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9

CLIMATE AND CLIMATE CHANGE

In the previous lessons, you have studied the dynamics of the atmosphere with special reference to its structure and composition, insolation, air pressure, winds, humidity and precipitation. These climatic elements have a significant effect on our existence. For instance, the houses we build, the garments we wear, and the food we consume largely depend on the climatic conditions. In this lesson, you will learn about the climate, major climate regions, climate change - causes and consequences and global initiatives to mitigate the effects of climate change. Climate and weather are sometimes used interchangeably but they are conceptually quite different. Therefore, to understand climate, it is very essential to comprehend the meaning of weather.

OUTCOMES

After studying this lesson, learner:

- differentiates between weather and climate;
- describes various climate regions;
- explains the concept of climatic change;
- identifies the causes and consequences of climate change and
- describes major global initiatives - related to climate change;

9.1 WEATHER AND CLIMATE

As you know, the blanket of air which surrounds Earth is called atmosphere. Earth's atmosphere is very dynamic and continually changing on a daily basis in terms of temperature, pressure, wind, humidity and precipitation. You are aware that there is an inverse relationship that exists between temperature and pressure; pressure and wind. For example, the area experiencing

high temperature will have low air pressure and consequently strong wind prevails and vice versa. In addition to that, temperature, pressure and wind affect precipitation, humidity, sunshine, cloudiness and other atmospheric conditions. Therefore, all these atmospheric elements are interconnected and influence the atmospheric conditions of a place. These conditions differ from place to place and time to time.

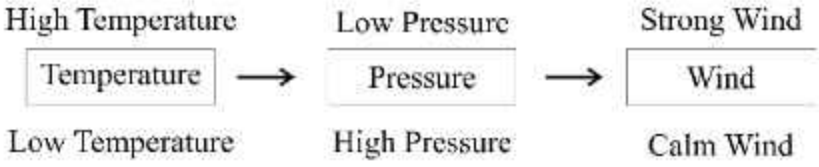

Fig. 9.1. Relationship among the Weather Elements

a. Difference between Weather and Climate

Climate and weather are sometimes used as synonyms but they are not the same (Table 1). The state of general atmospheric conditions with respect to temperature and pressure is called weather. An important characteristic of weather is it changes every day and can be erratic. That is why we get daily weather updates and alerts. The meteorological agencies like Indian Meteorological Department (IMD) provide weather forecasts. On the other hand, climate refers to the long-term averaged weather conditions of a particular area or region. According to the World Meteorological Organisation (WMO), the average of the weather conditions is calculated from the data collected over the period of 30 years.

Table 9.1 Difference between Weather and Climate

Criteria	Weather	Climate
Definition	Daily changes in the atmospheric conditions is called weather	Averaged weather conditions of a particular regions is called climate
Period of time	Short period -24 hrs	Long period - more than 30 years
Elements	Temperature, air pressure, wind, precipitation, humidity, sunshine, cloudiness	Average temperature, average pressure conditions, average wind velocity etc
Areal Extent	Small area/Local	Large area/Global
Change	Very frequently	Largely permanent
Types	Different types of weather conditions prevail in a day	Broadly one type of climate is experienced in an area

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b. Factors Affecting Climate

There are various types of climate on the basis of elements for example, hot or cold (with reference to temperature), dry or wet (amount of rainfall), arid or humid (humidity or moisture content). Different regions of the world experience different types of climate and influence human activities. To understand the variation in climates, let us discuss the factors which cause the variation in the climate of a particular region. The climate of an area is determined by various factors. These factors are as follows:

i. **Distance from the equator or Latitude:** The climate of an area is influenced by the distance from the equator. The places located near the equator are warmer than the places located away from it. The reason, you have already learnt in lesson 5, is insolation. Equatorial areas receive more heat as intense vertical sun rays fall on a small area whereas Temperate and Polar Regions receive slant rays which are less intense. Maldives is located near the equator which experiences a hot climate whereas Switzerland is situated far away and has a cold climate.

ii. **Elevation:** Highlands are cooler than the lowlands. As we move upwards from the sea level, temperature decreases. The lapse rate is 1 decreases with every 100 metres. Leh is situated at a higher altitude when compared to Jaisalmer. Therefore, Leh is cooler than Jaisalmer.

iii. **Global Winds and Ocean Currents:** Global winds are also known as prevailing winds. They are the result of atmospheric circulation cells and pressure belts. Upwards and downwards movement of air causes precipitation. Besides that, onshore winds are moisture-laden as they come from sea or ocean therefore bring rain, whereas off-shore winds originate from land and they are dry.

Another characteristic of prevailing winds is that they bring air from one type of climate to another. For example, warm winds that travel over water are moisture-laden, the water vapour in the air will condense as it moves into cooler climates and temperature coastal regions receive heavy rainfall.

Surface ocean currents are driven by a global wind system. Their pattern is determined by the wind direction, Coriolis force and position of landforms. The warm current raises the temperature of the coast and may bring rainfall while the cold current reduces the temperature and creates fog and mist.

