2. In Search of the Source of Wind

Let us Assess

1. Question

Temperature, altitude, and humidity are inversely proportional to atmospheric pressure. Justify.

Answer

Temperature, Altitude, and Humidity are inversely proportional to atmospheric pressure. Here an attempt is made and analyzed below:

Temperature: Air also expands when it gets heated and the expanded air is less dense and hence it ascends. This leads to the lowering of atmospheric pressure. The ascending air spreads to the sides and it starts cooling. On cooling, it becomes dense and descends. As a result, atmospheric pressure increases. The atmospheric pressure decreases as the temperature increases and vice versa. The pressure of a given amount of gas held at constant volume is directly proportional to temperature. As the pressure goes up, the temperature also goes up, and vice-versa. For example, day and night

Altitude: As one goes up, there is a decrease in atmospheric pressure due to the rarification of air with altitude. This is due to the fact that air molecules are constantly being pulled downwards (towards the center of the Earth) by Gravity. The pressure decreases at the rate of 1 millibar (MB) per an altitude of 10 meters. This is the reason mountaineers carry oxygen cylinders with them. The atmospheric pressure and altitude are inversely proportional.

Humidity: Humidity refers to the quantity of water present in the atmosphere. Water vapor is lighter than air and hence it moves up. If the quantity of water vapor is more in a unit volume of air, then naturally the atmospheric pressure will be less. Thus, humidity and atmospheric pressure are inversely proportional.

Altitude, temperature, and humidity influence the atmospheric pressure. Variations in atmospheric pressure occur in variations. For example, if the atmospheric pressure of an area is higher than that of the surrounding regions, it can be designated as ‘high pressure’ and low pressure below pressure.

2. Question

Prepare notes on the role of solar energy and the Earth's rotation in the formation of pressure belts.

Answer

Pressure belt is seasonally identical horizontal pressure variations created in the earth's atmosphere due to the seasonal and spatial variation of energy received by the earth at different places. In the formation of pressure belt, solar energy and Earth’s rotation played a different role. Let us understand the following:

a. *Equatorial low-pressure belt*: This is the zone where the **sun's ray’s** fall vertically throughout the year therefore temperature will be high in this zone. This low-pressure belt extends from 0 to 5° North and South of Equator. As the air expands due to the sun's heat and rises up on a massive scale. The air, therefore, expands and rises as convection current causing low pressure to develop here. This pressure belt is also known as 'doldrums', meaning 'the zone with no winds'. This low-pressure belt is also called as doldrums because it is a zone of total calm without any breeze.

b. *Subtropical high-pressure belt*: The hot air ascending from the equatorial low-pressure belt cools gradually and subsides at the subtropical zone due to the **rotation of the Earth**. At about 30°North and South of Equator lies the area where the ascending equatorial air currents descend. This area is thus an area of high pressure. It is also called as the Horse latitude. Winds always blow from high pressure to low pressure.

c. *Subpolar low-pressure belt*: As this zone is close to the Pole, the air is colder here. Though the cold air remains close to the Earth, the air is thrown away due to the **rotation of the earth.** As a result, low pressure is experienced all along the subpolar region. These belts located between 60° and 70° in each hemisphere are known as Circum-Polar Low-Pressure Belts. In the Subtropical region, the descending air gets divided into two parts. One part blows towards the Equatorial Low-Pressure Belt. The other part blows towards the Circum- Polar Low-Pressure Belt. Due to earth’s rotation, the winds surrounding the Polar region blow towards the Equator.

d. Polar high-pressure belt: This zone experiences severe cold throughout the year. As a result, the air remains chilled under the extreme cold that prevails over the Poles, and this contributes to the steady high pressure experienced here. At the North and South Poles, between 70° to 90° North and South, the temperatures are always extremely low. The cold descending air gives rise to high pressures over the Poles.

This shows how variations in the amount of solar energy received and the rotation of the earth contribute to

the formation of different pressure belts.

3. Question

Describe how the Coriolis Effect causes the deflection of winds on the basis of the direction of the winds mentioned below.

a. Trade winds

b. Westerlies

Answer

The speed and direction of the wind are based on the Coriolis force. This force is generated by Earth's rotation. When winds from in Northern Hemisphere deflected towards the right and the wind of Southern Hemisphere deflected towards left. This is called the Coriolis Effect. There is an attempt to find out the cause of deflection of winds in the following ways:

a. Trade winds- Trade winds blow continuously towards the equatorial low-pressure belt. As these winds blow from the northeast in the Northern Hemisphere, they are known as northeast trade winds. In the Southern hemisphere, they blow towards the equatorial low and became Southeast Trade winds. The equatorial low-pressure zone where the trade winds from both the hemispheres converge is known as the Inter-Tropical Convergence Zone (ITCZ). Trade winds are the product of the Coriolis Effect. In the Northern Hemisphere, the air seems to blow from north to south but Coriolis Effect would deflect the air because earth is rotating at the faster rate in the Equator then in Northern Hemisphere/ Southern Hemisphere. These winds blow from the Northeast in the Northern Hemisphere and from the Southeast in the Southern Hemisphere. Easterlies or trade winds are the prevailing winds that blow from the east towards the west in polar and tropical regions.

b. Westerlies: Winds blow continuously from the subtropical high-pressure zones to Subpolar low-pressure zones. As the direction of these winds is mostly from the west, they are known as the westerlies. The westerlies are stronger in the Southern Hemisphere than in the Northern Hemisphere. This is due to the vast expanse of oceans in the Southern Hemisphere.

If a moving object is going towards north or south from the equator it will deflect toward the east due to Coriolis force. Westerlies are the prevailing wind that blows from west to east in between 30 to 60 degrees north to south. Similarly, if a moving object is going from north and south towards the equator it deflects to west.