CLIMATE

❖ Weather vs. Climate

- ***Weather*** *is the condition of the atmosphere at a particular time — like a sunny morning or a rainy evening.*
- ***Climate*** *is the average weather of a large area over a long period (at least 30 years).*

Both weather and climate include things like ***temperature, pressure, wind, humidity, and rainfall****.*
Weather keeps changing daily, but climate shows a general pattern over months or seasons.
Based on these patterns, the year is divided into ***seasons*** *like winter, summer, and rainy season.*

India's Climate
India has a ***monsoon-type climate****.*
Monsoon comes from the Arabic word 'mausim', meaning ***season****.*
Monsoon refers to the ***seasonal change in wind direction*** *that brings rain.*
Although India has a general climate pattern, there are big differences between different regions.

Temperature Differences in India

- *In* ***summer****, Rajasthan may reach* ***50°C****, but Pahalgam in Jammu & Kashmir may be only* ***20°C****.*
- *In* ***winter****, Drass (J&K) can go down to* ***–45°C****, while Thiruvananthapuram stays around* ***22°C****.*
- *Some places (like the Thar Desert) have a big difference between* ***day and night*** *temperatures.*
- *Coastal areas (like Kerala, Andaman & Nicobar) have almost* ***no difference*** *between day and night temperatures.*

Rainfall Differences

- *In the Himalayas, precipitation mostly falls as* ***snow****.*
- *In other parts, it falls as* ***rain****.*
- ***Meghalaya*** *gets very heavy rainfall (over* ***400 cm*** *annually).*
- ***Ladakh and western Rajasthan*** *get very little (less than* ***10 cm****).*

Most of India gets rain from ***June to September*** *(southwest monsoon).*
But ***Tamil Nadu*** *gets most of its rain in* ***October–November*** *(northeast monsoon).*

- *Coastal areas have* ***less variation*** *in temperature.*
- *Interior areas have* ***more variation****.*
- *Rainfall decreases from* ***east to west*** *in the Northern Plains.*

❖ Climatic Controls and Factors Affecting India's Climate:

1. Latitude

- *Because the earth is round, different places get different amounts of sunlight.*
- *Places near the* ***equator*** *get more heat and are warmer.*
- *As we move towards the* ***poles****, temperature decreases.*

2. Altitude (Height)

- *As we go higher above sea level, the air becomes thinner and cooler.*
- *That is why* ***hill stations are cool even in summer****.*

3. Pressure and Wind System

- *The air pressure and wind in a place depend on its latitude and altitude.*
- *Winds influence the* ***temperature and rainfall*** *of an area.*

4. Distance from the Sea (Continentality)

- *The sea has a moderating effect on climate.*
- *Places* ***near the sea*** *have* ***mild temperatures*** *(neither too hot nor too cold).*

- *Places **far from the sea** have **extreme temperatures**:*
  ***very hot in summer and very cold in winter** → This is called **continentality**.*

5. Ocean Currents

- *Ocean currents can be warm or cold.*
- *When winds blow from the ocean to the land (onshore winds), they bring the temperature of the current with them.*
- *Therefore, coastal areas may become warmer or cooler depending on the current.*

6. Relief Features (Mountains, plains, etc.)

- *High mountains block cold or hot winds.*
- *They can also force clouds to rise and cause rain on one side.*
- *The other side (leeward side) remains **dry**.*

❖ *Factors Affecting India's Climate*

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1. Latitude

- *The **Tropic of Cancer** passes through the middle of India.*
- *Areas south of it are **tropical** (hot).*
- *Areas north of it are **subtropical** (less hot).*
- *So India has both **tropical and subtropical climate features**.*

2. Altitude

- *The **Himalayas** in the north (about 6000 m high) stop the **cold winds from Central Asia**.*
- *Because of this, India has **milder winters** than places at the same latitude in Central Asia.*
- *Coastal areas have low altitude (around 30 m), which also affects their temperature.*

3. Pressure and Winds

India's climate is influenced by:

1. ***Pressure and surface winds***
2. ***Upper air circulation***
3. ***Western cyclonic disturbances and tropical cyclones***