Due to the rotation of the earth, circulation of winds is deflected towards the right in the northern hemisphere and left towards the southern hemisphere. This defection is called Coriolis Effect.

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iv. **Geographic Character:** Geographic character of an area encompasses the locational aspect such as distance from the sea or ocean, direction of mountains etc. As you know, the sea has a moderating effect. The places near large water-bodies have a low range of temperature and very high humidity. The places which are away from the oceans experience extreme temperature as they are away from water-bodies.

Direction of mountains is another factor which affects the climate of a region by influencing the direction of moist winds to rise and cause rainfall on the windward side. And when they descend on the leeward side they become dry and cause less rainfall. For example, the places located on the windward side of Western Ghats like Mumbai receive more rainfall as compared to Nagpur, which is located on the leeward side.

v. **Vegetation:** Climate produces forest, desert and so on. Temperature and rainfall patterns decide the characteristics of the soil formation and eventually affect the type of vegetation. Stony or sandy soils are good conductors of heat while black clay soil absorbs heat quickly. The areas which lack vegetation like deserts are hot during the day time and cold at night. On the other hand, forested areas have a lesser range of temperature throughout the year.

vi. **Other Factors:** There are various other climate controlling factors which have been highlighted in following Table.

Table 9.2: Climate Controlling Factors

Factors	Effects
Land Surface	Albedo Evaporation Temperature
Oceans	Albedo Evaporation Energy transferred from the ocean currents and vertical mixing
GreenHouse Gases	Co_2, O_2
Solar Radiations	Orbital controls, Latitude
Clouds	Albedo, Emissivity, Absorption, scattering of solar radiation
Aerosols	Absorption, Scattering of solar radiation, Condensation nuclei

INTEXT QUESTIONS 9.1

1. Write True against the correct statement and write False against the wrong statement.

   (i) Weather provides average atmospheric conditions of a particular area.

   (ii) Area located near equator experience low temperature

   (iii) Warm ocean currents increases the temperature of the coast

   (iv) The lower the elevation higher is the temperature.

9.2 CLIMATIC REGIONS

An area which has homogenous climatic characteristics and has geographic continuity is known as climate regions. To create similar types of climate regions, various attempts have been made by the scholars but there is no single perfect classification available. It is believed that Greek philosopher, Aristotle, probably made the first attempt to classify Earth's climate on the basis of insolation. He divided the world into three thermal zones viz. torrid zone, temperate zone and frigid zone.

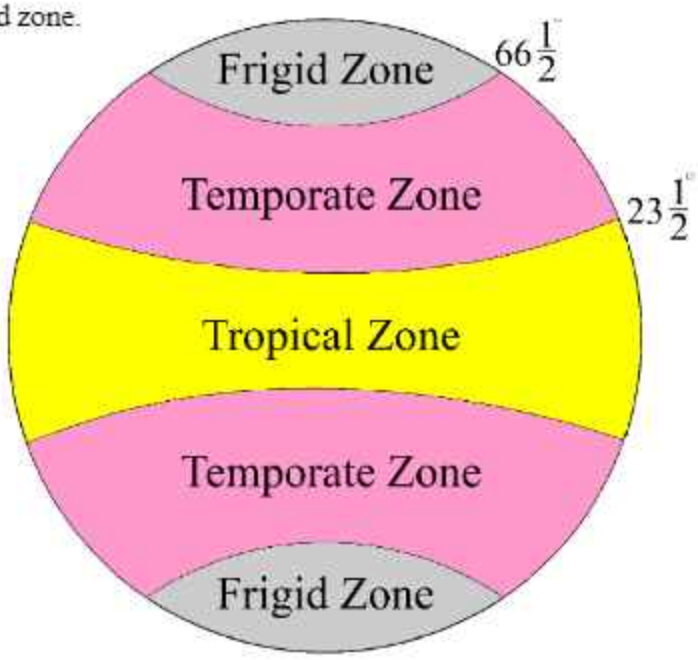

Fig 9.2: Thermal Zones of the World

a. Koppen's Classification of Climate

The most widely used empirical classification of climate was developed by Waldimir Koppen. He identified a close relationship between climate and vegetation and believed that vegetation is an indicator of climate type. On the basis of annual and mean monthly

Notes

temperature and precipitation data along with the distribution of vegetation, he divided Earth's climate into five major regions tropical, dry, temperate, cold and polar.

Design of Koppen Classification: He recognised five major climatic regions and designed by four capital English letters- A, C, D, E on the basis of temperature and one, B, on precipitation. These major groups were subdivided and designed by small letters, f, m, w, s based on seasonality of precipitation and temperature characteristic.

