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Climate: Introduction and factors affecting it

The Atmosphere

- Gases and vapours form the atmosphere. When they receive solar energy, it gives rise to 'Climate'. Thus, the climate is defined as the *average atmospheric conditions of an area over a considerable period of time*. When this consideration of atmospheric condition is about a certain place at a certain time then it is called weather.
- There are five layers of the atmosphere. Those are:

Elements of climate

1. Temperature
2. Precipitation
3. Rainfall
4. Pressure and planetary winds
5. Land and sea breezes
6. Cyclonic activity

Temperature

Temperature decides the following factors-

- Amount of water vapour, the moisture-carrying capacity of the air.
- Rate of evaporation and condensation, governing degree of stability of the atmosphere.
- Relative humidity affecting nature and types of cloud formation and precipitation.

Factors that affect temperature:

1. Latitude – Temperature diminishes from equatorial regions to poles because of the earth's inclination. Direct rays travel a shorter distance and heat up smaller surface whereas oblique rays travel a longer distance and heat up a large area.
2. Altitude – Temperature of air decreases with increasing height above sea level. This rate of decrease in temperature with increasing altitude is called as 'Lapse rate'. This rate is not constant. The lapse rate is greater by day than at night, greater on elevated highlands than on level plains.

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3. Continentality – Land surface gets heated more quickly than water surface because of the higher specific heat of the water. (Specific heat is the energy required to raise the temperature of giving volume by 1 degree Fahrenheit)
4. Ocean currents and winds – Both transport their heat or coldness into adjacent regions. On-shore winds carry ocean currents landwards thereby affecting the temperature of an area. Local winds also change temperature according to their own temperature.
5. Slope, shelter and aspect – Steep slope show a rapid change in temperature than a gentle slope. Sheltered slope (north facing) has less temperature than sunny slope (south-facing).
6. Natural vegetation and soil – Thick vegetation has less temperature than open spaces. Colour of soil (light or dark) give rise to slight variation in temperature.

Precipitation

- When condensation occurs at ground level, haze, mist or fog are formed.
- When condensation of water vapour takes place in the atmosphere at a temperature below freezing point, snowfall occurs.
- When moist air ascends rapidly cooler layers of the atmosphere, water droplets freeze and fall to the earth as hail or hailstone.
- Frozen raindrops melt and refreeze forming sleet.

Rainfall

- Convectional rain: When earth surface gets heated by conduction, it comes into contact with air. This heated air contains the capacity to hold moisture. This air rises up and cools down. When saturation point is reached, rainfall occurs. In regions with high relative humidity, this moisture carrying capacity is huge, resulting in torrential downpours. Convection current goes through the process of expansion, cooling, saturation and finally condensation.
- Orographic rain: When moist air ascends the windward side of a mountain barrier, it cools down until complete saturation and orographic clouds form. Precipitation occurs on the upwind side. Leeward side acts as a rain shadow area where usually low precipitation occurs.
- Cyclonic or frontal rain: When air masses with different temperatures and different physical properties meet, warmer air rises over cooler air. In ascent, air expands and cools. Condensation takes place in the form of frontal rainfall.

Pressure and planetary winds

World pressure belts: Circulation of air over the surface of the earth caused by the difference in pressure forms pressure belts. Those are:

- Equatorial Low-Pressure Belt- Between 5 degrees north and south, also called as Doldrums. It is the zone of wind convergence.
- Sub-Tropical High-Pressure Belt- Between 30 degrees north and south, also referred to as Horse Latitudes. It is the zone of wind divergence, with cyclonic activity.
- Temperate Low-Pressure Belt- Between 60 degrees north and south, also called as sub-polar low-pressure areas. It is the zone of wind convergence, with anticyclonic activity.
- Polar High-Pressure Belt- At 90 degrees north and south. Here the temperature is permanently low.

Planetary winds

Within the pattern of permanent pressure belts, winds blow from high pressure to low-pressure belts, as planetary winds. Trade winds, westerlies and polar easterlies flow under the effect of Coriolis force.

Land and sea breezes

- Differential heating of land and sea is a basic factor responsible for monsoon. Land breeze forms a diurnal rhythm and sea breeze form a seasonal rhythm.

Cyclonic activity

- Tropical cyclones (as named in the Indian ocean), typhoons in China sea (tropical latitudes), hurricanes in West Indian island in Caribbean and tornadoes in Guinea lands of West Africa and southern USA and willy-willies in north-western Australia occurs.