

**GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO. 4001
TO BE ANSWERED ON WEDNESDAY, 12TH AUGUST, 2026**

AI-BASED EARLY WARNING SYSTEM

4001. SHRI KUNDURU RAGHUVeer:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether the Government is leveraging Artificial Intelligence (AI), Machine Learning and Big Data to improve forecasting of heatwaves, thunderstorms, lightning, cyclones, floods, cloudbursts and other extreme weather events;
- (b) if so, the details of AI-based technologies, projects and decision-support systems implemented during the last five years;
- (c) whether the Government has assessed the impact of AI-enabled forecasting on forecast accuracy and reduction in loss of lives, property and livelihoods and if so, the details thereof;
- (d) whether there is any proposal to establish an integrated National AI-based Early Warning Platform by linking satellite observations, Doppler Weather Radars, weather stations, ocean and river data and climate models for real-time prediction and disaster preparedness and if so, the details thereof; and
- (e) the measures taken to provide AI-generated weather alerts in regional languages through mobile applications, SMS, television and radio particularly for farmers, fishermen, coastal communities, hilly regions and other vulnerable populations?

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

- (a) Yes Sir. The Government is actively leveraging Artificial Intelligence (AI), Machine Learning (ML) and Big Data technologies to improve the accuracy and timeliness of weather forecasting and early warning services for extreme weather events across the country. The National Centre for Medium Range Weather Forecasting (NCMRWF), under the Ministry of Earth Sciences (MoES), is integrating AI/ML-based forecast guidance with operational data assimilation, coupled Earth System modelling, ensemble prediction systems, High Performance Computing (HPC), and conventional Numerical Weather Prediction (NWP) models. The forecast guidance generated through these AI/ML systems is being utilized by the India Meteorological Department (IMD) to enhance forecasting skills for various weather extremes across different spatial and temporal scales. AI/ML-derived data products have also been integrated into the indigenously developed GIS-based Multi-Hazard Early Warning Decision Support System.

The major AI-based initiatives include:

- Establishment of a dedicated functional group in IMD to strengthen research and development in AI/ML applications for weather, climate and extreme weather forecasting.
- Development of a deep learning model (meteoGAN) for the Delhi-NCR region, successfully tested for rainfall downscaling at 300-metre spatial resolution using ground-based observations and Climate Hazards Group InfraRed Precipitation with Station Data (CHIRPS).
- Development of an AI-based medium-range weather forecasting model for generating daily forecasts up to seven days using ECMWF Reanalysis Version 5 (ERA5) data.
- Collaborative research through MoUs with premier academic institutions and R&D organizations, including IIT Kharagpur, IIIT Allahabad, IIIT Vadodara, Ashoka University, Google Asia Pacific Ltd. and Bharat Electronics Limited (BEL), for advancing AI/ML applications in weather and climate services.
- Capacity building through specialized AI/ML training programmes, workshops and nomination of scientists for advanced training.
- Conduct of annual refresher courses on the Fundamentals of Artificial Intelligence and Machine Learning for IMD officials since 2024.
- Establishment of a Virtual Centre at the Indian Institute of Tropical Meteorology (IITM), Pune, for developing AI/ML and Deep Learning (DL)-based applications for weather and climate services.

- (b) Under Mission Mausam, AI/ML and data-driven methodologies constitute one of the major pillars for next-generation weather forecasting. AI is being used to complement conventional Numerical Weather Prediction by accelerating forecast generation, improving forecast accuracy, reducing systematic biases, generating probabilistic guidance for extreme events, producing high-resolution downscaled forecasts and strengthening early warning services

Major AI-based developments include:

- A Convolutional Neural Network (CNN)-based model for bias correction of rainfall forecasts generated by the Bharat Forecast System (BFS).
- Application of AI/ML techniques for improving lightning forecasting.
- Development of the “MausamVani” application using Generative AI and Large Language Models (LLMs) to provide weather-based decision support in regional languages.
- Development of an AI/ML-dynamical hybrid blended model for dissemination of localized agronomic monsoon onset advisories to farmers.
- Generation of experimental machine-learning weather forecasts at NCMRWF using pretrained AI-based weather prediction models initialized from the operational Mithuna-GLB analysis. These forecasts are being shared with IMD for evaluation and comparison with forecasts from the operational Mithuna Global Numerical Weather Prediction System.

- (c) Forecast accuracy for short- to medium-range weather prediction has shown improvement through the implementation of the CNN-based bias correction model. However, as most AI/ML forecasting systems are presently in the experimental and evaluation stage, no separate quantitative assessment has yet been carried out regarding their independent contribution to reducing the loss of lives, property and livelihoods.
- (d) Under Mission Mausam, the Indian Institute of Tropical Meteorology (IITM), Pune, has established a dedicated AI/ML Centre to develop the technology stack required for assimilating real-time observations and forecasts for improved weather prediction, disaster preparedness and dissemination of weather information in regional languages. Further, IMD is working towards establishing an integrated National AI-based Early Warning Platform by integrating satellite observations, Doppler Weather Radar observations, in-situ weather observations, Automatic Weather Stations, oceanic and river observations, physics-based weather and climate models, and AI-based forecasting systems. The platform aims to generate Impact-Based Forecasts and Risk-Based Warnings with improved accuracy and enhanced lead time to support disaster preparedness and risk reduction.
- (e) An AI/ML hybrid blended model has been developed for dissemination of localized agronomic monsoon onset advisories during the 2026 southwest monsoon season. Using this system, SMS advisories were disseminated to approximately 5.28 crore farmers across 15 States and one Union Territory. The MausamVani application is being developed as a Retrieval-Augmented Generation (RAG)-based platform to automatically convert real-time weather forecasts into localized weather advisories in regional languages. IMD disseminates weather forecasts and warnings through multiple communication channels, including mobile applications, SMS, television, radio, websites and social media platforms. AI-enabled multilingual tools, including Bhashini, are being leveraged to enhance dissemination in regional languages. Weather forecasts and Impact-Based Warnings are also disseminated through coordinated mechanisms involving Central and State Government agencies, disaster management authorities and media organizations to reach farmers, fishermen, coastal communities, residents of hilly regions and other vulnerable populations. Further, Large Language Model (LLM)-based applications such as “MausamGPT” are under development to generate concise, user-friendly multilingual summaries of weather forecasts, impact-based warnings and climate outlooks, thereby strengthening last-mile dissemination of weather information.
