

Paper code: GGY HC – 2026

Part- I

Group- A: Climatology

Topic: Pressure Belts and Wind System

Atmospheric pressure is a force of dry air exerted on a particular place/surface. The distribution of atmospheric pressure on the earth is explained across the latitude. This is considered as horizontal distribution of atmospheric pressure. The distribution of pressure belts is very distinct and classifiable. Based on the characteristics of different belts, they are grouped into four: They are:

- 1) Equatorial low pressure belt
- 2) Sub-tropical high pressure belt
- 3) Sub-polar low pressure belt
- 4) Polar high pressure belt

Last three have two cases of each – northern and southern hemisphere. In fact the first one has also two cases but both north and south cases of equatorial low forms a single belt. That is why, it is call as one.

- 1) **Equatorial Low Pressure Belt:** This belt extends from 10° north to 10° south latitude. It is a thermally induced belt because here the temperature remains very high throughout the year due to the vertical sun's rays. Consequently the air is warmed up. Warm air has lower density. Being lighter, it is uplifted and calm condition prevails. Since, there is almost an absence of horizontal movement of wind, the calm condition is termed as 'doldrum'. The winds converging from both hemisphere's high pressure belts results into a zone of convergence. It is known as inter tropical convergence zone (ITCZ). Strong convectional rainfall occurs at the late afternoon and this results adiabatic cooling at this time of highest diurnal temperature. The different air pressure belts can be observed from the Figure 1.

The risen air from the equatorial low reaches to the upper troposphere and dragged towards poles. By reaching in the tropics, air descends from 200to 350latitudesin

both the hemispheres. It is caused by cooling of the air. Cool air is heavier and hence, it subsides. Subsidence of air in the tropics causes to additional air accumulation. Therefore, high pressure belt is created here.

