

GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES  
RAJYA SABHA  
UNSTARRED QUESTION NO. - 184  
ANSWERED ON – 03/02/2022

**DEVIATION IN WEATHER FORECASTING**

184. SHRI K.R.N. RAJESHKUMAR:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether it is a fact that the weather forecast and its predictions have gone wrong sometimes during the last five years;
- (b) if so, the instances along with details;
- (c) whether the regional meteorological centers have observed these deviations; and
- (d) if so, the kind of advanced instruments that are planned to be used and research studies to be conducted to improve its accuracy?

**ANSWER**

THE MINISTER OF STATE (INDEPENDENT CHARGE) FOR  
MINISTRY OF SCIENCE AND TECHNOLOGY  
AND EARTH SCIENCES  
(DR. JITENDRA SINGH)

- (a) No Sir. During the past few years, IMD has been continuously improving weather prediction services in terms of accuracy, lead time and associated impact. The accuracy of the weather forecast is more than 80% qualitatively and 65-70% quantitatively for various regions in the country. The forecasts and warnings are issued by IMD at the national, State and district levels. It has a network of State Meteorological Centres for better coordination with State and district level agencies. With the upgradation of observations and prediction system, noticeable improvements have been made in the recent past in the skill of prediction, especially with respect to heavy-rainfall, heat-wave, thunderstorm and cyclones. The weather forecast accuracy is verified by IMD and errors and skill scores are calculated seasonwise and annually.

Details of improvement in Weather Forecast Accuracy are follows:

- Probability of Detection (POD) for heavy rainfall warning with 24 hr lead period is 74% in 2021, which has improved by 51% in year 2021 as compared to their skill between 2002-20. False Alarm Rate (FAR) and Missing Rate (MR) are 26% in 2021, which has improved by 21% & 53% respectively in year 2021 as compared to their skill between 2002-20. **(Fig.-1 in Annexure-I)**.
- Probability of Detection (POD) for heat wave warning with 24 hr lead period is 97% in 2021, which has improved by 15% as compared to their skill between 2014-20. False Alarm Rate (FAR) and Missing Rate (MR) are 2% & 3% respectively in 2021, which has improved by 63% & 82% respectively as compared to their skill between 2014-20. **(Fig.-2 in Annexure-I)**

- The annual average landfall point forecast errors of tropical cyclones in 2021 have been 16.4 km, 10.6 km and 19.8 km respectively for 24, 36 and 48 hrs against the past five year (2016-2020) average error of 31.9 km, 43.7 km and 61.5 km based on data of 2016-2020. Considering the diameter of the central region (eye) as 10-15 km, there was almost zero error in landfall point forecasts of cyclone in 2021 upto 48 hours in advance.
- The annual average track forecast errors of tropical cyclones in 2021 have been 63 km, 91 km and 164 km respectively for 24, 48 and 72hrs lead period against the past five year (2016-2020) average error of 77, 117 and 159 km based on data of 2016-2020. **(Fig.-3 in Annexure-I).**
- The track forecast skills compared to climatology and persistence forecast have been 75%, 82% and 68% respectively for the 24, 48 and 72 hrs lead against the long period average (2016-2020) skill of 64%, 76% & 78% respectively. **(Fig.-3).**
- The annual average absolute error(AE) in intensity (wind) forecast has been 6.2 knots, 9.5 knots and 10.8 knots (108 nautical miles per hour) respectively for 24, 48 and 72 hrs lead period of forecast against the past five year(2016-2020) average error of 7.9, 11.4 and 14.1 knots. The skill in intensity forecast as compared to persistence forecast was 63.2%, 78.4% and 85.6% against the long period average (2016-20) skill of 52.2, 72.1 and 75.1 for 24, 48 and 72 hours lead period. **(Fig.-3).**
- Probability of Detection (POD) for thunderstorm warning with 24 hr lead period is 86% in 2021 against 31% in 2016. **(Fig.-4 in Annexure-I).**
- Probability of Detection (POD) for thunderstorm warning with 3 hourly nowcast during March to June 2021 has been 79%.

