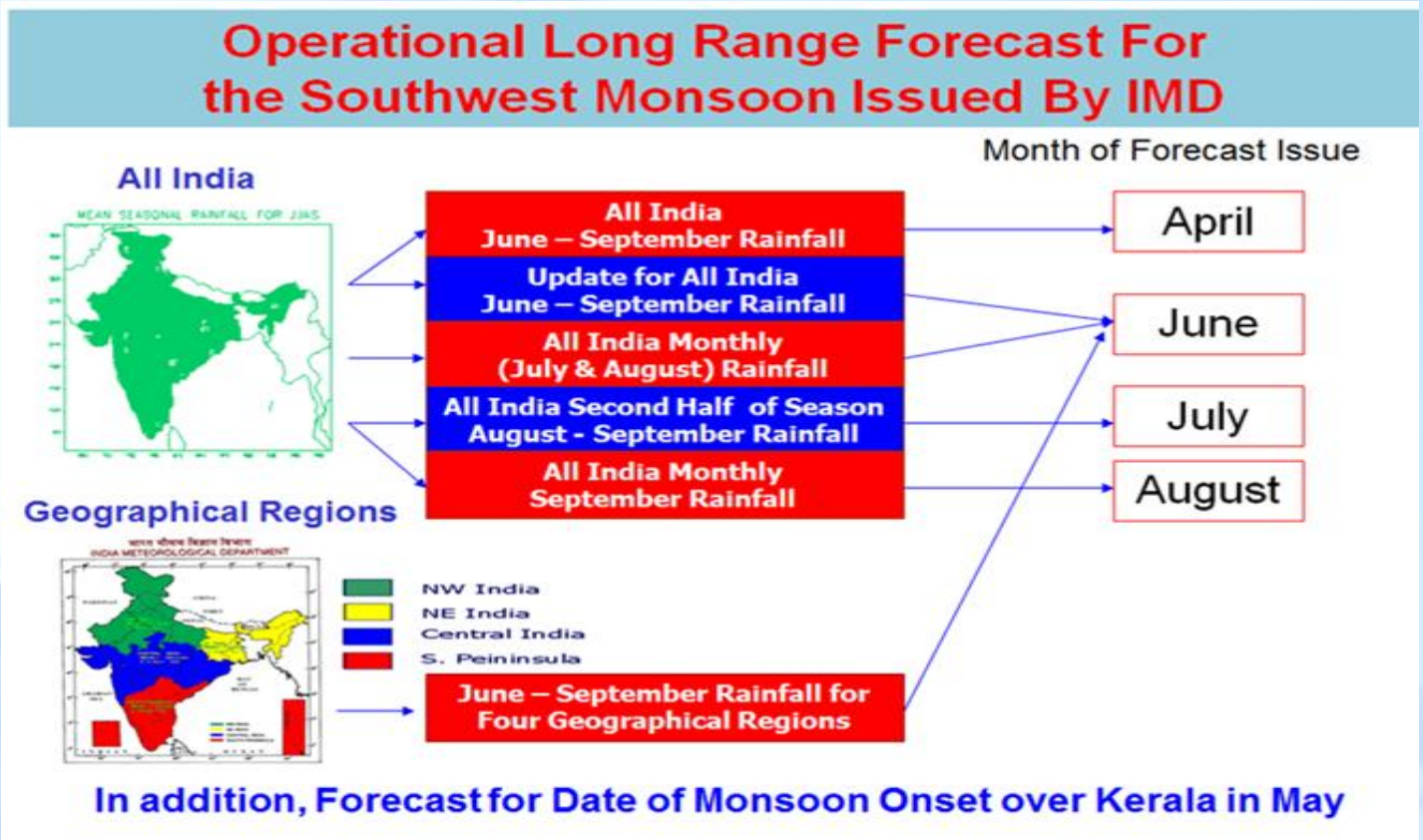
Ministry of Earth Sciences (MoES)
India Meteorological Department
Welcomes You All for the Press Release
of

