

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION No. **845**
TO BE ANSWERED ON WEDNESDAY, JULY 16, 2014

ACHIEVEMENTS IN EARTH SCIENCE

845. SHRI. RAVNEET SINGH:

Will the MINISTER OF EARTH SCIENCES be pleased to state:

- a) the progress made in the field of Earth Sciences during each of the last three years and the current year;
- b) whether the Government is satisfied with its achievements;
- c) if not, the reasons therefor; and
- d) the steps taken by the Government in this regard?

ANSWER

MINISTER FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND
MINISTRY OF EARTH SCIENCES
(DR. JITENDRA SINGH)

- a) The progress made during the last 3 years and the current year has been considerably significant under various schemes sphere headed by the institutions of the Earth System Science Organization (ESSO) of this Ministry. Some of the major accomplishments are described in detail in the Annexure.
- b) Yes Madam.
- c) Does not arise.
- d) Not with standing with the above, the ESSO of this Ministry is constantly endeavoring to improve quality of knowledge based services in weather, climate, ocean state and natural hazards (cyclones; tsunami; earthquakes; severe weather phenomena) backed by continued R & D efforts.

i) **Atmospheric Observation Network and Services:** Recognizing the importance of real-time observational weather and climate data for various operational forecast and advisory services, state-of-the-art observing system networks have been commissioned during the last 3 years through augmentation with 1188 Automatic Rain gauges (ARGs) and 554 Automatic weather stations (AWSs) all across the country. 13 Nos. of Doppler Weather Radars (DWRs) have been set up, respectively at Delhi airport, New Delhi Lodi Road, Nagpur, Jaipur, Hyderabad, Lucknow, Patna, Patiala, Agartala, Mohanbari, Bhopal, Bhuj and Mumbai to the earlier network of 5-DWRs installed at Kolkata, Visakhapatnam, Machilipatnam, Chennai and Sriharikota. Origin, development/ movement of severe weather phenomena are regularly monitored through DWRs and with all available other observing systems (AWSs; ARGs; Automatic Weather Observing Systems-AWOS; satellite derived wind vectors, temperature, moisture fields etc.). A specific nowcasting (3-6h) weather service (Thunderstorms; heavy rainfall from lows/depressions over the land) covering 117 urban centers on experimental basis under which nowcast of severe weather has been initiated.

The Agro-Meteorological Advisory Service (AAS) has been extended to district level from the agro-climatic zone level (cluster of 4-6 districts) and extended to 600 districts of the country. Currently, over 5.0million farmers have been receiving crop specific advisories under the AAS service in vernacular languages. During the last 1-year, the country is impacted by 3- tropical cyclones Phailin, Helen, and Lehar on the east coast of India. Track, intensity and landfall of these severe cyclones has been forecasted with sufficiently lead time so as to assist appropriate emergency response actions by the respective state government/UT authorities in order to minimize the loss of life. The prediction of storm surge and associated inundation were also provided along with high wave alerts associated with the landfall of cyclones during 2013 on experimental basis.

A weather and air quality forecast service for next 24 had been launched over the NCR of Delhi and Pune. Under the framework of Regional Integrated Multi-hazard Early warning System (RIMES), a data-sharing arrangement has been established with the nine countries to provide rainfall forecast for next 3-days. The countries include Bangladesh, Bhutan, India, Lao People's Democratic Republic, Maldives, Mongolia, Myanmar, Nepal, and Sri Lanka.

ii) **Atmospheric Processes, Modeling and Climate Change Research:** A National Monsoon Mission has been launched to build a state-of-the-art coupled ocean-atmospheric climate model for a) improved prediction of monsoon rainfall on extended range to seasonal time scale (16 days to one season) and b) improved prediction of temperature, rainfall and extreme weather events on short to medium range time scale (up to 15 days) so that forecast skill gets quantitatively improved further for operational monsoon forecast, seasonal and extended range prediction and short range monsoon forecast has been initiated.

.Operational implementation of improved forecast suite of models after the commissioning of the High Performance Computing (HPC) systems have enhanced the weather forecasting capacities through assimilating all available global satellite radiance data for the production of forecast products at 22Km grid globally and 9Kms/3Kms grid over India/regional/mega city domains. The performance evaluation of the updated global/meso-scale forecast systems for the past 5-7 years have demonstrated enhanced forecast skill by about 18% quantitatively as far as the track and landfall forecasts of the tropical cyclones are concerned.