IMD follows a seamless forecasting strategy. The long-range forecasts (for the whole season) issued are being followed with extended range forecast issued on every Thursday with a validity period of four weeks. To follow up the extended range forecast, IMD issues short to medium range forecast and warnings at 36 meteorological sub-divisions levels daily four times by the National Weather Forecasting Centre (NWFC), New Delhi valid up to next five days with an outlook for subsequent two days. The short to medium range forecast and warning at district and station level are issued by state level Meteorological Centres (MCs)/Regional Meteorological Centres (RMCs) with a validity of next five days and are updated twice a day. The short to medium range forecast is followed by very short range forecast of severe weather up to three hours (nowcast) for all the districts and 1085 cities and towns. These nowcasts are updated every three hours. The forecast finalisation is carried out by daily video conference between NWFC, RMCs & MCs. Hence, the verifications of forecast and its presentation are also carried out in collaboration with RMCs/MCs.

(b)-(c) Does not arise.

- (d) For modernization, expansion and improvement in Weather & Climate services, various plans are underway in India Meteorological Department (IMD) under the umbrella Central Sector Scheme ACROSS. There are 4 sub-schemes of IMD under ACROSS namely, Atmospheric Observation Network (AON), Upgradation of Forecast System (UFS), Weather & Climate Services (WCS) and Commissioning of Polarimetric Doppler Weather Radars (PDWR).

Advanced instruments to be deployed are given in Annexure-II.

Other future plans under the scheme are:

- Upgradation of the existing Visualisation Platform & Decision Support System, which would enable the weather forecasters in India Meteorological Department to analyse a huge volume of data and various other products and inputs more efficiently and within the given time frame.
- The proposed system is planned to incorporate all the latest technological developments available in the field of Information Technology as well as 3-dimensional visualization capability.
- A forecast dissemination tool which will enable the inclusion of more user friendly textual & graphical products as well as videos are also envisaged to be procured under this programme.

**ANNEXURE-I**

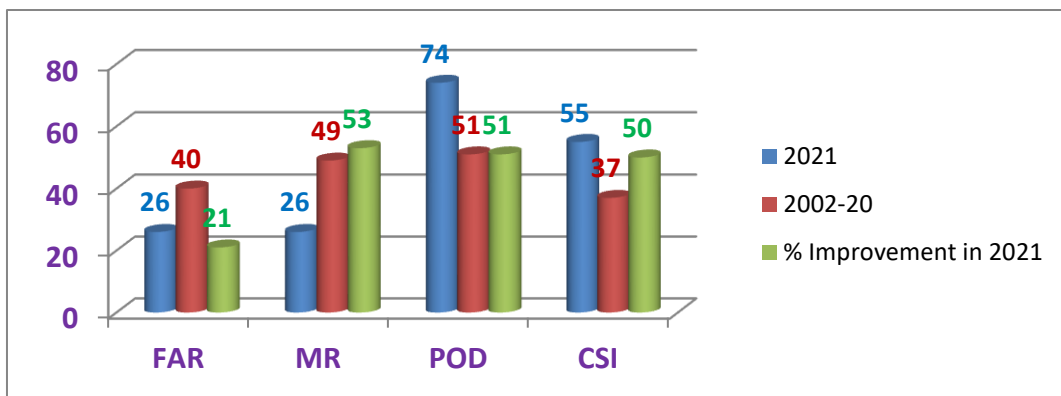
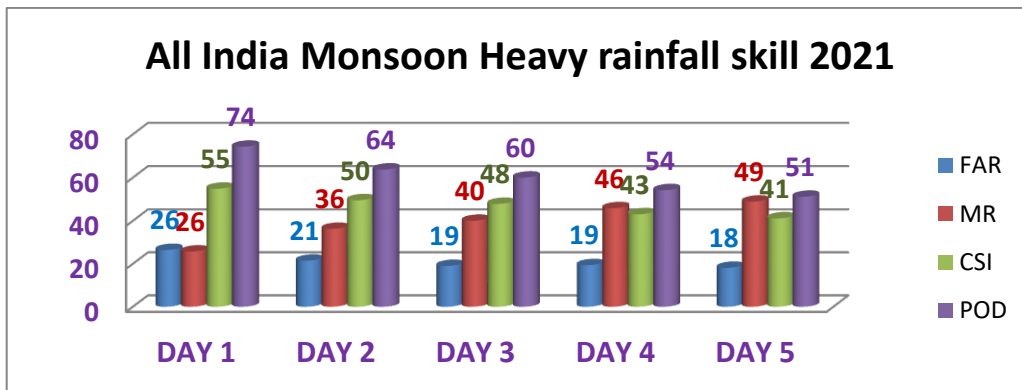


