

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 1324
ANSWERED ON 30/07/2026

OCEAN OBSERVATION NETWORK AND FORECASTING

1324. # SHRI SHAMBHU SHARAN PATEL:
DR. KALPANA SAINI:
SHRI LAHAR SINGH SIROYA:
SHRI BHASHYAM RAMA KRISHNA:

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

- (a) the present status of Ocean Observation Network including Ocean Observation Buoys, Deep Sea Moorings and Coastal Observation Systems;
- (b) the details of role of these observation systems in improving the forecasting of monsoon, cyclones and ocean conditions;
- (c) whether any measures have been taken to expand and strengthen the Ocean Observation Network and if so, the details thereof; and
- (d) the manner in which real-time ocean observations are integrated with forecasting systems to improve weather and ocean forecasts?

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

- (a) The present status of the Ocean Observation Network, comprising Ocean Observation Buoys, Deep Sea Moorings and Coastal Observation Systems, is as follows:
 - i. **Ocean observation moorings:** A total of 19 subsurface moorings (16 in the mainland Exclusive Economic Zone (EEZ) and 3 in the equatorial Indian Ocean) are operational for monitoring ocean currents and zooplankton biomass, generating critical observations for ocean model validation.
 - ii. **Tsunami monitoring network:** The Indian Tsunami Early Warning System is supported by a network of 17 broadband seismic stations, 7 deep-ocean tsunami buoys, and 36 coastal tide gauges, complemented by 35 Global Navigation Satellite System (GNSS) receivers and strong-motion accelerometers for real-time tsunami detection and monitoring.
 - iii. **Coastal observation systems:** The Indian National Centre for Ocean Information Services (INCOIS) operates a comprehensive coastal observing network comprising 17 Directional Wave Rider Buoys, 20 Acoustic Doppler Current Profilers (ADCPs), 32 Automatic Weather Stations (AWS), 2 Water Quality Buoys, and 50 tide gauges to continuously monitor coastal and oceanographic conditions.
 - iv. **Deep-sea and autonomous observations:** INCOIS has deployed 302 Argo profiling floats (2014–2025), 12 deep-sea glider missions, 45 drifting buoys, and 64 wave drifters. The observation network is further strengthened by advanced instruments such as Vertical Microstructure Profilers (VMPs), Underway Conductivity–Temperature–Depth (uCTD) systems, and Wire Walker systems, which support enhanced ocean observations and research.

- (b) The Ocean Observation Network plays a vital role in improving the accuracy of monsoon prediction, cyclone forecasting, and ocean-state forecasts by providing high-quality, near-real-time ocean observations for numerical weather prediction and ocean forecasting systems. Observational data from Argo profiling floats, moored buoys, tide gauges, and other ocean observing platforms are transmitted through the Global Telecommunication System (GTS) to the Indian National Centre for Ocean Information Services (INCOIS), where the data are quality-checked and assimilated into operational numerical models. This enables the generation of accurate initial ocean conditions, thereby reducing forecast uncertainties and enhancing the skill of monsoon and cyclone forecasts as well as ocean-state predictions. Further, real-time observations from wave rider buoys are utilized by INCOIS for operational wave forecasting, coastal inundation assessments, and dissemination of coastal early warning services, thereby supporting maritime operations, coastal communities, and disaster risk reduction.
- (c) Yes. The Government is continuously taking measures to expand and strengthen the national Ocean Observation Network. Recent initiatives include the installation of 14 additional tide gauges and 15 co-located Global Navigation Satellite System (GNSS) receivers to enhance tsunami monitoring and coastal observations. A Directional Wave Rider Buoy has also been deployed off Mauritius to improve the prediction of Southern Ocean swells affecting the north Indian coastal waters. Further, regular pre- and post-monsoon research vessel cruises have been institutionalized for the deployment, servicing, and maintenance of ocean observation systems. Collaboration with the Council of Scientific and Industrial Research – National Institute of Oceanography (CSIR–NIO), the National Centre for Polar and Ocean Research (NCPOR), and other partner institutions has also been strengthened to ensure the sustained operation, maintenance, and expansion of the national ocean observation network.
- (d) Real-time observations from the Ocean Observation Network are received at the Indian National Centre for Ocean Information Services (INCOIS) and assimilated into operational ocean and coupled atmosphere–ocean forecasting systems to improve weather and ocean forecasts. Assimilation of these observations has improved wave forecast accuracy by about 43% compared to 2014, with sustained improvements over the five-day forecast period. The enhanced observation network has also enabled coastal forecast systems with an accuracy of about 70%. In addition, observations from tsunami buoys, tide gauges, GNSS receivers, and strong-motion accelerometers enable INCOIS to issue tsunami advisories within the stipulated 10-minute window following a tsunamigenic earthquake, in accordance with international standards. The real-time ocean observations are assimilated into the INCOIS Global Ocean Data Assimilation System (INCOIS-GODS), which provides initial ocean conditions for the Coupled Forecast System (CFS) used for seasonal and extended-range forecasts, and the Hybrid Coordinate Ocean Model (HYCOM), which provides initial ocean conditions for the Hurricane Weather Research and Forecasting (HWRF) model used by the India Meteorological Department (IMD) for cyclone prediction. These data assimilation systems have substantially strengthened the country's capabilities in monsoon, cyclone, and ocean-state forecasting.