LONG RANGE FORECAST
FOR
2021 SOUTHWEST MONSOON RAINFALL

16th April 2021

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

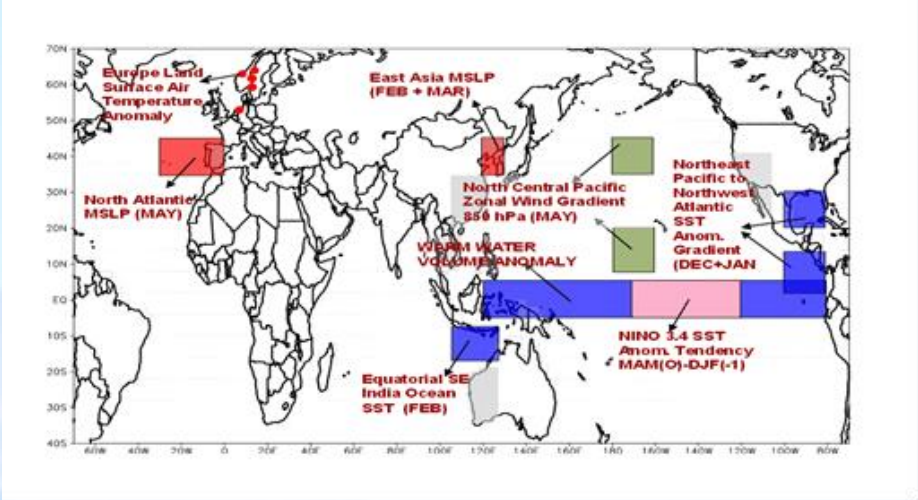
Monsoon Forecasts



Currently MMCFS model developed under Monsoon Mission is used to generate the dynamical model seasonal forecast.

Statistical Ensemble Forecasting System (SEFS) for Seasonal Rainfall over Country as a whole

S.No	Predictor Used	Issued in
1	Europe Land Surface Air Temperature Anomaly (January)	April
2	Equatorial Pacific Warm Water Volume (February + March)	April
3	SST Gradient Between Northeast Pacific and Northwest Atlantic (December +January)	April and June
4	Equatorial SE Indian Ocean SST (February)	April and June
5	East Asia Mean Sea Level Pressure (February + March)	April and June
6	Nino 3.4 Sea Surface Temp (MAM + Tendency (MAM-DJF))	June
7	North Atlantic Mean Sea Level Pressure (May)	June
8	North Central Pacific Zonal Wind Gradient 850 hPa (May)	June



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NEW FORECASTING STRATEGY

Multi-Model Ensemble Model

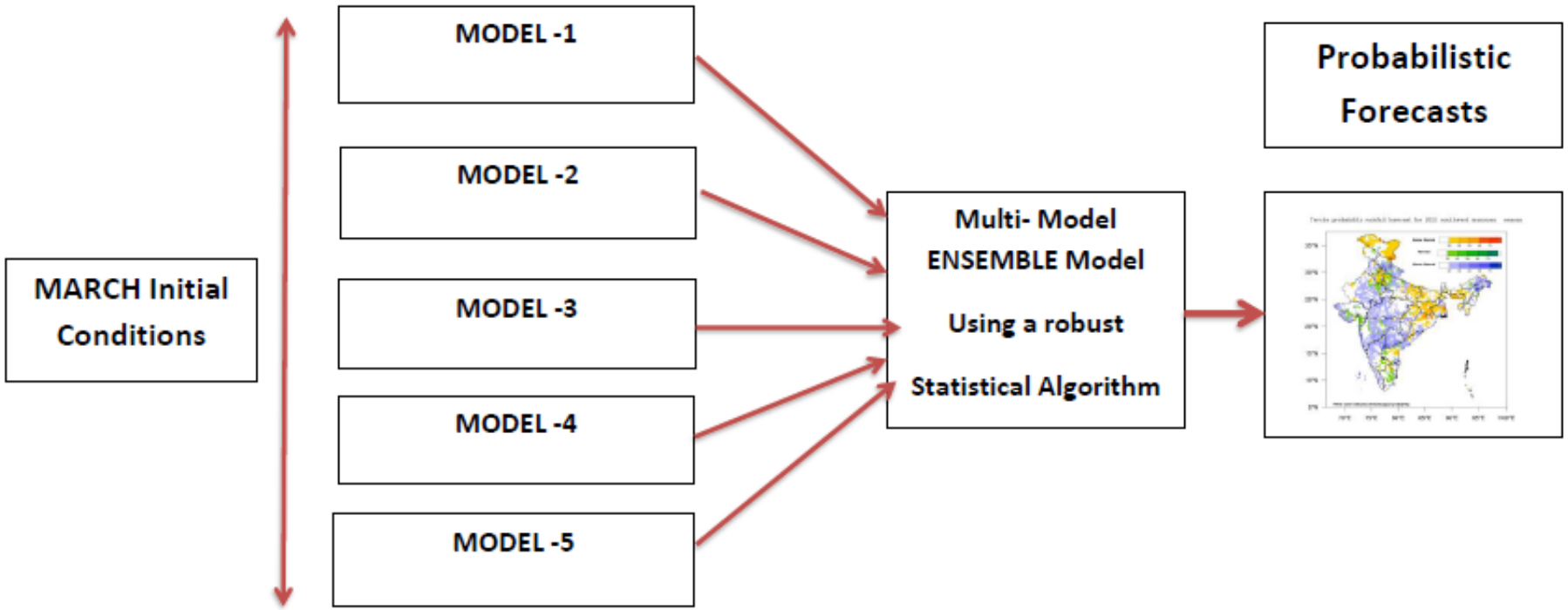
- **Demands from different users and government authorities for forecasts of spatial distribution of seasonal rainfall along with the regionally averaged rainfall forecasts for better regional level planning of activities.**