Fig 1: Heavy rainfall warning skill during 2021(FAR (False Alarm Rate), MR(Missing Rate), PoD (Probability of Detection) and CSI (Critical Success Index).IMD has high skill for heavy rainfall warning upto Day 5 as POD for Day 5 is more than 50%.

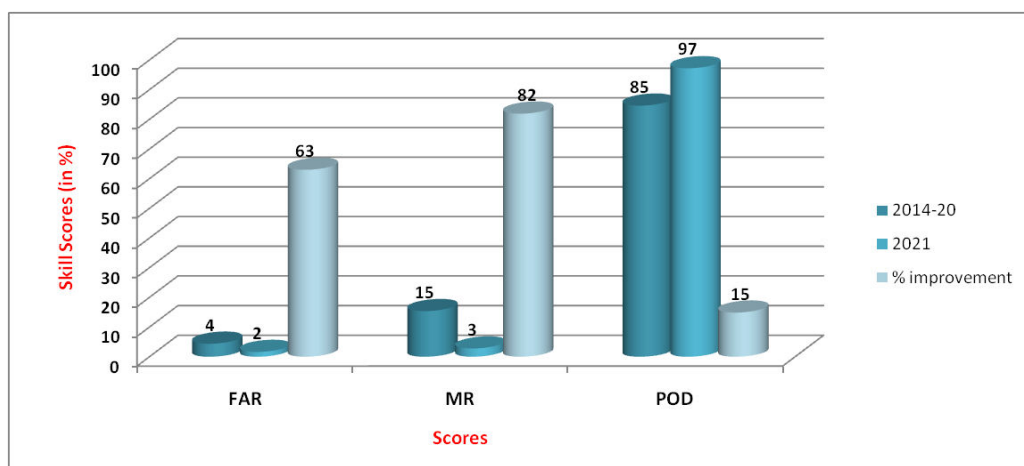


Fig 2: All India Summer months (April to June) 2021vs 2014-20 heat wave skill scores

