Changing Monsoon pattern in India

October 18, 2022

Manifest Pedagogy:

The heavy October rainfall over North and Northwest India underscores the changing patterns of monsoon activity over the subcontinent. Driven by climate change, the 'normal' has shifted, and the country may soon have to make adjustments in a range of sectors. There is an urgent need to tackle the issue of climate change which is severely impacting India's monsoon pattern. This calls for concerted effort at the national and global level to reduce GHGs emission to mitigate the impact of climate change.

In News: Monsoon rainfall in India has been surplus by around 7% this year though with extreme inequity.

Placing it in Syllabus: Geography and Environment.

Static Dimensions

- About Monsoon

Current Dimensions

- Changing monsoon patterns
- Longer rainy season
- Climate change is responsible for changing monsoon in India
- A challenge for forecasting
- Impact on of changing pattern on different sectors

Content

About Monsoon

- The seasonal reversal of wind direction during a year

accompanied by corresponding changes in precipitation.

- The monsoon or southwest monsoon is a sea-breeze from the Arabian Sea and the Bay of Bengal that officially onsets over Kerala on June 1 and retreats from Rajasthan by the end of September.
- It is then replaced by the retreating, or northeast monsoon in November which is the key source of rainfall for several parts of Tamil Nadu, Andhra Pradesh and north interior Karnataka.

Changing monsoon patterns

- **Surplus precipitation:**Central and southern India saw a sharp surge in rainfall.
    - Rains in Central India were surplus by 20% and in southern India by 25%, with the last month seeing several instances of flooding in Kerala, Karnataka and Madhya Pradesh.
- **Deficit:**On the other hand, large parts of U. P., Bihar, Odisha have seen large deficits. The east and northeast of India have reported a 17% shortfall and the northwest 2%.
- Incessant rain over Delhi and several other parts of North and Northwest India over the last few days provide further evidence of the shifting patterns in monsoon activity over the Indian subcontinent.
- **More intense**-Not only has monsoon rainfall become more erratic – fewer rainy days but more intense rain – the monsoon season, earlier confined neatly to the four-month June-September period, is clearly spilling over into October now.
    - This has been officially recognised. Three years ago, the India Meteorological Department (IMD) had revised the expected dates of onset and withdrawal of the monsoon for several regions of the country.
- **The withdrawal dates** for North, Northwest and Central

India were pushed back by one to two weeks to account for the trends witnessed over the last 50 years.

- Thus, the October rainfall over North India of the kind that happened over the last few days should no longer surprise anyone. It should in fact, be increasingly seen as the norm rather than an exception.
- Delhi and its surrounding areas had received pretty good rainfall in October 2021 as well – so much so that Delhi had its fourth wettest October of the last 120 years.
    - Considering the huge amounts of rain that have fallen in the first 10 days of this month – eight times more than the normal – this October could turn out to be even wetter than last year's.

THE NEW MONSOON NORMAL

STATION	ONSET		WITHDRAWAL	
	New	Existing	New	Existing
Hyderabad	Jun 8	Jun 7	Oct 14	Oct 15
Pune	Jun 10	Jun 9	Oct 11	Oct 6
Mumbai	Jun 11	Jun 10	Oct 8	Sept 29
Ahmedabad	Jun 21	Jun 14	Sept 30	Sept 22
Kolkata	Jun 11	Jun 10	Oct 12	Oct 14
Lucknow	Jun 23	Jun 20	Oct 3	Sept 30
New Delhi	Jun 27	Jun 23	Sept 25	Sept 22
Chandigarh	Jun 26	Jul 1	Sept 22	Sept 22

Existing dates for normal onset and withdrawal of the southwest monsoon based on 1901–40 data; new dates being used by IMD from June 1, 2020 based on 1961–2019 and 1971–2019 data for onset and withdrawal respectively.

Longer rainy season

- In any case, rainfall in October – after the traditional date of withdrawal of the southwest monsoon – isn't entirely unheard of.
    - It has happened in several previous years as well. But the rain in those years was mostly caused by different, often local, atmospheric phenomena.
- What is being witnessed in more recent years is a clear prolongation of the monsoon season. The nature of rainfall is very different – it is not a short-duration heavy downpour, but sustained rain over a few days.
- The recent spell of rainfall over Western Uttar Pradesh, Uttarakhand, Haryana, Eastern Rajasthan and Delhi were a result of the interaction of monsoon winds, moving east to west, with the western disturbance wind system.

- Such interactions happen several times during the monsoon season.

