Pressure and Winds

Lesson No.	Title	Activity
11	Pressure and Winds	Try to identify the winds found in your area.

Meaning

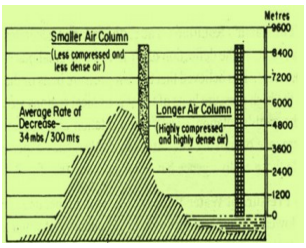
Air has weights and it exerts pressure which varies from place to place. These variations are specified ion pressure belts. The pressure at different location of the world also varies in different seasons. This variation causes the movement of air called winds. These winds are divided into different types as per their features and specifications. Air masses and cyclones are also formed due to such steep difference in air pressure.

Measurement of Air Pressure

- A column of air exerts weight in terms of pressure on the surface of the earth.
- The weight of the column of air at a given place and time is called air pressure or atmospheric pressure.
- Atmospheric pressure is measured as force per unit area by an instrument called barometer and marked in millibar (mb).
- A pressure of 1000 millibars is equal to the weight of 1.053 kilograms per square centimeter at sea level.

Distribution of Air Pressure

Vertical Distribution



- Air pressure decreases with increase in altitude but it does not always decrease at the same rate.
- The normal rate of decrease in air pressure is 34 millibars per every 300 metres increase in altitude.
- The columnar distribution of atmospheric pressure is known as vertical distribution of pressure.
- Temperature of the air, amount of water vapour present in the air and gravitational pull of the earth determine the air pressure of a given place and at a given time.
- Since these factors are variable with change in height, there is a variation in the rate of decrease in air pressure with increase in altitude.

Horizontal Distribution

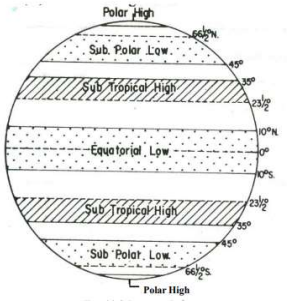
- The distribution of atmospheric pressure over the globe is known as horizontal distribution of pressure and shown on maps through isobars.
- An isobar is a line connecting points that have equal values of pressure.
- The spacing of isobars expresses the rate and direction of change in air pressure.
- This change in air pressure is referred to pressure gradient.

Factors responsible for variation

i. Air Temperature
ii. The Earth's Rotation
iii. Presence of Water Wapour

Pressure Belt

- The horizontal distribution of air pressure across the latitudes is characterized by high or low pressure belts. These are:
  i. The Equatorial Low Pressure Belt;
  ii. The Sub tropic High Pressure Belts;
  iii. The Sub-polar Low Pressure Betts;
  iv. The Polar High Pressure Belts



i. The Equatorial Low Pressure Belt;

- The sun shines almost vertically on the equator throughout the year resulting in warm air and rises over the equatorial regioncausing equatorial low pressure.
- It extends from equator to 10˚N and 10˚S latitudes.
- Due to excessive heating horizontal movement of air (wind) is absent here. This belt is called doldrums (the zone of calm).
- Its also known as-Inter Tropical Convergence Zone (ITCZ).

ii. *The Sub tropic High Pressure Belts*

- It extends from the tropics to about 35˚ latitudes in both the Hemispheres.
- This pressure belts is formed because the rising air of the equatorial region is deflected towards poles due to the earth's rotation.
- After becoming cold and heavy, it descends in these regions and get piled up resulting in high pressure.

iii. *The Sub-polar Low Pressure Belts*

- It extends between 45˚N and the Arctic Circle in the northern hemisphere and between 45°S and the Antarctic Circle in the southern hemisphere.
- Winds coming from the sub-tropical and the polar high belts converge here to produce cyclonic storms or low pressure conditions.
- This zone of convergence is also known as polar front.

iv. *The Polar High Pressure Belts*

- Slanting sun rays resulting in low temperatures causing compressed air with increased density. Hence, high pressure is found here.
- In northern hemisphere it called the North polar high pressure belt andSouth polar high pressure belt in the southern hemisphere.

DO YOU KNOW?

- Sub-tropical high pressure belts are also called horse latitudes.
- Convergence of subtropical and polar winds result in the formation of cyclones in the sub-polar regions.
- The location of the pressure belts is not permanent.

Seasonal Distribution of Pressure

i. Distribution of Air Pressure (January)

- As the land cools more rapidly than oceans, its temperatures are lower in winter than the surrounding seas.
- In the southern hemisphere, the sub-polar low pressure belt circles the earth as a real belt of low pressure and is not divided into cells.
- In northern hemisphere two cells of low pressure namely Iceland low and Aleutian low develop over the North Atlantic and the North Pacific oceans respectively.
- The Sub-tropical high pressure cells are centered over the ocean in the southern hemisphere.
- The belt of high pressure is interrupted by the continental land masses where the temperature is much higher.
- In the northern hemisphere, ridges of high pressure occur in the sub-tropical latitudes over the continent.
- A well developed high pressure cell occurs in the interior parts of Eurasia.

ii. Distribution of Air Pressure (July)

- The equatorial low pressure belt shifts a little north of the mean equatorial position because of the northward apparent movement of the Sun.
- All the pressure belts shift northwards in July.
- The Aleutian and Icelandic lows disappear from the oceans while the landmasses, which developed high pressure during winter months, have extensive low pressure cells now.
- In Asia, a low pressure develops. The subtropical highs of the northern hemisphere are more developed over the oceans - Pacific and Atlantic.
- In the southern hemisphere, the sub-tropical high pressure belt is continuous.
- Sub-polar low forms a continuous belt in the southern hemisphere while in northern hemisphere, there is only a faint oceanic low.

