

# CLIMATE

## Climate of India

Weather describes the day-to-day meteorological conditions such as wind, temperature, cloudiness, moisture, rainfall, etc. affecting a place. Climate is the average weather usually taken over a 30-year period for a particular region and time. The basic elements of weather are wind, temperature, air pressure, precipitation and moisture.

‘Monsoon’ refers to the seasonal reversal in the wind direction during the year. The two important elements of climate are temperature and precipitation.

Some parts of Rajasthan desert, the temperature in summers is 50 degrees Celsius, whereas summer temperature in Jammu and Kashmir is 20 degrees Celsius. During winters, the temperature in Jammu and Kashmir may be -45 degrees Celsius. Drass in Jammu and Kashmir is the second coldest inhabited place in the world.

In India, the Tropic of Cancer passes through the central part of the country, from the Rann of Kutch in the west to Mizoram in the east. India has both tropical and subtropical climates. Altitude refers to the height a place above sea level.

Contrasts in temperature are experienced more in the interior of the country. The rainfall in India varies in its form, types, amount and seasonal distribution. The upper parts of the Himalayas, precipitation

is mostly in the form of snowfall, whereas the remaining parts of the country receive rains. There is a decrease in the rainfall generally from east to west in the Northern Plains. Climatic variations also affect the way people live i.e. depends on the food, the clothes and the kind of houses they live in.

In India, the elevation of land ranges from 30 metres to 6,000 metres. The Himalayan mountains to the north of India have an average height of about 6,000 metres. The average summer temperature on the Himalayas can vary from zero degrees Celsius to 14 degrees Celsius, while winters can see the temperature dipping below freezing point with heavy snowfall. The Himalayas prevent the cold winds from Central Asia from entering the subcontinent. The rainfall in India is

governed mainly by pressure and surface winds, upper air circulation, and western cyclonic disturbances and tropical cyclones.

Due to the Coriolis force, these winds move on towards the equatorial low-pressure area. The Coriolis force also known as 'Ferrel's Law,' is an apparent force caused by the earth's rotation. This force deflects winds towards the right in the northern hemisphere and towards the left in the southern hemisphere.

The north-easterly winds are land-bearing winds; hence they carry very little moisture and bring little or no rain in India.

During winter, a high-pressure area is created in the north of the Himalayas. In summer, a low-pressure area develops over interior Asia as well as over north-western

India. This causes a complete reversal of the direction of winds during summer.

Winds move from the high-pressure area over the southern Indian Ocean, cross the equator and turn right towards the low-pressure areas over the Indian subcontinent. These winds are known as the south-west monsoon winds.

An important component of the flow is the jet stream. Jet streams are a narrow belt of high altitude westerly winds that blow in the troposphere. Their speed varies from about 110 kilometres per hour in summer to about 184 kilometres per hour in winter.

A number of separate jet streams have been identified. The most constant are the mid-latitude and the sub-tropical jet streams. They originate from the

Mediterranean region and are known as subtropical westerly jet streams. An easterly jet stream, called the tropical easterly jet stream, blows over peninsular India, approximately over  $14^{\circ}\text{N}$  during the summer months. The movement of water in the oceans is called currents.

### Climatic Controls

The day-to-day changes that we experience are referred to as weather. Weather is the state of the atmosphere of a particular area at any point of time. Atmospheric conditions that describe the weather include elements like temperature, precipitation, pressure, wind and humidity.

During a year, the weather changes in cycles, the cyclic changes in the

atmospheric conditions are called seasons. By observing the weather pattern for longer periods, usually over 30 years, the climate of a place can also be determined. The basic elements of weather are wind, temperature, air pressure, precipitation and moisture.

Climate describes the long-term pattern of weather that generally prevails over an area. Based on climatic differences, the world can be divided into a number of climatic regions. Each climatic region has its own characteristic vegetation and wildlife. The climatic conditions also influence the lifestyles of the people living in these regions.

The factors affecting the climate of a place are referred to as controls and are latitude, altitude, pressure and wind system,

distance from the sea, ocean currents, and relief features.