- **For this, now a Multi-Model Ensemble (MME) forecasting system based on coupled global climate models (CGCMs) from different global climate prediction and research centers including the MMCFS**

- **MME is a universally accepted technique used to improve skill of forecasts and reduce forecast errors when compared to a single model-based approach. The performance improvements are completely attributed to the collective information of all models used in the MME forecasting system.**

- **CGCMs with the highest forecast skills over the Indian monsoon region including MMCFS have been used to generate MME forecasts.**

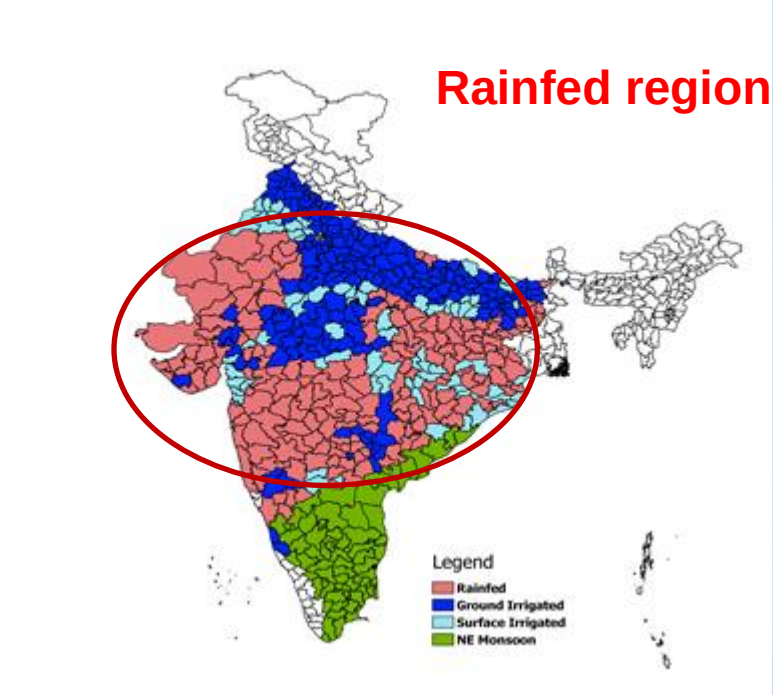
Multi-Model Ensemble (MME)



Monthly Forecasts

- **IMD has been issuing monthly forecasts for every month using an indigenously developed statistical model.**
- **From this year onwards, IMD will use a dynamical MME model framework for preparing monthly forecasts.**
- **Monthly forecasts will be prepared during the last week of previous month, and updated every month.**

Forecasts for Monsoon Core Zone



There are many common areas in both the rainfed region and monsoon core zone

From May onwards, IMD will prepare monthly Probabilistic Forecasts for the monsoon core zone with zero lead time.

