Chapter 3

Atmosphere and Climate

The Big Questions

1. *What is the composition of the atmosphere?*
2. *How do the different layers of the atmosphere affect the planet Earth?*
3. *What is the mechanism of monsoon?*
4. *How can we reduce our carbon footprint?*

0908CH03

What do you see when you look up in the sky? You might see the floating clouds, the sunshine, and feel a breeze as well. All of these are a result of a blanket of air surrounding the Earth, called the atmosphere. It is pulled down around the Earth by **gravity**, and is a mixture of gases in various proportions, vital for the survival of all living beings on the Earth. The atmosphere shields us from the harmful radiation coming from the Sun, including ultraviolet radiation. It regulates the Earth's temperature by trapping some of the Sun's energy and prevents it from escaping back into space. The atmosphere is a key component of the Earth's weather and climate systems, influencing factors such as temperature, humidity, and air pressure.

Gravity: Gravity is a fundamental physical force of attraction between objects that have mass or energy such as the Sun and the Earth. The force of attraction that the Earth's mass exerts on the objects that are on or close to its surface is referred to as Earth's gravity.

THINK ABOUT IT

Fig. 3.1

Can you imagine what would happen if there were no atmosphere? Discuss your thoughts with your friends and teachers.

Composition and Structure of the Atmosphere

Composition of the Atmosphere

The Earth's atmosphere is composed of a mixture of various gases. Nitrogen and oxygen are the two primary and most abundant gases that are essential to life on the Earth. Carbon dioxide, argon, helium, neon, krypton, xenon, ozone, and hydrogen are some other gases present in the atmosphere, but are found in lesser quantities. Besides these, the atmosphere also consists of water vapour and tiny dust particles. The amount of water vapour in the atmosphere varies, but it generally ranges from 0.1 per cent to 0.4 per cent. It plays a significant role in cloud formation and precipitation. The composition of the atmosphere also varies with altitude.

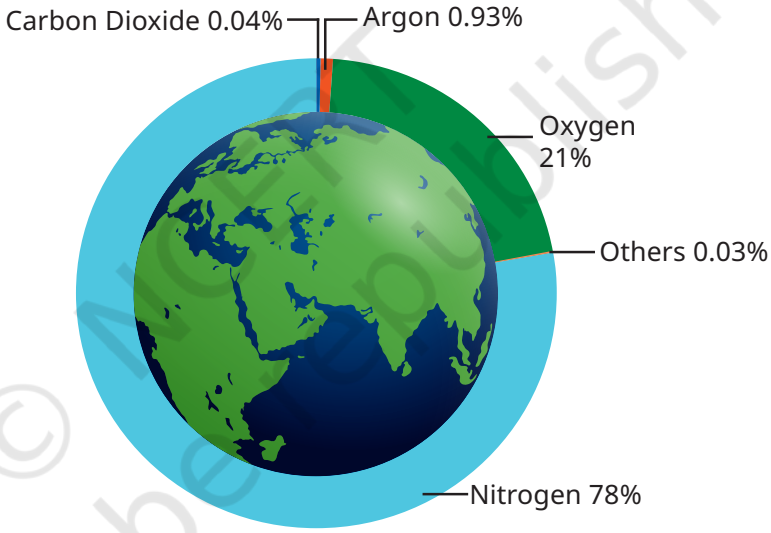


Fig. 3.2. Composition of the atmosphere

LET'S RECALL

How is nitrogen useful for plants? Remember that you learnt this in the chapter 'The Invisible Living World: Beyond Our Naked Eyes', in your Grade 8 Science textbook.

Structure of the Atmosphere

The atmosphere has a layered structure. These layers are defined on the basis of changes in temperature and density with increasing altitude. The density of air is highest near the Earth's surface and

decreases with **altitude**. The major layers extending from the Earth's surface to outer space are illustrated below.