Table 9.3: Major Climate Regions of the World by Koppen

Major Group		Sub-Group		Characteristics	Climate
A	Tropical Hot and Humid Climate	Af	Tropical rainforest	Hot and rainy all seasons	Hot and humid climate
		Am	Tropical Monsoon	Hot; seasonally excessive rainfall	Monsoon Climate
		Aw	Tropical Wet and Dry	Hot; seasonally dry esp. winter	Savanna Climate
B	Dry Climate	BSh	Subtropical Steppe	Semi arid; hot	Hot Steppe Climate
		BWh	Subtropical Desert	Arid; hot	Hot Desert Climate
		BSk	Mid-Latitude Steppe	Semiarid; cool	Cool Steppe Climate
		BWk	Mid-Latitude Desert	Arid; cool	Cool Desert Climate
C	Warm Temperate Climate	Cs	Mediterranean	Mild winter; summer dry	Mediterranean Climate
		Cw	China Type	Mild winter; winter dry	China Type Climate
		Cf	Europe	Mild winter; moist all seasons	Europe Climate

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D	Cold Snow Forest Climate	Df	Humid continental	No dry season; severe winter	Taiga Climate
		Dw	Subarctic	Winder dry and very severe	Continental Climate
E	Polar Climates	Et	Tundra	Very short summer	Tundra
		Ef	Polar ice cap	Perpetual ice and snow	Polar ice cap
H	Highlands		Highland	Highland with snow cover	Undifferentiated highland climates

b. Climatic Regions of the World

As you are aware, Koppen has provided a climate scheme with the first (Major Group) and second letter symbols. For some regions like B, C and D, he has created third letter symbols as well which has been discussed below. The distribution of climate major groups, sub-groups and its characteristics are presented in Table 9.3 and map highlights the locational aspect. If has been devided five major groups.

(i) Major Group A: Tropical Hot and Humid Climate

(ii) Major Group B: Dry Climate

(iii) Major Group C: Warm Temperate Climate

(iv) Major Group D: Cold Snow Forest Climate

(v) Major Group E: Polar Climate

i. **Group A Climate:** The tropical hot and humid climate is characterised with high temperature (>18°C) and high rainfall (6 cms) throughout the year. On the basis of seasonality and periodicity of rainfall, it has been further subdivided into Af, Aw and Am.

ii. **Group B Climate:** Dry climate is signified with low precipitation and high rate of evaporation. The region is further classified into BW and BS. On the basis of annual temperature, it has been further subdivided into-

BWh = Tropical hot desert with mean annual temperature >18°C

BSh = Tropical steppe climate with average annual temperature >18°C

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BWk = Moderate latitude cold desert climate with mean annual temperature <18°C

BSk = Moderate latitude cold steppe climate with average annual temperature <18°C

iii. **Group C Climate:** Warm Temperate Rainy climate is characterised with precipitation throughout the year with mean temperature ranging between 3°C to 13°C. On the basis of seasonality of rainfall, the region further categorised into-

Cf = Precipitation > 1.2" throughout the year. This category has three second order sub-classes namely Cfa (Humid subtropical), Cfb (marine west coast type) and Cfc (marine type with short cool summers)

Cw = Winters are mild and dry. Its second order classes are Cwa (Subtropical monsoon) and Cwb (Tropical Upland)

Cs = Winters are wet but summers are dry, precipitation < 1.2". The second order sub-categories are Csa (Interior Mediterranean) and Csb (Coastal Mediterranean).

iv. **Group D Climate:** In the cold snow frost climate, average temperature varies between 0°C to > 10°C. This type of climate has been further classed into Df and Dw. The second order sub-regions are:

Df = Humid cold climate with no dry season

Dfa = Humid continental with long warm summer

Dfb = Humid continental with short warm summer

Dfc = Sub-arctic with humid short cool summer

Dfd = Sub-arctic with humid extremely cold winters

Dw = Humid cold with dry winters

Dwa = Humid Continental climate with long hot summers

Dwb = Humid Continental warm summer

Dwc = Sub-arctic short cool summers

Dwd = Sub-arctic extremely cold winters and short cool summers

v. **Group E Climate:** The region is featured with very cold conditions in which average temperature is <10°C. The second order classes are as follow

ET = Tundra climate ranging between 0°C to 10°C

EF = Permanent snow field temperature <0°C.

