



## In Depth — Monsoon: Respite For Agriculture

Monsoon is considered to be the lifeline of the Indian subcontinent, where economy is still largely dependent on agriculture. And at a time when several parts of the country are witnessing agricultural distress, the India Meteorological Department has announced that the country is likely to witness a near-normal monsoon this year, with a well distributed rainfall that could be beneficial for the agricultural sector.

As per the forecast, there is a 39% chance of a 'near normal' rainfall, 32% possibility of a 'below normal' rainfall and a 10% chance of an 'above normal' rainfall. The seasonal rainfall is likely to be 96% of the Long Period Average, with a model error of plus or minus five per cent.

### Monsoon

It refers to a seasonal change in the direction of the prevailing winds of a region. It arises due to a difference in temperature between the landmass and the adjacent ocean. Monsoons cause wet and dry seasons throughout much of the tropics and are most often associated with the Indian ocean.

### Southeast Asia and Indian Monsoon

- The summer monsoon and the winter monsoon determine the climate for most of the India and South east Asia.
- **Southwest summer monsoon:**
  - It is attracted by low pressure area that is **caused by the extreme heat of the Thar desert and adjoining areas during summer.**
  - During the monsoon, the wind direction reverses, moisture laden winds from the Indian ocean come up to fill up the void, but because they cannot pass through the Himalayas, they are forced to rise.
  - The gain in altitude of the clouds results in a drop in temperature bringing about rains.
  - The summer monsoon between April and September brings about heavy rainfall.
  - **Humid climate and torrential rainfall in countries like India, Sri Lanka, Bangladesh and Myanmar** is brought about by the summer monsoon.
- **Southwest Monsoon in India:**
  - When the southwest monsoon reaches India, **it splits into two parts** around the mountainous region of the Western ghats in South central India.
  - **One part moves northwards over the Arabian sea** and up the coastal side of the western ghats.
  - **The other flows over the Bay of Bengal** up through Assam and hits the eastern Himalayas.
  - The Southwest monsoon reaches the coast of Kerala around June 1st every year.
  - It usually arrives in Mumbai approximately 10 days later, reaches Delhi by the end of June and covers the rest of India by mid-july.
  - **This four-month rainy season contributes to more than 70% of India's annual showers.**
- **Winter Monsoon:**

- The winter monsoon lasts from **October to April**.
- The dry winter monsoon blows from the northeast and is **less powerful than summer monsoons** in Southeast Asia.
- This is because the Himalayan range prevents much of the wind and moisture of the monsoons from reaching the coast.
- The Himalayas also prevent much of the cool air from reaching places like Southern India and Sri Lanka, thus keeping them warm.

## The Asian-Australian monsoon

- It stretches from Northern Australia to Russia's Pacific coast and also includes the Indian ocean.
- It happens once a year, usually in the middle of the summer.
- Warm moist air from the gulf of California blows northeast while warm moist air from the gulf of Mexico blows northwest.
- These two winds meet over the Sierra Madre occidental mountains in central Mexico.
- The Monsoon brings moisture to the mountain ecosystem before continuing north to the U.S. states of Arizona, New Mexico and Texas.

## Theories about the origin of the monsoon

### The Thermal Wave theory

- It says that when the sun changes its position during summer, sun rays directly fall over the Tropic of Cancer.
- This creates a **very low pressure in the Thar desert or northwest part of India**.
- Besides this, the center of excessive low pressure in the northwestern region **pulls in the southeast trade winds flowing from the southern hemisphere**.
- The southeast trade winds cross the equator and enter as southwest monsoon winds.
  - Because of the coriolis effect, southeast trade winds are deflected east in the northern hemisphere, transforming into South West trade winds.
- Southwest monsoon winds are moisture laden as they blow over the ocean which is why they trigger rains on entering India.
- Monsoons can be categorised into two branches based on their spread over the subcontinent, the **Arabian Sea Branch** and the **Bay of Bengal branch**.
- The Arabian Sea branch causes rains in Western coast and Western ghats, while the Bay of Bengal branch hits the Arakan Yoma mountains of Myanmar and causes rains in the northeastern and eastern part of India and heads towards the Gangetic plains.

