(ii) Upper Air Circulation

The upper air circulation of the Indian sub-continent is dominated by a westerly flow which is governed by **Jet stream**. Due to their location over 27°-30° N latitude, these jet streams are known as **sub-tropical westerly jet streams**. They blow South of the Himalayas, throughout the year except in summer.

(iii) Western Cyclonic Disturbances and Tropical Cyclones

The Western cyclonic disturbances are weather phenomena of the winter months brought in by the westerly flow from the Mediterranean region. They usually influence the weather of the North and North-Western regions of India. Tropical cyclones occur during the monsoon as well as in October-November and are part of the easterly flow. These disturbances affect the coastal regions of the country.

In summer, the sub-tropical westerly jet stream moves North of the Himalayas due to apparent shifting of the sun. An easterly jet stream, called sub-tropical easterly jet stream, blows over peninsular India approximately over 14° N during the summer months.

The Indian Monsoon

Monsoon winds strongly influence the climate of India. The monsoons are experienced in the tropical area roughly between 20° N and 20° S.

The word monsoon is derived from the Arabic word 'mausim' which literally means season. 'Monsoon' refers to the seasonal reversal in the wind direction during a year.

Mechanism of Monsoon

The following facts are important to understand the mechanism of the monsoons

- The differential heating and cooling of land and water creates low pressure on the landmass of India while the seas around it experience comparatively high pressure.
- The **Inter Tropical Convergence Zone** (ITCZ) in summer season shifts its position over the Ganga plain. This is the equatorial trough normally positioned about 5°N of the equator. It is also known as the '**monsoon trough**' during the monsoon season.

- The presence of the high-pressure area, East of Madagascar (approximately at 20°S over the Indian Ocean). The intensity and position of this high-pressure area affects the Indian monsoon.
- The Tibetan plateau gets intensely heated during summer. This results in strong vertical air currents and the formation of low pressure over the plateau at about 9 km above sea level.
- The difference in pressure over Tahiti (Pacific Ocean, 18°S/149°W) and Darwin in Northern Australia (Indian Ocean, 12°30'S/131°E) is computed to predict the intensity of the monsoons.
- If the pressure differences were negative, it would mean below average and late monsoons.

Monsoon and the Southern Oscillation

Changes in the pressure conditions over the Southern oceans also affect the monsoons. When the tropical Eastern South Pacific Ocean experiences high pressure, the tropical Eastern Indian Ocean experiences low pressure.

But in past a few years, there is a reversal in the pressure conditions and the Eastern Pacific has lower pressure in comparison to the Eastern Indian Ocean. This periodic change in pressure conditions is known as the **Southern Oscillation** (SO).

EL Nino Southern Oscillations (ENSO)

The EL Nino phenomenon is a feature connected with the Southern Oscillation. In this, a warm ocean current flows past the Peruvian Coast, in place of the cold Peruvian current. It occurs at the interval of 2 to 5 years.

The changes in pressure conditions are connected to the EL Nino. Hence, the phenomenon is referred to as ENSO (EL Nino Southern Oscillations).