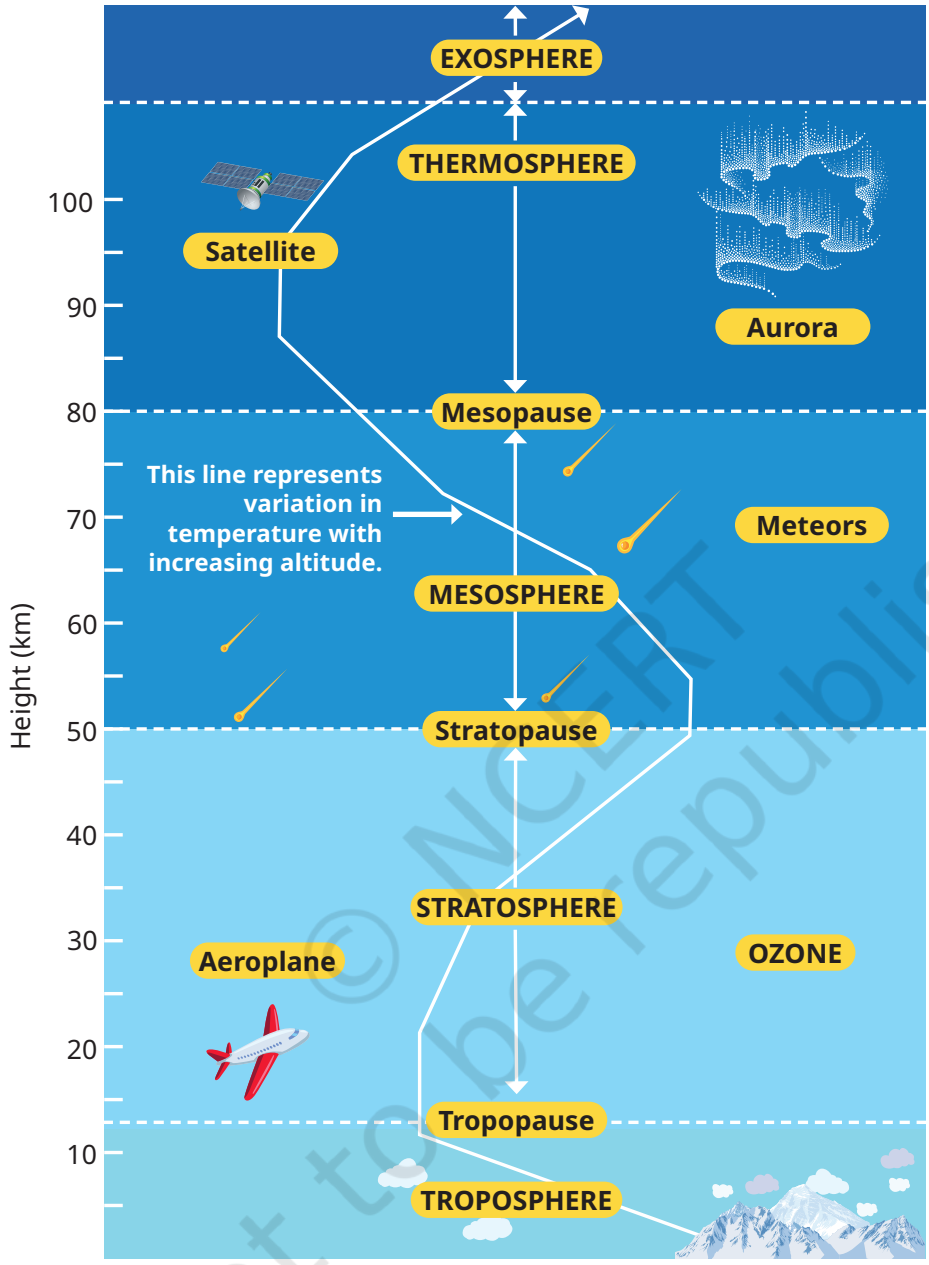


Fig. 3.3. Layers of the atmosphere

- **Troposphere:** The troposphere is the most important layer of the atmosphere, with an average height of about 12 kilometres. In this layer, temperature decreases with increasing altitude. The air we breathe exists here, along with most of the water vapour and clouds. Nearly all the weather phenomena, such as rainfall, fog, and hail, occur in this layer. The troposphere is separated from the stratosphere by a transition zone known as the tropopause.

Altitude: The height of a location above mean sea level is called altitude, usually measured in metres or feet. The mean sea level is considered zero.

- **Stratosphere:** Above the troposphere lies the stratosphere, extending up to 50 kilometres. This layer is ideal for flying aeroplanes because it is free of clouds and other weather disturbances. A notable feature of the stratosphere is that it contains a layer of ozone gas, which shields us by filtering the Sun's harmful radiation, including ultraviolet radiation. The stratopause marks the boundary between the stratosphere and the mesosphere.
- **Mesosphere:** Above the stratosphere lies the third layer of the atmosphere, the mesosphere. It extends up to a height of 80 kilometres. In this layer, temperature decreases with increasing altitude. Most meteorites entering from space burn up in the mesosphere.

DON'T MISS OUT

Temperature decreases with altitude only in the troposphere and mesosphere.

- **Thermosphere:** In the thermosphere, temperature rises very rapidly with increasing altitude, as the gas molecules in this layer absorb the X-rays and short-wave ultraviolet radiation of the Sun. The thermosphere extends from 80 to 700 km. It also helps with radio transmission by reflecting radio waves transmitted from the Earth back towards it. Ionosphere is a part of the thermosphere. Additionally, the northern and southern lights (**auroras**) also occur in the thermosphere.

Fig. 3.4: Aurora

The word 'aurora' originates from Latin, meaning 'dawn' or 'morning light.' It is named after the Roman goddess Aurora, the goddess of dawn , and refers to the colourful display of light seen in the sky near the poles. The 'solar wind' (charged particles emitted by the Sun), upon reaching the Earth's atmosphere, is directed towards the magnetic poles. As these particles interact with different atmospheric gases, each gas glows with a particular colour. This phenomenon is known as the Aurora Borealis in the Northern Hemisphere and the Aurora Australis in the Southern Hemisphere.

- **Exosphere:** The uppermost layer of the atmosphere is known as the exosphere, characterised by very thin air. Light gases like helium and hydrogen float into space from this layer due to weak gravity. All of these layers play a vital role in the Earth's atmospheric processes and also affect its weather and climate.

DON'T MISS OUT

The air above us exerts a significant force on our bodies, and yet we do not feel it. This is because air presses on us from all sides, and our bodies exert a counter-pressure in response.

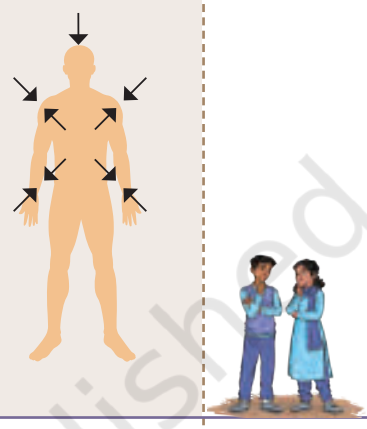


Fig. 3.5. The pressure inside our bodies is also equal to the atmospheric pressure and cancels the pressure from outside.

Weather and Climate

'Is it going to rain today?' 'Will it be bright and sunny today?' How often do you find yourself wondering about these questions when you want to go out and play?

The term **weather** refers to the hour-to-hour and day-to-day conditions of the atmosphere. Hot or humid weather may make one irritable, while pleasant or breezy weather may make one cheerful, or even plan for an outing. Weather can vary significantly from day-to-day. The average weather conditions of a place over a longer period of time refer to the **climate** of the place. Climate refers to the sum total of weather conditions and variations over a large area for an extended period of time, usually thirty years or more.

Elements of Weather and Climate

Various elements influence weather and climate. The major elements of atmosphere that impact human life on the Earth are temperature, precipitation, humidity, wind, and atmospheric pressure. These elements can change under varying conditions.

- **Temperature:** The temperature of the atmosphere varies not only between day and night but also across seasons, just as summers tend to be hotter than winters. An important factor affecting temperature distribution is **insolation**. The amount of

Insolation: The incoming solar energy from the Sun that is intercepted by the Earth.

insolation decreases from the equator towards the poles. Hence, the temperature decreases from the equator towards the poles.

