

MODULE - 4

*The domain of Air on
the Earth*



Notes



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13

WEATHER AND CLIMATE

In the preceding three lessons, we have discussed about the temperature, atmospheric pressure, winds and precipitation. These elements of weather have an important effect on our lives. For example the houses we construct, the clothes we wear and the food we prefer mainly depend on weather and climatic conditions. In this lesson, we will study about the difference among weather, season and climate and also the factors affecting climate of a place.



OBJECTIVES

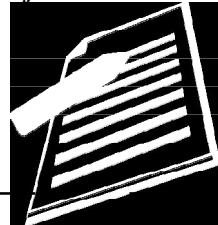
After studying this lesson you will be able to:

- name the various elements of weather and climate;
- differentiate among weather, season and climate;
- explain the need for forecasting weather in advance;
- explain with specific example the various factors affecting the climate of a place or region;
- describe the important characteristics of each thermal zone with the help of a diagram;
- state Koeppen's classification of climate.

13.1 WEATHER AND CLIMATE

(i) Weather

Temperature, pressure, wind, humidity and precipitation, interact with each other. They influence the atmospheric conditions like the direction and velocity of wind, amount of insolation, cloud-cover and the amount of precipitation. These are known as the elements of both weather and climate. The influence of these elements differs from place to place



and time to time. It may be restricted to a small area and for a short duration of time. We very often describe this influence in the name of weather as sunny, hot, warm, cold, fine, etc depending upon the dominant element of weather at a place and at a point of time. Therefore, **weather is the atmospheric condition of a place for a short duration with respect to its one or more elements.** Two places even a short distance apart may have different kind of weather at one and the same time.

(ii) Weather Forecast

It is important to know by some means the coming weather in advance. You may be planning to go on a hike without knowing that the particular day may be rainy. Farmers, sailors, aviators, tourists and many others are interested to know the weather conditions in advance for their own benefits. That is why newspapers publish weather reports and weather forecasts along with a map showing this information. Now, better weather forecasts are available with the use of weather satellites. Weather conditions are televised every day. When a cyclone or dangerous weather is expected, warnings are issued over the radio, television and newspapers so that people can prepare to save themselves and their property from its hazard.

The weather office collects data on temperature, wind, cloud cover, rainfall and other atmospheric phenomena through its numerous observation centres. These centres are scattered all over the country. Similar information is also received from the ships sailing in the high seas. The analysis of these data thus collected, helps in forecasting weather conditions for the next 48 hours or even for a week. The significance of a weather information supplied through a map and its forecast is better utilised in a country like the U.K. where weather changes are very rapid.

(iii) Season

You know that a year is divided into seasons depending upon variations in atmospheric conditions. They are specified periods in a year which have similar weather conditions. Season is a period of the year characterized by a particular set of weather conditions resulting from the inclination of the earth's axis and the revolution of the earth round the sun. The same cycle of season is repeated year after year. Four seasons, each of three months duration have been recognized in temperate regions. They are spring, summer, autumn and winter. In our country, we have three distinct seasons which are summer, winter and rainy. The Indian Meteorological Department has recognized four main seasons. They are (1) cold weather season (December to February.) (2) hot weather seasons (March to May) (3) advancing

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monsoon season or rainy season (June to September.) and. (4) retreating monsoon season (October to November.)

Traditionally there are six seasons in north India. They are (1) Basant Ritu (Chaitra- Vaisakh or March-April), (2) Greeshm Ritu (Jaystha-Asharh or May-June), (3) Varsha Ritu (Shravan-Bhadrapad or July-Aug.), (4) Sharad Ritu (Aswina-Kartika or Sept - Oct.), (5) Hemant Ritu (Margashirsh-Posh or Nov-Dec.) and (6) Shishir Ritu (Magh-Falgun or Jan-Feb.)

The rays of the sun are more or less direct on the equator throughout the year. Hence, equatorial regions experience the same temperature all the year round. Therefore, seasons are insignificant on or near the equator. Near the coast, the oceanic influence reduces the seasonal variations. In the polar regions, there are only two seasons i.e. long winter and short summer.

