

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. - 1305
ANSWERED ON – 09/12/2021

RESEARCH AND DEVELOPMENT IN EARTH SCIENCES

1305. Shri P. Bhattacharya:
Shri Harnath Singh Yadav:
Shri Vijay Pal Singh Tomar:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether the Government proposes to increase the allocation of fund for Research and Development (R&D) in Earth Sciences and if so, the details thereof;
- (b) the percentage of GDP incurred on R&D initiatives in Earth Sciences during the last three years;
- (c) the other plans of the Government to attract students for research in Earth Sciences and give fruitful results; and
- (d) whether scientists are given world class facilities, equipment, resources, and packages to carry on their research, etc. and if so, the details thereof?

ANSWER

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

- (a) Yes Sir. There has been a gradual increase in the allocation of funds for Research and development in the earth sciences. The year-wise total allocation including plan and non-plan for the last 5 years are as follows:

Year	RE	Actual Expenditure
2015-16	1420.98	1296.80
2016-17	1579.11	1459.76
2017-18	1597.69	1547.73
2018-19	1800.00	1745.63
2019-20	1809.74	1722.59
2020-21	2070.00 (BE) 1300.00*	1285.76

* Funds crisis due to COVID-19 pandemic

- (b) The percentage of expenditure incurred with respect to GDP for R&D initiatives of earth sciences during the 3 years are 0.0092, 0.0085 and 0.0065 for 2018-19, 2019-20 and 2020-21, respectively.

- (c) Towards attracting the students for conducting research in the field of earth sciences, the Ministry of Earth Sciences had started Development of Skilled Manpower in Earth System Sciences (DESK) program. DESK was initiated to create a large pool of trained and dedicated multidisciplinary earth system and climate research manpower in the country with in-depth hands-on expertise on individual physical processes of the land, ocean, atmosphere, biosphere and cryosphere with special emphasis on climate modeling. Besides, an International Training Centre for Operational Oceanography has been setup in Hyderabad for development of skills to conduct front ranking research in the field of Ocean Science.

A set of five Project Appraisal and Monitoring Committees (PAMCs) and a Technology Research Board have been constituted for appraisal, review and monitoring of the various projects for consideration for extramural funding. An Apex committee chaired by the Secretary has also been constituted to consider specific proposals recommended by these committees.

Under Earth Science & Technology Cell (ESTC), MoES supports theme based focused network R&D activities involving multi institutions with focused objectives and definite deliverables that can be translated into operational use. It also helps towards capacity building and creating adequate expertise in various disciplines of earth system Science for the benefit of society and national development.

As of now, 11 projects are funded under the theme of Atmospheric Science including Climate Change; 33 projects under Geosciences; 10 projects under Hydrology & Cryosphere; 17 Projects under Seismology 13 projects under Ocean science and 1 project under ESTC.

All these initiatives are expected to enhance the skill of the operational weather, climate, ocean state and multi-hazard services incrementally for accruing the societal benefits in terms of minimizing the loss of life and property. Further, MoES supports various capacity building programs in academic institutions and the details are given at annexure-1.

- (d) Yes, Sir. Scientists are being given world class facilities, equipment and resources to carry out the research in earth sciences. The major initiative for creation of facilities viz., (i) geochronology laboratory to support contemporary cutting-edge research in isotope geochemistry and geochronology pertaining to earth, atmospheric, oceanic and planetary sciences at international level of a facility for Geochronology at Inter-University Accelerator Centre (IUAC), New Delhi (ii) Scientific deep drilling in Koyana Intra-plate Seismic Zone of Maharashtra is aimed at setting up of borehole observatories at depth for directly measuring the in-situ physical properties of the 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, leading to a better understanding of the mechanics of faulting, physics of reservoir triggered earthquakes and preparing a predictive model (iii) provide logistic and scientific support to conduct front ranking research in the polar regions ie., Antarctic and Arctic (iv) Supporting the Advanced Centre for Atmospheric Radar Research (ACARR) in Cochin University Of Science And Technology. ACARR facility is the state-of-the-art indigenously developed Stratosphere-Troposphere Wind Profiler Radar operating at 205 MHz frequency and (v) provide state of the art super computing facility, real-time data of various atmospheric and oceanographic parameters, and high resolution models for better prediction of weather and climate.

