GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION No. 161
TO BE ANSWERED ON WEDNESDAY, NOVEMBER 16, 2016

RESEARCH PROJECTS

161. SHRI SUNIL KUMAR MONDAL:
SHRI B. SRIRAMULU:

Will the Minister of EARTH SCIENCES be pleased to state:

(a) the details and present status of various ongoing research and other projects of the Ministry, project-wise, the likely benefits of these projects;
(b) the details of funds allocated these projects and utilized to during lach of the last three years and the current year so far.
(c) whether the Government proposes more financial assistance for the awareness of earth sciences and if so, the details thereof; and
(d) the details of plan/projects envisaged for the coming three years for earth sciences activities in the country.

ANSWER
MINISTER OF STATE FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND MINISTRY OF EARTH SCIENCES
(SHRI Y. S. CHOWDARY)

(a) Towards improving the understanding of the earth system (the atmosphere, ocean, solid earth, biosphere) and their response to the natural and human induced changes, research projects in academic and research institutes in the various areas of Earth System Sciences namely, (1) Atmospheric Science including Climate Science; (2) Geoscience; (3) Ocean Science and Resources and Technology; (4) Hydrology and Cryosphere; (5) Earth System Technology, are supported. The project-wise details and benefits are given at Annexure-1.

(b) The program-wise budget details including allocation and expenditure (Rs. in crores) are as follows.

No	Name of Scheme	RE 2013-14	Actual 2013-14	RE 2014-15	Actual 2014-15	Rationalized Schemes	R.E. 2015-16	Actual 2015-16	BE 2016-17	Exp. as on Sept 2016
1	Atmospheric Observation Systems Services	129.00	117.25	87.00	103.61	Atmosphere & Climate Research-Modelling Observing Systems & Services (ACROSS)	312.00	278.87	360.00	120.36
2	Atmospheric Process & Modeling	53.00	50.08	64.63	64.39					
3	Climate Change Research	30.00	29.82	32.59	32.56					
4	High Performance Computing System	104.00	103.02	68.54	68.53		0.50	0.36		
5	Airborne Platforms	0.01	0.00	10.00	10	Airborne Platforms for Institute Observations Ocean Research Vessels(APOORV)	80.00	76.46		
10	Ocean Research Vessels	55.48	56.47	36.04	36.04					
6	Ocean Observations	40.00	38.57	45.00	44.49	Ocean Services Technology Observations Resources Modelling and Science (O-STORMS	295.50	279.70	355.00	175.51
7	Ocean Science & Services	70.00	68.30	71.08	68.5					
8	Ocean Survey & Mineral Resources	50.00	41.03	60.43	60.42					
9	Ocean Technology	83.52	83.52	51.00	51					
11	Polar Sciences & Cryosphere	155.99	155.98	200.00	163.55		123.50	118.66	156.00	90.01
12	Seismological Research	57.00	46.97	74.35	74.56	Seismological & Geosciences (SAGE)	131.50	117.78	150.00	13.59
13	Geosciences	15.00	8.11	53.51	53.5					

14	Research, Education Training and Outreach	82.00	76.88	70.83	69.13		70.00	60.99	49.90	10.01
15	Assistance to Autonomous bodies								129.10	70.35
	Total	925.00	876.00	925.00	900.28		1013.00	932.93	1200.00	479.93

(c) No, Madam.

(d) In addition to implementation of the above ongoing schemes of the Ministry, it is proposed to take up a set of new programmes recommended by NITI Aayog for implementation during the next three years, as detailed below:-

a) **Marine Observation System Along Indian Coast (MOSAIC)**
b) **Development Ballast Water Treatment Facility**
c) **Energy from Oceans- Ocean Thermal Energy Conversion (OTEC) Plant at Kavaratti**
d) **Block level forecasts (around 6000) through 660 district centres**
e) **Development of high resolution (12 km) weather prediction models through high Performance Computing- 10 Peta flop**
f) **Customized Forecasts for Tourism/Pilgrimage - 300 destinations spread over the country**
g) **Modernization of Weather and Climate Services**
h) **Atmospheric Chemistry.**

Annexure1: Project –wise details of achievements and benefits.

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 4 years through augmentation with 1291 Automatic Rain gauges (ARGs) and 680 Automatic weather stations (AWSs) all across the country. 15 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. 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 608 districts of the country. Currently, over 19.5 million farmers have been receiving crop specific advisories under the AAS service in vernacular languages. During the past few years, several tropical cyclones viz., Hudhud, Phailin, Helen, and Lehar have been impacted 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.. A weather and air quality forecast service for next 24 had been launched over the NCR of Delhi, Mumbai 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. Block level forecast for 37 districts (342 blocks) has been initiated in pilot mode.

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 to15 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 19 moored buoys including 7 tsunami buoys, 270 Argo Floats, 144 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) on 1:100k scale for the entire country were prepared and provided to all stakeholders. Coast vulnerability maps on 1:25K has also been prepared for the entire coast and undergoing validation. Launched Indo-US ocean experiments in the Bay of bengal for studying monsoon studies.

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 (ROSIS) has been developed and was tested at a water depth of ~5400m in the Central Indian Ocean Basin (CIOB).

viii) Seismological Research: The Borehole Geophysical Research Laboratory was established in Karat, Maharashtra to carry out "Scientific Deep Drilling in the Koyna Intra-plate Seismic zone", to measure the in-situ physical properties of rocks, pore-fluid pressure, hydrological parameters, temperature and other parameters of an intra-plate, active fault zone in the near-field of earthquakes – before, during and after their occurrence. A set of 6 have been drilled so far (to depths of 1522.5m (Rasati), 1196m (Udgiri), 1134m (Kundi), 1211.6 (Nayari), ~1500m (Panchgani) and ~1500m (Ukhalu)) with logging and heat flow measurements.. 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 large seismic network established by the Ministry has provided more insights to the Nepal earthquake occurred in April 2015. A report on Seismic Hazard Microzonation of NCT Delhi 1:10000 scale has been prepared. : First time conducted deep sea drilling in the Arabian Sea in May 2015 onboard D/V JOIDES Resolution as a part of International Ocean Drilling Program to document the co-evolution of mountain building, weathering, erosion, and climate over a range of timescales including the study of evolution of continental breakup between India and the Seychelles and its relationship to the plume-related volcanism of the Deccan Plateau

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 the Antarctica for acquiring data from all passing polar orbiting satellites. Arctic mooring Observation system has been established. Accorded approval for acquisition of Polar Research Vessel. Towards augmentation of ocean observations networks, the retrieval of Arctic Observatory and deployment of Polar Remotely Operable Vehicle (PROVe) in the Antarctic were carried in July 2015 and February 2015, respectively

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 has been established. The International Training Centre for Operational Oceanography (ITCOcean) had conducted 4 short term training programmes in the past one year. More than 135 participants from India and three neigbouring countries attended the courses. 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 2014 in India. OUTREACH: Towards promoting awareness about the programmmes and achievements among the public, student and user communities, major National and International exhibitions held in India and Seminars, Symposia, Workshops, have supported.

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;

National Centre for Earth Science Studies (NCESS): Considering the importance of studies on solid earth for understanding earth system science research, NCESS a centre of the Government of Kerala was taken over by the Ministry in January 2014. The CESS has been engaged in various research areas relting to solid earth and earth science application. Crustal evolution and geodynmics, quarternary evolutionprocesses, sedimentology and deploistion process, weather and surface processes, coastal dynamics.