GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
**RAJYA SABHA**
**STARRED QUESTION NO. *309**
ANSWERED ON 21/08/2025

## NEW INITIATIVES TO STRENGTHEN INDIA'S CLIMATE PREPAREDNESS

***309. SHRI ASHOKRAO SHANKARRAO CHAVAN:**

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

(a) whether Government has recently launched any new initiatives to strengthen India's climate preparedness and if so, the details thereof;
(b) the manner in which these initiatives are expected to improve India's capability in climate forecasting, disaster management and early warning systems;
(c) whether Government proposes to collaborate with any international agency/agencies and private sector to upgrade its climate preparedness and if so, the details thereof; and
(d) whether Government is also planning to explore underwater wealth as a potential driver of future economic growth, if so, the details thereof and steps taken in this regard?

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

(a)-(d) A statement is laid on the table of the House.

**STATEMENT REFERRED TO IN REPLY TO PARTS (A) TO (D) OF RAJYA SABHA STARRED QUESTION NO. *309 REGARDING 'NEW INITIATIVES TO STRENGTHEN INDIA'S CLIMATE PREPAREDNESS' FOR ANSWER ON 21ST AUGUST 2025**

(a) Yes. The Government of India recently launched Mission Mausam under the Ministry of Earth Sciences (MoES) to strengthen the country's climate preparedness. The Mission Mausam is launched with a goal of making a "weather-ready and climate-smart" initiative to mitigate the impact of climate change and extreme weather events and strengthen the resilience of communities. In addition, initiatives have also been undertaken focused on enhancing early warning systems and improving the weather and climate forecasts.

Climate services are one of the most cost-effective tools for climate adaptation. To strengthen these services in India, the Ministry of Earth Sciences has established the Climate Research and Services (CRS) division under the India Meteorological Department (IMD) in Pune. The CRS, IMD, Pune office conducted a stakeholder's workshop to establish the National Framework of Climate Service (NFCS) during 5-6 October 2023. The main aim of the workshop was;

- To provide a brief background and progress on the development of the concept of NFCS to consolidate the efforts of various agencies involved in climate services in India.

- To seek inputs from all relevant stakeholders and their participation to collectively work towards the development of a well-defined NFCS in India to better support decision-making in climate-sensitive sectors.

- To assess the baseline capacities at the national level in both providers and users of climate services, across all five Global Framework for Climate Services (GFCS) pillars and their priority areas (agriculture, energy, health, water sector, and disaster management);

- To prepare a comprehensive mapping of the existing capacities, draw up a list of key stakeholders and outline their potential contributions to the NFCS;

- To identify the needs and priorities, as well as current and projected capabilities for developing climate information and products tailored to the decision-making for different users in the country;

- To bring the core agencies together to consider developing a joint action plan to begin the establishment of NFCS-India.

(b) Under Mission Mausam, initiatives have been taken to increase the observational network and improve the weather and climate predictions and projections. These initiatives are expected to significantly enhance the country's capability in climate forecasting, disaster management and early warning systems by advancing high-resolution weather and climate models and delivering tailored climate services to vulnerable sectors.

Mission Mausam is envisaged to be a multi-faceted and transformative initiative to boost India's weather and climate-related science, research and services. It will help better equip stakeholders, including citizens and last-mile users to tackle extreme weather events and the impacts of climate change. Mission Mausam is expected to enhance weather monitoring and provide accurate forecasts across various timescales. This will be achieved through the deployment of next-generation observation 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 and prediction resolution.

In 2021, the India Meteorological Department (IMD) adopted a new strategy based on a Multi-Model Ensemble (MME) approach to enhance the accuracy of monthly and seasonal forecasts for rainfall and temperature (both maximum and minimum). This approach also enables the issuance of spatially distributed outlooks for heat waves and cold waves on a monthly and seasonal scale.

