

# INDIA METEOROLOGICAL DEPARTMENT MINISTRY OF EARTH SCIENCES

## Long Range Forecast For 2012 South-west Monsoon Season Rainfall

### 1. Background

India Meteorological Department (IMD) issues various monthly and seasonal operational forecasts for the rainfall during the south-west monsoon season. Operational models are reviewed regularly and improved through in-house research activities. Operational forecasts for the southwest monsoon season (June – September) rainfall over the country as a whole are issued in two stages. The first long range forecast for the all India monsoon rainfall is issued in April and the forecast update is issued in June.

From 2007 onwards, IMD has been using the following statistical models for preparing quantitative and probabilistic forecasts of the south-west monsoon season rainfall for the country as a whole:

- a) A 5- parameter statistical ensemble forecasting system requiring data up to March, for the first forecast in April.
- b) A 6- parameter statistical ensemble forecasting system requiring data up to May for the forecast update in June.

The first stage forecast for the 2012 South-west monsoon rainfall for the country as a whole is presented here.

### 2. Operational Statistical Forecast System

In the IMD's Ensemble Statistical Forecasting system for the April forecast, the following 5 predictors are used. The model error of the April forecasting systems is  $\pm 5\%$ .

S.No	Predictor	Period
1	North Atlantic Sea Surface Temperature	December + January
2	Equatorial South Indian Ocean Sea Surface Temperature	February + March
3	East Asia Mean Sea Level Pressure	February + March
4	NW Europe Land Surface Air Temperature	January
5	Equatorial Pacific Warm Water Volume	February + March

The 5-parameter ensemble statistical forecasting system was also used to prepare probability forecasts for five pre-defined rainfall categories. These are deficient (less than 90% of LPA), below normal (90-96% of LPA), normal (96-104% of LPA), above normal (104-110% of LPA) and excess (above 110% of LPA). The climatological probabilities in percentage for the above categories are 16%, 17%, 33%, 16% and 17%, respectively. *The predicted probabilities based on the 5-parameter ensemble forecasting system for these 5 categories for the 2012 southwest monsoon season are 8%, 24 %, 47%, 17% and 4%, respectively.*

### **3. IMD-IITM Experimental Dynamical Model Forecasting System**

Since 2004, IMD has been generating the experimental dynamical long range forecast for the southwest monsoon rainfall using an atmospheric general circulation model. Ministry of Earth Sciences (MoES) has recently initiated the Monsoon Mission programme with an objective to improve the monsoon forecasts over the country in short range to long range time scales. Indian Institute of Tropical Meteorology (IITM), Pune is responsible for implementing the dynamical model framework for long range forecasts and coordinating research work on improving long range forecasts using dynamical models. For this purpose, IITM, Pune has recently implemented the state-of-the-art coupled climate model, the Coupled Forecasting System (CFS) developed by the National Centers for Environmental Prediction (NCEP), USA. Under the monsoon mission program, IITM, Pune along with other national and international partners including IMD are working on to improve the skill of the CFS model for more accurate long range forecasts of monsoon rainfall. IMD has now adopted the latest high resolution research version of the coupled model (CFS Version 2) being implemented at IITM.

*The experimental forecast for the 2012 monsoon season using the IMD – IITM dynamical prediction system using February initial conditions indicates that the rainfall during the 2012 monsoon season (June to September) averaged over the country as a whole is likely to be 100% of long period model average (LPMA).*

### **4. Other Forecasts by national and international institutions**

In addition, IMD has taken into account the experimental forecasts prepared by the national institutes like Space Applications Centre, Ahmedabad, Centre for Mathematical Modeling and Computer Simulation, Bangalore, Center for Development of Advanced Computing, Pune and Indian Institute of Tropical Meteorology, Pune. Operational/experimental forecasts prepared by international institutes like the National Centers for Environmental Prediction, USA, International Research Institute for Climate and Society, USA, Meteorological Office, UK, Meteo France, the European Center for Medium Range Weather Forecasts, UK, Japan Meteorological Agency, Japan Agency for Marine-Earth Science and Technology, Asian-Pacific Economic Cooperation (APEC) Climate Centre, Korea and World Meteorological Organization's Lead Centre for Long Range Forecasting - Multi-Model Ensemble have also been taken into account.

## **5. Sea Surface Temperature Conditions in the equatorial Pacific & Indian Oceans**

After the disappearance of moderate to strong La Nina conditions in May 2011, weak La Nina conditions reemerged in early August, 2011 and became weak to moderate during the later part of 2011. The weak/moderate La Nina conditions continued till the first half of February 2012. It started weakening subsequently and at present the event is in transition towards the ENSO neutral conditions. The latest forecasts from a majority of the dynamical and statistical models indicate moderate probability (about 53%) for the ENSO neutral conditions to prevail during the monsoon season. There is also noticeable probability (about 39%) for emergence of weak El Nino conditions during the later part of the monsoon season. However, the probability of reemergence of La Nina conditions during the monsoon season is very less.

It is important to note that in addition to ENSO events, many other factors such as the Indian Ocean Sea surface temperatures (SSTs) also influence monsoon performance. Recent forecasts from a few coupled models suggest the possibility of development of a weak negative Indian Ocean Dipole event during the second half of the year

## **6. Forecast for the 2012 South-west monsoon rainfall**

**IMD's long range forecasts for the 2012 south-west monsoon season (June to September) are as follows:**

**(a) Southwest monsoon seasonal rainfall for the country as a whole is most likely to be Normal (96-104% of Long Period Average (LPA)) with the probability of 47%. The probability (24%) of season rainfall to be below normal (90-96% of LPA) is also higher than its climatological value. However, the probability of season rainfall to be deficient (below 90% of LPA) or excess (above 110% of LPA) is relatively low (less than 10%).**

**(b) Quantitatively, monsoon season rainfall is likely to be 99% of the LPA with a model error of  $\pm 5\%$ . The LPA of the season rainfall over the country as a whole for the period 1951-2000 is 89 cm.**

IMD will issue update forecast in June 2012 as a part of the second stage forecast. Along with the update forecast, separate forecasts for the monthly (July and August) rainfall over the country as a whole and seasonal (June-September) rainfall over the four geographical regions of India will also be issued. Forecast for the rainfall over the country as a whole during the second half of the season (August + September) will be issued in July and that for September will be issued in August.

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