GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 999
ANSWERED ON 13/02/2025

INACCURATE WEATHER FORECASTS BY IMD

999. SHRI A. A. RAHIM:

Will the Minister of EARTH SCIENCES be pleased to state:

(a) the number of instances of inaccurate weather forecasts by the IMD reported in the last five years;
(b) whether Government has taken note of the IMD's failure to issue a red alert in Wayanad on July 30, and if so, the details thereof;
(c) if not, whether Government is willing to conduct an investigation into the inaccurate weather report provided by the IMD; and
(d) the specific steps taken to prevent such inaccuracies in weather forecasting in the future?

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

(a) The India Meteorological Department (IMD) regularly verifies its forecasts. There is an improvement in the skill score of 24-hour forecasts (1 day in advance) of heavy rainfall occurrences from 48% in 2013 to 77% in 2020 and then to 85% in 2024.The percentage (%) of heavy rainfall events not captured in real-time was around 15% of its total days in 2024 (23% in 2020), which could not be predicted but realized, or if predicted in some days, it was not realized (for all 1 days in advance). Overall, it shows the accuracy of the 1-day forecast has improved by 8% during the last 5 years. Further, the Day-5 skill in 2024 (58%) is better than the Day-1 skill in 2016 (52%) and all proceeding years. Hence, there is also an improvement in the lead period of forecast by 4 days.

Compared to others, IMD's forecasting skill for severe weather events is currently among the few top in the world. In fact, due to improvement and augmentation of observational networks, up-gradation of the high-performance computing (HPC) systems, and improvement of dynamical numerical weather prediction (short range up to 3 days to medium range up to 10 days) and climate models (extended range up to 4 weeks to one seasonal), there has been significant advances in operational weather and climate forecasting skills. There has also been a significant increase in skill of accuracy with a higher lead period against natural hazards like cyclones, heavy rainfall events, thunderstorms, and heatwaves, which have helped disaster managers and the general public to minimize loss of lives and property. Overall, there has been about 40% improvement in forecast accuracy of severe weather events, including heavy rainfall, tropical cyclones, thunderstorms, heatwaves, cold waves, etc., in 2023-2024 compared to 2014.

For any forecasting system, uncertainty arises due to the intensity and scale of the system. Severe localized events, like localized heavy rainfall events, cloudbursts, and severe thunderstorms, have a worldwide issue in forecasting the timing and location of occurrences and their severity at 1-2 days lead time. This is mainly attributed to the event's smaller spatial and temporal pattern, the short duration and sudden development of such events, and the complexity of associated atmospheric processes that prevail in tropical regions like India.

Currently, attempts are made using high-resolution numerical weather prediction (NWP) models and with an increased observational network including radar network and by assimilating more of these data and by improving parametrization of physical process to capture such events at nowcasting to short-range forecasting scale from 3-6 hours to 1-3 days scale.

(b)-(c) IMD issued timely warnings and alerts based on the prevailing weather conditions and model forecasts. IMD had been consistently predicting heavy rainfall over Kerala well in advance through its extended-range forecast, daily weather bulletins, and heavy rainfall warnings.

For the period of 25thJuly to 1stAugust 2024, IMD's extended range forecast and subsequent updates indicated above-normal rainfall over Kerala, including heavy rainfall on all days. The daily weather bulletin for 29th to 30thJuly 2024 predicted widespread rainfall, and IMD continuously issued heavy to very heavy rainfall warnings for five consecutive days before the event.

On the 29th July midday bulletin, an orange alert was issued for Wayanad, predicting heavy (7-11 cm) to very heavy (12-20 cm) rainfall within 24 hours. Additionally, IMD issued district-specific impact-based forecasts (IBF) for Wayanad in RED colour, highlighting the risk of landslides due to continuous rainfall. A special bulletin on 29th July also warned of flash flood risks in North Kerala.

IMD followed established protocols and provided timely advisories to all relevant authorities, including the Kerala State Disaster Management Authority, district administration, and emergency response teams. Bulletins were also disseminated to various stakeholders and the media to ensure widespread communication of warnings. Thus, IMD issued timely and appropriate alerts based on forecast data, and there was no lapse in warning dissemination for Wayanad.

(d) The India Meteorological Department continuously enhances and upgrades meteorological observations, communications, modeling tools, and forecasting systems.The IMD uses the latest tools and technologies to predict severe weather events.This includes sophisticated dynamical numerical weather prediction models at higher spatial and temporal resolution, multi-model ensemble methods, artificial intelligence, and machine learning (AI/ML) & data science methodologies, complemented with improved ground-based & upper air observations and advanced remote sensing network for real-time monitoring and predictions. IMD uses the latest dissemination tools, including Common Alert Protocol (CAP), mobile apps, websites, APIs, and other social media platforms, to provide efficient, effective, and timely early warning services. IMD is constantly working to improve and adapt to the latest technologies.

The Ministry is coordinating the initiative to enhance weather monitoring and forecasting capabilities across the country through its operational and R&D institutions, such as the India Meteorological Department (IMD), the Indian Institute of Tropical Meteorology (IITM), and the National Centre for Medium Range Weather Forecasting (NCMRWF). The Mission Mausam was launched recently and is expected to provide accurate forecasts across various timescales, from short-term weather predictions (hours to days) to medium-term forecasts (weeks) and long-term (seasonal) predictions. This will be achieved by deploying next-generation observational systems, high-performance computing infrastructure, and advanced Earth system models. The integration of artificial intelligence (AI) and machine learning (ML) technologies will further improve the precision of predictions by enhancing model accuracy.

The Mission Mausam is launched to make Bharat a "weather-ready and climate-smart" nation, with the following objectives:

- Strengthening observations (in-situ & remote sensing)
- Gaining a better understanding and use of Science, Innovation and Technology, and Data Science for societal benefit
- Improve our Model/Data Assimilation/HPC for giving accurate information to the Public and stakeholders (Numerical+Artificial Intelligence and Machine Learning)
- Trained Manpower in Earth System Science
- Forecast dissemination: Effective communication with Society: Early Warning for ALL

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