Lesson - 16

Classification of Climate

The temperature, pressure, humidity, clouds, rainfall and movement of winds of a place, are called elements of weather and climate. There is differencebetween weather and climate.

Weather-

The sum total of atmospheric conditions (like temperature, pressure, winds, humidity, precipitation and clouds) at a place and time is called weather. The weather always keeps on changing. In other words we may say that weather is a momentary state of atmosphere.

Climate-

The climate is the average summary of weather conditions of a particular place. It is the description of atmospheric conditions for a longer period of time of an extensive region. Therefore climate is much broader term than weather. According to Monkhouse- climate is basically, includes the description of atmospheric conditions for a longer period of time of a particular place.

Classification of climate

Different types of climate are found in different parts of the world. This is due to a number of factors that affect the climate out of which the major ones are location, distance from the sea ,mountain barriers, ocean currents, direction of winds, height above sea level and atmospheric disturbances.

The first attempt of classification of climate was done by ancient Greeks. They divided the world on the basis of temperature into three major zones-

1. Tropical Zone 2 .Trade Zone 3. Frigid Zone.

Therefore, the description of climate after the collection and arrangement of data in sequential way and providing regional description on the basis of analysis of data collected, is called classification of climate. No climatic classification is complete in itself. Therefore the classification is done in a generalized way. Many scholars of the world have classified the climate out of them the major ones are Koppen, Miller, Thornwaite, Trewartha.

The climate greatly influences the physical and mental activities of human beings. The climate determines, the place of their dwelling and their development, occupation they will adopt to and the regions where they will cultivate crops. The climate effects the occupation, business, health , physical and mental capacities of human beings.

Classification of climate according to Koppen

The famous German climatologist Wladimir Koppen presented his classification of climate first of all in 1900, which was on the basis of the vegetation regions of the world. He modified his classification many times from 1900 to 1936. The basis of his classification was temperature, rainfall, and their relationships with the weather conditions. He tried to corelate these elements with the vegetation , as he believed that the climate as a whole, is well represented by natural vegetation. In this way, Koppen adopted such a quantitative method of classification of climates which could establish a deeper connection between climate and

vegetation. Koppen classified the climate of the world into 5 major types by using English alphabets

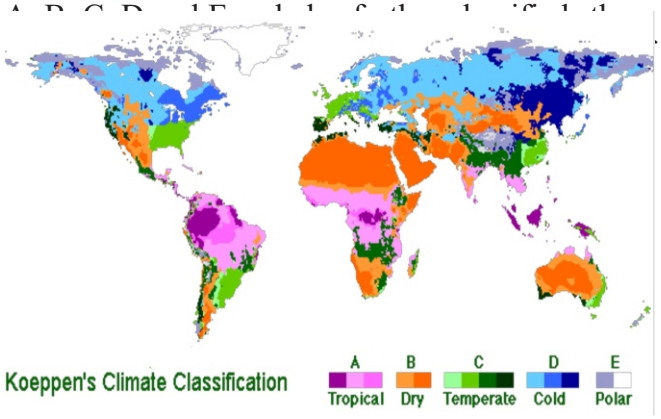

Fig.16.1 : Classification of Climate according to Koppen

	Classification of climate	Characteristis
A	Humid Tropical Climate	Mean temperature of all the months is above 18°C, winterless season, rainfall exceeds amount of evaporation
B	Dry Climate	Evaporation exceeds the amount of rainfall, scarcity of water
C	Mid-latitudes warm temperate climate	Both summers and winters are found here, the mean temperature of the coldes month is less than 18°C and more than 3°C
D	Cold Temperature Climate	Severe winters, Mean temperature during winters is less than 3°C but more than 10°C in summer
E	Polar Climate	Summerless season. The mean temperature of the warmest month is less than 10°C

Table 16.1
Classification of climate according to Koppen

The description of climatic classification by Koppen is as follows-

1. A Tropical Humid Climate

The average temperature here, is above 18°C of every month. Winter season is not found in this type of climate. The rainfall occurs throughout the year. The amount of rainfall exceeds the amount of evaporation. It is further classified into three sub divisions on the basis of temperature, rainfall and aridity.

(i) Af- Tropical humid Climate

The rainfall occurs throughout the year, there is no annual range of temperature, aridity is also deficient.