- *India is mainly influenced by **northeasterly winds**, which blow from the high-pressure areas of land towards the sea.*

❖ *The Seasons in India*

*India has a **monsoon type of climate**, which means the weather changes clearly from one season to another.*
*The **interior parts** (far from the sea) feel these changes more strongly.*
*The **coastal areas** have smaller temperature changes but do have rainfall differences.*
*India mainly has **four seasons**:*

1. ***Cold Weather Season (Winter)***
2. ***Hot Weather Season (Summer)***
3. ***Advancing Monsoon (Rainy Season)***
4. ***Retreating Monsoon (Autumn / Post-Monsoon)***

❄ *1. Cold Weather Season (Winter)*

When does it occur?

- *From **mid-November to February**.*
- ***December and January** are the coldest months in northern India.*

➢ ***Temperature Pattern***

- *Temperature **decreases from south to north**.*
- *Chennai (south/east coast): **24–25°C***
- *Northern plains: **10–15°C***
- *Days are **warm**, nights are **cold**.*
- ***Frost** is common in northern India.*

- *The **Himalayan slopes** get **snowfall**.*

Winds in Winter
- ***Northeast trade winds** blow over India.*
- *They blow **from land to sea**, so they are **dry**.*
- ***Exception**: Tamil Nadu gets rainfall because here the winds blow **from sea to land***

Weather Conditions
- *Clear skies*
- *Low temperature*
- *Low humidity*
- *Light and variable winds*

Western Disturbances
- *In winter, **cyclonic disturbances** come from the **Mediterranean Sea and Western Asia**.*
- *They bring:*
  - ***Rain** to northern plains (important for rabi crops)*
  - ***Snowfall** in the Himalayas*
- *This winter rain is called **mahawat**.*

Peninsular India in Winter
- *Southern India does **not have a strong winter**.*
- *Temperatures do not change much because of the **sea's moderating influence**.*

❖ *The Hot Weather Season (Summer)*

(March to May)

Why does it become hot?
- *The sun appears to move **northward**, so the heat belt also shifts north.*
- *This makes **March to May** the summer season in India.*

Temperature Pattern
- ***March:** Highest temperature (~38°C) on the **Deccan Plateau***
- ***April:** Gujarat & Madhya Pradesh reach **~42°C***
- ***May:** Northwest India reaches **45°C***
- ***Peninsular India** is cooler due to the **sea's moderating effect**.*

Falling Air Pressure
- *As temperatures rise, **air pressure decreases** over northern India.*
- *By late May, a long **low-pressure zone** forms from the **Thar Desert to Patna**.*
- *This low pressure starts pulling air towards it.*

The 'Loo'
- *The **loo** is a hot, dry, strong wind blowing over **north and northwest India**.*
- *It occurs mainly during daytime and can be **dangerous** if exposed directly.*

Dust Storms
- *Common in May in northern India.*
- *They **lower temperatures** briefly and may bring small showers.*

Thunderstorms
- *Local thunderstorms occur in many regions.*
- *In **West Bengal**, these are called **'Kaal Baisakhi'**.*
- *They bring strong winds, sudden heavy rain, and sometimes hail.*

Pre-Monsoon Showers
- *Common in **Kerala and Karnataka** near the end of summer.*
- *Help in ripening mangoes → called **'mango showers'**.*

➢ ***Simple Explanation: Advancing Monsoon (Rainy Season)***

(June to September)

How do monsoon winds form?
- *By early June, low pressure over northern plains becomes strong.*
- *It **pulls in** the **southeast trade winds** from the southern hemisphere.*

- *These winds cross the equator, turn southwest, and enter India as the*
  ➤ ***South-West Monsoon Winds***

What do they bring?

