

**MINISTRY OF EARTH SCIENCES**

## DEMAND NO. 23

**Ministry of Earth Sciences***(In ₹ crores)*

	Actual 2017-2018			Budget 2018-2019			Revised 2018-2019			Budget 2019-2020		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
Gross	1497.88	55.43	1553.31	1704.28	100.00	1804.28	1704.15	100.00	1804.15	1765.05	141.00	1906.05
Recoveries	-11.80	-0.04	-11.84	-4.28	...	-4.28	-4.15	...	-4.15	-4.29	...	-4.29
Receipts	...	...	...	...	...	...	...	...	...	...	...	...
<b>Net</b>	<b>1486.08</b>	<b>55.39</b>	<b>1541.47</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1760.76</b>	<b>141.00</b>	<b>1901.76</b>
A. The Budget allocations, net of recoveries, are given below:												
<b>CENTRE'S EXPENDITURE</b>												
<b>Establishment Expenditure of the Centre</b>												
1. Secretariat	33.70	...	33.70	36.20	...	36.20	40.90	...	40.90	43.00	...	43.00
2. Meteorology	357.82	...	357.82	384.45	...	384.45	394.87	...	394.87	423.55	...	423.55
	-3.62	...	-3.62	-4.28	...	-4.28	-4.15	...	-4.15	-4.29	...	-4.29
<i>Net</i>	<i>354.20</i>	...	<i>354.20</i>	<i>380.17</i>	...	<i>380.17</i>	<i>390.72</i>	...	<i>390.72</i>	<i>419.26</i>	...	<i>419.26</i>
3. Oceanographic Survey (ORV and FORV) and Marine Living Resources (MLR)	30.32	...	30.32	30.00	...	30.00	28.50	...	28.50	30.00	...	30.00
4. National Centre for Medium Range Weather Forecasting (NCMRWF)	7.83	...	7.83	8.40	...	8.40	9.90	...	9.90	10.50	...	10.50
<b>Total-Establishment Expenditure of the Centre</b>	<b>426.05</b>	...	<b>426.05</b>	<b>454.77</b>	...	<b>454.77</b>	<b>470.02</b>	...	<b>470.02</b>	<b>502.76</b>	...	<b>502.76</b>
<b>Central Sector Schemes/Projects</b>												
5. Ocean Services, Technology, Observations, Resources Modelling and Science (O-STORMS)	310.63	9.96	320.59	384.00	15.00	399.00	445.00	15.00	460.00	...	...	...
6. Ocean services, Modelling, Application, Resources and Technology (O-SMART)	...	...	...	...	...	...	...	...	...	465.00	18.00	483.00
7. Atmosphere and Climate Research - Modelling Observing Systems and Services (ACROSS)	366.51	34.80	401.31	300.00	75.00	375.00	262.00	71.00	333.00	310.00	103.00	413.00
8. Polar Science and Cryosphere (PACER)	126.88	...	126.88	225.00	...	225.00	145.00	...	145.00	120.00	...	120.00
9. Seismological and Geoscience (SAGE)	75.99	10.67	86.66	100.00	10.00	110.00	82.00	14.00	96.00	95.00	20.00	115.00
10. Research, Education and Training Outreach (REACHOUT)	45.90	...	45.90	74.23	...	74.23	94.50	...	94.50	90.00	...	90.00
<b>Total-Central Sector Schemes/Projects</b>	<b>925.91</b>	<b>55.43</b>	<b>981.34</b>	<b>1083.23</b>	<b>100.00</b>	<b>1183.23</b>	<b>1028.50</b>	<b>100.00</b>	<b>1128.50</b>	<b>1080.00</b>	<b>141.00</b>	<b>1221.00</b>
<b>Other Central Sector Expenditure</b>												
<b>Autonomous Bodies</b>												
11. Indian National Centre for Ocean Information Services (INCOIS)	23.17	...	23.17	25.00	...	25.00	25.00	...	25.00	28.00	...	28.00

(In ₹ crores)