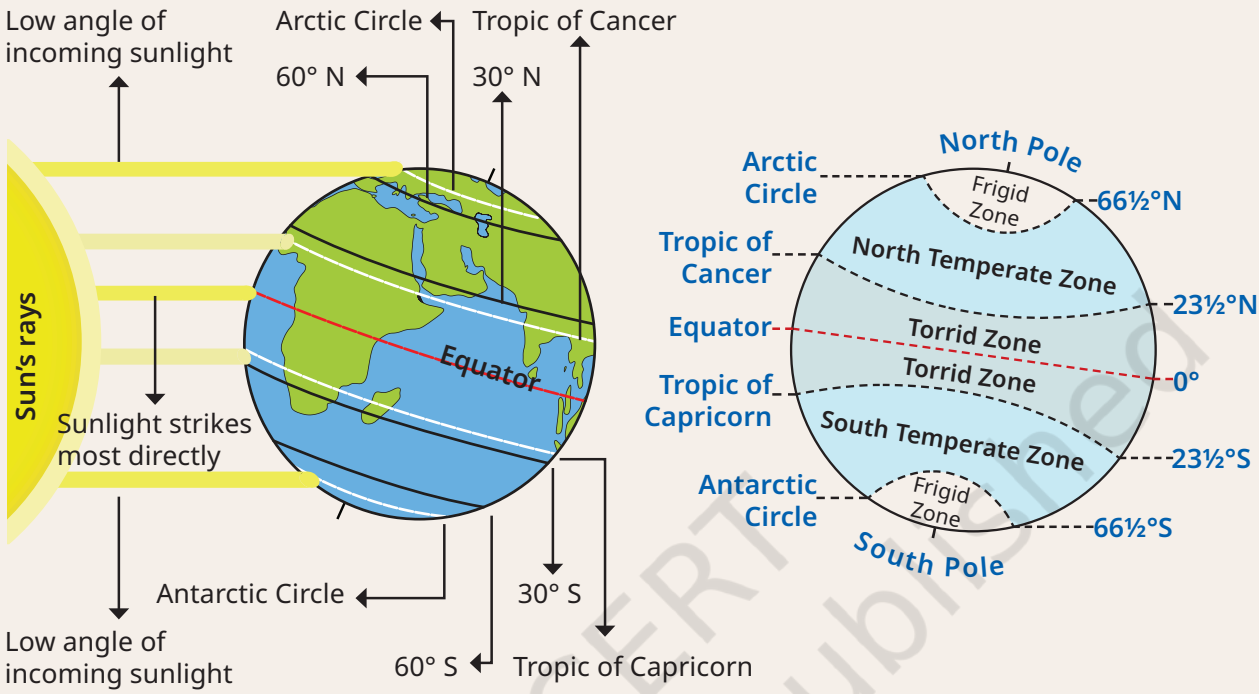


Fig. 3.6. Temperature zones of the Earth

- **Humidity:** When water evaporates from land and different water bodies, it becomes water vapour. When the levels of water vapour in the air are high, it leads to humidity. Therefore, humidity refers to the presence of water vapour in the air, creating moisture. As the air gets warmer, its capacity to hold water vapour increases, leading to higher humidity levels. On such a day, clothes take longer to dry, and sweat evaporates more slowly, leaving us feeling very uncomfortable.
- **Precipitation:** It occurs when a part of the atmosphere becomes saturated with water vapour, which condenses and 'precipitates', or falls on the Earth due to gravity. This includes drizzle, rain, snow, sleet, and hail. The main factors that affect precipitation include prevailing winds, mountains, and seasons. When precipitation falls on the the Earth in liquid form, it is called rain. Rain is the most common form of precipitation and lowers the temperature of a place. A long absence of rainfall results in a dry climate. Most of the groundwater is collected from rainwater.

- **Atmospheric pressure:** The pressure exerted by the weight of air on the the Earth's surface is called air pressure. As we go higher in the atmosphere, pressure falls rapidly. It is highest at sea level and decreases with altitude. Horizontally, the distribution of air pressure is influenced by the air's temperature at a given place. In areas with high temperatures, air heats up and rises. This creates a low-pressure area. Low pressure is associated with cloudy skies and wet weather. In areas with lower temperatures, air is cold. It is therefore heavy and sinks, creating a high-pressure area. High pressure is associated with clear and sunny skies. Air always moves from high-pressure areas to low-pressure areas. You can refer to Chapter 8 of the Grade 8 Science textbook *Curiosity* to learn more about this.

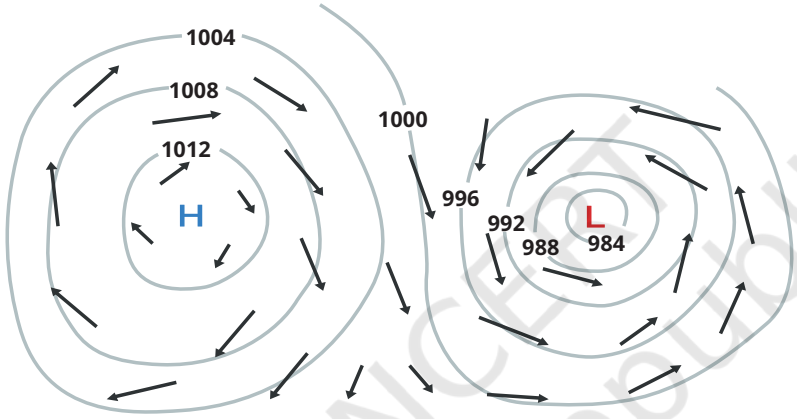


Fig. 3.7. Wind is caused by air flowing from high-pressure to low-pressure areas. Its direction is influenced by the Earth's rotation.

- **Wind:** The movement of air from a high-pressure area to a low-pressure area is called wind. It can be gentle or strong. You can observe the flow of wind as it blows dry leaves down the pavement, gently blows away dust particles, or uproots trees during a storm.

THINK ABOUT IT

You might have noticed that sometimes the wind is so strong that it is difficult to walk against it. Can you think of some other times when strong winds have caused problems for you?

