

Monsoon Forecast Models

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Monsoon is referred to as the lifeline of India. It greatly influences the agriculture yield, economy, water resources, power generation and ecosystem. The accurate prediction of monsoon rainfall is a basic need for India but remains a challenge over the decades.

In news: India Meteorological Department (IMD) may introduce new monsoon models

Placing it in syllabus: Science & Technology

Dimensions:

- Monsoon forecast models
- LPA method
- Indian monsoon mission
- Megha tropique satellite
- New models

Content

Monsoon Forecast Models

- Monsoon has always been critical for India's economy.
- If variations in monsoon rainfall are known well in advance, it would be possible to reduce the diverse impacts related to excess or deficient rainfall.
- A reliable monsoon forecast with sufficient lead time is essential for policy makers and farmers for planning and sowing of crops, as well as making long-lead plans for the future.
- There are several methods to assess the likelihood of Monsoon rainfall.
- Currently, IMD relies on an **ensemble model** for forecasting monsoon. This traditional model **uses a statistical technique**.

- It uses an average of 6 meteorological values correlated to the monsoon such as sea surface temperatures in the Pacific, and North Atlantic sea level pressure.
- These meteorological values are traditionally derived from century-old meteorological data linked to the historical performance of the monsoon.
- This model equates relationships of physical parameters, such as for instance sea surface temperatures, snowfall, the temperature of landmass etc with the actual observed rainfall in the past.
- India currently operates a **global model on a 12-km grid size** – that is, information is gathered every 12 km. This is the highest resolution ensemble system, and at present India has the best model in the world.
- However, this traditional approach has failed to predict monsoon recent decades (for instance in 2002 and 2004) leading meteorologists to call for a new, modern forecasting system.

Dynamical Monsoon Model

- The dynamical monsoon model simulates the weather on powerful computers (supercomputers) and extrapolates it over particular timeframes.
- This modern forecasting model is being tested at the **Indian Institute of Tropical Meteorology (IITM), Pune.**
- The dynamical monsoon model is also called the **Coupled Forecast System version 2.**
- So far it has achieved only 60% accuracy in forecasting the monsoon.
- This method is widely used in forecasting weather over a few days. But using it to forecast the annual monsoon over 3 or 4 months has proved difficult.

LPA Method

- LPA of rainfall is the rainfall recorded over a

particular region for a given interval (like month or season) **average over a long period like 30years, 50-years** etc.

- It **acts as a benchmark** while forecasting the quantitative rainfall for that region for a specific month or season.
- For example, LPA of south west monsoon rainfall over Kerala for the months June, July, August and September are 556mm, 659mm, 427mm and 252mm respectively.
- Current LPA of all India south west monsoon rainfall based on the average rainfall over the period 1961 -2010 is 880.6mm.

Indian Monsoon Mission (NMM):

- The accurate prediction of monsoon rainfall remained a challenge for decades. The conventional forecast in use so far is based on the statistical approach and is low skilled in forecasting rainfall anomalies.
- Several new approaches (high resolution, super parameterizations, data assimilation etc.) developed in recent times have shown that the variability in tropics can be reasonably resolved
- The **National Monsoon Mission (NMM)** was envisaged in 2012 by the **Ministry of Earth Sciences (MoES)** to develop a dynamical coupled prediction system specially suited for the Indian region.
- The main objectives of NMM are **to improve Seasonal and Intra-seasonal Monsoon Forecast and to improve Medium Range Forecast.**

To achieve its objectives the NMM envisages to:

- Build a working partnership between the academic research and development organisations and the operational agency to improve the monsoon forecast skill;
- Set up a **dynamical modelling framework** for improving

prediction skill of seasonal and extended range prediction system, and short and medium range prediction system; and,

- Set up the **infrastructure and train manpower** required to improve the prediction skill in all time scales.

Megha-Tropiques satellite:

- The main objective of the Megha-Tropiques mission is **to study the convective systems that influence the tropical weather and climate**.
- The satellite was launched in 2011 into a **non-sun synchronous orbit (Low Earth Orbit)**, unlike other IRS spacecraft.
- Megha-Tropiques provides **scientific data on the contribution of the water cycle to the tropical atmosphere**, with information on condensed water in clouds, water vapour in the atmosphere, precipitation, and evaporation.
- The Megha-Tropiques is a **unique satellite for climate research** that also aids scientists seeking **to refine prediction models**.
- It is operated as part of a joint programme between the Indian Space Research Organisation (ISRO) and France's Centre National d'Etudes Spaciales (CNES).
- This Megha-Tropiques satellite carries four payloads namely, **MADRAS**-a microwave imager, **SAPHIR**-scanning radiometer instrument, **SCARAB**-scanner for radiative budget and GPS occultation receiver for atmospheric studies.

New models

- The India Meteorological Department (IMD) may introduce new monsoon models this year to better forecast changes in rainfall.
- Three different models would be tested this year. Two of them were dynamical models and one a statistical model.

The three models under consideration are:

- **12 global circulation models (dynamical)** : The outputs these models would be combined into a single one
- a model that gauges rainfall based on the sea surface temperature in the tropics (developed by **Prof. Sumant Nigam**, University of Maryland, U.S.) and
- the statistical model based on climate **variables observed during the pre-monsoon.**

All of them are **'ensembles'** meaning **smaller models are combined to arrive at an average value.**

Mould your thought: Why do we need a Monsoon forecast? Discuss different monsoon forecast Models used in India.

Approach to the answer:

- Introduction
- Uses of Monsoon Forecast
- Mention different forecast models used by IMD
- Mention their strengths and weaknesses
- Conclusion