A dedicated Centre for Climate Change Research was established as a part of ESSO-IITM, Pune to address various science issues relating to climate variability and change.

iii) **Ocean Observations:** The augmentation of Ocean Observation networks in the seas surrounding India includes deployment of 16 moored buoys including 10 tsunami buoys, 194 Argo Floats, 74 drifters, 16 wave rider buoys etc., for acquisition of real-time data from the seas around India. An appropriate system of archival and retrieval for the various types of ocean observations has been established. In particular, moored buoy data sets were found to be very useful during the passage of cyclones over the open seas. A dedicated OCEANSAT Satellite Ground Station was commissioned at ESSO-INCOIS, Hyderabad for real time direct reception of satellite data for rendering various operational Ocean Information Services.

iv) **Ocean Science and Services:** A unique system of Fisheries Advisories based on identification of potential fishing zones (PFZ) using remote sensing technology has been made operational by expanding it to cover Tuna fish to deep sea fishing industry. The advisories were issued daily for the entire Indian coast. Ocean state forecast at every six hours for sea surface temperature, currents, waves, etc. is provided daily for next 5-days. A Coral Bleaching Alert System (CABS) has been set up for providing biweekly status on 5 major coral environments of India viz., Andaman & Nicobar, Lakshadweep, Gulf of Mannar, Gulf of Kutch. A state-of-the-art Tsunami Warning System was set up, in September 2007, which has been now recognized as a Regional Tsunami Service Provider (RTSP), provided advisories at 1800 forecast points for all the Indian Ocean Rim countries.

The maps of Coastal Vulnerability Index (CVI) for the entire country were prepared and provided to all stakeholders.

v) **Ocean Survey & Mineral Resources:** As a part of hydrothermal sulphide exploration program, seven cruises of 30-day each have been conducted in the Central Indian Ocean Basin for acquisition of marine geophysical data. Quantum of data has been collected to date, in the Central Indian Ridge (CIR) and South West Indian Ridge (SWIR) using Multi-beam Eco Sounder (MBES) surveys of ~65,000 km²(area), Magnetic surveys of ~17,000 km²(line) and Gravity surveys ~9,115 km²(line). India has filed an application with the International Seabed Authority in July 2013 for allotment of specifically identified zones over the Indian for exploration of Polymetallic Sulphides.

India's had made claim to the extended continental shelf, in pursuant to Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS).

vi) **Geoscience:** India's scientific proposal for deep sea drilling in the Arabian Sea has been accepted by Integrated Ocean Drilling Program (IODP) and drilling will commence in 2015. This will provide information on evolution of Himalayas and origin of monsoon.

vii) **Ocean Technology:** Two more Low Temperature Thermal Desalination (LTTD) plants have been commissioned in the islands of Lakshadweep, respectively, at Minicoy and Agatti during March 2011 and August 2011. A full-fledged hatchery unit for the breeding and rearing of ornamental fishes has been established at Agatti, Lakshadweep islands. The remotely operable submersible (ROSUB) was tested at ~5300m at the Indian mining site over the Indian Ocean which is a land mark achievement for exploitation of ocean resources. A Remotely Operable In-situ Soil Tester (ROSI) has been developed and was tested at a water depth of ~5400m in the Central Indian Ocean Basin (CIOB).

viii) **Seismological Research:** Initiated investigations at the Deep Borehole Observatory site in the Koyna-Warna region for direct and continuous monitoring of intra-plate seismic zones at different depths, for improved understanding of the mechanics of faulting, physics of reservoir triggered earthquakes as well as earthquake hazard assessment. Eight shallow boreholes have already been drilled, and seismometers have been placed in two of them. National Seismological Network consisting of 82 field observations including two telemetric clusters have been set up for monitoring of seismic activity in and around country on 24X7 basis. A report on Seismic Hazard Microzonation of NCT Delhi 1:10000 scale has been prepared.

ix) **Polar Science:** India attained 'Observer' status within the Arctic council for conducting scientific research. The Third Antarctic Station "Bharati" was successfully commissioned in March 2012 for operations towards conducting front line research. A satellite ground receiving station has been setup at the Bharati Station in Antarctica for acquiring data from all passing polar orbiting satellites.

x) **High Performance Computing System:** In order to process and assimilate huge volume of global scale weather and climate data for a suite of forecast models, the computation facilities have been substantially augmented to the Petaflop scale.

xi) **Research Education and Outreach:** An Advanced Training School was established with facilities for training and research in Earth System Science and Climate at ESSO-IITM, Pune. The first batch of students joined various units of ESSO. The second and third batch of 20 students was inducted in August 2012 and August 2013 through an exhaustive national level selective process.

International Training Centre for Operational Oceanography at ESSO-INCOIS, Hyderabad under agreement with UNESCO-IOC is established. MoES Chairs have been established in various leading academic institutions like Indian Institute of Technologies for promotion of research in various branches of earth sciences. As a part of outreach programs, the ESSO had supported organization of Earth Science Olympiad in September 2013 in India.

xii) **Ocean Research Vessels:** A fleet of six scientific research vessels are under regular operation by undertaking various targeted oceanographic research activities for acquisition of multidisciplinary oceanographic data; conducting geophysical survey to assess marine non-living resources; campaign mode survey for assessment of living resources; measurement on seawater quality of coastal waters.