DON'T MISS OUT

Winds are named after the direction they blow from, for example, the wind blowing from the west is called westerly.

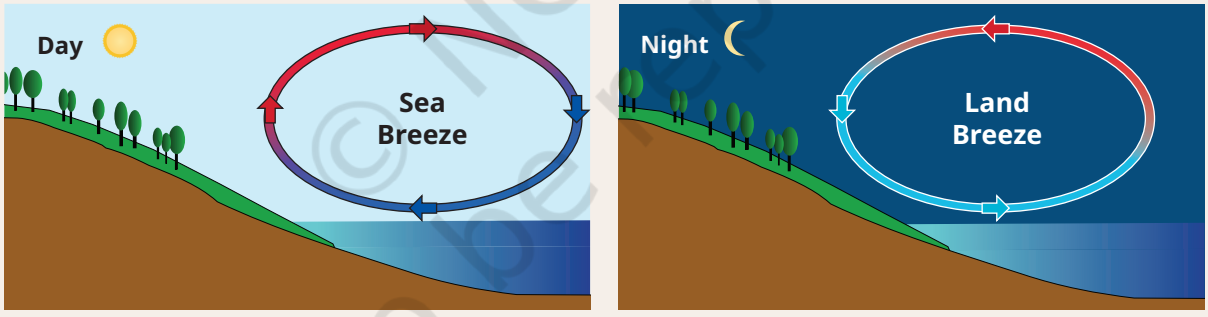
Table 3.1. Wind speeds and their common effects

Wind	Speed (km/hr)	Common Effects
Calm	0–1	Calm, smoke rises vertically.
Light breeze	6–11	Wind can be felt on the face. Leaves rustle. An ordinary vane moves by winds.
Strong breeze	39–49	Large branches sway in the wind. Umbrellas are difficult to use.
Storm	103–117	It is very rarely experienced. Usually accompanied by widespread damage.

LET'S EXPLORE

Find out other categories of wind based on speed and their common effects, and share your findings in class.

Local winds such as the land breeze and the sea breeze, also affect the weather and climate of a place. They are essential in creating moderate climatic conditions in the coastal region.



Land is warmer than the water *Water is warmer than the land*

Fig. 3.8. Land and sea breeze

Sea breeze

It is a local wind that blows from sea to land during the day, especially in the afternoon, when the land becomes relatively warmer than the sea. This results in the formation of a low-pressure region over land, and so the wind starts blowing from the sea.

Land breeze

It is a local wind that blows from land to sea during the night, resulting from differential surface cooling between the land and the sea. Land cools faster than sea at night. Since the difference in temperatures and air pressure between the sea and the land is low, the wind speed is low.

You may have observed that weather conditions often fluctuate, sometimes even within a single day. However, based on generalised monthly atmospheric conditions, or a common pattern over a few weeks or months—such as the days being cool or hot, windy or calm, cloudy or bright, and wet or dry—the year is divided into seasons.

LET'S ANALYSE

Note down the weather report from a local newspaper for two weeks and observe the changes occurring in the weather.

Seasons in India

The climate of India can be broadly classified as tropical monsoon. The Indian Meteorological Department (IMD) has recognised four distinct seasons in India:

- **Winter:** The winter season generally lasts from December to early April. The coldest months of the year are December and January, when the average temperature in the north-west is around 10–15°C. Temperatures increase towards the equator, reaching around 20–25°C in mainland India's south-east.
- **Summer or pre-monsoon:** The summer or pre-monsoon season spans from April to June, or up to July in north-western India. In western and southern regions, the hottest month is April; in northern regions, it is May. The average temperature across most of inland India ranges from 32–40°C.
- **Monsoon or rainy (Advancing monsoon):** The monsoon season generally spans from June to September. This season is dominated by the humid south-west summer monsoon, which slowly sweeps across the country in late May or early June. Monsoon rain begins to recede from north India at the beginning of October, and South India typically receives more rainfall during this time.
- **Post-monsoon (Retreating monsoon):** The post-monsoon season lasts from October to December. In north-western India, October and November are usually cloudless.

The Himalayan states, being more temperate, experience two additional seasons, autumn and spring.

DON'T MISS OUT

Traditionally, India experiences six seasons, each about two months long—spring, summer, monsoon, early autumn, late autumn, and winter. These seasons are based on the astronomical division of the 12 months into six parts. The traditional Indian calendar also reflects these seasons through its arrangement of months.

Table 3.2. Traditional Indian seasons. These seasons and their duration may vary across different parts of the country.

Seasons (*Ṛtu*)	**Months (According to the Indian Calendar)**	**Months (According to the Gregorian Calendar)**
Vasanta	*Chaitra–Vaiśhākha*	March–April
Grīṣhma	*Jyeṣhṭha–Āṣhāḍha*	May–June
Varṣhā	*Śhrāvaṇa–Bhādrapada*	July–August
Śharad	*Āśhvina–Kārtika*	September–October
Hemanta	*Mārgaśhīrṣha–Pauṣha*	November–December
Śhiśhira	*Māgha–Phālguna*	January–February

THINK ABOUT IT

Hindustani Classical music associates certain *rāgas* with specific seasons. Find out which *rāgas* are connected to each season with the help of your elders and teachers.

DON'T MISS OUT

Kauṭilya's *Arthaśhāstra* contains records of scientific measurements of rainfall and their practical application in managing the country's revenue and relief efforts.

Monsoon

The climate of India is strongly influenced by **monsoon** winds. The sailors who came to India during ancient times were among the first to notice the phenomenon of monsoon. They benefited from the reversal of the wind system as they travelled by sailing ships at the mercy of the winds. The Arabs, who had also come to India as traders, named this seasonal reversal of the wind system 'monsoon', derived from the Arabic word *mausim*, which literally means season.

Monsoon: It refers to the seasonal reversal in the wind direction during a year.

DON'T MISS OUT

Since crop production often depended on seasonal monsoon rains, Indians worked out methods to predict rainfall. *Kṛiṣhiparāśhara* and the *Bṛihatsaṁhitā* describe such methods in every season. *Kṛiṣhiparāśhara's* main technique was based on the positions of the Moon and the Sun in the sky. Varāhamihira in his *Bṛihatsaṁhitā* considered **lunar mansions (*nakṣhatras*)** in predicting seasonal rainfall. Even today, a large number of farming practices in India are based on these ancient methods.

