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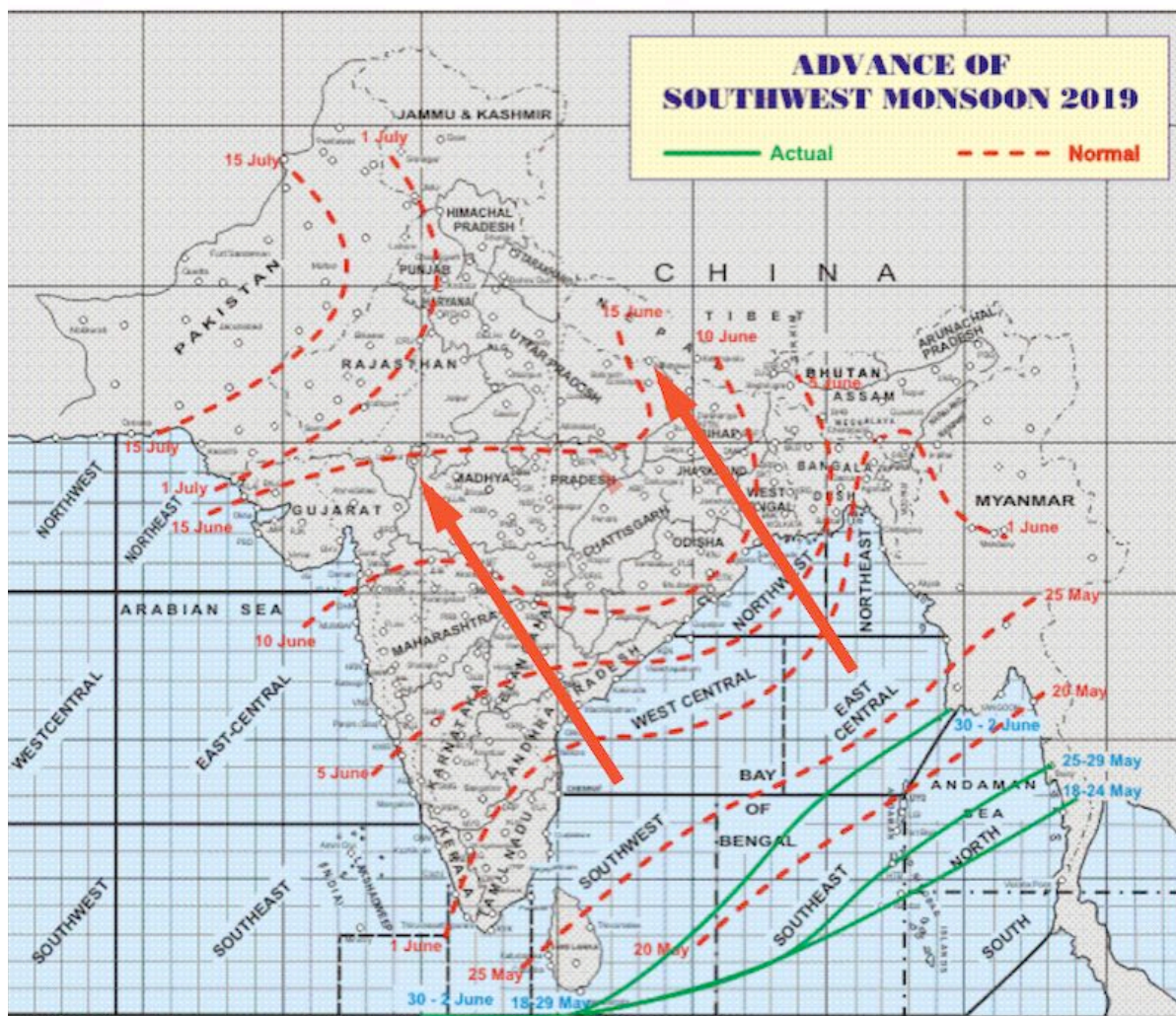
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Salient Features of Indian Climate



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Climate of India: Salient Features