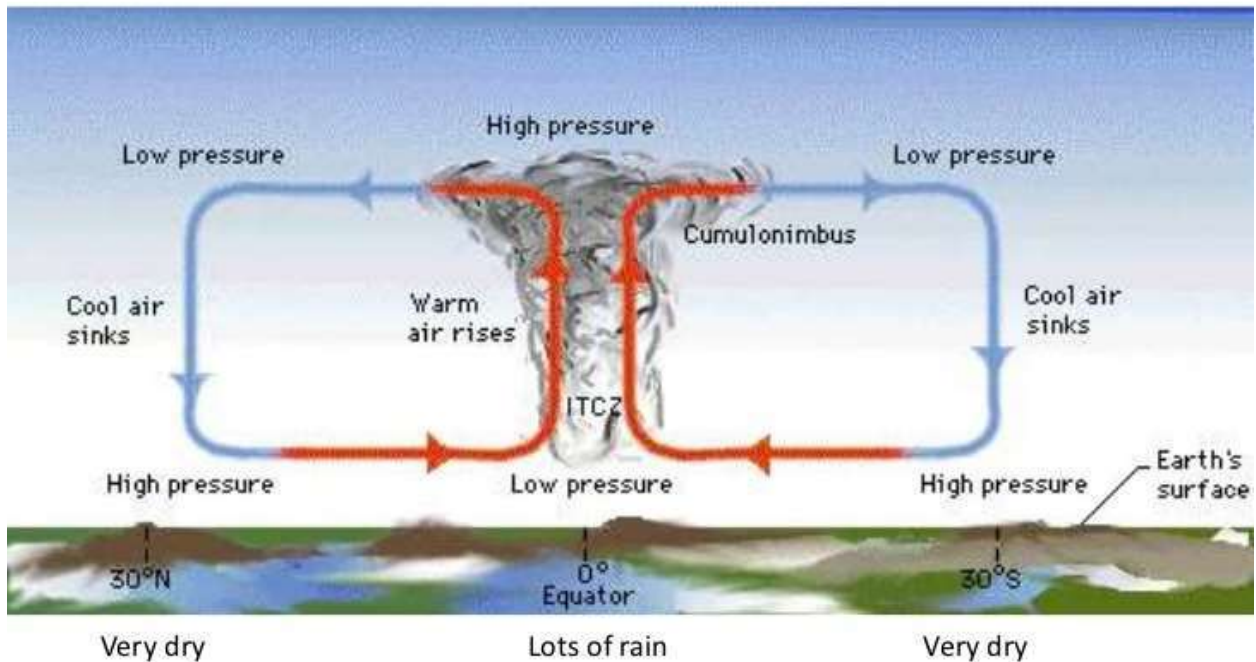


Figure 1: ITCZ and Equatorial Low Pressure Belt

- 2) **Sub-Tropical High Pressure Belts:** These belts are extended from 20° to 35° latitudes in both hemisphere. These belts are situated over tropic of Cancer and tropic of Capricorn. Since, there is subsidence of air from the upper troposphere in this zone, a high pressure belt is developed here. From this high pressure belt, the wind moves equatorward to fill the temporarily created vacuum/gap produced by rising air at the low pressure zone. Hence, an atmospheric cell is created by rising air at equator – moving up – getting drifted towards pole – getting subsided due to cooling – becoming heavier – climbing down at sub-tropical high and finally moving towards equator to fill the gap created by rising air. This cell (circular motion) is known as Hedley cell (Figure 1 and 2). Due to subsiding dry air, most of the deserts are found in these pressure belts but in the western margin of the continents. A calm and feeble wind is created in this region which is known as ‘horse latitude’. In early day sailing vessel with cargo of horses was very difficult

under such calm conditions. The horses were thrown into the sea to reduce the load of the ship.

- 3) **Sub-Polar Low Pressure Belts:** These belts are found between 50° to 70° latitudes in both the hemispheres. These belts are induced due to ascend of air as a result of convergence of wind coming from sub-tropical high pressure belts (westerlies) and polar high pressure belts (easterlies). The air moving from sub-tropical high to sub-polar low – rises above – gets cooled – diverted towards equatorward and descends at sub-tropical high – makes a cell (circulation motion) known as Ferrel’s cell (Figure 2). During winter season, because of high contrast of temperature between land and sea, this belt is broken into two low pressure centers in northern hemisphere - one in the vicinity of the Aleutian Island, and other between Iceland and Green Land. During the summer season, the variation is less. Therefore, more regular low pressure belt develops.

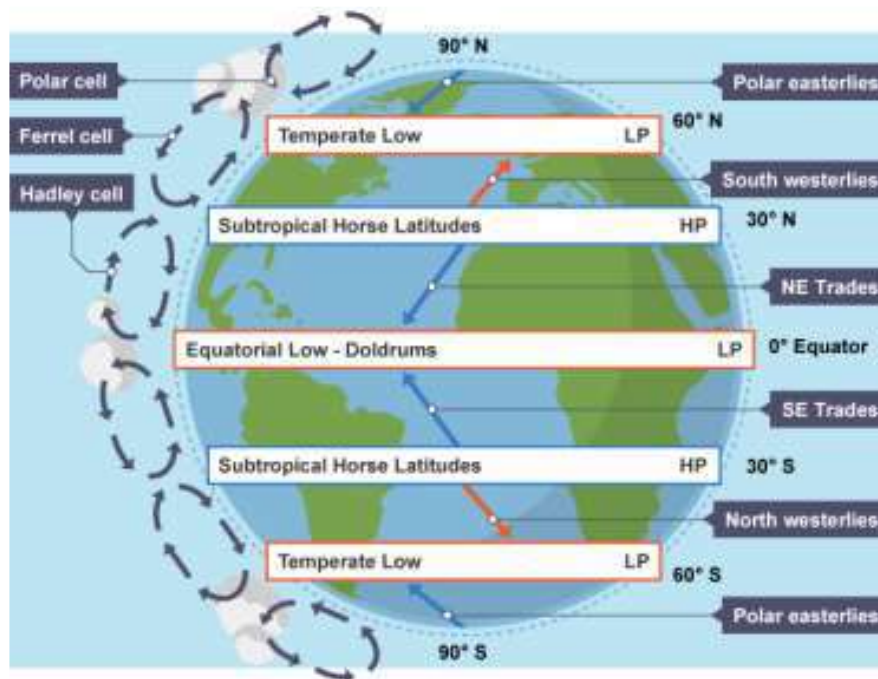


Figure 2: Air Pressure Belts

Source: <https://bam.files.bbc.co.uk/bam/live/content/zyb2n39/large>

- 4) **Polar High Pressure Belts:** High pressure prevails over both the polar regions due to excessive cold condition. The cold climatic condition itself is caused by slanting sun’s

ray at the poles. In these pressure zones, thermal factor is more important than dynamic factor. The air coming from polar region – rises up at the sub-polar low – finally pushed towards pole and descends at the polar high. This also makes a cell known as Polar cell (Figure 2).