Lunar Mansions (*nakṣhatras*): *Nakṣhatras* are a way of dividing the sky into 27 equal parts along the path the Moon travels. Each part is linked to a star or group of stars, but really it is just a fixed section of the sky. The Moon takes about 27 days to go around the Earth relative to the stars, so it moves through one *nakṣhatra* each day. That's why they are called "lunar mansions"—it's like the Moon stays in a different "house" in the sky every night.

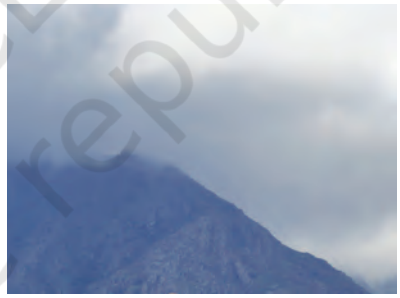


Fig. 3.9. Arrival of monsoon in the Mountains

Monsoon winds are seasonal winds. They can be categorised into the south-west and the north-east monsoon. The south-west monsoon, also known as the summer monsoon, is characterised by winds blowing from sea to land across the Indian Ocean, the Arabian Sea, and the Bay of Bengal between June and September. It is mainly caused by the unequal heating of land and the sea. During summer, the landmass of India heats up faster than the surrounding oceans. This creates a low-pressure area over the Indian subcontinent, while the Indian Ocean remains relatively cooler and has high pressure. Winds move from high-pressure areas to low-pressure areas, so moist winds blow from the ocean towards the land, bringing rainfall. It accounts for most of the rainfall in the country throughout the year.

The winter monsoon, also known as the north-east monsoon, occurs in India from October to February. During this season, the Indian landmass cools faster than the surrounding oceans, creating a high-pressure area over the land and low pressure over the seas.