Introduction

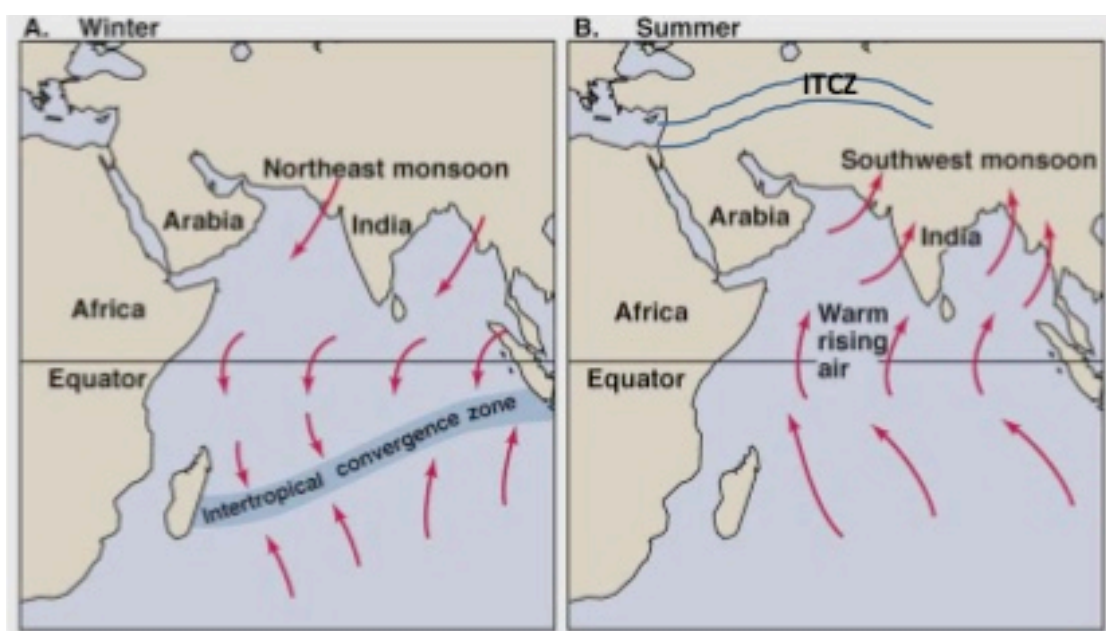
Climate plays very significant role in the physical environment of human beings. In a country like India climatic characteristics do play a dominant role in affecting the economic pattern, way of life, mode of living, food preferences, costumes and even the behavioural responses of the people. In India despite a lot of scientific and technological developments our dependence on monsoon rainfall for carrying out successful agricultural activities, has not been minimised.

The climate of India belongs to the 'tropical monsoon type' indicating the impact of its location in tropical belt and the monsoon winds. Although a sizeable part of the country lying north of the Tropic of Cancer falls in the northern temperate zone but the shutting effects of the Himalayas and the existence of the Indian Ocean in the south have played significant role in giving India a distinctive climatic characteristics.

