

Class 11 Geography Notes Chapter 10 Atmospheric Circulation and Weather Systems

Air expands when heated and gets compressed when cooled. This results in variations in the atmospheric pressure. The result is that it causes the movement of air from high pressure to low pressure, setting the air in motion.

Air in horizontal motion is wind. Atmospheric pressure also determines when the air will rise or sink.

The wind redistributes the heat and moisture across the planet, thereby, maintaining a constant temperature for the planet as a whole. The vertical rising of moist air cools it down to form the clouds and bring precipitation.

As one moves up the air gets rarified and one feels breathless.

The atmospheric pressure is expressed in units of millibar or Pascal. Widely used unit is called kilopascal which is expressed as hpa.

At sea level the average atmospheric pressure is 1,013.2 millibar. Due to gravity the air at the surface is denser and hence has higher pressure.

Air pressure is measured with the help of a mercury barometer or the aneroid barometer.

The pressure decreases with height. At any elevation it varies from place to place and its variation is the primary cause of air motion, i.e. wind which moves from high pressure areas to low pressure areas.

In the lower atmosphere the pressure decreases rapidly with height. The decrease amounts to about 1 mb for each 10 m increase in elevation. It does not always decrease at the same rate.

Air is set in motion due to the differences in atmospheric pressure. The air in motion is called wind. The wind blows from high pressure to low pressure.

Frictional force is greatest at the surface and its influence generally extends upto an elevation of 1 – 3 km. Over the sea surface the friction is minimal.

The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force after the French physicist who described it in 1844.

It deflects the wind to the right direction in the northern hemisphere and to the left in the southern hemisphere. The deflection is more when the wind velocity is high.

The Coriolis force is directly proportional to the angle of latitude. It is maximum at the poles and is absent at the equator. The Coriolis force acts perpendicular to the pressure gradient force. The pressure gradient force is perpendicular to an isobar. The higher the pressure gradient force, the more is the velocity of the wind and the larger is the deflection in the direction of wind.

The velocity and direction of the wind are the net result of the wind generating forces. The winds in the upper atmosphere, 2 – 3 km above the surface, are free from frictional effect of the surface and are controlled mainly by the pressure gradient and the Coriolis force.

During the day, the land heats up faster and becomes warmer than the sea. Therefore, over the land the air rises giving rise to a low pressure area, whereas the sea is relatively cool and the pressure over sea is relatively high. Thus, pressure gradient from sea to land is created and the wind blows from the sea to the land as the sea breeze. In the night the reversal of condition takes place. The land loses heat faster and is cooler than the sea. The pressure gradient is from the land to the sea and hence land breeze results.

In mountainous regions, during the day the slopes get heated up and air moves upslope and to fill the resulting gap the air from the valley blows up the valley. During the night the slopes get cooled and the dense air descends into the valley as the mountain wind. The cool air, of the high plateaus and ice fields draining into the valley.

Class 11 Geography Notes Chapter 10 Important Terms:

- Atmospheric pressure: The weight of a column of air contained in a unit area from the mean sea level to the top of the atmosphere is called the atmospheric pressure. The atmospheric pressure is expressed in units of millibar.
- Wind: The air in motion is called wind.
- Pressure gradient force: The differences in atmospheric pressure produces a force. The rate of change of pressure with respect to distance is the pressure gradient.
- Frictional force: It affects the speed of the wind. It is greatest at the surface and its influence generally extends upto an elevation of 1 – 3 km. Over the sea surface the friction is minimal.
- Coriolis force: The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force after the French physicist who described it in 1844.
- Geostrophic wind: When isobars are straight and when there is no friction, the pressure gradient force is balanced by the Coriolis force and the resultant wind blows parallel to the isobar. This wind is known as the geostrophic wind.
- General circulation of the atmosphere: The pattern of the movement of the planetary winds is called the general circulation of the atmosphere.
- Cell: The easterlies from either side of the equator converge in the Inter Tropical Convergence Zone (ITCZ). Such circulations from the surface upwards and vice-versa are called cells.
- Hadley cells: A cell in the tropics is called Hadley cell.

- Ferrel cells: In the middle latitudes the circulation is that of sinking cold air that comes from the poles and the rising warm air that blows from the subtropical high. At the surface these winds are called westerlies and the cell is known as the Ferrel cell.
- Polar cell: At polar latitudes the cold dense air subsides near the poles and blows towards middle latitudes as the polar easterlies. This cell is called the polar cell.
- Valley breeze: In mountainous regions, during the day the slopes get heated up and air moves upslope and to fill the resulting gap the air from the valley blows up the valley. This wind is known as the valley breeze.
- Polar high: Near the poles the pressure is high and it is known as the polar high.
- El Nino: The warm water of the central Pacific Ocean slowly drifts towards South American coast and replaces the cool Peruvian current. Such appearance of warm water off the coast of Peru is known as the El Nino.
- Southern oscillation: The change in pressure condition over Pacific is known as the southern oscillation.
- ENSO: The combined phenomenon of southern oscillation and El Nino is known as ENSO.
- Katabatic wind: During the night, the slopes get cooled and the dense air descends into the valley as the mountain wind. The cool air, of the high plateaus and ice fields draining into the valley is called katabatic wind.
- Air mass: The air with distinctive characteristics in terms of temperature and humidity is called an air mass. It is
- defined as a large body of air having little horizontal variation in temperature and moisture.
- Source regions: The homogeneous surfaces which are formed over air masses are called the source regions.
- Fronts: When two different air masses meet, the boundary zone between them is called a front.
- Cold front: When the cold air moves towards the warm air mass, its contact zone is called the cold front.
- Warm front: If the warm air mass moves towards the cold air mass, the contact zone is called warm front.
- Occluded front: If an air mass is fully lifted above the land surface, it is called the occluded front.
- Extra tropical cyclone: The systems developing in the mid and high latitude, beyond the tropics are called the middle latitude or extra tropical cyclones.
- Landfall of the cyclone: The place where a tropical cyclone crosses the coast is called the landfall of the cyclone.
- A mature tropical cyclone: It is characterized by the strong spirally circulating wind around the centre, called the eye. The diameter of the circulating system can vary between 150 and 250 km. The eye is a region of calm with subsiding air.
- Tropical cyclones: Tropical cyclones are violent storms that originate over oceans in tropical areas and shift to the coastal areas bringing about large scale destruction caused by violent winds, very heavy rainfall and storm surges. This is one of the most devastating natural calamities.

- Tornado: From severe thunderstorms sometimes spiralling wind descends like a trunk of an elephant with great force, with very low pressure at the centre, causing massive destruction on its way. Such a phenomenon is called a tornado.
- Water spouts: The tornado over the sea is called water spouts.