New Strategy for Long Range Forecast

1st Stage Forecast April	All India averaged Season (June – September) Rainfall	Spatial pattern of probability forecast for the Season Rainfall over the country	Based on Statistical and MME
2nd Stage Forecast May	Update for the April forecast for the All India averaged Season Rainfall and spatial pattern of probabilistic forecast over the country	Forecast for Season Rainfall: for the Four Homogeneous Regions & Monsoon Convergence Zone (MCZ)	Based on Statistical and MME
Monthly Forecast	End of May, June, July & August for subsequent one month	Probabilistic Forecast for Monthly rainfall	Based on MME of Dynamical models

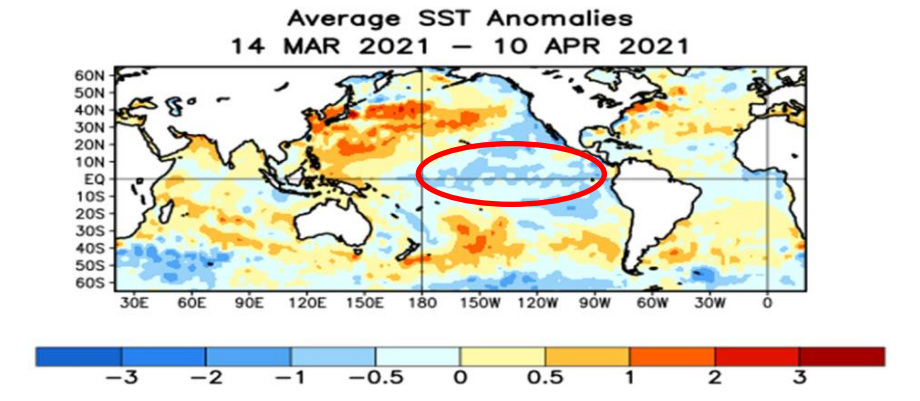
In addition, Forecast for Date of Monsoon Onset over Kerala in May

Status of Some Important Factors that Having Influence on Monsoon

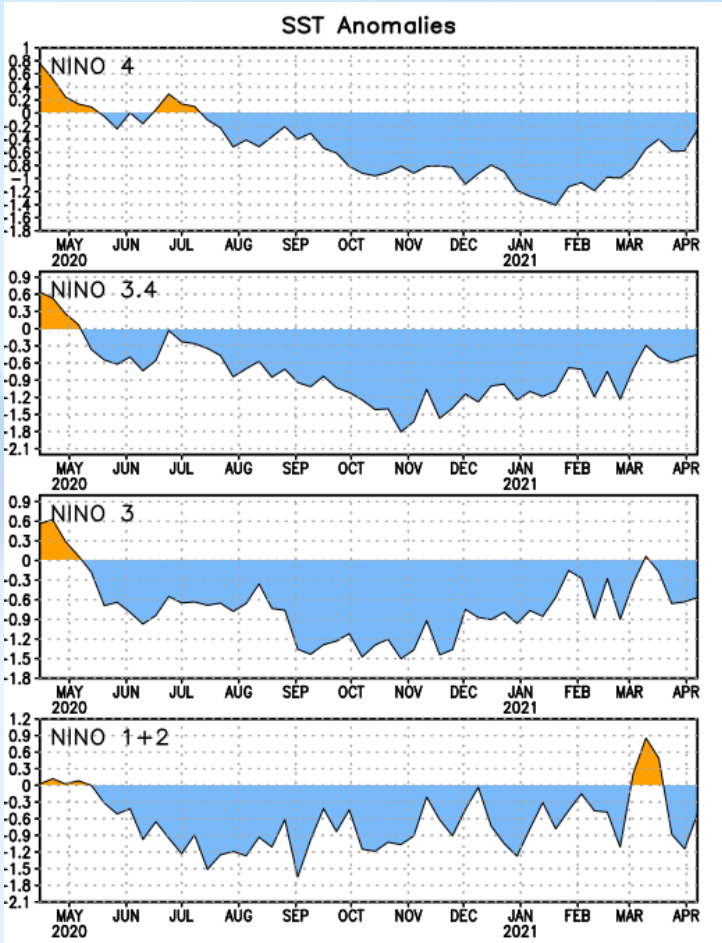
Physical Mechanisms for Monsoon Variability