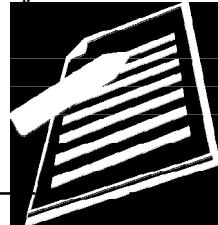
(iv) Climate

The average weather conditions, prevalent from one season to another in the course of a year, over a large area is known as climate. The average of these weather conditions is calculated from the data collected for several year (about 35 years) for a larger area. Rajasthan, for example, experiences hot and arid climate, Kerala has tropical rainy climate, Greenland has cold desert climate and the climate of Central Asia is temperate continental. Climate of a region is considered more or less permanent.

- Weather is the atmospheric condition of any place for a short period of time with respect to its one or more elements such as temperature, pressure, wind, humidity, precipitation, sunshine, cloud cover etc.
- The periods of the year which are characterised by particular set of weather conditions are mainly caused by the inclination of the earth's axis and the revolution of the earth around the sun, are known as seasons.
- The average weather conditions of a large area for the past several years is known as its climate persisting more or less permanent.

The difference between weather and climate can be tabulated as under

<i>Weather</i>	<i>Climate</i>
(1) Weather is the study of atmospheric conditions for short duration of a limited area.	(1) Climate is the study of the average weather conditions observed over a long period of time for a larger area.

**Notes**

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| (2) Weather is influenced by anyone of its predominant elements i.e., temperature or humidity. | (2) Climate is the collective effect of all its elements. |
| (3) The weather changes very often | (3) It is more or less permanent. |
| (4) It is experienced over small areas of a country. | (4) It is experienced over large area of the continent. |
| (5) A place can experience different types of weather conditions in a year. | (5) A place can experience only one type of climate. |



Fill in the blanks by the most appropriate word from those given within brackets against each of the following:

1. Weather depends upon predominance of _____ of its elements
{(a) one, (b) two, (c) three (d) one or more }
2. The season is _____ in equatorial region {(a) predominants, (b) good, (c) insignificant, (d) always changing. }
3. The average weather conditions for _____ duration represent climate. {(a) one year, (b) long, (c) short, (d) many years. }
4. The exposed skin of our body starts cracking in winter season mainly due to _____ {(a) rainy season, (b) high humidity, (c) summer season, (d) low humidity}
5. Seasons are caused by _____ {(a) ocean currents and revolution, (b) air masses and rotation of the earth (c) ocean current and rotation of the earth, (d) inclination of the earth's axis and earth's revolution}
6. Four seasons each of three months duration are noticed in _____ zone/region {(a) Temperate, (b) Tropical, (c) Equatorial, (d) Frigid. }

13.2 FACTORS AFFECTING CLIMATE

Different regions of the world have differences in temperature, humidity and precipitation. You know that these differences influence the lifestyle of the people living under different climatic conditions. To understand different climatic conditions, let us discuss the factors which cause the variations in the climate of a place or a region.

**1. Latitude or Distance from the Equator**

The places near the equator are warmer than the places which are far away from it. This is because the rays of the sun fall vertical on the equator and slanting in the temperate and polar regions. As we have discussed earlier the vertical rays are concentrated over a small area than the slanting one. Again, the vertical rays pass through a shorter distance in the atmosphere before reaching the earth's surface. Therefore, lower the latitude higher is the temperature and vice versa. Malaysia which is near the equator is warmer than England which is far way from the equator.

2. Altitude or the Height from the mean sea level

We all know that mountains are cooler than the plains. Shimla situated on a higher altitude is cooler than Jalandhar, although both are almost on the same latitude. The temperature decreases with the height of a place. For a vertical rise of 165 metres there is an average decrease in temperature at the rate of 1°C. Thus the temperature decreases with increase in height.

3. Continentally or the Distance from the Sea

The water is a bad conductor of heat i.e. it takes longer time to heat and longer time to cool. Due to this moderating effect of the sea, places near the coast have low range of temperature and high humidity. The places in the interior of the continent do not experience moderating effect of the sea. These places have extreme temperatures. The places far from the sea have higher range of diurnal (daily) and annual temperatures. Mumbai has relatively lower temperature and higher rainfall than Nagpur, although both are almost situated on the same latitude.