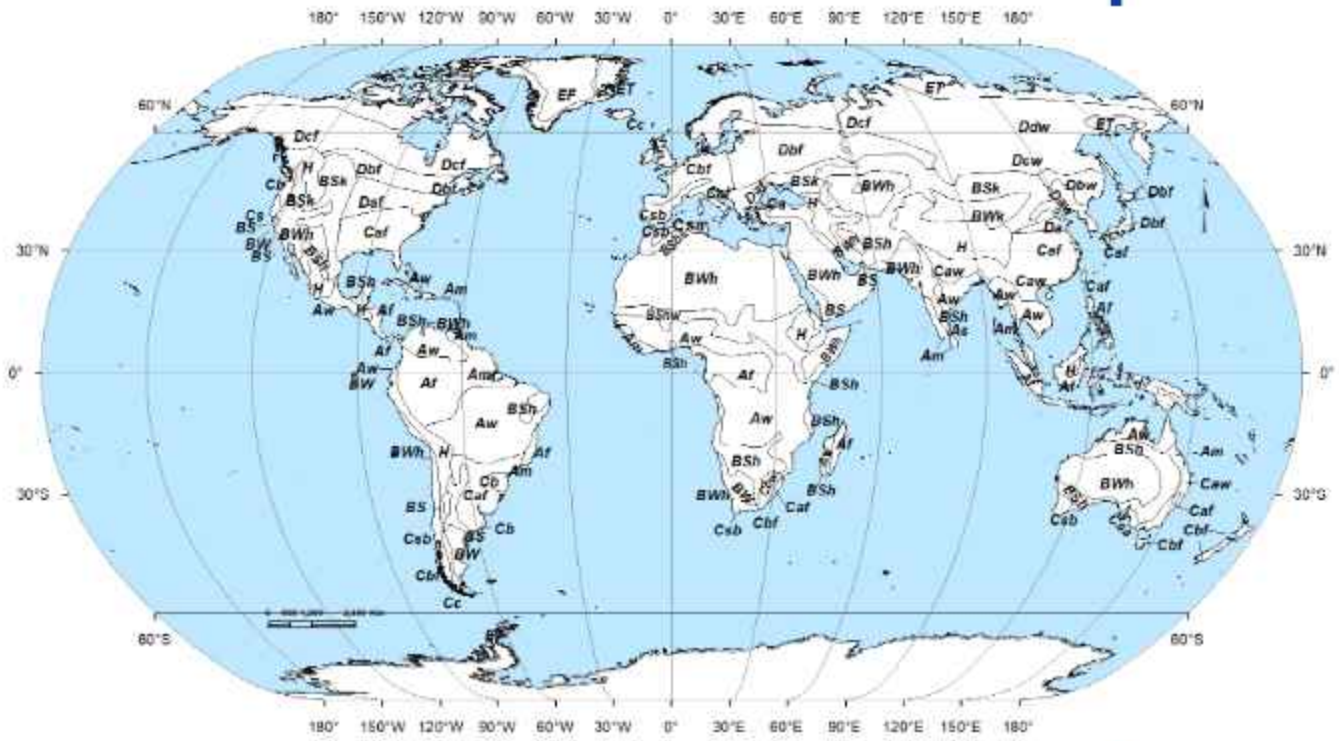

Fig. 9.3 Koppen's Climatic Classification

INTEXT QUESTIONS 9.2

1. Multiple Choice Questions

   i. Koppen identified how many major climatic regions of the world:

   (a) 6 b) 4

   (c) 5 (d) 7

   ii. Climate classification of Koppen is considered as

   (a) Applied

   (b) Empirical

   (c) systematic

   d) Generic

   iii. Greeks divided the world climate into how many thermal zones

   (a) 3 (b) 4

   (c) 5 (d) 6

iv. Major climate group "C" refers to:

(a) Tropical hot and humid climate

(b) Dry Climate

(c) Warm Temperate Climate

(d) Polar

9.3 CLIMATE CHANGE

In the previous sections, you got some understanding about the present climatic regions. Largely, the type of climate we experience might have prevailed thousands of years ago with mild changes. The earth has observed various changes in the climate since its evolution. Geological and historical records prove that climate change is not a new phenomenon; instead, it's natural and continuous. Geological records with reference to glacial and interglacial periods provide traces of advance and retreat of glaciers in the highlands. On the other hand, historical records especially documents signify that earth experiences dry and wet periods.

Currently, the climate of all the regions of the world is changing drastically. Therefore, climate change is a global phenomenon which refers to significant variations in the statistics of averaged weather conditions over a period of time. It has become a serious problem for mankind.

a. Climate Change and Climate Variability

If a person truly wants to understand the concept of climate change then its important to understand climate variability. As you are aware that Earth's climate is dynamic and another significant feature is its variability. Therefore, climate variability refers to anomalies in the existing state of climate which can be observed spatially and temporally. On the other hand, climate change denotes changes in either the average state of climate or in terms of its variability, continuing for several decades or more. The difference between climate variability and climate change is given in Table 9.4.

Table 9.4: Difference between Climate Variability and Climate Change

Climate Variability	Climate Change
The fluctuations in the distinct weather events results in climate variability	A mean or average trend of climate variability is known as Climate change
It includes short period of combined form of weather trends	It includes long period of accumulated form of climate variability
It is a micro level or regional phenomenon	It is a macro level or global phenomenon.

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b. Global Warming

Global warming refers to the heating of the whole Earth's air temperature over the past few centuries. This phenomenon occurred due to the presence of greenhouse gases. Greenhouse is a structure in which sun's heat is trapped and used for providing warmth. For example, if you park your car in an open area on a hot sunny day, after sometime you will find that solar energy entered into the car through the door's glass or windscreen and trapped in the car resulting in excessive heating. Similarly, our atmosphere behaves like a greenhouse in the presence of greenhouse gases. The gases that absorb long wave radiation are called greenhouse gases. The whole process that heats the atmosphere is referred to as the greenhouse effect. It increases the temperature of the troposphere.