	Actual 2017-2018			Budget 2018-2019			Revised 2018-2019			Budget 2019-2020		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
12. National Institute of Ocean Technology (NIOT)	28.10	...	28.10	32.00	...	32.00	44.68	...	44.68	35.00	...	35.00
13. National Centre for Antarctic and Ocean Research (NCAOR)	14.35	...	14.35	20.00	...	20.00	25.00	...	25.00	...	...	...
14. National Centre for Polar and Ocean Research, Goa (NCPOR)	...	...	...	...	...	...	...	...	...	25.00	...	25.00
15. Indian Institute of Tropical Meteorology (IITM)	60.36	...	60.36	65.00	...	65.00	93.30	...	93.30	70.00	...	70.00
16. National Centre for Earth Science Studies (NCESS)	16.32	...	16.32	20.00	...	20.00	13.50	...	13.50	20.00	...	20.00
<b>Total-Autonomous Bodies</b>	<b>142.30</b>	...	<b>142.30</b>	<b>162.00</b>	...	<b>162.00</b>	<b>201.48</b>	...	<b>201.48</b>	<b>178.00</b>	...	<b>178.00</b>
<b>Others</b>												
17. Actual Recoveries	-8.18	-0.04	-8.22	...	...	...	...	...	...	...	...	...
<b>Total-Other Central Sector Expenditure</b>	<b>134.12</b>	<b>-0.04</b>	<b>134.08</b>	<b>162.00</b>	...	<b>162.00</b>	<b>201.48</b>	...	<b>201.48</b>	<b>178.00</b>	...	<b>178.00</b>
<b>Grand Total</b>	<b>1486.08</b>	<b>55.39</b>	<b>1541.47</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1760.76</b>	<b>141.00</b>	<b>1901.76</b>
<b>B. Developmental Heads</b>												
<b>Economic Services</b>												
1. Oceanographic Research	531.01	...	531.01	716.00	...	716.00	713.18	...	713.18	703.00	...	703.00
2. Other Scientific Research	48.53	...	48.53	82.63	...	82.63	104.40	...	104.40	100.50	...	100.50
3. Secretariat-Economic Services	33.36	...	33.36	36.20	...	36.20	40.90	...	40.90	43.00	...	43.00
4. Meteorology	873.18	...	873.18	865.17	...	865.17	841.52	...	841.52	914.26	...	914.26
5. Capital Outlay on Oceanographic Research	...	9.96	9.96	...	15.00	15.00	...	15.00	15.00	...	18.00	18.00
6. Capital Outlay on Meteorology	...	45.43	45.43	...	85.00	85.00	...	85.00	85.00	...	123.00	123.00
<b>Total-Economic Services</b>	<b>1486.08</b>	<b>55.39</b>	<b>1541.47</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1760.76</b>	<b>141.00</b>	<b>1901.76</b>
<b>Grand Total</b>	<b>1486.08</b>	<b>55.39</b>	<b>1541.47</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1700.00</b>	<b>100.00</b>	<b>1800.00</b>	<b>1760.76</b>	<b>141.00</b>	<b>1901.76</b>

1. **Secretariat:** The Budget Provision is required for Secretariat Expenditure of the Ministry of Earth Sciences including Departmental Accounting Organization of Ministry of Earth Sciences.

2. **Meteorology:** India Meteorological Department (IMD) is the Principal Government agency in all matters relating to all aspects of atmospheric sciences including climate and weather services and allied subjects. The primary objectives are to undertake (i) meteorological observations and to provide current and forecast meteorological information for optimum operation of weather-sensitive activities like agriculture, irrigation, aviation, pilgrimage etc. (ii) warn against severe weather phenomena like tropical cyclones, dust storms, thunder storms, heavy rains and snow, cold & heat waves etc. which cause destruction of life and property, and (iii) maintain liaison with other scientific organizations in the country in the fields of agriculture, hydrology, oceanography, air pollution monitoring and forecasting, to provide customized meteorological services for specific purposes.