- *These winds blow over warm oceans and carry **huge amounts of moisture**.*
- *They blow at a speed of about **30 km/hr**.*
- *They cover most of India within **one month**.*

Rainfall Distribution

- ***Western Ghats (windward side):** Very heavy rain (**250+ cm**)*
- ***Deccan Plateau:** Gets rain but less (rain-shadow area)*
- ***North-East India:** Maximum rainfall*
  - ***Mawsynram** receives the **highest rainfall in the world***
- ***Ganga Valley:** Rain decreases from **east to west***
- ***Rajasthan & Gujarat:** Very little rain*

➢ ***Monsoon "Breaks"***

- *Monsoon does **not** rain continuously.*
- *There are **wet spells (rainy days)** and **dry spells (no rain)**.*
- *These breaks happen because the **monsoon trough shifts**:*
  - *When the trough moves over the **plains** → good rainfall*
  - *When it shifts towards the **Himalayas** → dry plains but heavy rain in mountains*
- *Heavy rainfall in mountains often causes **floods** in the plains.*

Tropical Depressions

- *These are low-pressure systems forming in the **Bay of Bengal**.*
- *They travel along the monsoon trough and influence:*
  - ***How much rain falls***
  - ***How long it rains***

Nature of Monsoon

*The monsoon is **highly unpredictable**:*

- *Can cause **floods** in one region*
- ***Drought** in another*
- *Arrival and retreat are **irregular***
- *This affects the **farming activities** of millions of farmers.*

❖ Distribution of Rainfall in India

*Rainfall in India is **not the same everywhere**. Some areas get a lot of rain, while others get very little.*

Areas with very high rainfall (over 400 cm per year)

- ***Western coast** (e.g., Western Ghats region)*
- ***Northeastern India** (e.g., Meghalaya, Assam)*

*These places receive the **heaviest rainfall in the country**.*

Areas with very low rainfall (less than 60 cm per year)

1. ***Western Rajasthan & nearby regions***
   - *Includes parts of **Gujarat, Haryana, Punjab***
   - *These areas are dry because:*
     - *They lie far from the sea*
     - *Hot desert winds dominate*
     - *Moisture-bearing winds lose strength before reaching here*
2. ***Interior Deccan Plateau***
   - *Especially the **leeward side of the Western Ghats***
   - *The mountains block monsoon winds, so these areas remain dry*
   - *This is called the **rain-shadow effect***
3. ***Leh (Ladakh region)***
   - *Very little rainfall because:*
     - *It is surrounded by **high mountains***

- *Monsoon winds cannot reach this region*
- *The air is very dry due to high altitude*

Moderate rainfall
- *Most of the rest of India receives **moderate rainfall**.*

Snowfall
- *Only the **Himalayan region** gets snowfall.*

❖ ***High Variability of Rainfall***
- *Because monsoons are unpredictable, rainfall changes from **year to year**.*
- *Variability is **highest** in low-rainfall regions like:*
  - *Rajasthan*
  - *Gujarat*
  - *Leeward side of Western Ghats*

This leads to:
- ***Floods** in high-rainfall areas*
- ***Droughts** in low-rainfall areas*

Simple Explanation: Monsoon as a Unifying Bond

*Even though India has diverse climates, the **monsoon brings unity** to the entire subcontinent.*

How geography helps:
- *The **Himalayas** protect India from freezing winds of Central Asia → keeping **north India warmer**.*
- *The **Peninsular Plateau**, surrounded by sea on three sides, enjoys **moderate temperatures**.*

Despite differences, monsoon unites India:
- *The **seasonal cycle** created by the monsoon (summer heat → monsoon rains → retreating monsoon → winter) is experienced across India.*
- *The rainfall may be uneven, but every part of India **depends on the monsoon**.*

Importance of monsoon:
- *It supports **agriculture**, which is the backbone of rural India.*
- *Crops, festivals, and rural life follow the **monsoon calendar**.*
- *People across India **eagerly wait for the monsoon** every year.*
- *Rivers filled by monsoon rains create **connected river valleys**, linking different regions.*

The monsoon unifies India because:
- *It brings **water**, which is essential for life.*
- *It influences the **economy, culture, lifestyle, and agriculture** of the entire country.*
- *From north to south and east to west, everyone depends on the arrival of the monsoon.*

1. Answer the following questions briefly

(i) What are the controls affecting the climate of India?

India's climate is controlled by:
- *Latitude*
- *Altitude*
- *Pressure and winds*
- *Distance from the sea (continentality)*
- *Ocean currents*
- *Relief features*

(ii) Why does India have a monsoon type of climate?