The major greenhouse gases (GHGs) which help in increasing global warming are carbon dioxide, chlorofluorocarbons, methane, carbon monoxide, ozone and nitrous oxide. The effectiveness of any greenhouse gas depends upon the magnitude of the increase in its concentration, its lifetime in the atmosphere and the wavelength of radiation that it absorbs. Chlorofluorocarbons and ozone are highly effective gases whereas carbon dioxide is largely concentrated in the atmosphere. The level of Co2 is constantly increasing due to burning of fossil fuel and changes in the land use. It is growing at about 0.5 per cent yearly.

Trends of Global Warming: One of the prime problems of the world in the present century is earth's rising temperature or global warming. Now, let us explore to what extent our earth has warmed up. Earth's rapid heating started with the industrial revolution. Since the advent of industrialization, the global annual temperature has risen to more than 1%. From 16880 to 1980, it has increased on an average by 0.07% every decade. Since 1981, the rate of growth in the global temperature has doubled. For the last four decades, it has risen by 0.18% every 10 years. If the trend continues then the global temperature would reach around 1.5% in 2040.

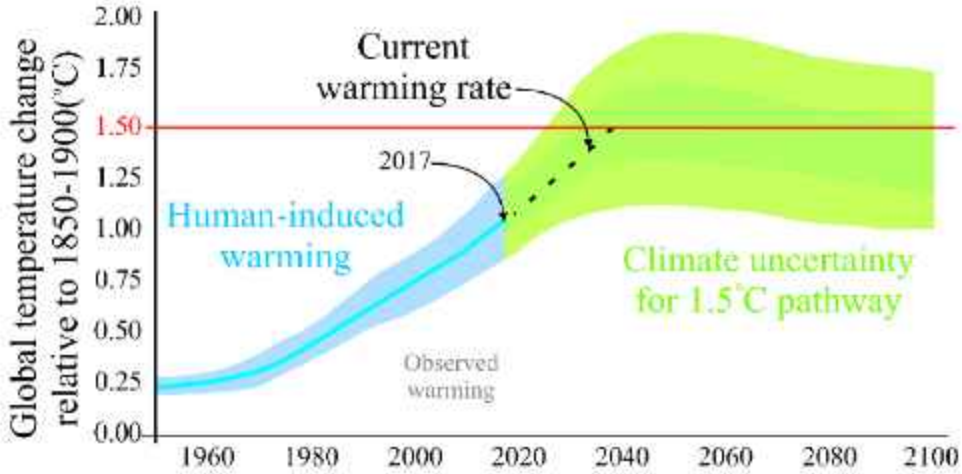

Fig. 9.3: Global Warming (Source: IPCC)

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DO YOU KNOW?

Till now, our planet has experienced 9 out of 10 warmest years since 1880.

It is believed that the year 1998 was the warmest in the history of earth's climate.

INTEXT QUESTIONS 9.3

1. Fill in the blanks

   (i) .....and ..... records prove that climate change is not a new phenomenon, instead it's natural and continuous.

   (ii) .....is the heating of the whole Earth's air temperature over the past few centuries.

   (iii) Climate change is a ..... phenomenon.

   (iv) The whole process of heating the atmosphere is called the .....

9.4 CAUSES AND CONSEQUENCES OF CLIMATE CHANGE

As you know, Earth's climate is dynamic and keeps on changing through natural processes. The matter of concern is that the changes that are occurring presently have been exaggerated due to human activities. The causes of climate change can be divided into two categories i.e. natural and man-made.

a. Natural Causes:

i. **Continental Drift:** Around 200 million years ago, the face of the earth was not the same. There was a large landmass which had drifted apart due to tectonic forces. The drift had an impact on climate as it changed the position of landmass and waterbodies. It resulted in the changes in the flow of ocean currents and winds. Besides that, Himalaya was born out of this phenomenon which shapes the climate of the Indian subcontinent.

ii. **Ocean Currents:** As you know, ocean absorbs large amount of heat and ocean currents move vast amount of heat across the planet. It has been discussed earlier that how ocean currents influence the climate. The interaction between ocean and atmosphere shapes the climate system and produce El nino Southern Oscillation (ENSO) which occur every 2 to 6 years. The ENSO describes the fluctuations in temperature between ocean and atmosphere, which has two phases El Nino (warm phase) and La Nina (cold phases). The deviation from normal surface temperature

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can have a large impact on ocean processes and global weather processes. Oceans play a significant role in determining the atmospheric concentration of co_2. Changes in the ocean pattern may affect the climate through the movement of co_2 into or out of the atmosphere. Now-a-days, the terms El Nino and ENSO are used interchangeably. El Nino produces severe and extensive changes in climate. Ecuador and northern Peru have arid climates but due to the El Nino affect rainfall has increased drastically. As it brings rain to the region, Indonesia and Australia experience drought.