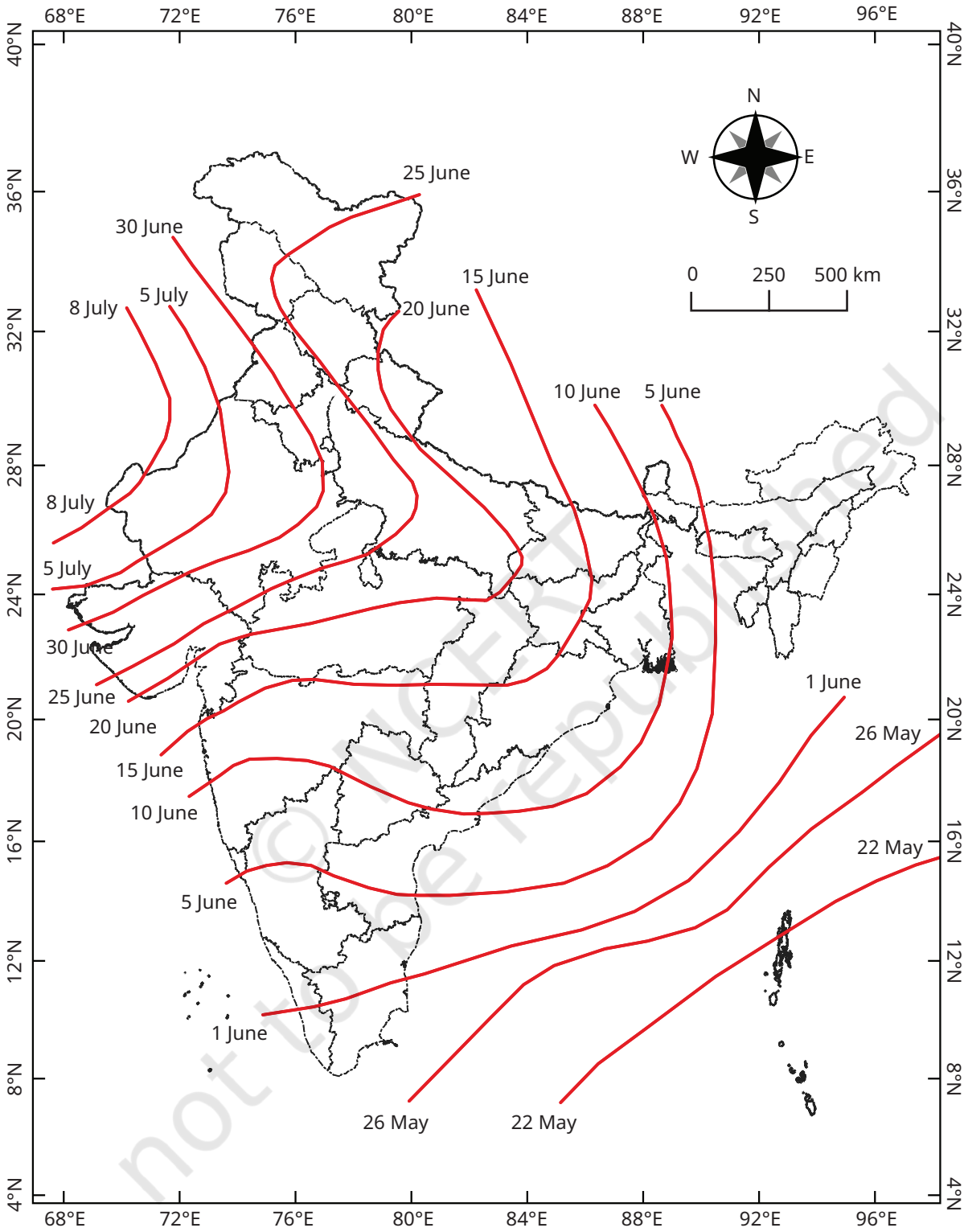


Fig. 3.10. Normal dates of advancing of south-west monsoon

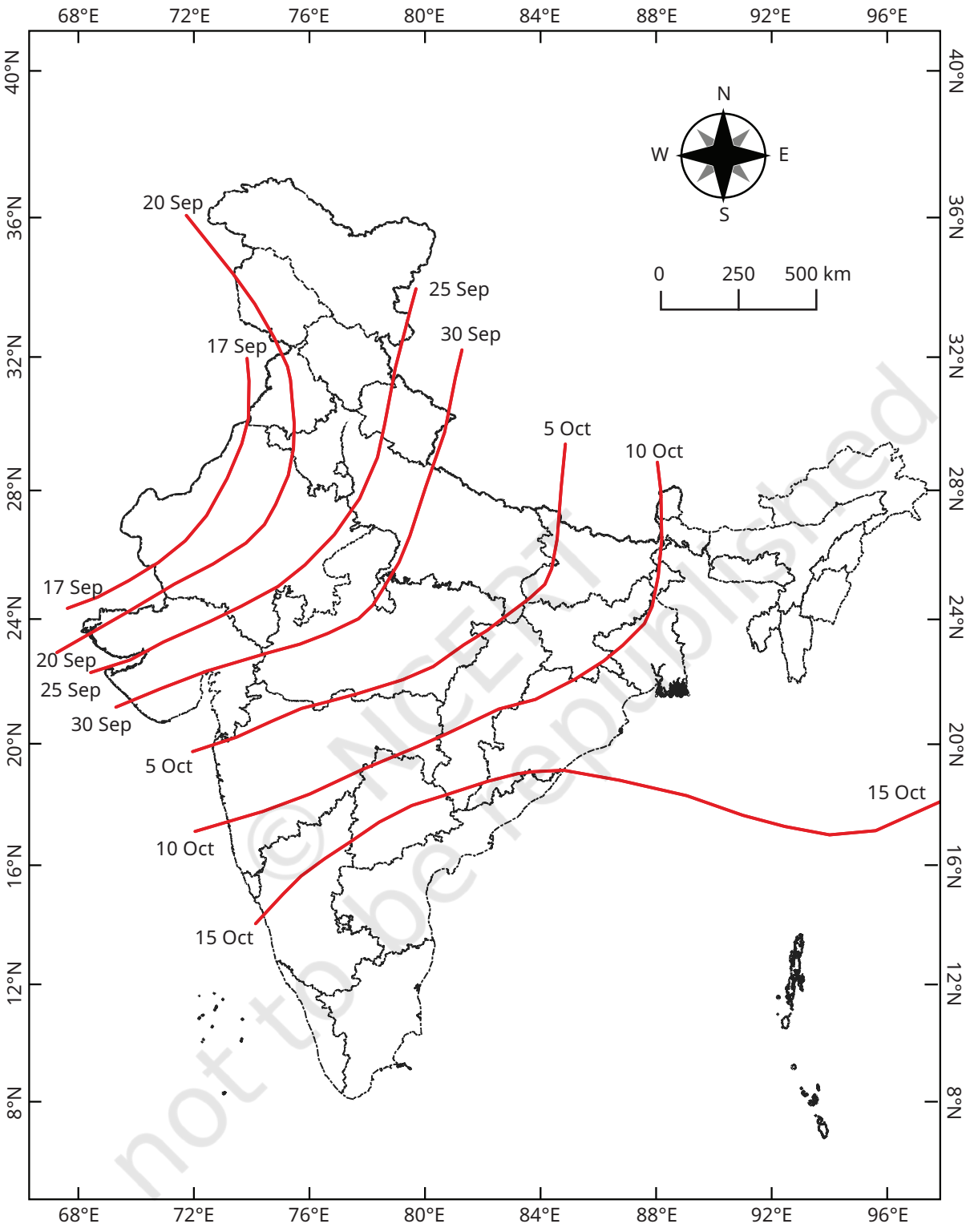


Fig. 3.11. Normal dates of retreating monsoon

As a result, cold and dry winds blow from land to sea. These winds generally do not bring rainfall to most parts of India. However, when the north-east monsoon winds pass over the Bay of Bengal, they pick up moisture and cause rainfall in the eastern coast of India, especially in Tamil Nadu, Andhra Pradesh, and parts of Karnataka. Thus, the winter monsoon is important for the rainfall of the south-eastern regions of India.

Monsoon plays a vital role in the lives of people in India. Most of India's agriculture depends on monsoon rainfall, as farmers rely on rain for sowing and growing crops. A good monsoon ensures sufficient food production and water supply in rivers, reservoirs, and wells. Monsoon also affects daily life, transport, festivals, and employment, especially in rural areas. However, excessive rainfall can cause floods, while weak monsoons can lead to droughts. Thus, monsoon greatly influences the economy, lifestyle, and livelihoods of people in India.

DON'T MISS OUT

Kālidāsa, in *Meghadūtam* written around the 5th century CE, mentions the date of the onset of the monsoon over central India and also traces the path of monsoon clouds.

LET'S EXPLORE

Describe in your own words how monsoon affects the lives of the people around you.

DON'T MISS OUT

Under the National Monsoon Mission (NMM), Ministry of Earth Sciences (Government of India) has developed state-of-the-art weather and climate prediction models. The overall objective of the NMM is to enhance monsoon predictions for India over all time frames.

'Mission Mausam' is designed to position India as a global leader in weather and climate sciences. The mission aims to make the nation 'Weather Ready' and 'Climate Smart', meeting the global standards. It aims to improve weather and climate services, ensuring timely and precise observation, modelling, and forecasting information for multiple sectors, including agriculture, disaster management, and rural development.

Climate Change

One of the most urgent challenges that the Earth is facing today is climate change. It refers to long-term changes in weather patterns, such as temperature, rainfall, and wind, caused mainly by human activities, including the burning of fossil fuels, deforestation, and industrial pollution that releases gases like carbon dioxide into the atmosphere. These actions increase greenhouse gases such as carbon dioxide, methane, nitrous oxide, water vapour in the atmosphere, trapping heat and raising global temperatures. As a result, we are witnessing more frequent floods, droughts, melting of glaciers, rising sea levels, and loss of biodiversity. Climate change not only threatens ecosystems but also impacts human health, agriculture, and livelihoods. You may recall that you have read about 'climate change' in your grade 8 Science textbook. What actions can be taken to reduce such changes? It also has great impact on almost all sections of the population including women and children. Tackling this issue requires collective efforts—reducing **carbon footprints**, using renewable energy, protecting forests, and adopting sustainable lifestyles. Every small step counts, and every human being plays a vital role in shaping a healthier and greener future.