(ii) Am- Tropical Monsoon Climate

It is also called monsoon type of climate. Dense vegetation is found because of excessive rainfall. A short dry season is also found here.

(iii) Aw- Tropical Wet and Dry Climate

It is also called Tropical Savanna climate. The temperatures is higher throughout the year. The rainfall occurs during summer season and winters remain dry.

2. B Dry Climate

In this type of climate evaporation exceeds the amount of rainfall. There is often scarcity of extra water. It is further divided into two types on the basis of temperature and rainfall-

(i) BS - Steppe Region - The amount of rainfall, is sufficient for the growth of dry grass.

(ii) BW- Desert Region- The amount of rainfall in this region is insufficient for the growth of vegetation.

On the basis of temperature the steppe and desert climate, each region is further divided into two sub-divisions-

(i) BSh- Tropical Steppe Climate
(ii) BSk- Cold Steppe Climate
(iii) BWh- Warm Tropical Desert Climate
(iv) BWk- Cold Desert Climate

3. C Warm Temperate Humid Climate

It is also called mesothermal climate.The average temperatures of the coldest month is below

18° C and above -3°C. The summer and winter both type of seasons are found here. Winters are not extreme. On the basis of seasonal distribution of rainfall it is further divided into following three divisions:-

(i) Cf- Precipitation throughout the year
(ii) Cw- Heavy rainfall during summers
(iii) Cs- Heavy rainfall during winters

Its other subdivisions are a- hot summer, b- cool summer, c- cool short summer.

4.D Cold Temperate Climate

The minimum temperature of coldest month is -3°C and the average temperature of the hottest month is more than 10°C. Coniferous Vegetation is found in this type of climate. It is further divided into two subdivisions-

(i) Df- Rainfall throughout the year
(ii) Dw- Rainfall during summers and dry winters.

5. E Polar Climate

(i) ET - Tundra type of climate

The temperature during summer season varies between 0 °to 10 °C.

(ii) EF - Perpetual Snow Climate

The temperature during summer season is less than 0°C. There is perpetual snow throughout the year.

In this way Koppen presented the classification of world climates by including, the secondary characteristics of rainfall and temperature.

Some scientist have considered the classification presented by Koppen to be incomplete. The climatologist like Thornwait, Jones, Ackermann have criticized the classification. They are of the opinion that this classification is suitable for plain regions but misleads for mountainous regions. It is not sufficient to divide the entire world into 5 climatic regions. But still koppen's classification is given importance in geographical studies, because it is very popular as it easy to understand.

The ease of teaching and learning of this classification is its most dominant characteristic.

Green House effect

In the colder regions, where the solar radiation is almost negligible, green houses are used to cultivate fruits and vegetables. The incoming solar radiation reaches inside through the glass of these green houses but do not allow to go out the re-radiation in the form of long waves. Due to this the temperature inside the green house increases. The atmosphere of the earth works similar to green houses. It maintains the average temperature of 35°C on the earth.

The gases found in the atmosphere like carbon dioxide, methane, water vapour, nitrous oxide, chlorofluorocarbon are responsible for greenhouse effect. These gases allow the shortwave radiation to reach the earth but return the long wave radiation towards the earth, specially by absorbing red rays which keeps the surface of the earth warm continously. This process is called greenhouse effect.

The water vapour present in the atmosphere keeps the earth warm but due to human activities, gases like carbon dioxide, Methane, nitrous oxide, chlorofluorocarbon are causing greenhouse effect. Carbon dioxide is the major Green house effecting gas. There is constant increase in the amount of carbon dioxide in the atmosphere.

The extensive industrial development and vehicular pollution causes increase in carbon dioxide. Due to the burning of coal, mineral oil, and fuel wood respiration of human beings, volcanic eruptions, decomposition of vegetation, the amount of carbon dioxide is constantly increasing. Methane gas is produced due to foodgrain cultivation, marshy lands, mining, termites and burning of fossil fuels. Nitrous oxide is basically produced due to use of Nitrogen based fertilizers and burning of fossil fuels. The production of Nylon also causes its increase. Chlorofluorocarbons are produced during chemical processes. According to studies done by scientist carbondioxide contributes 57%, Methane 18%, Nitrous oxide 6%, Chlorofluorocarbon 17% in the green house effect.