iii. **Volcanoes:** Massive volcanic eruption changes the climate of the earth, temporarily. The material erupted such as sulphur dioxide, water vapours, ashes and dust reached lower stratosphere, blocked the sun rays and reduced the temperature about 0.5°C. The eruption of Novarupta in 1912 and Mount Pinatubo in 1991 are the example which has affected the climate of earth to some extent.

iv. **Solar Output:** The Sun is the prime source of energy. Global climate is affected by the long and short variation in the intensity of the sun. A smallest change in the intensity can lead to changes in our climate. Scientists demonstrate that solar variations have played a key role in past climate changes. It is believed that a slight decrease in solar movement has caused the little Ice age between 1650 and 1850. But present global warming cannot be described with this phenomenon.

v. **Earth's Orbital Changes:** Earth is tilted at an angle of 23.5 degree to the perpendicular plane of its orbital path. Any change, whether big or small, in the tilt can affect seasons. In other words, we will experience warmer summers and cold winters if the tilt is more and cool summers and mild winters if the tilt is less. The orbital changes lead to Milankovitch cycles. According to IPCC, Milankovitch cycles have a great impact on climate. It is belived that they drove the ice age cycles.

b. Human Induced Causes

The increase in temperature affects other variables of the climate system. Combined effects of human activities on the climate are known as human induced climate change.

There are:

i. **Fossil Fuels:** Climate is a physical phenomenon but anthropogenic factors have altered it immensely. After the advent of the Industrial Revolution, the amount of greenhouse gases in the atmosphere has increased. More greenhouse gases mean more absorption of heat and increase in earth's temperature which will lead to global warming, largely due to burning of fossil fuel like coal and petroleum. Besides that, Industries are exhausting our resources and polluting land, water and air in the

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wake of developmental activities. It is estimated that about 20 percent contribution is due to changes in the emission of greenhouse gases.

ii. **Land use Change:** The change in the land use is largely governed by industrialization, urbanisation and cutting of trees for agricultural activities. Deforestation changes the amount of sunlight reflected from the ground back to space, Albedo. In Eurasia and North America, around 50 percent of the land use changes occurred during the industrial period due to replacement of forest with either agricultural or industrial activity.

iii. **Deforestation:** The rainforest plays a vital role in regulating the temperature of the world. These forests absorb one-fifth of human induced carbon emission. Hence, deforestation has been considered as a major contributor to the cause of climate change. The carbon is stored in the form of wood and vegetation through carbon sequestration.

iv. **Agricultural Activities:** According to IPCC, agricultural activities are one of the major drivers of climate change. In order to fulfil human's food demands, more land has been brought under cultivation and animal husbandry. Agricultural activities like animal keeping and rice cultivation have increased the carbon and methane emission. It is believed a quarter of methane emission comes from domesticated animals such as cows, pigs, etc. Moreover, paddy fields also release methane when the field is flooded during the sowing and maturing stage of the crops. Around 90 percent of the rice grows in Asia as a staple crop. Therefore, Asians are considered as a major contributor of climate change.

c. Consequences of Climate Change

Climate change is creating serious threats to the survival of humankind. Every aspect of ecology has been disturbed by human interference. The impacts of climate change are easily visible on water systems (glaciers and sea), agriculture, flora and fauna and human health.

i. **Melting of Glaciers and Ice-caps:** Glaciers and ice-caps are either vanishing or receding especially in the highlands of our planet due to rising atmospheric temperature. Man-made influences have significantly contributed to the retreat of glaciers since 1960's. Earth has lost more than 600 glaciers over the past few decades. They are largely melted in the Greenland, Canadian Arctic, Rocky Mountains, Andes, Patagonia, Himalayas and on various other continents.

ii. **Rising sea level:** The level of sea is rising at an alarming rate due to thermal expansion and the loss of glaciers. The increased concentration of co_2 in the ocean triggered the change and made the water more acidic. Presently, our oceans are

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more than 40 percent acidic than it used to be affecting marine life ecally. corals and shellfish. the coral reefs of great Barrier Reef of Australia and Lakshadweep island of India, are facing problems like bleaching and loss of habitat.

iii. **Extreme weather:** Extreme weather events are common phenomena occurring on earth like heat waves, heavy rainfall, intense cyclones, droughts, ice storms, avalanches, dust storms and floods. The frequency and magnitude of these events have also increased due to change in the temperature conditions of the earth. Tropical cyclones have been increasing since the 1970s and causing huge destruction. In India, cyclone Tauktae emerged from Arabian Sea in 2021, killed more than 100 people and was classified as a very severe cyclonic storm.

