

Study notes for Geography topic Climate and atmosphere

Hello learners, today's topic in geography section is about climate and atmosphere. So let's know about it.

Climatology is defined as the scientific study of climate. Climate represents the composite of day-to-day weather over a longer period of time. It is the study of the Earth's weather patterns and the systems that cause them. Climatology comes from the Greek word. Klima means "zone" or "area" and "logia" means "study". Climatology is not meteorology; they differ a lot as Climate science examines **long-term patterns** and trends whereas meteorologists examine **short-term weather patterns**. Climate is the average of the weather conditions of a particular area for a long period of time. The climate of an area is affected by many factors such as latitudes, altitudes, distance from the sea, prevailing winds, cloud cover, ocean currents etc.

There are 3 types of classifications of climate:

1. Empirical: Based on observed data, temperature and precipitation.
2. Genetic: Based on causes.
3. Applied: This type of classification is for specific purpose

Koppen classification of Climate

The world is divided into 5 types of climate according to the koppen classification. This is an empirical type of classification. The temperature, precipitation and dryness are the factors which were kept in mind while dividing the climate types. Following is the table defining all the classifications of climate.

GROUP	CHARACTERISTICS
A (Tropical)	Average temperature of the coldest month is 18 degrees Celsius or higher
B (Dry climate)	Potential evaporation exceeds precipitation
C (Warm temperate)	The average temperature of the coldest month of the climate is higher than -3° Celsius but below 18° Celsius
D (Cold snow forest climate)	The average temperature of the coldest month is -3 degree Celsius or below
E (Cold climates)	Average temperature for all months is below 10° C
H (Highland)	Cold due to elevation.

Climate change

Climate change is a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Causes of climate change

Climate change occurs all the time. However, climate change has become severe and erratic due to anthropogenic activities that cause severe damage to the environment. The causes of climate change can be as follows:

- **Astronomical:** Climate is affected by sunspots. Increase in sunspots causes cooler and wetter climate and causes storms. Decrease in sunspots causes warmer and drier conditions.
- **Milankovitch Oscillations:** Variations in earth's orbital characteristic, wobbling of the earth and changes in the earth's axial tilt cause climatic changes.
- **Terrestrial changes:** Activities like volcanic explosions cause release of aerosols (suspension of fine solid particles or liquid droplets in air) and affect the climate.
- **Human activities:** Many human activities like deforestation, use of electronics that cause the release of aerosols or greenhouse gases etc. cause climate change.
- **Global Warming:** Global warming occurs when carbon dioxide (CO₂) and other air pollutants collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally this radiation would escape into space, but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapor, and synthetic fluorinated gases—are known as greenhouse gases, and their impact is called the greenhouse effect.

Kyoto Protocol: It was proclaimed in 1997 and went into effect in 2005. It was ratified by 141 nations. It requires the 35 industrialised countries to reduce their emissions by the year 2012 to 5% less than the levels prevalent in the year 1990. Climate is often confused with weather. As some think, both are the same.

Difference between climate and weather

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Weather	Climate
Weather is day-to-day information of the changes in the atmospheric condition in any area.	Climate provides statistical information about the average weather condition of a particular place over a long period.
Weather is affected by temperature, pressure, humidity, cloudiness, wind, precipitation, etc.	The climate is the long term atmospheric observations like humidity, temperature, sunshine, wind, etc.
The changes in the weather condition can be observed very frequently.	The changes in climate take a longer time to change.
The study of weather is known as Meteorology. It is done by meteorologists.	The study of climate is known as Climatology. It is done by climatologists.

Importance of Climatology:

- Through the use of latitude, one can determine the likelihood of snow and hail reaching the surface.
- It helps determine future climate expectations.
- It is used to identify the thermal energy from the sun that is accessible to a region.
- It is used as a tool in weather forecasting and therefore chances are it can help prevent any kind of natural disaster.
- It provides a basis for working out what crops will grow where so it's important for food production.

Atmosphere

Air is very much essential for all living organisms to live. We keep breathing each and every second of our lives. Where is this air present? This is present in the atmosphere which surrounds the earth. In this chapter, we will study in detail about the atmosphere and its constituents. 99% of the atmospheric mass is confined to the height of 32km. Hence, air is an integral part of Earth's mass.

Composition of the atmosphere

The atmosphere is a mixture of gases which surrounds the earth. It is composed of gases, water vapour and dust particles. The following table shows the composition of the atmosphere.

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Gases	Volume in percentage
Nitrogen	78.08
Oxygen	20.95
Argon	0.93
Carbon dioxide	0.036
Neon	0.002
Helium	0.0005
Krypto	0.001
Xenon	0.00009
Hydrogen	0.00005

Important Points:

- The proportion of gases in the atmosphere changes with altitude such that there is almost no oxygen at and above 120kms from the Earth's surface.
- Carbon dioxide is the main gas responsible for the greenhouse effect as it is transparent to incoming solar radiations but opaque to outgoing terrestrial radiations.
- Water vapour decreases with altitude.
- Dust particles are concentrated in the lower atmosphere but convectional air currents may transport them to higher areas.
- Water absorbs insolation from the sun and preserves heat radiated by the Earth. Hence it acts as a blanket and keeps Earth neither too hot nor too cold.

Structure of Atmosphere

Besides the composition of the atmosphere on the basis of gases present in it, it is also divided among different layers. Following are the different layers of the atmosphere:



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1. **Troposphere:** it is the layer closest to the surface of the earth. It extends up to 18 km above the equator and 9 km above the poles. It is in this layer where all the weather changes take place. Temperature decreases gradually with the height in this layer. The upper limit of the troposphere is known as tropopause.
2. **Stratosphere:** above the tropopause lies the stratosphere. It extends up to 50 kms above the earth surface. The temperature starts increasing gradually with the height in this layer. This layer is most suitable for flying jet aircrafts. Ozone gas which protects our earth from the harmful UV radiations coming from the sun, is also present in the stratosphere.
3. **Mesosphere:** it is the next layer lying above the stratopause. This layer extends up to 30 km above the stratopause. The temperature decreases with the increasing height in this layer. This layer holds the coldest temperature range found on the earth.
4. **Thermosphere:** this layer extends up to 400 km above the earth surface. The temperature again starts increasing in this layer. There is no cloud formation and radio waves come back to the earth after hitting this layer. Ionosphere where electrically charged currents flow in the air, is also present in this layer. Have you ever heard of aurora borealis and aurora australis? These are the northern and southern lights which are formed due to the ionisation of the atmosphere by solar radiations. These lights are visible in the thermosphere.
5. **Exosphere:** this is the outermost layer of the atmosphere. It extends beyond 400 km above the earth surface. All the satellites orbit in this layer of atmosphere.

This was it about climate and atmosphere. Continue learning with us.