- Year to Year Variability of Indian summer monsoon rainfall is influenced by many global climate phenomenon like El Nino/Southern Oscillation (ENSO) over the Pacific Ocean and Indian and Atlantic Oceans and anomalies over Eurasia.
- However, the ENSO is the most dominant forcing for year to year variability.
- An El Nino (La Nina) is generally associated with deficient (surplus) monsoon rainfall over India. However, there is no one to one relationship between El Nino and Indian monsoon.
- The Indian Ocean Dipole (IOD) event is a climate event occurring over the equatorial Indian Ocean. A positive (negative) dipole event is associated with warming (cooling) over the west Indian Ocean and Cooling (warming) over the east Indian Ocean

Latest Global SST Departures (ºC) and ENSO Conditions over the Pacific Ocean



Recent evolution of NINO SSTs

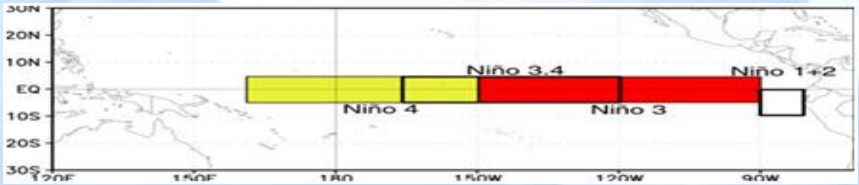


Data source
CPC, USA

The latest weekly SST departures are:

Data source
CPC, USA

Niño 4	-0.3ºC
Niño 3.4	-0.5ºC
Niño 3	-0.6ºC
Niño 1+2	- 0.5ºC



Equatorial SSTs were mostly below average from the west-central to the east-central Pacific Ocean