Harmful effects of greenhouse effect are as follows:-

1. Increase in Temperature

The global rise in temperature of the Earth is due to the greenhouse effect created by human beings. This is the major cause of rise in greenhouse

gases in nature. Due to increase in temperature the climate of the earth will change. The desperancies in the weather conditions are the result of this.

2. Increase in Rainfall

Due to increase in temperature ,there will be more evaporation from water bodies which would cause excessive rainfall.

3. Melting of Polar Ice

As the temperature of the earth will rise the ice on the mountain peaks and polar regions will melt.

4. Rise in the Sea Level

Due to the increase in average temperature of the world, the ice on the mountains and polar regions would melt which would causes rise in the sea level. This will cause the submergence of coastal margins.

5. Effect on Agriculture

As the pattern of rainfall will change the agriculture will also be affected.

6. Effect on living creatures and vegetation

The living creatures who will not be able to adapt themselves according to increasing temperature will get extinct. Due to the rise of sea level the vegetation near the coastal margins will be submerged under water. The biodiversity of the world will decline.

Measures to Control Green House Effect

Green house effect has caused danger to entire biosphere. To control this effect following measures are suggested:-

1. The drastic rise of carbon dioxide gas, which has the highest contribution in greenhouse effect , should be checked. The burning of fossil fuels should be reduced for this. Alternative fuels should be used more.
2. Deforestation on the large scale should be checked and afforestation should be done extensively.
3. Proper measure should be taken to check the increase in population.
4. Such devices should be used in vehicles and industries which may emit lesser polluted gases and these gases should get disintegrated before they reach the atmosphere.
5. The use of chlorofluorocarbons should be very limited.
6. The chemical fertilizer should be used in restricted amount. Organic Fertilizers should be used more.

Global warming

The temperature of the earth is constantly rising due to increase in greenhouse gases. Excess amount of carbon dioxide is produced by industries and vehicles, which is comparatively higher than the proportion of carbon dioxide utilised by plants. This results in the increase of carbon dioxide in the atmosphere at the rate of 2% per year. As this gas is heavier it accumulates in the form of a layer near the surface of the earth. The Terrestrial radiation from the earth, is reflected back towards the earth which is the cause of increase in temperature of the earth. This increase of temperature of the earth is called Global warming.

The scientists after studying the Global temperature from1400 till present, have found that 1990 1995 and 1997 have been the warmest years. It is estimated that in there is rise of 1°C in the earth's temperature in the past 50 years. According to the scientist the amount of carbon dioxide will be double in the 21st century in comparison to the period before the industrialisation (1860). This will result into the increase in global temperature of 1.50 to 4.5° C by 2050.

Kirbati and many other island countries using "Migration with Dignity" policy are requesting many International platforms. The proportion of people going out of Kirbati island group may be more but due to rise in oceanic level, there will be no possibility of them to return home . Due to these climatological reasons there will be mass migration in the future. Therefore, it is the moral responsibility of all to establish sociological, cultural and economic harmony globally.

The National Academy of Sciences, US (2015) has studied the rise of sea level in 3000 years due to global warming. According to the

academy, if the Global Warming continues at the same rate, the sea level will rise by 1.5 m by the end of this century. This will affect 20 million people who are residing on the coastal margins in the world. It includes China, India, Japan, Indonesia, Vietnam, Bangladesh ,Maldives and thousands of islands in Pacific Ocean. According to the report of USA, 16% of Bangladesh region and 15% of its population is directly related to this danger. The existence of many islands of Pacific Ocean like Tora, Solomon, Marshall and many other low lying island countries, which are formed of corals and volcanoes, are in danger.

Impact of Global Warming

The impact of global warming will be as follows:-

1. Due to the increase of temperature there will be large scale climatic changes. The presently observed climatic discrepancies is the result of global warming.
2. The rainfall patterns will be changed due to rise in temperature. Due to increase in temperature there will be more evaporation of water bodies. The increase in water vapour and temperature will cause more rainfall. This will result into change in the cycle of seasons. The summers will extend and winters will be shorter.
3. Global warming will increase the El Nino effect and the cyclones will be more frequent.
4. As the temperature of the earth will rise, the ice of the polar regions and mountain peaks will melt .This will cause rise in sea level and submergence of coastal margins. The islands in the oceans will also be submerged under water.
5. Increase in temperature the ice in the glaciers will also melt. Therefore the rivers originating from these glaciers will cause floods, as they will carry more amount of water in them.
6. The changes in the cycle of seasons, caused due to rise in temperature, will greatly affect the agriculture. This will cause change in agriculture pattern and its methods.
7. The existence of all plants, trees and all living creatures will be in danger.