*India has a monsoon type of climate because of the **seasonal reversal of winds**.*
Winds blow from land to sea in winter and from sea to land in summer, bringing rainfall.

(iii) Which part of India experiences the highest diurnal range of temperature and why?
- *The **Thar Desert (Rajasthan)** has the highest diurnal (day–night) temperature range.*
- *Because sand heats up quickly during the day and cools quickly at night.*
- *Also, the air is very dry, causing more temperature variation.*

(iv) Which winds account for rainfall along the Malabar Coast?
South-West Monsoon Winds

(v) Define monsoons. What do you understand by "break" in monsoon?
- ***Monsoon:*** *Seasonal reversal of winds, bringing heavy rainfall to India.*
- ***Break in monsoon:*** *Periods when rainfall stops for some days between rainy spells.*

(vi) Why is the monsoon considered a unifying bond?
- *Because every part of India—north, south, east, west—depends on monsoon rains.*
- *It supports agriculture, fills rivers, influences festivals, and affects daily life.*
- *People across the country eagerly wait for the monsoon every year.*

2. Why does rainfall decrease from east to west in Northern India?
- *The monsoon winds enter India from the* ***Bay of Bengal*** *in the east.*
- *As they move westward, they* ***lose moisture****.*
- *Therefore, rainfall decreases from* ***West Bengal → Bihar → Uttar Pradesh → Punjab → Rajasthan****.*

3. Give reasons
(i) Why does seasonal reversal of wind direction take place?
Because of the ***difference in temperature and pressure*** *over land and sea in summer and winter.*

(ii) Why is most rainfall in India concentrated in a few months?
Because the ***south-west monsoon****, which brings most of India's rain, blows only from* ***June to September****.*

(iii) Why does the Tamil Nadu coast receive winter rainfall?
Because the ***north-east monsoon winds*** *pick up moisture from the Bay of Bengal and bring rain to Tamil Nadu in* ***October–November****.*

(iv) Why is the delta region of the eastern coast frequently struck by cyclones?
Because low-pressure systems and tropical cyclones often form in the ***Bay of Bengal*** *and move toward the* ***eastern coastal deltas*** *(Odisha, Andhra Pradesh, Tamil Nadu).*

(v) Why are parts of Rajasthan, Gujarat and the leeward side of the Western Ghats drought-prone?
- *Rajasthan & Gujarat: Far from the sea, monsoon winds lose moisture before reaching.*
- *Leeward side of Western Ghats: Lies in* ***rain shadow****, so it gets very little rainfall.*

4. Describe regional variations in India's climate
India has great climatic diversity. Examples:
- ***Rajasthan desert:*** *Very hot summers (50°C) and very low rainfall.*
- ***Jammu & Kashmir:*** *Very cold winters (–45°C) and heavy snowfall in mountains.*
- ***Kerala & coastal areas:*** *Small temperature changes, heavy rainfall.*
- ***Northeast India:*** *World's heaviest rainfall (Mawsynram).*
- ***Ladakh:*** *Very cold and dry; desert at high altitude.*

5. Weather conditions and characteristics of the cold season (Winter)
- *Season:* ***Mid-November to February***
- *Temperature:*
  - *North:* ***10–15°C***
  - *South:* ***24–25°C***
- *Days warm, nights cold*
- *Clear skies, low humidity*
- ***Northeast trade winds*** *prevail*

- *Western disturbances bring **winter rain** in north India*
- *Snowfall in the Himalayas*
- *Peninsular India has no distinct winter due to sea influence*

6. Characteristics and effects of monsoon rainfall in India

Characteristics

- *Caused by **south-west monsoon winds***
- *Highly **variable** and **unevenly distributed***
- *Comes in **spells** with "breaks"*
- *Heaviest rainfall in **Western Ghats** and **Northeast India***
- *Least rainfall in **Rajasthan**, **Ladakh**, **Gujarat***

Effects

- *Essential for **agriculture** (Kharif crops)*
- *Can cause **floods** in heavy rainfall areas*
- *Can cause **droughts** where rainfall is low*
- *Influences rivers, forests, economy, festivals*
- *Affects transport, water supply, and daily life*