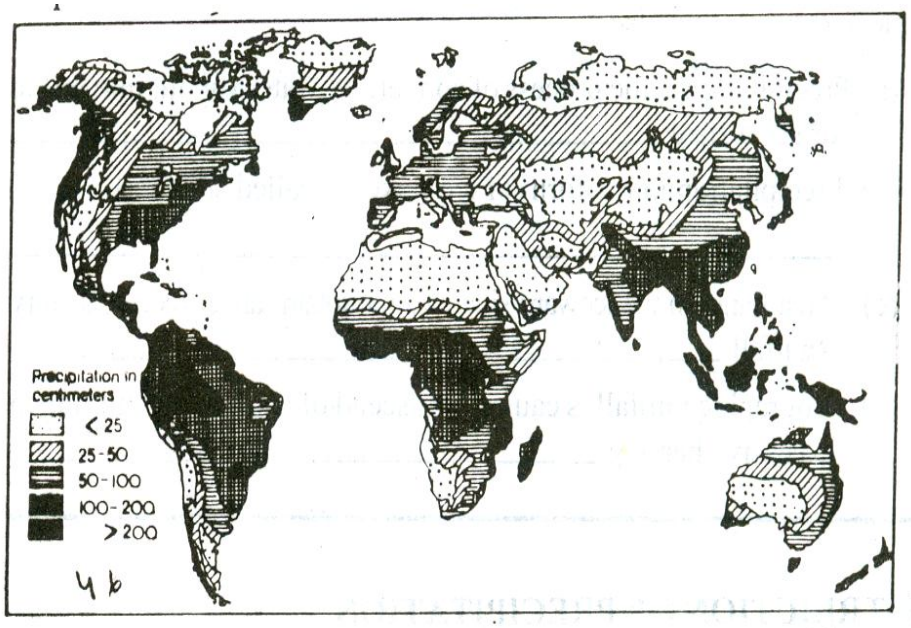



*Fig. 12.6 Distribution of Mean Precipitation in the world*

Now let us carefully study the map showing the annual average precipitation distribution of the world (fig. 12.6) in order to come to the following conclusions.

(1) Precipitation is greatest in the equatorial region and decreases towards the poles.

(2) Precipitation is heaviest in the coastal regions and decreases towards the interior of the continents.

(3) Eastern coastal areas of tropical lands and western coastal areas of temperate lands receive heavy precipitation including equatorial regions.

(4) Precipitation is very heavy on the windward side of highlands; very dry condition prevail on the leeward side.

(5) Coastal areas adjacent to cold currents are drier than coastal areas near warm currents.

(6) The western margin of tropical land and polar region receive scanty rainfall. The main reason being that easterlies become dry winds and polar winds are cold and dry.

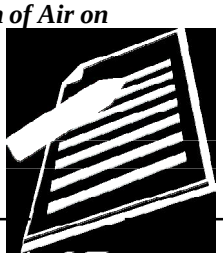
**(b) Seasonal Variations**

The regional variations in the distribution of precipitation in different parts of the world are based on average annual precipitation which do not give us any correct picture of the nature of precipitation specially of those regions where seasonal fluctuations in the amount of precipitation are very common, for example arid, semi arid or sub-humid regions. Therefore, it is important to study seasonal variations of precipitation in the world. The facts related to this are as follows:

(i) The equatorial regions and the western parts of temperate lands receive precipitation throughout the year. The former receive conventional type of rain while the later gets cyclonic cum orographic type through westerlies.

(ii) About 2 per cent land areas of the world receive precipitation only in winter. These include Mediterranean regions of the world and Coromandel Coast of India. Due to the seasonal shift in pressure and planetary wind systems, these regions (Mediterranean) do not get precipitation in summer as they come under sub-tropical high pressure belts and trade winds which become dry while reaching to the western margins of continents.

(iii) The remaining parts of the world receive precipitation only in summer. It makes us clear that most parts of the world experience marked seasonal variation in precipitation. Seasonal distribution of precipitation



provides us idea to judge its effectiveness. For example, the scanty precipitation during short growing season in high latitudes is more effective than that of heavy precipitation in lower latitudes. Likewise, precipitation in the form of dew, fog and mist in some parts like Central India and Kalahari desert has an appreciable affect on standing crops and natural vegetation.

**(c) Factors Affecting Rainfall Distribution**

(i) Moisture supply to the atmosphere is the main factor in determining the amount of rainfall in any region. Equatorial and rest of the tropical region have highest evaporation and hence highest supply of moisture. Coastal areas have more moisture than interior parts of continents. Frigid regions have very low evaporation hence very scanty precipitation.

(ii) Wind direction in the belts of trades and westerlies winds is very important. Winds blowing from sea to land cause rainfall. Land bearing winds are dry. Winds blowing from higher to lower latitudes will get heated and give no rain while those blowing from lower to higher latitudes will get cooled and cause rainfall. Sub-tropical deserts have very little rainfall because they have off-shore winds.

(iii) Ocean currents : Warm current are associated with warm moist winds which cause rainfal1, cold current have cold dry wind and hence no rainfall.

(iv) Presence of mountain across the direction of wind causes more rainfall on the windward side and creates rain shadow on the leeward side.

(v) Pressure belts are closely related with wind direction and rainfall. Areas of low pressure attract rain bearing winds while areas of high pressure do not.

- The distribution of precipitation in different parts of the world shows marked regional and seasonal variation.
- Factors affecting rainfall distribution are: moisture supply, wind direction, ocean currents, presence of mountains and pressure belts.

