

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
STARRED QUESTION NO. *274
ANSWERED ON 13/08/2026

**STRENGTHENING PREPAREDNESS FOR EXTREME WEATHER EVENTS AND
CLIMATE RESILIENCE**

274. SHRI SANJAY RAUT:

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

- (a) whether Government has assessed the impact of heatwaves, erratic monsoon, flash floods, cyclones and cloudbursts on agriculture, public health, infrastructure and the economy during the last three years;
- (b) the State-wise details of casualties, economic losses and damage caused by such extreme weather events, along with forecast accuracy and effectiveness of early warning systems;
- (c) whether Government proposes to modernize IMD through nationwide Doppler weather radar coverage, AI-driven forecasting and district-level weather warnings; and
- (d) the details of the national strategy, timeline and financial outlay for Himalayan glacial lake monitoring, earthquake and tsunami preparedness, the Deep Ocean Mission and coastal resilience?

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. *274 REGARDING 'STRENGTHENING
PREPAREDNESS FOR EXTREME WEATHER EVENTS AND CLIMATE
RESILIENCE' FOR ANSWER ON 13TH AUGUST 2026**

(a) Yes. The Government regularly assesses extreme weather events, climate variability, and their multi-sectoral impacts through various scientific studies and operational assessments. Key initiatives include:

- **National Assessment:** The Ministry of Earth Sciences (MoES) has published the report, *Assessment of Climate Change over the Indian Region*, which provides a comprehensive assessment of observed and projected climate change and associated risks across India. Mission Mausam has also been launched to build a "Weather-ready and Climate-smart" nation by enhancing forecasting capabilities, strengthening resilience and reducing the impacts of extreme weather events.
- **Climate Hazard & Vulnerability Atlas of India:** The India Meteorological Department (IMD) has developed the *Climate Hazard & Vulnerability Atlas of India*, providing district-level hazard and vulnerability maps for heatwaves, floods, cyclones, lightning, thunderstorms and extreme rainfall to support disaster risk reduction, infrastructure planning and adaptation measures.
- **Climate Monitoring and Trend Analysis:** IMD regularly publishes monthly and annual climate summaries, 30-year State and district rainfall trend analyses, and the *Climate Diagnostic Bulletin of India (CDBI)*, which monitors climate variability and large-scale drivers such as El Niño–Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD).

The assessment of sector-specific impacts of extreme weather events on agriculture, public health, infrastructure and the economy is undertaken by the respective Ministries/Departments concerned, based on their domain-specific mandates and requirements.

(b) Detailed data on casualties and property damage resulting from extreme weather events are compiled and published annually in IMD's *"Annual Disastrous Weather Reports"*, which inform state disaster response actions and ex-gratia distributions. Modernization under *Mission Mausam* has led to quantifiable improvements in forecast accuracy over recent periods:

Weather Event / Forecast Type	Key Performance Improvements
Seasonal Monsoon Forecast	Average absolute error reduced to 2.27% of LPA (2021–2025) from 7.5% of LPA (2016–2020).
Extended Range Monsoon	Forecast skill improved by 15% for Week 1 and 18% for Week 3.

Heavy Rainfall (>6.5 cm)	Lead time increased by 4 days since 2020; Probability of Detection (POD) increased by up to 45%; False Alarm Rate reduced by 20–40%.
Cyclone Forecasting	Track error reduced by 10–15% (up to 72h) and 25–30% (96–120h); Landfall location accuracy reaching 90% at 108 hours.
Heatwave Forecasting	POD improved by 15% (2-day) and 50% (3-day); 5-day forecast accuracy now matches previous 3-day accuracy.
Thunderstorms	24-hour forecast accuracy improved by 30% over recent years.

- (c) Yes. Under the Central Sector Scheme 'Mission Mausam' (aligned with the 15th Finance Commission cycle), the observational grid is expanding nationwide; IMD currently receives real-time data from 51 DWRs operated by MoES institutions and ISRO. The mission incorporates AI/ML-driven forecasting models, high-performance computing (HPC), dynamic downscaling and localized district/block-level weather advisories.
- (d) The National strategies for the Tsunami Preparedness, Coastal Resilience, Deep Ocean Mission and Earthquake Preparedness & Monitoring are as per following detail;
1. Tsunami Preparedness & Coastal Resilience: The Indian Tsunami Early Warning Centre (ITEWC) at INCOIS detects tsunamigenic events within 10 minutes, serving India and 26 Indian Ocean rim countries under UNESCO-IOC. Total twenty six (26) coastal villages in Odisha have been recognized as UNESCO "Tsunami Ready" communities, with active expansion to other coastal States.
 2. Deep Ocean Mission (DOM) & Sea Level Projections: As an important component of the Deep Ocean Mission led by the Ministry of Earth Sciences (MoES), the Indian National Centre for Ocean Information Services (INCOIS) published the technical report, "Projected Climate Change-Induced Extreme Sea Levels and Coastal Vulnerability along the Indian Coasts". The report presents a comprehensive assessment of projected climate change-induced extreme sea levels along the Indian coastline by integrating future sea-level rise, storm surges, tides, and extreme waves. It also includes detailed coastal vulnerability maps for eleven (11) selected coastal locations: **Bhavnagar (Gujarat), Mumbai (Maharashtra)**, Mormugao (Goa), Mangalore (Karnataka), Cochin (Kerala), Minicoy (Lakshadweep), Chennai (Tamil Nadu), Visakhapatnam (Andhra Pradesh), Paradip (Odisha), Diamond Harbour (West Bengal), and Port Blair (Andaman & Nicobar Islands). As per the SSP5-8.5 projection scenario by the year 2100 the mean sea level is expected to rise between 0.62 m (Visakhapatnam) and 0.87 m (Bhavnagar), while extreme sea levels could rise between 0.68 m (Chennai) and 1.12 m (Bhavnagar).

3. Earthquake Preparedness & Monitoring: The National Centre for Seismology (NCS), under the Ministry of Earth Sciences, has expanded the National Seismological Network (NSN) to 174 real-time seismic observatories across the country for continuous earthquake monitoring and rapid dissemination of information. The Bureau of Indian Standards (BIS) classifies India into four seismic zones—Zones II, III, IV, and V—based on seismic hazard, and earthquake-resistant design provisions are incorporated in the National Building Code and relevant BIS standards, particularly for high seismic risk areas. To support seismic risk assessment and disaster preparedness, the Ministry has completed seismic microzonation studies for Bhubaneswar, Chennai, Coimbatore, and Mangaluru. Seismic microzonation studies for Agra, Amritsar, Dhanbad, Kanpur, Lucknow, Meerut, Patna, and Varanasi are currently underway. The NDMA routinely conducts capacity building, mock drills, and local responder training across states as part of the regular Earthquake Preparedness exercise.