Measures Preventing Global Warming Effects

Following measures can be taken to prevent the global warming:-

1. The burning of fossil fuels like coal, Mineral oil and gases should be reduced. Instead alternative fuels should be used.
2. The forest should be extended by afforestation.
3. The growth in population should be controlled.
4. The industries and vehicles should use such devices that may cause lesser pollution.

Climatic Change

The average of weather conditions of a place is called climate. When there is a change in these average weather conditions (temperature, rainfall, humidity pressure etc), it is called as climate change. After the study of geological history of the earth, it had been proved that there had been climatic changes since the beginning of the earth. The places which are presently deserts, they were green fields long ago. In the same way which are presently in form of land mass ,were water bodies earlier. There are evidences for these changes. These climatic changes are proved on the basis of evidences of changes in the structure, series of the shale, sediments found in lakes and other water bodies, fossils and radio isotopes. There are evidences that the magnetic poles of the earth have changed their positions. Ice ages, progresses in a sequential manner on the earth. The earth was totally covered with layers of snow during these ice ages.

After the discovery of Barometer in 1640 and Rain Gauge in 1676, systematic study of climate is being done. Thus the climatic changes are also being studied methodologically.

Presently, the earth is undergoing through following climatic changes:-.

1. The temperature of the earth is constantly rising. This will result into the increase in global temperature of 1.50 to 4.5° C by 2050 according to scientists.
2. The amount of rainfall and its distribution pattern, cycle of seasons are constantly changing.
3. The snow of the glaciers are melting. Therefore they are shrinking backwards.
4. There is rise in sea level. This is resulting into submergence of coastal margins. Maldives and a number of islands of Pacific Ocean, are under this danger.

Important points

1. The sum total of atmospheric conditions of a place at a particular period of time is called weather. The average summary of weather conditions of a particular place for longer period of time is called climate.
2. The earliest attempt of classification of climate was done by Greeks. The German climatologist Koppen, classified climate on the basis of temperature and rainfall. Thornthwait classified climate on the basis of temperature, rainfall and evaporation.
3. Trewartha modified Koppen's classification and presented it comparatively in a simpler form. Trewartha classified the world climate into 6 major divisions.
4. The temperature of the Earth is constantly rising due to Green House Effect. The gases which are responsible for the greenhouse effect are Carbon dioxide, Methane, Nitrous oxide, Chlorofluorocarbon.
5. The entire biosphere is in danger due to Green House Effect. The average increase in temperature of the earth, is called global warming.

Exercise
Multiple choice questions

1. Koppen classified the climate into how many divisions?
   (A) 4 (B) 5
   (C) 7 (D) 9

2. According to Koppen, E type of climate is...
   (A) Dry Climate
   (B) Polar Climate
   (C) Cold Temperate
   (D) Humid Climate

3. In which type of climate, evaporation exceeds precipitation?
   (A) Dry Climate
   (B) Polar Climate
   (C) Cold Temperate
   (D) Mountain Climate

4. 'Am' climate is-
   (A) Tropical Humid Climate
   (B) Tropical Monsoon Climate
   (C) Steppe Climate
   (D) Desert Climate

5. Koppen, presented his climatic classification for the first time in
   (A)1990 (B) 1901
   (C) 1936 (D) 1952

Very short type questions.

6. What do you mean by 'A' type of climate according to Koppen?
7. What do you mean by 'BW' climate?
8. Excess of evaporation over precipitation is the characteristics of which type of climate?
9. Which type of climate does not have summer season?
10. In which climatic region rainfall occurs throughout the year?

Short type questions

11. In how many climatic region the world has been divided by Koppen ? Describe briefly.
12. What is the difference between weather and climate?
13. What is climate?
14. What are the factors that affect climate?
15. Give the characteristics of Polar climate.

Essay type questions

16. Give the basis of classification of climate according to Koppen. Describe its types.
17. Differentiate between weather and climate and describe the major characteristics of Koppen's five types of climatic.
18. Give a comparative description of Dry Climate and Tropical humid Climate.

Answer key

1. B. 2.B. 3.A. 4.B. 5.A