Annexure-I

The details of various capacity building programs to attract students for research in earth sciences including providing world class facilities, equipment, resources, packages to carry on their research:

1. Fellowship support for academic programme such as M.Tech/Ph.D along with laboratory set-up. The details of such projects/programmes being supported by the ministry are as follows:

- Under international collaboration with Norwegian Polar Institute (NPI), Norway, a Ph.D. fellowship programme has been initiated. Presently two Indian students have been sponsored by the ministry for doing Ph.D. in Glaciology at NPI.
- 5 M.Tech students/scientists and 5 Ph.D. students are being sponsored under an MoU with Indian Institute of Technology (IIT) Delhi. The ministry also supported establishment of M.Tech Lab in the Centre for Atmospheric Studies, IIT Delhi.
- Similarly Ministry is also sponsoring 10 M.Tech students in Ocean Technology and Engineering at IIT Madras.
- Six basic labs including advanced analytical facility lab, a Museum/library have been established at IISc Bangalore for augmenting the research in the earth sciences Department. This has led to the initiation of M.Tech programme in the field of earth science with intake of 5 students per year.
- Supported initiation of 2 year M.Sc. course in Ocean and Atmospheric Science at Centre for Earth & Space Sciences, University of Hyderabad.

2. Establishment of Chair Professorship in premier institutes wherein the students benefit through credit courses/research programs initiated by the Chairs who are generally eminent scientists from abroad. This also exposes the students/researchers in the academic institutes to pioneer in the field of earth sciences, and thereby help in development of human resources. In addition, MoES also supports outstanding Young Faculty Fellowships granted to young faculty to encourage them to carry out research in the Earth System Science. Presently the following Chairs exist in 4 IITs :

S.No	Institute	Name of the Chair
1	IIT Delhi	Sir Gilbert Walker MoES Chair in Atmospheric Science & Sudhanshu Kumar Outstanding Young Fellow
2	IIT Kanpur	D.N. Wadia MoES Chair in Climate Change
3	IIT Kharagpur	Samudragupta MoES Chair in Ocean Science & James Rennell MoES Young Fellow
4	IIT Gandhinagar	Varhamihira MoES Chair in Earth System Science & Engineering & Varhamihira Young Fellows

3. The Ministry supports Establishment of National Facilities, wherein once the facility is established the researchers/students from various academic/research institutes submit their research proposals/science plan and as per the merit of the proposal the student is allocated time to use the National facility, generally free of cost for undertaking the research work.

Name of the facility	Name of the Institute	Aim of the facility
Accelerator Mass Spectrometry (AMS) Measurement facility for ¹⁴ C	Inter-University Accelerator (IUAC), New Delhi	A dedicated AMS facility for the measurement of Carbon 14 and to measure ultra-low concentrations of the isotopes of carbon14 for applications in radiocarbon dating and earth sciences.
Laser Raman Spectrometer	National Centre for Earth Science Studies (NCESS), Thiruvananthapuram	The facility will be used to study the application of fluid inclusion technique for oil exploration by using the drill core/cutting samples from ONGC.
Laser Diamond Anvil Cell at IISER Kolkata	Indian Institute of Science Education and Research (IISER), Kolkata	To be used by researchers to simulate conditions of the core and lower mantle of the Earth
Advanced Centre for Atmospheric Radar Research (ACARR)	Cochin University Of Science And Technology, Ernakulam	A state-of-the art, indigenously developed Stratosphere Troposphere (ST) wind profiler radar operating at 205 MHz Frequency.

4. Under bilateral and multilateral international agreements with various Government agencies in the field of Earth system science, the Ministry supports research proposals, joint observational campaigns, joint development work, exchange of resources personnel and training abroad, workshops etc. Projects been implemented under these collaboration provide excellent opportunity to students to work and interact with foreign researchers, visit their labs etc.
- Under a MoU with Belmont Forum countries, Indian Scientists are supported for international collaborative research through joint calls in societal relevant global environmental change challenges.
 - Under an MoU with the Natural Environmental Research Council (NERC), the students are participating in joint observational campaigns for studying the various processes involved in understanding the monsoonal behavior.
 - Under the MoU with Research Council of Norway, the students are part of the various projects being funded by the Ministry for undertaking research in Polar Research and Geo-Hazards.
 - Mission mode programs: The Ministry has launched various flag ship and mission mode programs such as Monsoon Mission, Metro Air Quality, Climate Change Research including atmospheric Chemistry where the students working in these projects get hands-on experience on the sophisticated equipment's through participation in field campaigns, laboratory experiments and data analysis /modeling techniques etc. The experience gained increases the job opportunities of the students.