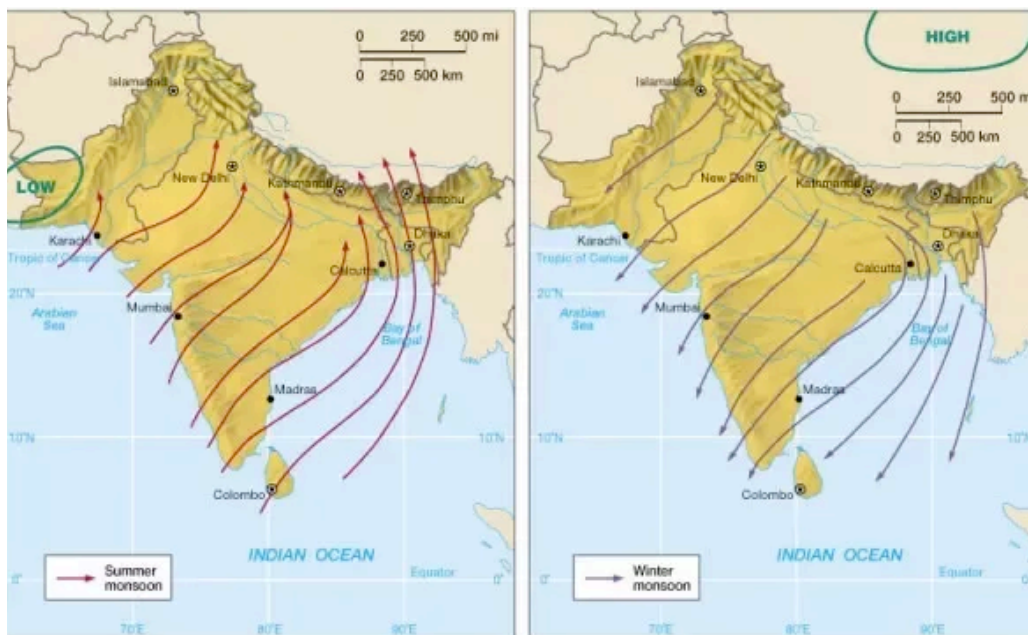
Salient Features of Indian Climate

Following are the salient features of the Indian climate:

1. **Reversal of Winds:** The Indian climate is characterised by the complete reversal of wind system with the change of season in a year. During the winter season winds generally blow from north-east to south-west in the direction of trade winds. These winds are dry, devoid of moisture and are characterised by low temperature and high pressure conditions over the country. During summer season complete reversal in the direction of the winds is observed and these blow primarily from south-west to north-east.



2. **Formation of Alternatively High and Low Pressure Areas over the Land:** There is a change in the atmosphere pressure conditions with the change of season. During winter season due to low temperature conditions high pressure areas is formed over the northern part of the country. On the other hand the intense heating of the land during summer season leads to the formation of a thermally induced low pressure cell over the north-western part of the country. These pressure areas control the direction and intensity of wind.



3. **Seasonal Variability in Rainfall:** In India over 80 per cent of annual rainfall is obtained in the latter part of the summer whose duration ranges from 1-5 months in different parts of the country. Since the rainfall is in the form of heavy downpour, it creates problems of floods and soil erosion. Sometimes there is continuous rain for many days and sometimes there is a long spell of dry period. Similarly, there is a spatial variation in the general distribution of rainfall. Cherrapunji has received in a single day an amount equal to 10 years of rainfall at Jaisalmer, Rajasthan.

In fact Indian climate is so varied and complex that it denotes climatic extremes and climatic varieties. While it provides enough heat to grow crops and carry on agricultural activities all over the country it also helps in the cultivation of a number of crops belonging to tropical, temperate as well as frigid areas.

4. **Plurality of seasons:** The Indian climate is characterised by constantly changing weather conditions. There are three main seasons but on broader consideration their number goes to six a year (winter, fall of winter, spring, summer, rainy and autumn).
5. **Unity of Indian Climate:** The Himalayas and the associated mountain ranges extend to the north of India from east to west. These tall mountain ranges prevent the cold northerly

winds of Central Asia from entering into India. Therefore, even the parts of India extending north of the Tropic of Cancer experience a tropical climate. These ranges force the monsoon winds to cause rainfall over India and the entire country comes under the influence of the monsoon winds. In this manner the climate in the entire country becomes monsoon type.

6. **Diversity of Indian Climate:** In spite of the unity of Indian climate, it is characterised by regional differences and variations. For example, while in the summer the mercury occasionally touches 55°C in the western Rajasthan, it drops down to as low as minus 45°C in winter around Leh. These differences are visible in terms of winds, temperature, rainfall, humidity and aridity etc. These are caused by differences in the location, altitude, distance from the sea, distance from mountains and general relief conditions at different places.
7. **Characterised by Natural Calamities:** Due to its peculiar weather conditions especially rainfall variability during rainy seasons has made Indian climate more prone to natural calamities like floods, droughts, famines and even epidemics.