Altitude is another factor controlling the climate of a place. Altitude refers to the height a place above sea level. The higher one travels into the troposphere, the lower the temperature becomes. The rate at which the temperature drops is known as the lapse rate.

The variations in air temperature control the pressure and wind system of a place. Warm air rises, creating low pressure areas, while cold air sinks, creating high pressure areas. As a result, winds blow outward from a high pressure location towards lower pressures.

The differences in air pressures near the equator and the poles are the main factors

that influence global pressure and wind systems. In India, the Tropic of Cancer passes through the central part of the country, from the Rann of Kutch in the west to Mizoram in the east. India has both tropical and subtropical climates.

The distance of a place from the sea is another important factor that regulates the climate of a place.

As the distance from the sea increases the weather conditions become extreme.

Places away from the sea have very hot summers and very cold winters. This condition is known as continentality.

Another important control of climate is the circulation of water and air. The air in the atmosphere and the water in the oceans are in constant motion, distributing heat around the world in regular patterns.

Warm air and water move towards the poles, while cool air and water move towards the equator.

Another major control of climate is the relief of a place. Mountains often act as natural barriers for wind and moisture, affecting the climate of the areas around it.

The Himalayas influence the climate of the Indian subcontinent by protecting it from the cold air mass of Central Asia.

The climate and related weather conditions in India are controlled by the following atmospheric conditions: Pressure and surface winds, Upper air circulation, Western cyclonic disturbances and tropical cyclones.

The earth's rotation causes the Coriolis force, which tends to turn the flow of air.

Jet streams are rivers of wind that blow horizontally through the upper layers of the troposphere, generally from west to east.

The movement of water in the oceans is called currents.

### The Mechanism of Monsoons

The climate of India is strongly influenced by the monsoon winds. It refers to a season in which the wind system reverses completely. The monsoons are experienced in the tropical area roughly between 20° N and 20° S.

Various atmospheric conditions influence the monsoon winds. The first condition is the differential heating and cooling of land and water. This creates low pressure on the

landmass, while high pressure is created over the seas around during day time, but is reversed during the night time.

The second condition is the shift in the position of Inter-Tropical Convergence Zone (ITCZ). In summer, the equatorial trough normally positioned about  $5^{\circ}\text{N}$  of the equator moves over the Ganga plain creating a monsoon trough during the monsoon season.

The third condition is the presence of the high-pressure area that develops east of Madagascar. It is approximately at  $20^{\circ}\text{S}$  over the Indian Ocean. The intensity and position of this high-pressure area affects the Indian Monsoon.

The fourth condition develops during the summer. The Tibetan Plateau gets

intensely heated resulting in strong vertical air currents and high pressure over the plateau about 9 km above sea level. The fifth condition develops during the summer due to the movement of the westerly jet streams to the north of the Himalayas and the presence of the tropical easterly jet stream over the Indian Peninsula.

Changes in pressure over the southern oceans also affect the monsoons. In certain years, there is a reversal in the pressure conditions. This periodic change in pressure conditions is known as the Southern Oscillation, or SO.

The Southern Oscillation is connected to El Nino, which is a warm ocean current that flows past the Peruvian Coast. It flows every two to five years in place of the cold

Peruvian current. The phenomenon is, referred to as ENSO (El Nino Southern Oscillations). In India, the monsoon lasts for 100 to 120 days from early June and to mid-September. The monsoon winds encounter various atmospheric conditions on their way and hence are pulsating in nature, and not steady.

The monsoon arrives with a sudden downpour of rainfall that continues for several days. This is known as the ‘burst’ of the monsoon.

The monsoon arrives at the southern tip of the Indian Peninsula generally by the first week of June. By early September, the monsoon starts to withdraw or retreat and is a more gradual process. By mid-October, it withdraws completely from the northern half of the peninsula. The

withdrawal takes place progressively from north to south from the first week of December to the first week of January. This is the start of the winter season.

The retreating monsoon winds move over the Arabian Sea and the Bay of Bengal, and collect moisture on the way. These monsoon winds reach the southern states of India by October, and are responsible for a second round of rainfall. These are called the winter monsoons. The winter monsoon is experienced in the states of Tamil Nadu, Kerala and Andhra Pradesh in the first week of January.