

Chapter 4

Climate

- **Climate** : Climate refers to the sum total of weather conditions and variations over a large area for a long period of time (more than thirty years).
- **Weather** : Weather is the state of atmosphere as determined by the meteorological phenomena that are occurring at any one place and time. The meteorological phenomena include temperature, precipitation, wind, clouds, sunshine, pressure and visibility.

Climatic controls

There are six major controls of the climate of any place. They are:

- *Latitude*
- *Altitude*
- *Pressure and wind system*
- *Distance from the sea*
- *Ocean currents and*
- *Relief features*

Factors affecting India's climate

- **Latitude**: The Tropic of Cancer passes through the middle of the country from the Rann of Kutch in the west to Mizoram in the east. Almost half of the country, lying south of the Tropic of Cancer, belongs to the tropical area.
- **Altitude**: India has mountains to the north, which have an average height of about 6,000 metres. India also has a vast coastal area where the maximum elevation is about 30 metres. The Himalayas prevent the cold winds from Central Asia from entering the subcontinent.
- **Pressure and Winds**: The climate and associated weather conditions in India are governed by the following atmospheric conditions:
Pressure and surface winds, Upper air circulation and Western cyclonic disturbances and tropical cyclones.
- **Jet stream** : The jet stream is a river of wind that blows horizontally through the upper layers of the troposphere, generally from west to east, at an altitude of 6,100 - 9,144 metres, or about 7 miles (11 kilometres) up.
A jet stream develops where air masses of differing temperatures meet. For this reason, surface temperatures determine where the jet stream will form. The greater the difference in temperature, the faster the wind velocity inside the jet stream. Jet streams can flow up to 200 mph (322 km/h), are 1000's of miles long, 100's of miles wide, and a few miles thick.
- **Monsoon** : 'Monsoon' refers to the seasonal reversal in the wind direction during a year. This type of climate is found mainly in the south and the Southeast Asia.
The monsoons are experienced in the tropical area roughly between 20° N and 20° S. To understand the mechanism of the monsoons, the following facts are important.

- The **differential heating and cooling of land and water** creates low pressure on the landmass of India while the seas around experience comparatively high pressure.
- The **shift of the position of Inter Tropical Convergence Zone (ITCZ) in summer**, over the Ganga plain (this is the equatorial trough normally positioned about 5°N of the equator - 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, which results in strong vertical air currents and the formation of high pressure over the plateau at about 9 km above sea level.
- The **movement of the westerly jet stream** to the north of the Himalayas and the presence of the tropical easterly jet stream over the Indian peninsula during summer.
- **Burst of monsoon**: The duration of the monsoon is between 100-120 days from early June to mid-September, when normal rainfall increases suddenly and continues for several days, it is known as break or burst of monsoon.
- By mid-June the Arabian Sea branch of the monsoon arrives over Saurashtra- Kutch and the central part of the country. The Arabian Sea and the Bay of Bengal branches of the monsoon merge over the north western part of the Ganga plains.
- Withdrawal of the monsoon begins in north western states of India by early September. By mid-October, it withdraws completely from the northern half of the peninsula. The withdrawal from the southern half of the peninsula is fairly rapid. By early December, the monsoon has withdrawn from the rest of the country.

The seasons

- (i) the cold weather season, (ii) the hot weather season (iii) the advancing monsoon and (iv) the retreating monsoon
- **The cold weather season** begins from mid-November in northern India and stays till February. December and January are the coldest months in the northern part of India. The temperature decreases from south to the north. The average temperature of Chennai, on the eastern coast, is between 24° - 25° Celsius, while in the northern plains, it ranges between 10° - 15° Celsius. Days are warm and nights are cold. Frost is common in the north and the higher slopes of the Himalayas experience snowfall.
- **The hot weather season** The influence of the shifting of the heat belt can be seen clearly from temperature recordings taken during March-May at different latitudes. In March, the highest

temperature is about 38° Celsius, recorded on the Deccan plateau. In April, temperatures in Gujarat and Madhya Pradesh are around 42° Celsius. In May, temperature of 45° Celsius is common in the north western parts of the country.