Factors Determining the Climate of India

India's climate is controlled by a number of factors which can be broadly divided into two groups –

A. Factors Related to Location and Relief

- I. **Latitude:** The Tropic of Cancer passes through the central part of India in east-west direction. Thus, northern part of the India lies in sub-tropical and temperate zone and the part lying south of the Tropic of Cancer falls in the tropical zone. The tropical zone being nearer to the equator, experiences high temperatures throughout the year with small daily and annual range. Area north of the Tropic of Cancer being away from the equator, experiences extreme climate with high daily and annual range of temperature.
- II. **The Himalayan Mountains :** As already discussed, the lofty Himalayas in the north along with its extensions act as an effective climatic divide between central Asia and Indian subcontinent. The cold and chilly winds that originate near the Arctic Circle are obstructed by the Himalayas and give a distinctive taste to climate of India.
- III. **Distribution of Land and Water :** India is flanked by the Indian Ocean on three sides in the south and girdled by a high and continuous mountain-wall in the north. As compared to the landmass, water heats up or cools down slowly. This differential heating of land and sea creates different air pressure zones in different seasons in and around the Indian subcontinent.

- IV. Distances from the Sea:** With a long coastline, large coastal areas have an equable climate. Areas in the interior of India are far away from the moderating influence of the sea. Such areas have extremes of climate. That is why, the people of the Konkan coast have hardly any idea of extremes of temperature and the seasonal rhythm of weather. On the other hand, the seasonal contrasts in weather at places in the interior of the country such as Kanpur and Amritsar affect the entire sphere of life.
- V. Altitude:** Temperature decreases with height, as air ascends it loses its temperature due to Normal Lapse Rate. So, it is found that places situated on higher altitudes are cooler than places located on relatively lower heights. For example, Agra and Darjeeling are located on the same latitude, but temperature of January in Agra is 16°C whereas it is only 4°C in Darjeeling.
- VI. Relief:** The physiography or relief of India also affects the temperature, air pressure, direction and speed of wind and the amount and distribution of rainfall. The windward sides of Western Ghats and Assam receive high rainfall during June-September whereas the southern plateau remains dry due to its leeward situation along the Western Ghats.

B. Factors Related to Air Pressure and Wind:

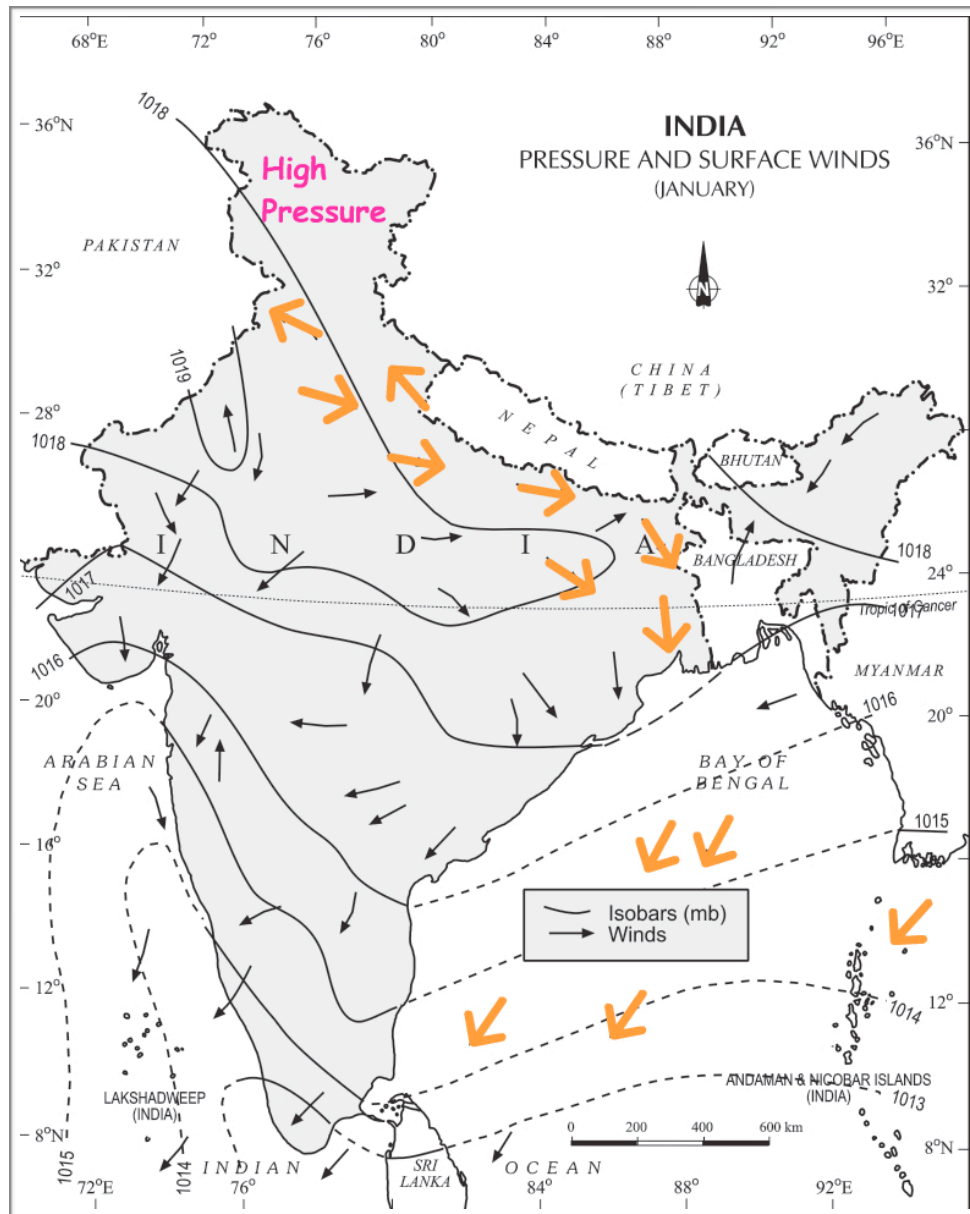
Air pressure and wind system is different at different altitude which affects the local climates of India. Consider the following factors:

- A. Distribution of pressure and surface winds.
- B. Upper air circulation and the movement of different air masses and the jet stream.
- C. Rainfall caused by the westerly disturbances in winter and the tropical depressions in south-west monsoon season.

The mechanism of these three factors can be understood with reference to winter and summer seasons of the year separately.

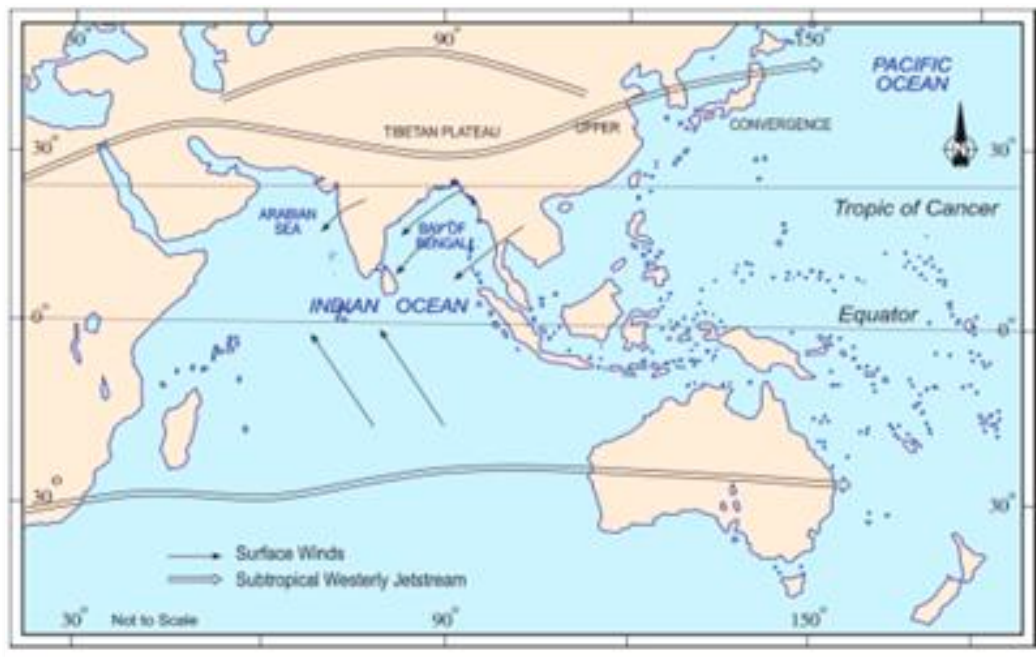
Weather Conditions in Winter:

- I. Surface Pressure and Winds:** During northern hemisphere's winter, high pressure is built up in the Central and West Asia. This centre of high pressure gives rise to the flow of air at the low level from the north towards the Indian subcontinent, south of the Himalayan mountain range, in the form of a dry continental air mass. These continental winds come in contact with trade winds over northwestern India. The contact zone is not stable and sometimes it shifts up to the middle Ganga valley thus bringing the entire north-western India under the influence of the north-westerly winds.



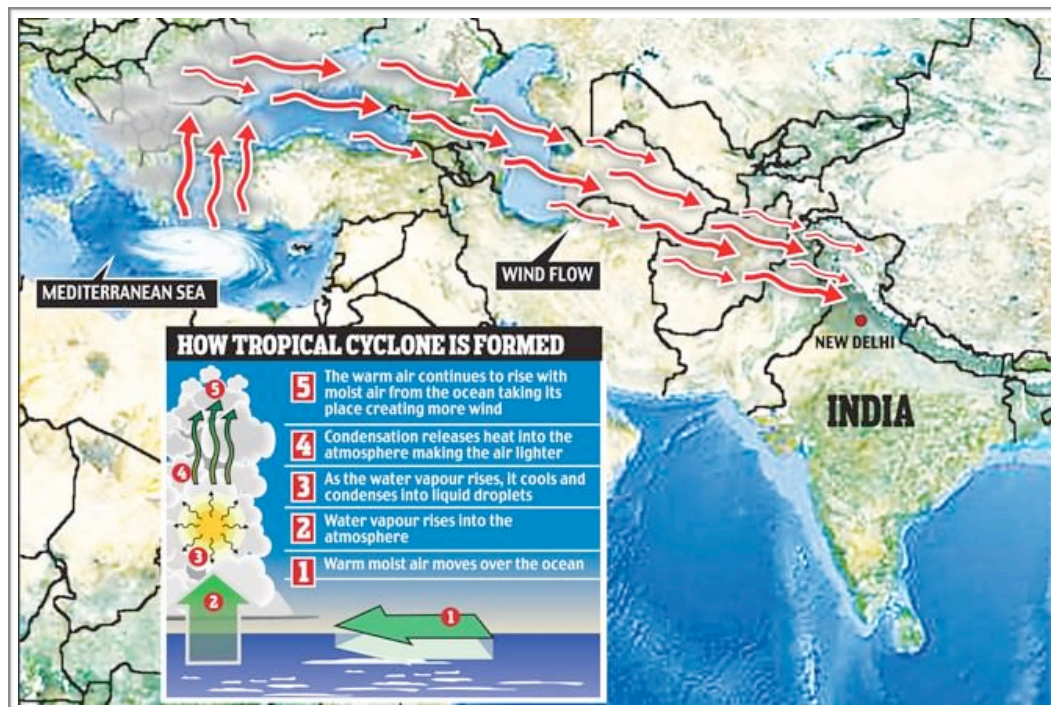
Winter Monsoon: Surface Winds

- II. **Jet stream and Upper Air Circulation:** A different pattern of air circulation is observed at a height of about 3 km above the surface. Direction and velocity of winds at this height are different from those of the surface winds. All of Western and Central Asia remains under the influence of westerly winds along the altitude of 9-13 km from west to east. These winds blow across the Asian continent at latitudes north of the Himalayas roughly parallel to the Tibetan highlands. These are known as Jet Streams. Tibetan highlands act as a barrier in the path of these jet streams. As a result, jet streams gets bifurcate – one to the south and other to the north of this mountain chain along 25° N latitude. This jet stream is responsible for bringing western disturbances from the Mediterranean region into Indian sub-continent. Winter rain and hail storms in northwestern plains and occasional heavy snowfall in hilly regions are caused by these disturbances.