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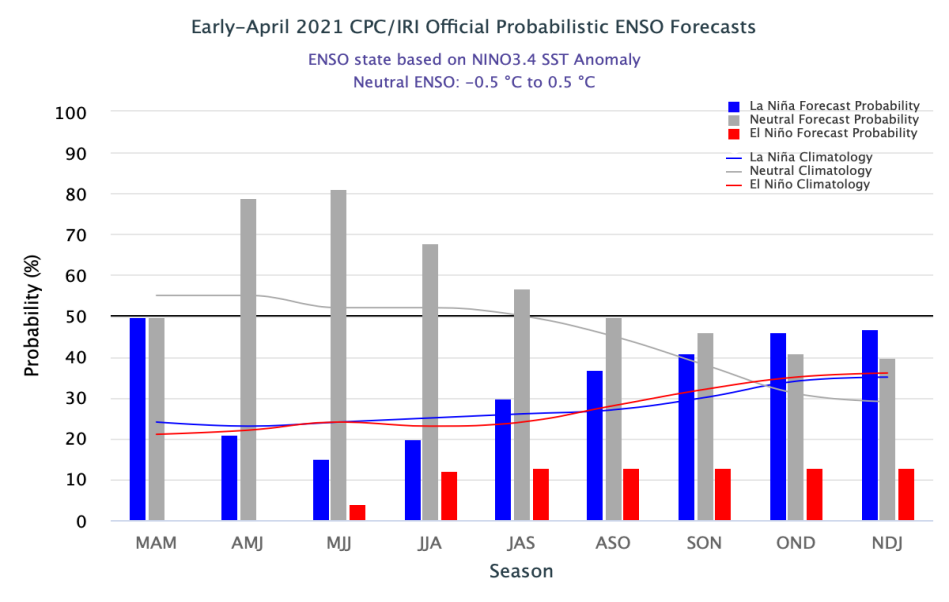
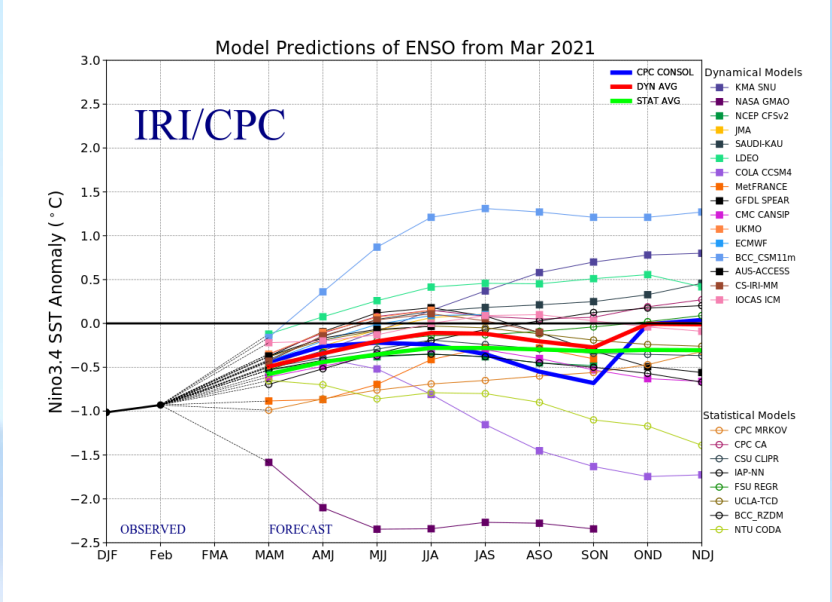
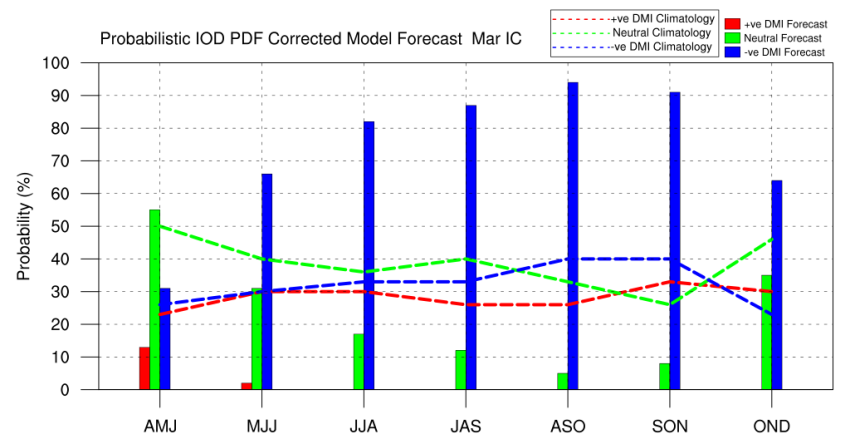
Latest ENSO Forecast : April 2021