### Shifting of ITCZ

- According to another theory of monsoon, during the summer months in the northern hemisphere, the **Inter Tropical Convergence Zone (ITCZ) shifts north, pulling the southwest monsoon winds on to the land from the sea**. However, the huge landmass of the Himalayas restricts the low pressure zone onto themselves.
  - ITCZ is a low pressure belt, caused by the convergence of northeast and southeast trade winds in the area encircling Earth near the Equator.
- It is only when the Tibetan plateau heats up significantly more than the Himalayas that the ITCZ abruptly and swiftly shifts north leading to the bursting of monsoon rains over the Indian subcontinent.
- The reverse shift takes place for the northeast monsoon winds leading to a second minor burst of rainfall over the eastern Indian peninsula during the northern hemisphere winter months.

### Jet Streams

- A major reason for the origin of monsoon is the Jet stream winds that flow in the upper atmosphere

of the Himalayas. It has two parts: **Eastern Jet stream** and **Western Jet stream**.

- In the winter season, the western jet stream blows over India or Asia. As long as the western jet stream blows over India, high pressure remains on India and it prevents the surface air from rising.
- Because of this, monsoon winds do not come to India but during the summer, the western jet stream slips towards north and the eastern jet stream blows over India.
- **Due to the eastern jet stream, the surface hot winds in the north-west part start rising upwards and build low pressure and to fill this void, monsoon winds start moving towards India and this causes onset of monsoon.**

## Impact of Monsoon on Indian Agriculture

- The Indian economy is heavily dependent on agriculture and the livelihood of Indian farmers largely depends on monsoon rains.
  - **70% of the Indian population depends on farming either directly or indirectly.**
  - **Around 58% of the total employment in the country is through agriculture.**
  - **Agriculture sector in our country contributes around 18% of the GDP.**
  - The fate of the **Kharif crops depends on the performance of Southwest monsoon.**
  - Crop failure and deficient rainfall is one big reason for mass farmer suicides across the country.
- A major portion of the country's crop area is completely dependent on monsoon rains as it is not equipped with methods of manual irrigation.
- The Indian economy gains due to good monsoon rains in the country.
  - Farm output goes up, boosting demand for consumer goods as well as income of rural people.
- **Southwest monsoon** in India is four month long affair from June till September. More than 75% of India's annual rainfall occurs during this period itself.
  - Monsoon friendly crops with a high requirement of water like sugarcane, jute and paddy can easily be cultivated during summers in areas where monsoon is good whereas crops like wheat and barley require moderate temperature and water and therefore can only be grown in winters.
- Normal monsoon rains keep a **check on food inflation** due to availability of food produce. However in a situation of drought, prices soar significantly.
  - Not only do the prices increase drastically, the cost of living also tends to reach new high.
  - Also, if poor monsoon results into less crop output, the country may need to import.
  - It also impacts as many as **a dozen sectors which depend on monsoon either directly or indirectly.**
  - The agricultural output of rainfed crop areas in the country has social, political as well as economic implications.

## El Nino

- El-Nino is a **spanish word that means 'the little boy'**. Scientifically, El-Nino is a **climate pattern that describes the unusual warming of surface waters in the eastern tropical pacific ocean.**
  - Due to El Nino, the surface temperature of the ocean could witness an increase of 5 degree celsius.
  - In such a condition, the warm water acts as a cap that prevents cool water from coming up to the surface. This not only affects the weather across the planet but also marine life and sea birds.
  - During an El Nino event, the prevailing winds across the Pacific weaken and sometimes, they can even reverse and blow the other way which in turn affects the global climate and disrupts normal weather patterns leading to intense storms in some places and droughts in others.
- It is one of the parameters which is considered for bringing out a weather forecast in India.

- El Nino does not occur in a perfectly regular pattern, but **it seems to happen every 2-7 years. The average period length is 5 years.**
- El Nino not only affects the unusual rainfall in Peru but also impacts India's monsoon patterns.
  - It has been **linked to droughts in Australia, floods in parts of South America.**
  - It can trigger **above average rains in northern Peru, drought in South east Asia, Australia, India and North eastern Brazil.**
  - It can also lead to **formation of cyclones in the central pacific and stormy weather in the southern and western United States of America.**
- Scientists, however, say that climate change might also be adding an extra kick to El Nino as warmer oceans add more fuel to storms and weather patterns.

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