- A striking feature of the hot weather season is the 'loo'. These are strong, gusty, hot, dry winds blowing during the day over in the north and north western India. In West Bengal, these storms are known as the '*Kaal Baisakhi*' or calamity for the month of Baisakh.

- **Advancing Monsoon (The Rainy Season)**

By early June, the low-pressure condition over the northern plains intensifies. It attracts the trade winds of the southern hemisphere. These south-east trade winds originate over the warm subtropical areas of the southern oceans. They cross the equator and blow in a south westerly direction entering the Indian peninsula as the south-west monsoon. As these

winds blow over warm oceans, they bring abundant moisture to the subcontinent. These winds are strong and blow at an average velocity of 30 km per hour. With the exception of the extreme north-west, the monsoon winds cover the country in about a month.

- **Retreating Monsoon (The Transition Season)**

The period is from mid-September. It marks transitional weather conditions between hot-wet and cool-dry weather. The south-westerly monsoon winds gradually retreat. Owing to the prevalence of high temperature-about 24degree centigrade-there is a period of hot weather called 'October heat'. Due to westerly jet stream, cyclonic rainfall is experienced in October. Violent tropical cyclone is also formed in Bay of Bengal and Arabian Sea. This monsoon is responsible for winter rainfall in Coromondal coast (Tamil Nadu) due to extensive local relief factors.

Exercise

1

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

- Which one of the following places receives the highest rainfall in the world?
 - (1) Silchar
 - (2) Cherrapunji
 - (3) Mawsynram
 - (4) Guwahati
- The wind blowing in the northern plains in summer is known as
 - (1) Kaal Baisakhi
 - (2) Trade winds
 - (3) Loo
 - (4) None of the above.
- Which one of the following causes rainfall during winters in the North-Western part of India?
 - (1) Cyclonic depression
 - (2) Retreating monsoon
 - (3) Western disturbances
 - (4) Southwest monsoon
- Monsoon arrives in India approximately in:
 - (1) Early May
 - (2) Early July
 - (3) Early June
 - (4) Early August
- Which one of the following characterizes the cold weather season in India?
 - (1) Warm days and warm nights
 - (2) Warm days and cold nights
 - (3) Cool days and cold nights
 - (4) Cold days and warm nights
- Climate types are not classified on the basis of
 - (1) Temperature & rainfall
 - (2) Water balance
 - (3) Vapotranspiration
 - (4) Distance from equator
- Which of the following factors is most important for determining the climate of a place?
 - (1) Rainfall
 - (2) Latitude
 - (3) Direction of winds
 - (4) Direction of sea
- All of the following types of climate occur in the southern hemisphere except
 - (1) Hot desert
 - (2) Savannah
 - (3) Equatorial
 - (4) Tundra
- Seasonal contrasts are maximum in
 - (1) Low latitude
 - (2) High latitude
 - (3) Mid latitude
 - (4) Subtropics
- Which of the following is recognised as a season by the meteorological department of India?
 - (1) Cold weather
 - (2) Hot weather
 - (3) Retreating monsoon
 - (4) North-eastern monsoon
- The retreating monsoon withdraws from the
 - (1) West coast to the east coast
 - (2) North to the south
 - (3) North east India to west coast
 - (4) North west India to Bengal
- Which of the factors does not have influence on the Indian climate?
 - (1) Presence of Indian Ocean
 - (2) Nearness to equator
 - (3) Monsoon
 - (4) Ocean current
- Rainfall from the south -west monsoon reaches
 - (1) Lahaul and Spiti
 - (2) Ladakh
 - (3) Tamil Nadu
 - (4) Delta region of Mahanadi
- Orographic rainfall occurs along the
 - (1) Eastern Ghats
 - (2) Himalayas
 - (3) Aravalis
 - (4) Jaintia hills
- The reason for Rajasthan being deficient in rainfall is because
 - (1) The monsoon fails to reach this area.
 - (2) It is too hot.
 - (3) There is no water available and thus the winds remain dry.
 - (4) The winds do not come cross any barrier to cause necessary uplift to be cooled.