Direction of Winds in India in winter at the Height of 9-13 km

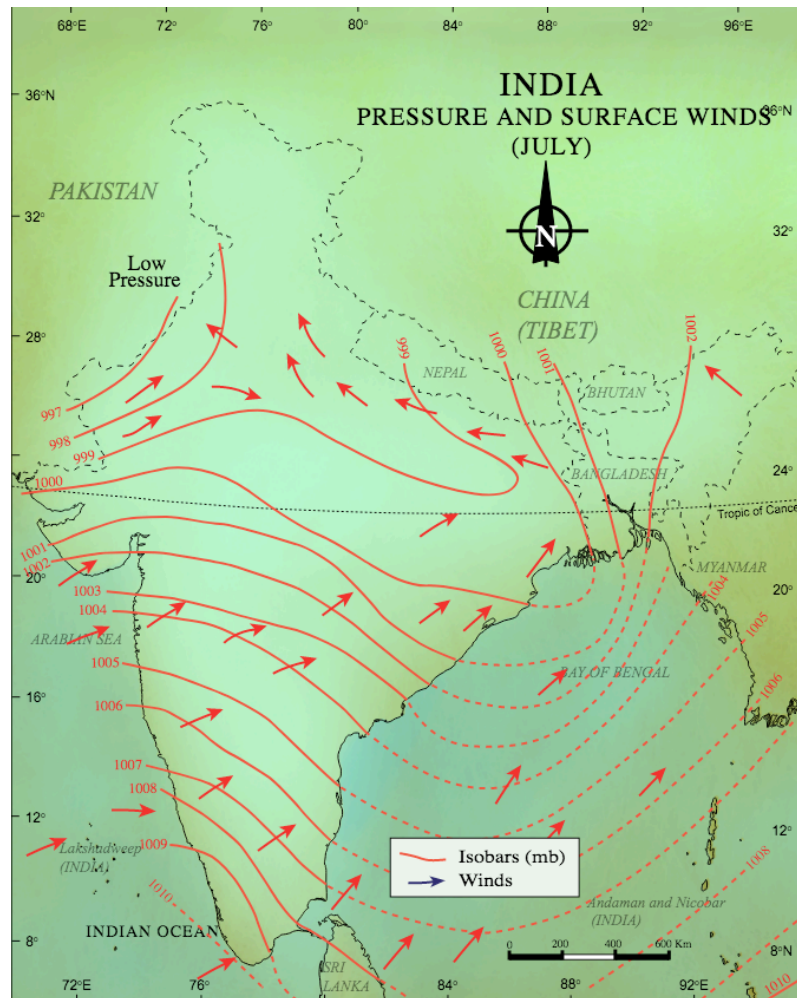
III. **Western Cyclonic Disturbance and Tropical Cyclones:** The western cyclonic disturbances which enter the Indian subcontinent from the west and the northwest during the winter months originate over the Mediterranean Sea and are brought into India by the westerly jet stream. An increase in the prevailing night temperature generally indicates an advance in the arrival of these cyclones disturbances.



It brings little rain in winter months. This rain is considered to be very good for wheat crops in northern plains. Tropical cyclones originate over the Bay of Bengal and the Indian Ocean. These tropical cyclones have very high wind velocity and heavy rainfall and hit the Tamil Nadu, Andhra Pradesh and Orissa coast. Most of these cyclones are very destructive due to high wind velocity and torrential rain that accompanies it.