iv. **Impact on Agriculture:** Agriculture is climate-sensitive and most vulnerable to climate change. As mentioned earlier, it is one of the major cause of climate change and prime source of greenhouse gases.It was predicted by IPCC that higher temperature will reduce crop yield while encourage the growth of weeds and pests.The climate change impact on farm productivity has been divided into two group: a) high and mid-latitude nations and b) low latitude nations. In the former region (North America, Europe, Australia), there is a strong probability that productivity will increase due to extended growing season whereas on the latter region (Africa and Asian countries) farm productivity will decrease.But the overall impact is expected to be negative which will threaten the global food security especially in the less developed countries.

v. **Impact on Flora and Fauna:** The distribution and size of flora and fauna largely depends upon the climate. Climate change can affect both plant and animal species in a number of ways-

- Changes in the climate altering the timing in reproduction and life cycle of plants (budding early) and animals,
- Migration pattern of birds and animals. They have to migrate early.
- Length of growing season of plants.
- Increase the frequency of weeds and pests outbreak.
- Increased the occurrence of diseases and invasive species.
- Altering the range boundaries of flora and fauna: In Europe butterflies have shifted their range 200 kms upwards; moreover, tree lines are also shifting.

vi. **Impact on Health:** Climate change is not only affecting human health but also affecting animals as well. Due to increased temperature and more frequency of

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heat waves, it has a direct effect on health. In the summer season, some regions have been experiencing increased heat-related mortalities such as heat stroke, cardiovascular and kidney diseases. The changes in the rainfall and temperature conditions have transformed the distribution of both waterborne and vector diseases like dengue fever, Lyme disease, West Nile virus. On the other hand, in the winter season, climate change has created conditions in some areas with warm and stagnant air eventually forming ground-level ozone or smog. Smog (air pollution) is one of the major reasons for asthma attacks. According to WHO, "Climate change is expected to cause approximately 250,000 additional deaths per year" between 2030 and 2050.

INTEXT QUESTIONS 9.4

1. Match the column

Climate Change		Impact
(i) Glaciers	(a)	severe floods
(ii) Extreme weather event	(b)	affect farm productivity and food security
(iii) Flora and Fauna	(c)	increased heat-related mortality
(iv) Agriculture	(d)	recede or vanish
(v) Health	(e)	alter the timing of reproduction and migration

9.5 GLOBAL INITIATIVES ON CHANGE

International initiatives on climate change are extensive efforts to mitigate the effects of global warming and reduce the emission of greenhouse gases across the globe. The most significant initiatives are the setting up of the Intergovernmental Panel on Climate Change (IPCC) and the Paris Climate Agreement.

a. Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change was created by the United Nations Environment Programme and World Meteorological Organization in 1988. It is an organisation of governments that are members of the UN or WMO. Presently, there are 195 members. The main objective of the panel was to provide scientific and rational information to all the governments of the world so that they can develop climate policies.

The main activity of the panel is the preparation of reports which provides an important

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input into global climate change negotiations. IPCC prepares three types of reports namely assessment reports, synthesis report and methodology report.

The Assessment Reports provides the state of the scientific, technical and socio-economic knowledge and basis of climate change, its effects, predictive risks and ways for adaptation and mitigation.

Thousands of people across the globe voluntarily contribute to work with IPCC in the form of report preparation and review reports. IPCC is divided into three working groups -

Group I - Physical science basis of climate change

Group II - Climate change impact adaptation and vulnerability

Group III - Mitigation of climate change

The first IPCC report played a pivotal role in the formation of UNFCCC, an international treaty to reduce global warming and combat the effects of climate change. Presently, the panel is working on the sixth Assessment Report that constitutes the above mentioned first three working groups contribution and a synthesis report.

b. Paris Climate Agreement

Global efforts have been initiated to reduce the emission of greenhouse gases into the atmosphere by signing the Paris Climate accord. The agreement was designed to replace the Kyoto Protocol. The United Nations Framework Convention on Climate Change(UNFCCC) adopted the Kyoto Protocol in 1997 but it came into effect in 2005. It was consented by 141 countries. The protocol restricted 35 industrialised nations to reduce their emission by the year 2012 to 5 percent less than the level prevalent in the year 1990.

The Paris agreement was adopted in 2015 but came into effect in 2016. It is a legally binding treaty in which industrialised economies work towards reducing GHGs emission and limit global warming to less than 2% compared to pre industrial level. In addition to that, the Paris Agreement insists that developed nations should provide financial and technological support to underdeveloped nations.

INTEXT QUESTIONS 9.5

1. Fill in the Blanks with suitable words:

   (i) The main objective of ..... to provide scientific and rational information to all the governments of the world so that they can develop climate policies.