4. Nature of the Prevailing Winds

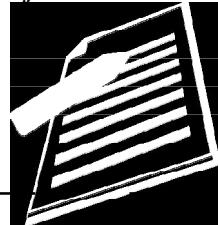
The on-shore winds bring the moisture from the sea and cause rainfall on the area through which they pass. The off-shore winds coming from the land are dry and help in evaporation. In India, the on-shore summer monsoon winds bring rains while off-shore winter monsoon winds are generally dry.

5. Cloud Cover

In areas generally of cloudless sky as in deserts, temperature even under shade are very high because of the hot day time sunshine. At night this heat radiates back from the ground very rapidly. It results in a large diurnal range in temperature. On the other hand under cloudy sky and heavy rainfall at Thiruvananthapuram the range of temperature is very small.

6. Ocean Currents

Ocean waters move from one place to another partly as an attempt to equalize temperature and density of water. Ocean currents are large movements of water usually from a place of warm temperature to one of cooler temperature or vice-versa. The warm ocean currents raise the temperature of the coast and sometimes bring rainfall, while the cold currents



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lower the temperature and create fog near the coast. Port Bergen in Norway is free from ice even in winter due to warm North Atlantic Drift while Port Quebec in Canada remains frozen during winter months due to chilling effect of the Cold Labrador Current in spite of the fact that Port Quebec is situated in much lower latitude than Port Bergen. The on-shore winds passing over a warm current carry warm air to the interior and raise the temperature of the inland areas. Similarly, the winds blowing over cold current carry cold air to the interior and create fog and mist.

7. Direction of Mountain Chains

The mountain chains act as natural barrier for the wind. The on-shore moisture laden winds are forced to rise after striking against the mountain; and give heavy rainfall on the windward side. These winds descending on the leeward side cause very low rainfall. The great Himalayas check the moisture laden monsoon winds from crossing over to Tibet. This mountain chain also checks biting polar cold winds from entering into India. This is the reason for which northern plains of India get rains while Tibet remains a perpetual rain shadow area with lesser amount of rainfall.

8. Slope and the Aspect

The concentration of heat being more on the gentler slope raises the temperature of air above them. Its lesser concentration along steeper slopes lowers the temperature. At the same time, mountain slopes facing the sun are warmer than the slopes which are away from the sun's rays. The southern slopes of Himalaya are warmer than the northern slopes.

9. The Nature of the Soil and Vegetation Cover

The nature of soil depends upon its texture, structure and composition. These qualities vary from soil to soil. Stony or sandy soils are good conductor of heat while black clay soils absorb the heat of the sun's rays quickly. The bare surface reradiates the heat easily. The deserts are hot in the day and cold in the night. The forest areas have lower range of temperature throughout the year in contrast to non-forested areas.

- The factors which affect the climate of a place or region are latitude or the distance from the equator, altitude or the height from the mean sea level, continentality or the distance from the sea, nature of the prevailing winds, ocean currents, direction of mountain chain, slope and its aspect, nature of soil and the vegetation cover.

Some of the following statements are false and some are true. Write true against

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1 Higher the latitude lower is the temperature

1. Higher the latitude lower is the temperature.
 2. Higher the altitude lower is the temperature.
 3. Nearer the sea coast lower is the range of temperature.
 4. Interiors of the continent have lower range of temperature.
 5. Cold ocean currents lower the temperature of the coast.

The varied effect of the major weather elements in different parts of the world and
every location a distinct climate. Hence, the number of different climate is large. In order to easily understand and comprehend this large variety, the climate of the world have been classified into a few major groups, each having certain common important characteristics.

Although several attempts have been made by scholars to classify the climate of the world for the proper understanding of major climate types no single classification is perfect, as climate stands for the generalized and composite weather conditions. However, the Greeks, perhaps, made the first attempt to classify the world climates on the basis of the distribution of temperature and insolation. They divided the world into five latitudinal thermal zones. The boundary of these zones are fixed on the basis of the angle at which the sun's rays strike the earth. The following are the five thermal zones.