Climate change is responsible for changing monsoon in India

- Like most of the changes being witnessed in global weather patterns, the changing trends in the Indian monsoon are also being driven primarily by climate change.
- In line with the experience in many other parts of the world, rainfall in India is increasingly taking place in short, intense bursts.
    - Extreme rainfall events are increasing both in intensity and frequency.
- The extension of the monsoon season could also be seen as a consequence of global warming.
- A robust study to establish the cause and effect relationship is yet to be done, but one possible reason for the spillover of monsoon rainfall to October could be the fact that the oceans (Bay of Bengal and Arabian Sea) are now warmer than earlier.
- **Warmer ocean currents** help the formation of monsoon winds. Earlier, rainfall during the monsoon season would bring down the temperature of the ocean.
    - But possibly because of global warming, the oceans continue to remain warm even after the traditional monsoon season is over.
    - The oceans could thus be playing a role in keeping the monsoon alive beyond the traditional period," Rajeevan said.
- **Global warming** is affecting rainfall patterns in other ways too. A warmer atmosphere has a greater capacity to hold water.
    - When this water is finally released, it often results in a heavier downpour than would be expected otherwise.
    - This accounts in part for the increasing instances

of extreme rainfall events.

- **Persistence of intense La Nina conditions, the abnormal warming of East Indian Ocean, negative Indian Ocean Dipole (IOD)**, southward movement of most of the monsoon depressions and lows and pre-monsoon heating over the Himalayan region and melting glaciers.
    - **Triple dip' La Nina:**India is seeing an extended spell of the La Nina, called a 'triple dip' La Nina which is a phenomenon lasting across three winter seasons in the northern hemisphere.

A challenge for forecasting

- The changing patterns and increased instances of erratic monsoon behaviour is creating forecasting complications for the IMD.
- Once infamous for its unreliable and generic forecasts, the IMD has over the past 10-12 years, invested heavily in setting up observational equipment, upgrading computing resources, and fine-tuning weather forecast models.
- It continues to battle public perception in many cases, the IMD's forecasts are now not just far more accurate and specific, they are also impact-based and actionable.
- The increased variability in weather systems brought about by climate change is threatening to dilute the gains made in recent years.
- Today, IMD is able to provide fairly good forecasts. It may not be 100 percent accurate, but it is at par with any other weather forecasting agency in the world.
- The current spell of rain in Delhi and other areas was forecast accurately well in advance. But climate change is posing a big challenge.

Impact on of changing pattern on differnt sectors

- Monsoon rainfall is not just a weather phenomenon. It is a key driver of the Indian economy.

- **Indian agriculture** still depends on monsoon rainfall for irrigation.
    - One of the major impacts of changes in track of monsoon systems can be seen on kharif crops, particularly rice production.
    - The uneven distribution of rain may impact the quality of the grain as well as the nutrition value may vary.
        - **Study**-'Climate change, the monsoon, and rice yield in India', very high temperatures (> 35°C) induce heat stress and affect plant physiological processes, leading to spikelet sterility, non-viable pollen and reduced grain quality.
    - Not just the preferred time of sowing of crops, but the entire cropping cycle – even the choice of crops – might need to be changed.
- **The supply of drinking water** and the **generation of electricity** are also linked to the monsoon.
- **Dams**-There are implications for dam management as well. Most reservoirs in the northern and central parts of the country seek to attain full capacity levels by the end of September because not much rain is expected after that.
    - But if the monsoon consistently spills over into October, as is being predicted, this practice would need to be revised as well.
- The other sectors are yet to react to the change in monsoon calendar that was announced by the IMD three years ago, but it will not be long before they are forced to respond.

Wayforward

- **Forecasting**-There is a need to set up more observation stations, collect more data, and do more computing. Capacity upgradation has to be a continuous exercise.

- With a warming climate, more moisture will be held in the atmosphere, leading to heavier rainfall, consequently, inter-annual variability of the monsoon will increase in future. The country needs to prepare for this change.
- Need to take effective and timely steps not just at the domestic front (National Action Plan on Climate Change) but also at the international front (UN Framework Convention on Climate Change).
- The current atmospheric carbon dioxide (CO_2) concentrations are higher than at any time in the last two million years.
    - To align with a 1.5°C target of limiting warming, global CO_2 emissions must reach net zero around 2050, with global GHG emissions reaching net-zero 15-20 years later.
- Agriculture must shift towards climate smart agriculture which is sustainable.

Mould your thoughts

1. Driven by climate change, the monsoon pattern in India is changing.The 'normal' has shifted, and the country may soon have to make adjustments in a range of sectors. Discuss (250 words)

Approach to the answer

- Introduction about gravity of the situation
- Changing monsoon pattern in India
- Climate change and how it is responsible.
- Impact on various sectors
- Remedial steps to be taken
- Wayforward and conclusion.