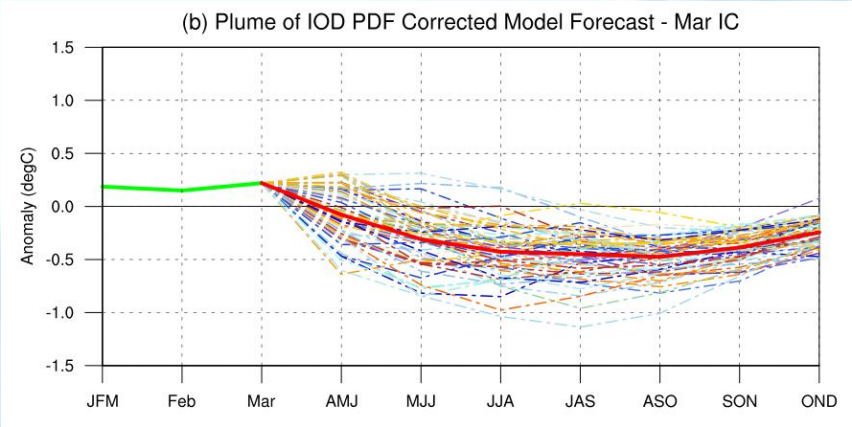


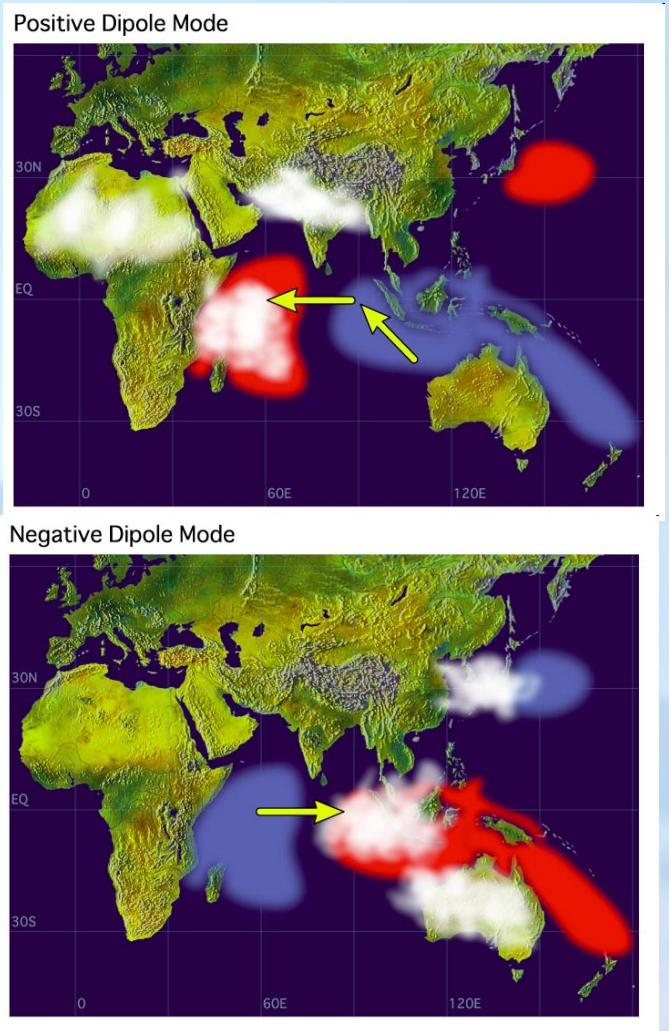


La Niña is favored through March-May 2021, with about 80% chance of a transition to ENSO-neutral in April-June 2021 and continuing through fall 2021. There is very less chance of El Nino development during the monsoon season.

Indian Ocean Dipole: MMCFS Mar IC







Neutral IOD conditions are observed over Indian Ocean and the latest MMCFS forecast indicates Negative IOD condition are likely to develop during Monsoon season.

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La Nina +1 Vs Monsoon

Year	Jun	Jul	Aug	Sep	JJAS
1955	5.1	-18.0	24.7	29.0	8.0
1956	25.7	27.5	1.3	-2.6	13.6
1957	-7.4	7.5	6.1	-22.3	-1.5
1965	-30.7	-5.2	-25.4	-23.0	-19.4
1971	37.5	-4.7	5.8	-11.5	5.1
1972	-26.6	-27.5	-13.8	-23.7	-22.5
1974	-23.4	0.3	-9.6	-15.0	-10.0
1977	11.6	13.4	-4.0	-12.6	2.9
1989	11.9	6.0	-7.6	-3.5	1.3
1999	4.0	-6.8	-14.0	10.9	-3.4
2000	11.0	-5.9	-12.5	-20.4	-7.4
2008	27.1	-10.1	3.1	-1.1	2.5
2011	10.0	-12.4	12.0	13.3	4.0
2012	-26.7	-9.6	1.5	17.2	-4.4

- **During (14) La Nina +1 years, Indian SW monsoon is distributed nearly equally on either sides of the normal with a slight tendency to be in the negative side.**
- **In recent years, La Nina +1 year is mostly normal year**

- During 1951-2020, there were 14 La Nina +1 years.
- 3 years - Deficient (<-10%) season rainfall (**2 out of 3 were El Nino years (1965& 1972)**
- 4 years -10 to 0% , 6 years 0 to 10%
- Only in one year (1956), it was above 10%.

