GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 1318
ANSWERED ON 30/07/2026

STRENGTHENING CLIMATE MONITORING AND WEATHER FORECASTING SYSTEMS

1318. DR. DHARMASTHALA VEERENDRA HEGGADE:

Will the Minister of **EARTH SCIENCES** be pleased to state:

(a) the details of measures taken to strengthen and modernise climate monitoring and weather forecasting systems in response to the increasing frequency and intensity of extreme weather events;
(b) whether Government has adopted advanced, State-of-the-art techniques, including high resolution weather prediction models, observational systems and AI-enabled forecasting tools, to improve the accuracy of monitoring and prediction of climate change and associated extreme weather events and if so, the details thereof; and
(c) whether Government, in coordination with ISRO, has strengthened satellite-based observation capabilities for improved monitoring of extreme weather events and climate parameters and if so, the details thereof?

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

(a)-(b) The Government has undertaken several measures to strengthen and modernise climate monitoring and weather forecasting systems in response to the increasing frequency and intensity of extreme weather events. The Government has adopted advanced, state-of-the-art techniques, including high-performance computing (HPC) facilities to support high-resolution numerical weather prediction (NWP) and climate modeling, observational systems, and artificial intelligence-enabled forecasting tools, to improve the accuracy of monitoring and predicting climate change and associated extreme weather events. Currently, the Ministry of Earth Sciences (MoES) has a weather observation network comprising manual observatories, Automatic Weather Stations (AWSs), Automated Rain Gauges (ARGs), Agro-AWS, Doppler Weather Radars (DWRs), upper-air observatories, and satellites to monitor climate change and extreme weather events across the country.

Under Mission Mausam, various global and regional NWP modeling systems have been implemented and operationalize to generate seamless short-range, medium-range, and extended-range forecasts. There are two different frameworks for global modeling systems: the Global Forecast System (GFS) of the IMD and the Mithuna-FS modeling systems of the National Centre for Medium Range Weather Forecasting (NCMRWF), Noida. Both models run in real-time with a horizontal resolution of 12 km. The Bharat

Forecasting System (BharatFS), with a spatial resolution of 6 km, generates forecasts at the cluster of Panchayat level, enabling the capture of localized weather features and improving the accuracy of weather forecasts. India Meteorological Department (IMD), in collaboration with the Ministry of Panchayati Raj (MoPR), has launched Panchayat-level weather forecasts covering nearly all Gram Panchayats in India. These forecasts are accessible through digital platforms such as e-Gramswaraj (https://egramswaraj.gov.in), Meri Panchayat app, e-Manchitra of MoPR, and Mausamgram of IMD, MoES (https://mausamgram.imd.gov.in). Furthermore, AI/ML is used for detecting and attributing climate change, downscaling climate projections, and identifying climate fingerprints.

Also, there are further plans for developing advanced Earth system models and data-driven methods, including the use of AI/ML. Currently, three AI-based global models (e.g., Pangu Weather, FourCastNet, GraphCast) are regularly operational to provide guidance to the forecaster to predict severe weather. Artificial Intelligence (AI) and Machine Learning (ML) applications and tools have been developed indigenously by weather scientists of the MoES-institutions for various aspects of monitoring and observational processing, such as the Nowcasting tool and downscaled urban forecasting.

(c) Yes. The Ministry, in coordination with the Indian Space Research Organisation (ISRO), has strengthened satellite-based observation capabilities for improved monitoring of extreme weather events and climate parameters. In this context, satellites such as INSAT-3DR, INSAT-3DS, and Oceansat-3 are being utilised for cyclogenesis prediction, cyclone detection, monitoring of storm evolution, track forecasting, and landfall assessment. The satellite-derived observations are integrated with ground-based observations and advanced numerical weather prediction models to enhance the accuracy and timeliness of forecasts. Further, the Government is using satellite-based remote sensing systems to monitor the melting and changes in the Himalayan glaciers. The Indian Space Research Organisation employs advanced remote sensing and Geographic Information System (GIS) technologies to systematically monitor glacier extent, mass, movement, and dynamics in the Himalayan region.

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