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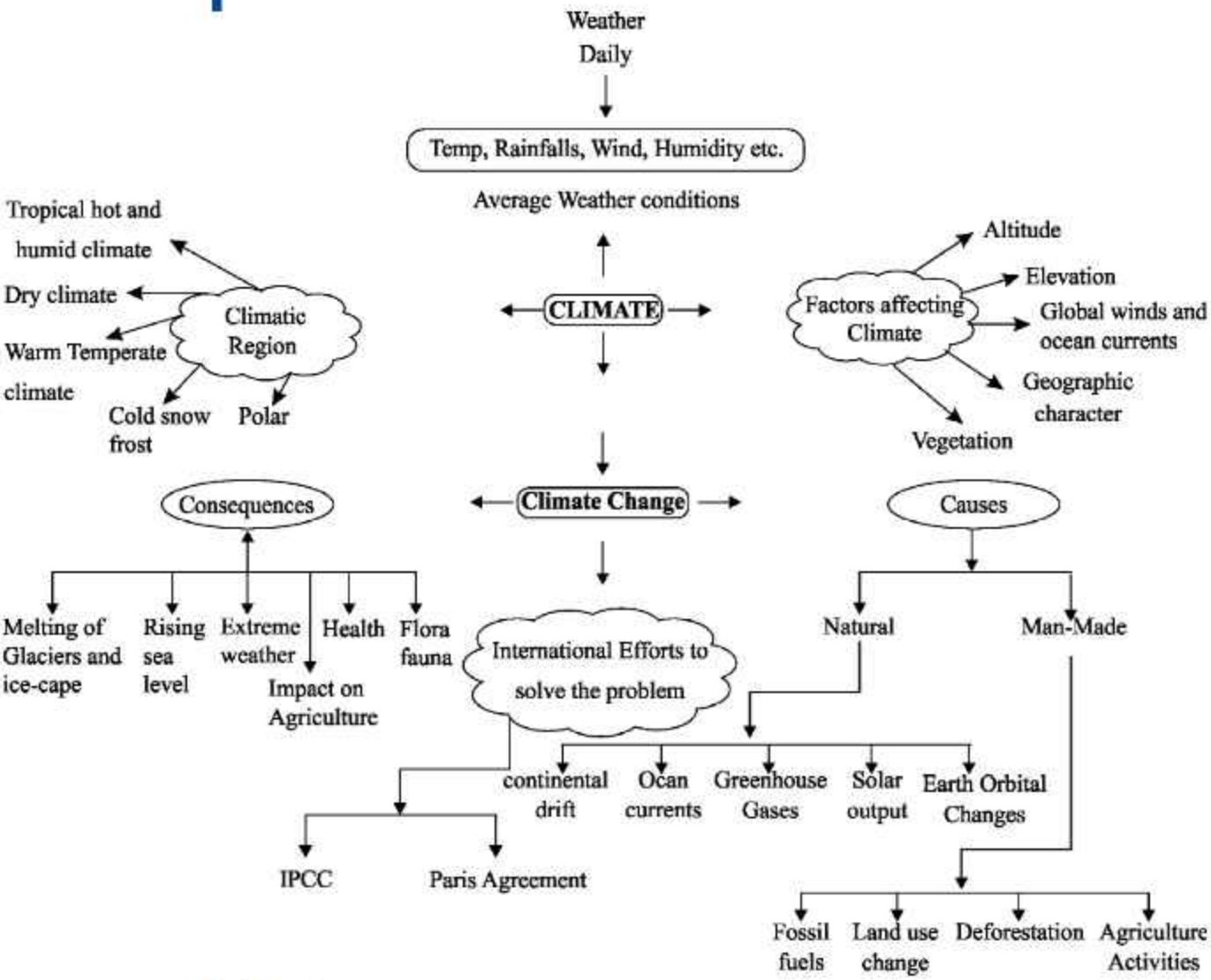
(ii) The Intergovernmental Panel on Climate Change was created by the ..... and .....

(iii) The Paris agreement designed to replace .....

(iv) The .....agreement limits global warming to less than 2% compared to pre industrial level.

WHAT YOU HAVE LEARNT



TERMINAL QUESTIONS

1. Differentiate between weather and climate.
2. Discuss the climate regions of the world.
3. What are the factors that affect the climate of a region?

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4. Define global warming. Why is the issue important?
5. What is Climate Change?
6. What is the significance of the Paris Agreement?
7. Define the term Greenhouse. Make a list of greenhouse gases.
8. Elaborate the factors that are propelling climate change?
9. Describe the major effects of climate change?
10. Explain the important global initiatives taken to combat climate change?

ANSWERS TO INTEXT QUESTIONS

9.1

(i) F (ii) F (iii) T (iv) F (v) T

9.2

(i) c (ii) b (iii) c (iv) c (v) a

9.3

(i) Geological records, historical records

(ii) Global warming

(iii) global

(iv) greenhouse effect

9.4

(i) d (ii) a (iii) e (iv) b (v) c

9.5

(i) IPCC (ii) UNEP and WMO (iii) Kyoto Protocol

(iv) Paris agreement (v) 2016

PROJECT WORK/ACTIVITY

1. Try to find out how you can protect an endangered species in your area.
2. Prepare a report on the initiatives taken to combat climate change in your area.

MODULE -5

Biogeography and Biodiversity

10. Biosphere, Biomes and Biodiversity