Winds

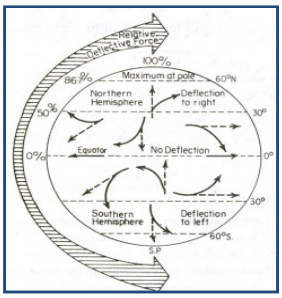
- Horizontal movement of air in response to difference in pressure is termed as wind while vertical or nearly vertical moving air is called air current.

Pressure Gradient and Winds

- The greater the difference in air pressure between the two points, the steeper is the pressure gradient and greater is the speed of the wind.
- The gentler the pressure gradient slower is the speed of the wind.

The Coriolis Effect and Wind

- They get deflected from their original paths due to the earth's rotation on its axis, known as the Corioliseffect or coriolis force.
- In northern hemisphere winds are deflected towards their right, and in the southern hemisphere towards their left known as Farrel's law.

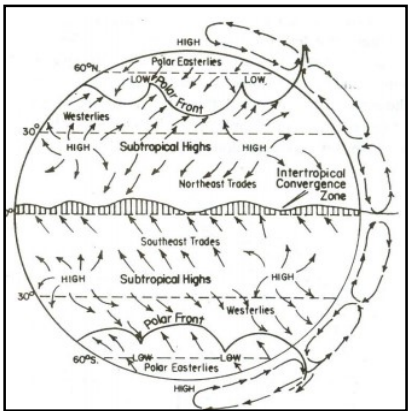


Type of Winds

Winds are generalized under three categories:

i. Planetary winds or Permanent winds

- Planetary or permanent winds blow



from high pressure belts to low pressure belts in the same direction throughout the year.

- They are easterly and westerlies and polar easterlies.

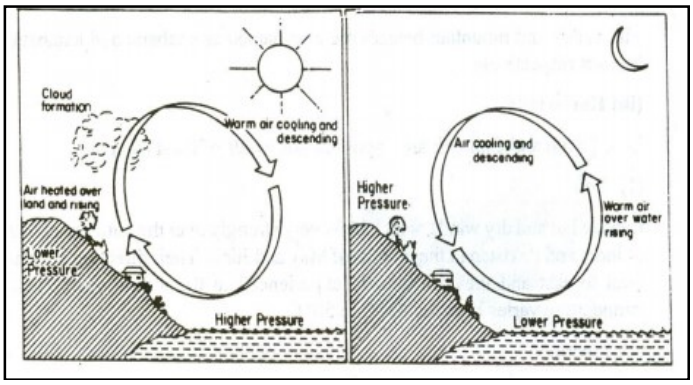
ii. Periodic winds (Monsoon Winds)

- The direction of these winds changes with the change of seasons i.e. Monsoon winds.

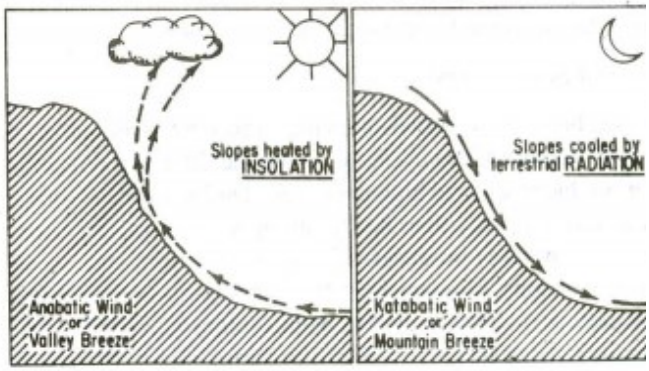
iii. Local winds (Including Hot and Cold wind)

- Local winds usually affect small areas and found in the lower levels of the troposphere

Land and Sea Breezes



The Mountain and Valley Breezes



Hot Winds

Loo

- Loo are hot and dry winds, which blow very strongly over the northern plains of India and Pakistan in the months of May and June.
- Their direction is from west to east and they are usually experienced in the afternoons. Their temperature varies between 45°C to 50°C.

Foehn

- Foehn is strong, dusty, dry and warm local wind which develops on the leeward side of the Alps mountain ranges.
- The temperature of the winds vary from 15°C to 20°C which help in melting snow. Thus making pasture land ready for animal grazing and help the grapes to ripe early.

Chinook

- Hot and dry local wind which moves down the eastern slopes of the Rockies in U.S.A. and Canada.
- They keep the grasslands clear of snow. Hence they are very helpful to ranchers.

Cold Winds

Mistral

- Mistrals originate on the Alps and move over France towards the Mediterranean Sea through the Rhone valley.
- They are very cold, dry and high velocity winds. They bring down temperature below freezing point in areas of their influence.

Tropical and Temperate Cyclones

Air Mass

- An air mass is an extensive portion of the atmosphere having uniform characteristics of temperature, pressure and moisture which are relatively homogeneous horizontally.
- Air masses, therefore, are of two kinds-polar and tropical air masses.
- Polar air mass is cold and tropical air mass is warm.

Evaluate Yourself

1. Explain the reasons causing variation in the horizontal distribution of pressures?
2. Differentiate between mountain and valley breeze with the help of graphics.