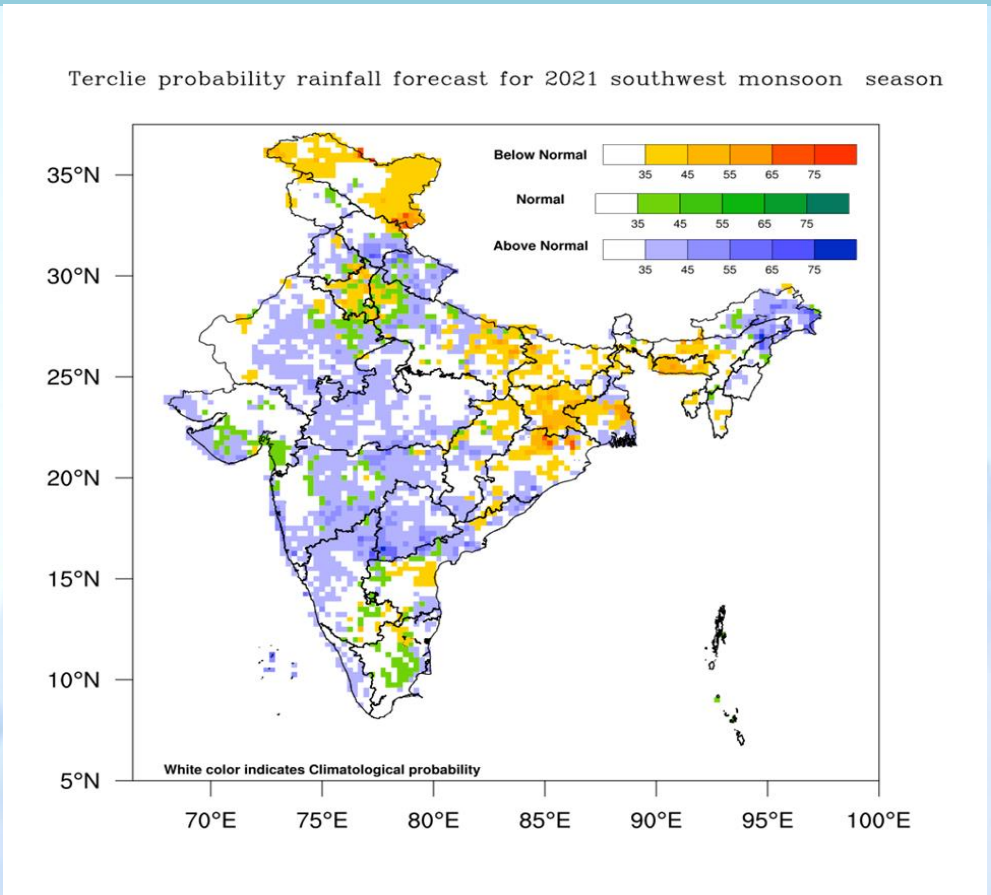
Forecast for the 2021 South-west Monsoon Rainfall

a) Southwest monsoon seasonal (June to September) rainfall over the country as a whole is most likely to be **normal (96 to 104 % of Long Period Average (LPA)).**

b) Quantitatively, the monsoon seasonal (June to September) rainfall is likely to be **98% of the Long Period Average (LPA) with a model error of ± 5%.** The LPA of the season rainfall over the country as a whole for the period **1961-2010 is 88 cm**.

c) Neutral ENSO conditions are prevailing over the Pacific Ocean and Neutral Indian Ocean Dipole (IOD) conditions are prevailing over the Indian Ocean. The latest global model forecast indicates neutral ENSO conditions are likely to continue over the equatorial Pacific and negative IOD conditions are likely to develop over the Indian Ocean during the ensuing monsoon season**.**

Probability forecast of tercile categories for the seasonal rainfall over India: 2021 SW monsoon season



The forecast suggests either normal or above normal probability is likely over most parts of the country.

The figure illustrates the most likely categories as well as their probabilities. The white shaded areas represent climatological probabilities. The probabilities were derived using the MME forecast prepared from a group of coupled climate models having good skill over the Indian monsoon region. (*Tercile categories have equal climatological probabilities, of 33.33% each).

Second Stage Forecast in May

- April Forecast update for All India using Statistical and dynamical MME model.
- Probabilistic Forecasts for homogenous regions of India using dynamical MME
- Seasonal Forecast for Monsoon Core Region - rainfed agriculture region.
- Monthly forecast for June for all India and Monsoon Core Zone.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Thank you