LET'S EXPLORE

My Carbon Footprint

Step 1: My Daily Habits

Tick the options that best describe you.

A. Transport

- I usually walk/use a cycle. (Low impact)
- I use public transport/carpool. (Medium impact)
- I travel by private cars even for short distances. (High impact).
- I take flights more than twice a year. (Very high impact)

B. Electricity Use

- I always switch off electrical appliances (lights, fans, etc.) when not in use. (Low impact)
- I sometimes forget to switch off electrical appliances (lights, fans, etc.). (Medium impact)
- I leave electrical appliances (lights, fans, etc.) on frequently. (High impact)

C. Water Use

- I use water judiciously, for example, just one bucket of water for bathing. (Low impact)

Carbon footprint: The total amount of greenhouse gases released into the atmosphere as a result of human activities, such as energy use, transportation, or the production of goods and services.

- I sometimes waste water (leaving the tap running/ more buckets of water for a bath/long showers). (Medium impact)
- I rarely think about saving water. (High impact)

D. Waste and Plastics

- I reuse, recycle, and avoid single-use plastics. (Low impact)
- I sometimes use disposable plastics (bottles/bags/ straws). (Medium impact)
- I often throw away plastic and do not recycle. (High impact)

Step 2: Score Yourself

- **Low impact choices = 1 point**
- **Medium impact choices = 2 points**
- **High impact choices = 3 points**
- **Very high impact choices = 4 points**

Now add up your total score: _____ points

Step 3: My Climate Action Pledge

Think about **two simple changes** you can make to reduce your score, and write them down below.

1. ----------
2. ----------

Punjab Floods 2025: A Case Study

Fig. 3.12. Floods in Punjab

In 2025, Punjab experienced severe floods due to heavy monsoon rains and the consecutive swelling of the rivers Satluj, Beas, and Ravi. The floods damaged large parts of the state, including villages, agricultural fields, houses, and important infrastructure such as roads and bridges. While the water started to recede in some

places and relief operations were carried out, the overall impact was devastating. The state suffered heavy economic losses, social disruption, and environmental damage, underscoring the urgent need for improved flood management and preparedness.

Causes

The floods in Punjab resulted from both natural and human-made factors.

- **Natural Causes:** In 2025, Punjab faced very heavy monsoon rains, which were intensified by the western disturbances that brought even more moisture and rain. It rained not only in Punjab but also in Himachal Pradesh and Jammu & Kashmir. The major rivers of Punjab—the Satluj, the Beas, the Ravi, and the Ghaggar—were already flowing high before the heavy rains began. When additional rain fell, water from the hills and local rainfall caused rivers to overflow, leading to severe flooding in many parts of Punjab.
- **Human-made Causes:** The floods were further aggravated by weak and old river embankments, or *dhūsī bāndh*, which could not stop the rising water during heavy monsoon rains. People had also built houses and farms too close to the rivers, reducing the natural space where floodwater could spread safely. Over time, silt and mud had collected in rivers and dams, reducing their capacity to hold and carry water. In some areas, flood warnings came late or were not clearly communicated, leaving people unprepared. All these factors together increased the damage caused by the floods.

Fig. 3.13. Relief operations during the floods

Effects of the Floods in Punjab

- Many people lost their lives in the floods.
- Thousands of people had to leave their homes and move to relief camps for safety.
- Large areas of farmland were covered with water, and crops like paddy were severely damaged.
- Poultry and dairy farms were damaged and destroyed. Many animals, including cows, buffaloes, and chickens, got sick or died.
- Roads, bridges, border fences, and some public buildings were also damaged.
- Murky standing water caused health problems, including the spread of waterborne diseases and sanitation concerns.

Classroom Discussion

- To what extent did natural factors cause these floods compared to human activities?
- Do you think better planning could have reduced the damage? How?
- What are the guidelines for the management of floods according to the National Disaster Management Authority (NDMA)?
- What role can students/youth play in helping with disaster preparedness?

Before we move on...

- The Earth's atmosphere is made up of different gases, mainly nitrogen and oxygen, along with small amounts of other gases like water vapour and dust, support life and help in forming clouds and causing rainfall.
- The atmosphere is made up of different layers, namely the Troposphere, Stratosphere, Mesosphere, Thermosphere, and Exosphere, which are divided based on changes in temperature and air density as we go higher above the Earth's surface.
- Weather refers to the daily atmospheric conditions, while climate is the average weather of a place over a long period of time.
- India has a tropical monsoon climate, and the Indian Meteorological Department (IMD) divides the year into four main seasons, namely—Winter, Summer, Monsoon, and Post-monsoon.

- Climate change is the long-term change in weather caused mainly by human activities like burning fuels and cutting trees, which leads to global warming and extreme weather conditions.
- We can reduce our carbon footprint by saving energy, using renewable sources, planting trees, and living in more eco-friendly ways.

Questions and activities

1. What is atmosphere? Explain its composition with the help of a pie diagram.
2. Draw a labelled diagram of the structure of atmosphere.
3. Which are the four main seasons of India?
4. Why do you not feel the pressure of the atmosphere?
5. In which layer of the atmosphere do aeroplanes fly and why?
6. Distinguish between the following:
   a. The troposphere and stratosphere
   b. The south-west monsoon and north-east monsoon
7. Do it yourself: Table 3.3 shows the average monthly temperatures and rainfall amounts for 10 representative stations. Study these figures on your own and convert them into 'temperature and rainfall' graphs. The visual representations will help you grasp their similarities and differences at a glance. One such graph (Fig. 3.14) is already prepared for you. See if you can arrive at some broad generalisations about our diverse climatic conditions.
   7.1. Now look at Table 3.3 again. Re-arrange the 10 stations according to their distance from the equator.
   7.2 Find out:
      a. Two stations with the most extreme climate.
      b. Two stations influenced by retreating monsoons.
      c. The two hottest stations in the months of
         (i) February (ii) June
   7.3. Now find out:
      a. Why does Shillong experience more rainfall than Kolkata?
      b. Why does Delhi receive more rainfall than Jodhpur?

