GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION No. **347**
TO BE ANSWERED ON MONDAY, DECEMBER 09, 2013

ACHIEVEMENTS IN EARTH SCIENCES

347. DR. T. SUBBARAMI REDDY:

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

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

ANSWER
MINISTER FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND
MINISTRY OF EARTH SCIENCES
(SHRI S. JAIPAL REDDY)

(a) - (e): A Statement is laid on the Table of the House.

STATEMENT IS LAID ON THE TABLE OF THE RAJYA SABHA IN REPLY TO (a) - (e) OF UNSTARRED QUESTION No. 347 REGARDING "ACHIEVEMENTS IN EARTH SCIENCES" TO BE ANSWERED ON 09 DECEMBER 2013

(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 below:

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 network augmentation with 1098 Automatic Rain gauges (ARGs) and 554 Automatic weather stations (AWSs) all across the country. 13 Nos. of Doppler Weather Radars (DWRs) have been augmented respectively at viz., 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.) ESSO-India Meteorological Department (IMD) has operationalized its location specific nowcasting weather service across the country and such service activity currently covers 117 urban centres on experimental basis under which nowcast of severe weather (Thunderstorms; heavy rainfall from lows/depressions over the land) in 3-6h range is issued.

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 3.5 million farmers have been receiving crop specific advisories under the AAS service in vernacular languages.

During the year, the country is impacted by 3- tropical cyclones Phailin, Helen and Lehar on the east coast of India and Uttarakhand and Gujarat have received extremely heavy rainfall spells during the Monsoon-2013. 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.

From the Commonwealth Games 2010, venue specific weather and air quality forecast service for next 24 had been launched over the NCR of Delhi and such service has just been launched for Pune as well.

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: During the XII Plan, under the National Monsoon Mission initiative, other institutions of ESSO, the Indian Institute of Tropical Meteorology (ESSO-IITM), Pune, Indian National Centre for Ocean Information Services (ESSO-INCOIS), Hyderabad and National Centre for Medium Range Weather Forecasting (ESSO-NCMRWF), NOIDA have embarked upon 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 services of ESSO-IMD.

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. The fish

potential in the Indian EEZ was estimated using both satellite and in-situ data, which was found to be 4.32 MSY (maximum sustainable yield).

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.

Ocean state forecast at every six hours for sea surface temperature, currents, waves, etc. is provided daily for next 5-days.

v) Ocean Survey & Mineral Resources: As a part of hydrothermal sulphide exploration program, a series of 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 km^2 (area), Magnetic surveys of ~17,000 km^2 (line) and Gravity surveys ~9,115 km^2 (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 recommended by Integrated Ocean Drilling Program (IODP). Towards organizing deep ocean drilling over the Arabian Sea under IODP, an advanced action has been initiated to charter a seismic vessel with appropriate data acquisition system from early 2014. Gravity surveys under the Geoid program and acquisition of data under Deep Sea Crustal studies have been initiated.

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 of Lakshadweep islands. The remotely operable submersible (ROSUB) was tested at 5300m at 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 (ROSIS) has been developed and was tested at a water depth of 5462m in the Central Indian Ocean Basin (CIOB). ESSO-National Institute of Ocean Technology (NIOT) had developed a drifter indigenously.

viii) Seismological Research: Initiated investigations at the Deep Borehole Observatory site in 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. Two shallow boreholes have already been drilled, at a depth of 1522m and 1196m respectively. Also, air-borne gravity survey has been completed for 5000 line km. in Koyna region and also work related to Magneto Telluric (MT) survey is completed. National Seismological Network consisting of 82 field observations including two telemetric clusters have been in successful operation 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: The First Scientific expedition was successfully undertaken to the South Pole in November 2010. 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 near 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. Setting up of National Knowledge Network (NKN) connectivity to all the ESSO institutions was accomplished for efficient communication and data transfer.

xi) Research Education and Outreach: An Advanced Training School was established with self-contained 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.

b) Yes Sir.

c) The progress is satisfactory both in quantitative and qualitative terms. The performance of the Ministry and the ESSO has been monitored objectively by the Performance Monitoring and Evaluation System (PMES) of the Cabinet Secretariat. The performance of Results-Framework Document of the Ministry were 95.07% and 97.15% and 93.45% for the years 2010-11, 2011-12 and 2012-13, respectively. The concerted efforts made by the ESSO have led to the improved quality of warning services in respect of weather, climate, ocean state and hazards.

According to a recent survey, various services such as AAS for farmers, potential fishing zone for fisherman, ocean state forecast for shipping, aviation services at airports/heliports, public weather services etc., have been extremely useful and beneficial for society at large. The contribution of AAS and fishery advisories to national GDP has been estimated to be Rs. 50,000crores and 34,000crores respectively. There has been a significant growth in reviewed research publications by the scientists of ESSO in various journals of repute during the last three years.

d) - e) Does not arise.

*****