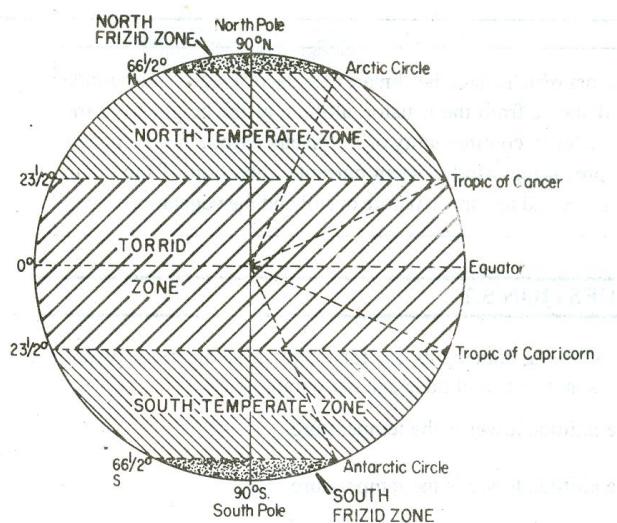
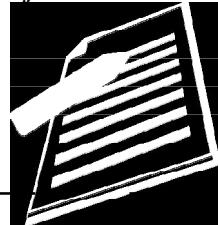


Fig. 13.1 Thermal Zone



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(a) **The Thermal Zones**

- (i) **Torrid Zone:** It is the largest of the thermal zones. It covers, almost half the area of the earth's surface. It is situated between the Tropic of Cancer ($23\frac{1}{2}^{\circ}$ N) and Tropic of Capricorn ($23\frac{1}{2}^{\circ}$ South) (See fig 13.1). The sun's rays are almost vertical throughout the year in this zone. The mid-day sun is overhead at equator on equinoxes, i.e. on 21st March and 23rd September. It is also overhead at Tropic of Cancer on 21st June and at Tropic of Capricorn on 22nd December. The duration's of day and night are always equal i.e. 12 hours each on the equator and they increase to 13 hours 27 minutes at tropics. The range of temperature is lowest at the equator and it increases towards the tropics.
- (ii) **Temperate Zone:** The temperate zones are on either side of the Torrid zone. The North Temperate Zone lies between Tropic of Cancer ($23\frac{1}{2}^{\circ}$ North) and Arctic Circle ($66\frac{1}{2}^{\circ}$ North). The South Temperate Zone lies between Tropic of Capricorn ($23\frac{1}{2}^{\circ}$ South) and Antarctic Circle ($66\frac{1}{2}^{\circ}$ South) (see fig. 13.1). The sun is never overhead in this zone in winter season, the nights are longer and days are shorter and vice versa in summer. The difference between the duration of the day and night increases towards the poles. The maximum duration of day in summer and that of night in winter in the polar circles is 24 hours. When it is summer in the northern hemisphere it is winter in the southern hemisphere and vice versa,
- (iii) **Frigid Zones:** Like the temperate zone, frigid zone is also found in both the hemispheres. The North Frigid Zone lies between Arctic Circle ($66\frac{1}{2}^{\circ}$ N) and North Pole (90° North). The South Frigid Zone lies between Antarctic Circle ($66\frac{1}{2}^{\circ}$ South) and South Pole (90° South). During winter season, the sun does not rise above the horizon for almost six months. These are the coldest regions of the world. The surface remains permanently frozen under thick snow.

- The earth is divided into five thermal zones on the basis of distribution of insolation and temperature.
- Five thermal zones are torrid zone, north and south temperate zones and north and south frigid zones.

**INTEXT QUESTIONS 13.3**

1. Fill in the blanks with suitable answers:
 - (i) The concept of thermal zones was first given by _____
 - (ii) The _____ passes through the middle of the torrid zone.

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- (iii) Days and nights are always equal at the _____
- (iv) The sun is overhead twice at _____ on 21st March and 23rd September.
- (v) The sun is overhead throughout the year in _____ zone.
- (vi) The _____ Zone lies between 23½° South and 66½° South.
- (vii) The North Frigid Zone lies between 66½° North and _____
- (viii) The perpetual thick snow covers the _____ zone.