Table 3.3. Average monthly temperatures and rainfall for 10 representative stations (temperature and rainfall data are representational)

Stations	Latitude	Altitude (Metres)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Rainfall
Temperature (°C) **Bengaluru**	12°58'N	909	20.5	22.7	25.2	27.1	26.7	24.2	23.0	23.0	23.1	22.9	18.9	20.2	
Rainfall (cm)			0.7	0.9	1.1	4.5	10.7	7.1	11.1	13.7	16.4	15.3	6.1	1.3	88.9
Temperature (°C) **Mumbai**	19°N	11	24.4	24.4	26.7	28.3	30.0	28.9	27.2	27.2	27.2	27.8	27.2	25.0	
Rainfall (cm)			0.2	0.2	–	–	1.8	50.6	61.0	36.9	26.9	4.8	1.0	–	183.4
Temperature (°C) **Kolkata**	22°34'N	6	19.6	22.0	27.1	30.1	30.4	29.9	28.9	28.7	28.9	27.6	23.4	19.7	
Rainfall (cm)			1.2	2.8	3.4	5.1	13.4	29.0	33.1	33.4	25.3	12.7	2.7	0.4	162.5
Temperature (°C) **Delhi**	29°N	219	14.4	16.7	23.3	30.0	33.3	33.3	30.0	29.4	28.9	25.6	19.4	15.6	
Rainfall (cm)			2.5	1.5	1.3	1.0	1.8	7.4	19.3	17.8	11.9	1.3	0.2	1.0	67.0
Temperature (°C) **Jodhpur**	26°18'N	224	16.8	19.2	26.6	29.8	33.3	33.9	31.3	29.0	20.1	27.0	20.1	14.9	
Rainfall			0.5	0.6	0.3	0.3	1.0	3.1	10.8	13.1	5.7	0.8	0.2	0.2	36.6
Temperature (°C) **Chennai**	13°4'N	7	24.5	25.7	27.7	30.4	33.0	32.5	31.0	30.2	29.8	28.0	25.9	24.7	
Rainfall (cm)			4.6	1.3	1.3	1.8	3.8	4.5	8.7	11.3	11.9	30.6	35.0	13.9	128.6
Temperature (°C) **Nagpur**	21°9'N	312	21.5	23.9	28.3	32.7	35.5	32.0	27.7	27.3	27.9	26.7	23.1	20.7	
Rainfall (cm)			1.1	2.3	1.7	1.6	2.1	22.2	37.6	28.6	18.5	5.5	2.0	1.0	124.2
Temperature (°C) **Shillong**	24°34'N	1461	9.8	11.3	15.9	18.5	19.2	20.5	21.1	20.9	20.0	17.2	13.3	10.4	
Rainfall (cm)			1.4	2.9	5.6	14.6	29.5	47.6	35.9	34.3	30.2	18.8	3.8	0.6	225.3
Temperature (°C) **Thiruvananthapuram**	8°29'N	61	26.7	27.3	28.3	28.7	28.6	26.6	26.2	26.2	26.5	26.7	26.6	26.5	
Rainfall (cm)			2.3	2.1	3.7	10.6	20.8	35.6	22.3	14.6	13.8	27.3	20.6	7.5	181.2
Temperature (°C) **Leh**	34°N	3506	–8.5	–7.2	–0.6	6.1	10.0	14.4	17.2	16.1	12.2	6.1	0.0	–5.6	
Rainfall (cm)			1.0	0.8	0.8	0.5	0.5	0.5	1.3	1.3	0.8	0.5	–	0.5	8.5

7.4. Now think why

a. Thiruvananthapuram has an equable climate?

b. Chennai has more rainfall only after the fury of the monsoon is over in most parts of the country?

c. Leh has moderate precipitation almost throughout the year?

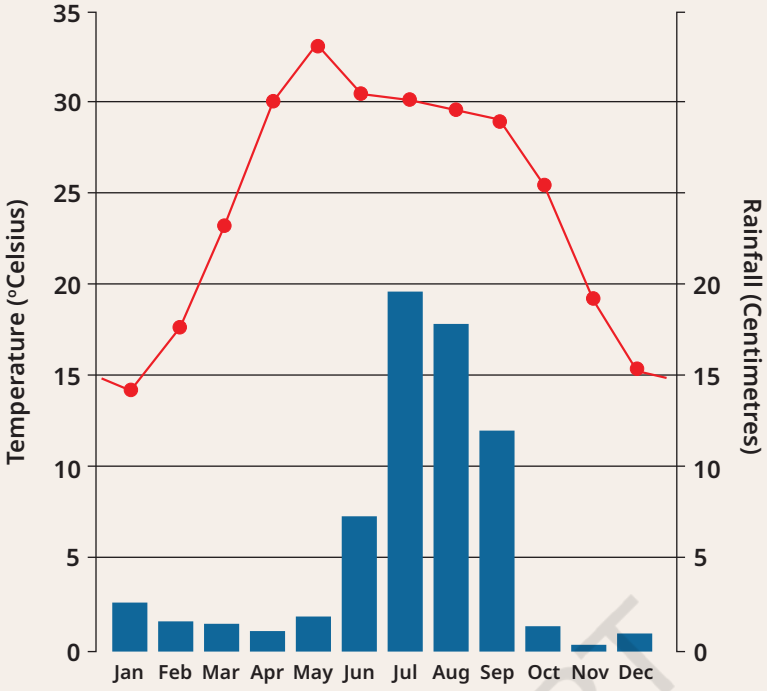


Fig. 3.14. Temperature and Rainfall of Delhi

7.5. Despite these differences across regions, can you observe any substantial evidence to conclude that the monsoons provide a very strong framework, lending overall climatic unity to the whole country?

8. Collect pictures of houses and clothing of people from different regions of India. Examine whether they reflect any relationship with the climatic conditions or the relief of those regions.

Notes