16. Which of the following states suffer from loo ?
 (1) Tamil Nadu (2) Uttar Pradesh
 (3) Gujarat (4) None of these
17. An imaginary line drawn on the map to join places having same pressure above the sea level is called
 (1) Isobar (2) Isohyet
 (3) Isotherm (4) both (1) and (2)
18. The term monsoon originated from
 (1) German (2) Hindi
 (3) Latin (4) Arabic
19. The tentative dates for the arrival of monsoon in Delhi are
 (1) Between 15th June to 1st July
 (2) Between 15th May and 1st June
 (3) Between 1st July and 15th July
 (4) Between 1st June and 15th June
20. Mawsynram is also reputed for its stalagmite and stalactite cave
 (1) Coldest (2) Hottest
 (3) Wettest (4) Driest
21. Chennai receives more rainfall in winter because
 (i) The North-East winds pick up moisture while crossing Bay of Bengal.
 (ii) In summer, Chennai lies in the rain shadow of Western Ghat.
 (iii) The South-East winds pick up moisture while crossing Bay of Bengal.
 (iv) In winter Chennai lies in the rain shadow of the Eastern Ghats.
 (1) (i) and (iii) are correct.
 (2) (i), (ii) and (iii) are correct.
 (3) Only (i) and (ii) are correct
 (4) Only (iv) is correct
22. Mango showers help in ripening of
 (1) Apples (2) Mangoes
 (3) Bananas (4) Coconut
23. The climate and associated weather condition in India are governed by :
 (i) Pressure and surface winds
 (ii) Upper air circulation
 (iii) Western cyclonic disturbance and Tropical cyclone
 (1) only (i) and (ii)
 (2) only (ii) and (iii)
 (3) All (i), (ii) and (iii)
 (4) (i) is true but (ii) and (iii) are incorrect.
24. _____ are the fast flowing cold air current in a narrow zone in the upper atmosphere.
 (1) Loo (2) Mango showers
 (3) Kal Baisakhi (4) Jet Streams
25. During winter, there is an area, north of
 (1) High pressure (2) Low Pressure
 (3) Moderate pressure (4) Low - High pressure
26. Which of the following is specially true of anti-cyclone in the southern hemisphere?
 (1) The air moves in a circular manner.
 (2) Pressure increases from the outside to the centre.
 (3) They often form over continent.
 (4) The air moves in an anti-clock wise direction
27. An upper air wind system with very high velocities in certain parts of the atmosphere is called
 (1) A cyclone (2) An anti-cyclone
 (3) A Jet stream (4) A tsunami
28. Monsoon winds are best developed over
 (1) South-east Asia (2) China
 (3) Japan (4) All the above
29. Which factor influences ocean current?
 (1) Coriolis force (2) Local winds
 (3) Continent shape (4) All of these.
30. Which type of climate is known for the minimum diurnal ranges of annual temperature?
 (1) Mediterranean (2) Equatorial
 (3) Hot desert (4) Cold desert
31. Which of the following is /are incorrect about monsoons in India?
 (1) The rain in north Indian plains is due to the easterly current of south-east monsoon.
 (2) The monsoon covers the whole of India in a few days from onset.
 (3) The retreating monsoon causes unstable weather conditions
 (4) None of these
32. Which of the following is /are true about anti-cyclone?
 (1) An anti-cyclone is a low pressure system.
 (2) An anti-cyclone has winds blowing clock-wise in the southern hemisphere.
 (3) An anti-cyclone is accompanied by clear and settled weather condition.
 (4) None of these

Hints & SOLUTIONS

Exercise 1

1. (3) Mawsynram is a village in India, in the state of Assam.
2. (3) The wind blowing in the northern plains in summer is known as loo.
3. (3) The western disturbances which arise from the mediterranean sea, as soon as these winds reach near the Himalayas, they reach the region of east. Thus they pour showers by the time of winters, then these winds take a turn towards the Bay of Bengal.
4. (3) 5. (3) 6. (4) 7. (2)
8. (4) 9. (3) 10. (4) 11. (4)
12. (4) 13. (4) 14. (3) 15. (4)
16. (2) 17. (1) 18. (4) 19. (3)
20. (3) 21. (3) 22. (2) 23. (3)
24. (4) 25. (1) 26. (4) 27. (3)
28. (4) 29. (4)
30. (2) Equatorial climate is known for the minimum diurnal ranges of annual temperature.
31. (3) 32. (3)