As part of efforts to strengthen climate monitoring, the India Meteorological Department (IMD) has been issuing State-Wise Annual Climate Statements in addition to the National Annual Climate Summary since 2021. (https://imdpune.gov.in/Reports/Statewise%20annual%20climate/statewise_annual_climate.html)

Recently, IMD has unveiled the Bharat Forecasting System (BharatFS)—the world's highest-resolution operational weather model, operating on a 6-kilometre grid. This is a major leap forward in India's weather prediction capabilities, especially for localized forecasts. Previously, IMD operated numerical models with a resolution of 9 km, which provided district-level forecasts. While effective, these models had limitations in capturing small-scale weather variations that significantly affect local communities, agriculture and disaster response. The BharatFS, developed with support from the Ministry of Earth Sciences, enables weather forecasts at a much finer scale, enhancing IMD's ability to deliver predictions at the block and panchayat levels. With this six-kilometre resolution, the model can capture localized weather phenomena such as thunderstorms, heavy rain spells, lightning, hailstorms and intense heatwaves which often vary sharply even within a district. This is especially useful for agriculture planning, disaster management and early warning systems. The launch of BharatFS aligns with IMD's broader goal to strengthen the last-mile connectivity of weather services, ensuring that the benefits of advanced forecasting reach every village and household. With BharatFS, India now joins the ranks of global leaders in high-resolution weather modeling, supporting a more climate-resilient future.

(c) Initiatives to foster such collaborations are currently underway. Collaboration with international agencies and the private sector is expected to facilitate the exchange of ideas, expertise and technology, thereby advancing emerging innovations and enhancing climate preparedness. In order to enhance communication and public outreach, an assessment of climate change over the Indian region was carried out using observations and climate model projections by the Ministry of Earth Sciences (MoES). The report is published as an open-access book "Assessment of Climate Change over the Indian Region" and is publicly available under the following link: https://link.springer.com/book/10.1007/978-981-15-4327-2.

Additionally, outreach activities and public data dissemination through dedicated tools and data dissemination systems are undertaken by the Ministry of Earth Sciences at the Indian Institute of Tropical Meteorology (IITM) and the India Meteorological Department (IMD) for advancing climate preparedness.

(d) Yes. The Ministry of Earth Sciences (MoES) has launched the Deep Ocean Mission (DoM). This mission is exploring the underwater wealth (mineral resources) in the deep seabed area beyond national jurisdiction by having two seabed mineral exploration contracts with the International Seabed Authority (ISA) in the Indian Ocean. The first seabed exploration contract signed during 2002 is for Polymetallic nodules in an allocated area of 75000 sq. km in the Central Indian Ocean Basin and another contract signed during 2016 is for Polymetallic Sulphides (PMS) exploration in the Indian Ocean Ridge in 2016 in an allocated area of 10,000 sq. km. Polymetallic nodules contain precious metals like copper, nickel, and cobalt. PMS sulphides contain valuable metals like copper, zinc, lead, iron, silver, gold, etc. The seabed mineral exploration activities are executed following an approved plan of work by ISA under the signed contracts, covering survey & exploration, environmental impact assessment, technology development for mining and metallurgical extraction process. Presently, the seabed mineral activities regulated by the ISA are limited to the exploration stage only.

The latest findings include the development of technologies for manned submersible, demonstration of the collection of over 100 kg of Cobalt-rich deep-sea polymetallic nodules from a depth of 1173m in the Andaman Sea in 2024, identification of two active hydrothermal vent fields in the Central Indian Ocean, and development of vulnerability maps for coastal areas to due to climate change.

The Centre for Marine Living Resources and Ecology (Kochi), under the MoES, has conducted six cruises surveying underwater biodiversity across 19 seamounts in the Arabian Sea and Bay of Bengal. Several (~1300) deep-sea organisms have been collected, studied, and vouchered, including conducting in-depth genomic analysis for select organisms and the discovery of nearly 23 species that are new to science.

The National Centre of Polar and Ocean Research (NCPOR), Goa, under the MoES, has conducted deep-ocean surveys in the Central and Southwest Indian Ridges, leading to the discovery of four active hydrothermal vent fields and two mineralised zones of polymetallic sulphides.

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