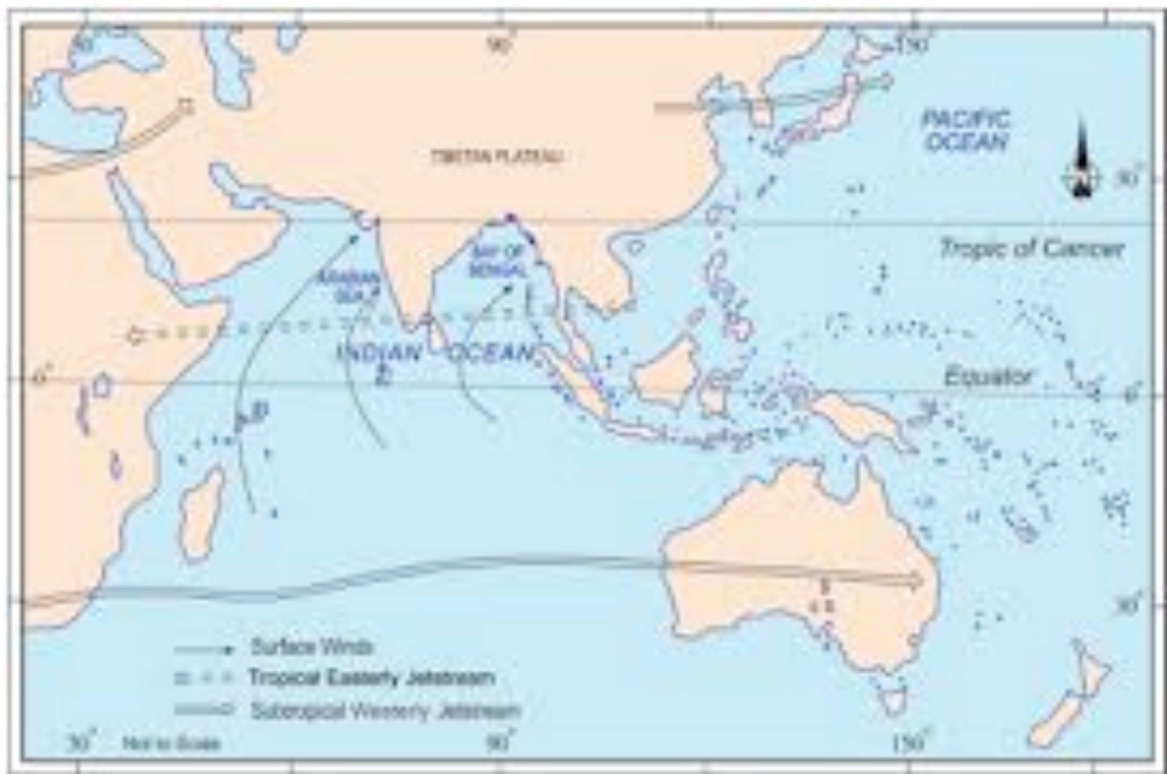
Weather Conditions in the Summer Reason (July)

- I. **Surface Pressure and Winds:** As the summer sets in and the sun shifts northwards, the wind circulation over the subcontinent undergoes a complete reversal at both, the lower as well as the upper levels. By the middle of July, the low pressure belt nearer the surface, termed as Inter Tropical Convergence Zone (ITCZ), shifts northwards, roughly parallel to the Himalayas between 20° N and 25° N. It extends from Punjab to the Chota Nagpur plateau. By this time, the westerly jet stream withdraws from the Indian region. There is a cause and effect relationship between the northward shift of the ITCZ and the withdrawal of the westerly jet stream from over the North Indian Plain. Being an area of low pressure, the ITCZ attracts winds from all around. The maritime tropical airmass (mT) from the southern hemisphere, after crossing the equator, rushes to the low pressure area in the general southwesterly direction.



These winds cross the Equator between 40°E and 60°E longitudes. Blowing over the ocean for a long distance, they pick up a large amount of moisture. It is this moist air current which is popularly known as the southwest monsoon.

II. Jet Streams and Upper Air Circulation: At the upper layers of the troposphere, the winds blow in a direction reverse to that of the surface winds. An easterly jet stream flows over the southern part of the Peninsula in June, and has a maximum speed of 90 km per hour. In August, it is confined to 15° N latitude, and in September up to 22° N latitudes.



The direction of winds at upper atmosphere in summer season

III. Tropical cyclones: The easterly jet stream steers the tropical depressions into India. These depressions play a significant role in the distribution of monsoon rainfall over the Indian subcontinent. The tracks of these depressions are the areas of highest rainfall in India. Their frequency, direction and intensity determine the rainfall pattern during the southwest monsoon period.