(b) Climatic Types

The concept of thermal zone is theoretical and explains the distribution of solar energy over the earth's surface. As discussed earlier, there are several other factors besides the angle of the sun's rays which influence the climate of a place. Keeping in view other factors responsible for the distribution and combined influence of temperature and rainfall, modern scientists have arrived to several classifications of climate and its types. The most widely used system of climatic classification in its various modified forms is that of Wladimir Koeppen (1846-1940). It is based upon temperature, precipitation and their seasonal characteristics. The relationship of climate with the vegetation is also included with it. According to this scheme, the world has been divided into five climatic groups and they are further sub-divided into 13 climatic types. They are as follows:

I Climatic Groups

- (A) Tropical climates (hot all seasons)

Climatic Types

- Af (i) Tropical rain forest

Aw (ii) Savanna Climate

Am (iii) Monsoon Climate

- (B) Dry climates

Bw (iv) Desert Climate

Bs (v) Steppe Climate

- (C) Warm temperate rainy or Middle latitude rainy climates (mild winters)

Cs (vi) Mediterranean Climate

Cw (vii) China Type Climate

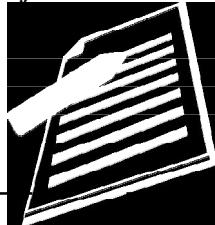
Cf (viii) West European Climate

- (D) Humid Middle latitude climates (severe winters)

Dw (ix) Taiga Climate

Df (x) Cool East-coast Climate

(xi) The Continental Climate



Notes

You will study the specific characteristics of some of these climatic types in the subsequent lesson dealing with the life of people in low latitude, mid-latitude and high latitude regions of the world.

- W.Koeppens scheme of climatic classification is based on temperature precipitation and their seasonal characteristics
 - According to this scheme the world has been divided into 5 climatic groups and 13 climatic types.



INTEXT QUESTIONS 13.4

1. Match correctly each item of column A with that of column B

A Climate Group

- (a) Tropical Climate
 - (b) Dry Climate
 - (c) Warm Temperate Climate
 - (d) Humid Middle Latitude Climates (severs winters)
 - (e) Polar Climates

B Climatic Types

- (1) Tundra Climate
 - (2) Taiga Climate
 - (3) Savanna Climate
 - (4) Steppe Climate
 - (5) Mediterranean Climate



WHAT YOU HAVE LEARNT

The difference among weather, season and climate is that of duration, extent and permanency. Weather is the atmospheric condition of a place for a short period of time with respect to one or more of its elements. It is not permanent. Season is the period of a year which is characterized by a particular set of weather condition. It is mainly caused by the inclination of the earth's axis and revolution of the earth round the sun. Its cycle is repeated year after year. Climate is the average weather conditions of a large area for the past several years. It is more or less permanent. Climate of any place or region is affected by several factors, such as distance from the equator, ocean currents, direction of mountains, slope and aspect, soil and vegetation cover etc. Ancient Greeks divided the world into torrid, temperate and frigid zones based upon the distribution of temperature. Torrid zone is the hottest, the frigid zone is the coldest and the temperate zone lies in between the two. It

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has a mild temperature. The length of the day varies from equator to poles. The days and the nights are almost equal on the equator. The length of the day increases in summer and decreases in winter as we move towards the poles.

Climate types are the outcome of the classification based upon regions of their formation. W. Koeppen classified the world into five climatic groups, namely (A) Tropical Climate, (B) Dry Climate, (C) Humid Mid-latitudes Climate (mid winters), (D) Humid Mid-Latitudes Climate (severe winters) and (E) Polar Climate. His classification is based on temperature, precipitation and their seasonal variation. He sub-divided the climatic groups into 13 climatic types.



1. Explain the factors which affect climate of a place.
2. Draw a simplified diagram of thermal zones and write important characteristics of each zone.
3. Distinguish between weather and climate by describing five points of distinction of each.
4. Name the three main basis of Koeppen's classification of climate and also state the five climatic groups and their sub-divisions into climatic types.



13.1

1. (d); 2. (c); 3. (d); 4. (d); 5. (d); 6. (a)

13.2

1. True; 2. True; 3. True; 4. False; 5. True

13.3

- (i) Greeks; (ii) equator; (iii) equator; (iv) equator; (v) Torrid; (vi) South Temperate; (vii) 90° N or North Pole; (viii) Frigid

13.4

- (a). (3); (b). (4); (c). (5); (d). (2); (e). (1)

HINTS TO TERMINAL QUESTIONS

1. Please see para 13.2
2. Please see para 13.3 (a)
3. Please see para 13.1 (iv)
4. Please see para 13.3 (b)