## INTEXT QUESTIONS 12.4

1. Name any two regions of heavy precipitation.

_____

2. Name any two regions of scanty precipitation.

_____

3. Name the regions where precipitation is heavy throughout the year.

_____

4. Name the regions which receive precipitation only in winters.

_____

5. Name five factors affecting rainfall distribution in the world.

(a)_____(b)_____(c)_____(d)_____

## WHAT YOU HAVE LEARNT

Water vapour is highly variable. It is an important component of atmosphere. It is responsible for global heat balance, atmospheric phenomena and sustaining plant and animal life on our planet. The water vapour present in the atmosphere is called humidity, which is expressed as absolute humidity and relative humidity. Of these, the relative humidity is most reliable measure. Water vapour enters into atmosphere through a process called evaporation. Temperature of the air controls the amount of moisture it can hold at a given volume. The air which holds the moisture to its full capacity is called saturated air and the temperature at which it reaches saturation point is termed as dew point. Condensation is a process of changing of water vapour into liquid or solid state. It happens when temperature of an air falls below dew point. Condensation occurs near the ground as dew, mist, or fog and at higher levels of clouds.

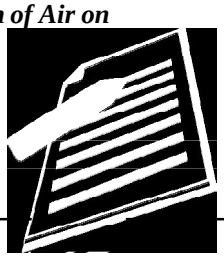
Falling down of atmospheric moisture is called precipitation which occurs due to continuous condensation. Drizzle, rainfall, snowfall, sleet and hail are various forms of precipitation. The rainfall occurs in three different ways conventional, orographic and cyclonic.

The distribution of precipitation in the world shows marked regional and seasonal variation. Some regions receive heavy rainfall while others scanty precipitation. Some regions receive precipitation throughout the year while others only in the winter or summer. Several factors affect rainfall distribution.

## TERMINAL QUESTIONS

1. Explain the importance of water vapour present in the atmosphere.

2. What is evaporation? Discuss the factors which affect the rate of evaporation. Give examples in support of your answer.



3. Explain the process and forms of condensation.

4. How does precipitation occur? Discuss the various forms of precipitation.

5. Differentiate between:

   (a) Evaporation and condensation;

   (b) Absolute humidity and relative humidity;

   (c) Saturated air and unsaturated air;

   (d) Rainfall and precipitation;

   (e) Sleet and hail;

   (f) Conventional and orographic rainfall.

6. Discuss in detail the regional and seasonal distribution of precipitation in the world.

7. Give reasons for each of the following:

   (a) Equatorial regions receive precipitation throughout the year.

   (b) Mediterranean regions receive rainfall only in winter.

   (c) Amount of precipitation decreases from coastal areas to interior, parts of continents.

   (d) Tropical deserts are found on the western parts of continent.

   (e) Evaporation decreases towards poles.

8. On the given outline map of the world, show the following with appropriate symbols:

   (a) Two areas getting precipitation above 200 cms.

   (b) Two areas of scanty precipitation in lower latitudes.

   (c) Two regions getting precipitation only in winter.

   (d) Cold deserts of the world.

## ANSWER TO INTEXT QUESTIONS

**12.1**

1. (a) Liquid (b) Solid (c) Gaseous

2. (a) humidity (b) absolute humidity (c) relative humidity (d) saturated air (e) dew point

**12.2**

1. (a) Temperature (b) air moisture (c) winds (d) cloud cover (e) accessibility of water bodies
2. (a) dew (b) frost
3. (a) mist (b) fog
4. (a) evaporation (b) condensation (c) cloud (d) cumulus (e) cumulonimbus.

**12.3**

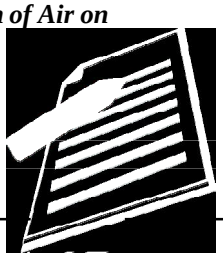
1. Drizzle, rainfall, sleet and hail
2. (a) Conventional (b) Orographic (c) Cyclonic
3. (a) Precipitation (b) Sleet (c) Front (d) Hail (e) Conventional rainfall
4. (a) F (b) T (c) T (d) F

**12.4**

1. Equatorial, eastern sub-tropical and western coastal temperate regions.
2. Western margins along tropics and interior parts of continents in temperate zone and polar region.
3. Equatorial regions
4. Mediterranean regions
5. (a) Moisture supply (b) wind direction (c) ocean currents (d) presence of mountains (e) pressure belts

**HINTS TO TERMINAL QUESTIONS**

1. Please refer to section 12.1
2. Please refer to section 12.3
3. Please refer to section 12.4
4. Please refer to section 12.5
5. See under the respective headings.
6. Please refer to section 12.7
7. (a) Due to the uniform high temperature throughout the year in the equatorial region, there is much evaporation, conventional air currents are set up, followed by heavy rainfall of conventional type.



(b) In summer the sun is overhead at the Tropic of Cancer, the belt of influence of the westerlies is shifted a little poleward. The Mediterranean Region falls under the sub-tropical high pressure belt and trade winds. Trade winds become dry before reaching the western margin of continents. Hence no rainfall in summer. But during winter, the Mediterranean region comes under the influence of westerlies due to their shift towards south. Thus the region gets rainfall in winter only.

(c) Precipitation decreases from coastal areas to interior parts because rain bearing winds loose their moisture as they go interior.

(d) The aridity of the tropical deserts located in the western part of continents is mainly due to the effects of off shore Trade winds.

(e) Evaporation decreases towards poles due to low temperatures.

(f) Please see maps.