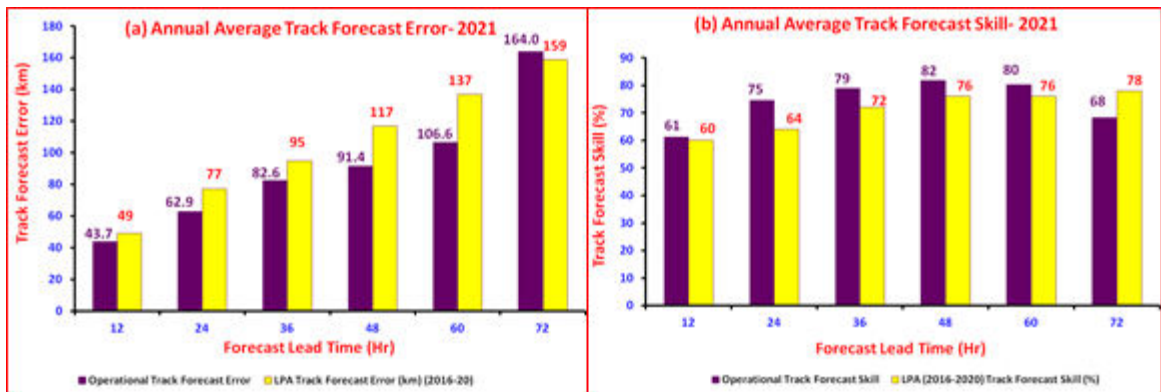


Fig 3: Annual average (a) track forecast errors (km) and (b) track forecast skill (%) during 2021 compared to long period average errors during 2016-20.

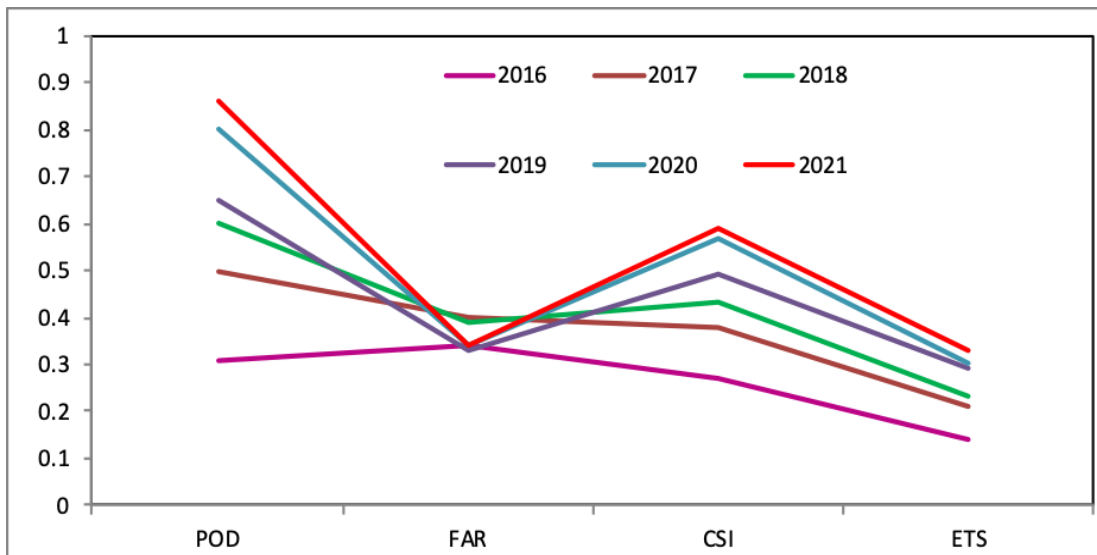


Fig.4. Skill Scores for 24 hr Thunderstorm forecast by IMD during past 6 years (2016 to 2021)

## ANNEXURE-II

Advanced instruments that are planned to be used to improve the accuracy follow:

<b>Component</b>	<b>Activity</b>
Integrated Meteorological Services (IHMP) for North-East (NE) region	Commissioning of met. instruments HAWOS/ AWOS, AWS/ARG/SG
Sustenance and augmentation of observational networks	Commissioning of 400 AWS
	Commissioning of 330 Agro-AWS
	AWS for PTOs
Urban Meteorological Services	Commissioning of 200AWS/ARG for development of Urban Meteorology
IHMP	Commissioning of AWS, ARG, HAWOS, surface observatories etc
AWS for Schools	Commissioning of AWS, computers and related infrastructure in various schools across India
Tourism AWS	Commissioning of AWS at Tourism sites and provision of Display

HAWOS	Heliport Automated Weather Observation Systems
ARGs	Automatic Rain Gauges
AWSs	Automatic Weather Stations
PTO	Part Time Observatory
AWOS	Aviation Weather Observing Systems
SG	Snow Gauges

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