3. **Oceanographic Survey (ORV and FORV) and Marine Living Resources (MLR):** The Oceanographic Research Vessel (ORV) Sagar Kanya and Fisheries Oceanographic Research Vessel (FORV)

Sagar Sampada have been primary platforms for conducting multi-disciplinary Oceanographic Research and Surveys for the exploration of both living and non-living resources in the Exclusive Economic Zone (EEZ) of India, including Central Indian Ocean Basin and Southern Ocean. The Marine Living Resources (MLR) Programme was initiated towards assessment of the fishery resources and explaining the physical and biological interactions. The assessment surveys and monitoring activities under these programmes are essential to harvest exploitable resources from the Indian EES. The Centre for Marine Living Resources and Ecology (CMLRE) has estimated systematically fish potential in India EEZ of 4.32 MTA, using Satellite and in situ data.

4. **National Centre for Medium Range Weather Forecasting (NCMRWF):** The National Centre for Medium Range Weather Forecasting is continuously developing advanced numerical weather prediction systems, with increased reliability and accuracy over India and neighboring regions through research, development and demonstrates new and novel applications, maintaining highest level of knowledge, skills and technical bases.

6. **Ocean services, Modelling, Application, Resources and Technology (O-SMART):** The scheme encompasses a total of 16 sub-projects addressing ocean development activities viz., Services, Technology, Resources, Observations and Science. In August 2018, the O-SMART was approved as an umbrella scheme for implementation during the period from 2017-18 to 2019-20 at an overall cost of ₹1623 crores. The O-SMART envisages implementation of highly multi-disciplinary schemes contributing to the blue economy for effective and efficient use of the vast ocean resources in a sustainable way. The technologies being developed under this Scheme will help in harnessing the vast ocean resources of both living and non-living resources from the seas around India. The O-SMART would contribute to achieve United Nations Sustainable Development Goal-14 to conserve and sustainably use the oceans, seas and marine resources for sustainable development. The ocean advisory services and technologies being rendered and developed under the scheme play a pivotal role in the development activities over dozen sectors, working in the marine environment including the coastal states of India, contributing significantly to the GDP. Besides, the state-of-the-art early warning systems setup for oceanic disasters viz., Tsunami, storm surges, are also providing round the clock services for India and countries of the Indian Ocean, which have been recognized by UNESCO. The important deliverables include (i) strengthening of Ocean Observations and Modelling (ii) Strengthening of Ocean Services for Fishermen (iii) setting up Marine Coastal Observatories for monitoring marine pollution in 2018 (iv) setting up Ocean Thermal Energy Conversion Plant (OTEC) in Kavaratti (v) acquisition of 2 Coastal Research Vessels for Coastal research (vi) Continuation of Ocean Survey and Exploration of Minerals and Living Resources (vii) Technology Development for Deep Ocean Mining- Deep Mining System and Manned Submersibles and (ix) setting up Six Desalination Plants in Lakshadweep.

7. **Atmosphere and Climate Research - Modelling Observing Systems and Services (ACROSS):** The ACROSS scheme approved in November 2018 by the Cabinet encompasses nine sub-schemes for implementation during 2017-2020 at an estimated cost of ₹ 1450 crore. It aims to establishment of National Facility for Airborne Research (NFAR) with a financial commitment of Rs 130 crore during 2020-21 and beyond. The scheme will provide improved weather, climate and ocean forecast and services, thereby ensuring transfer of commensurate benefits to the various services like Public weather service, disaster management, Agro-meteorological Services, Aviation services, Environmental monitoring services, Hydro-meteorological services, climate services, tourism, pilgrimage, power generation, water management, Sports and adventure etc. To ensure last-mile connectivity of the weather based services to the end-user, a large number of agencies like the Krishi Vigyana Kendras of Indian Council of Agricultural Research, Universities and local municipalities are roped in thus generating employment opportunities to many people. ACROSS scheme pertains to the atmospheric science programs of the Ministry of Earth Sciences (MoES) and addresses different aspects of weather and climate services, which includes warnings for cyclone, storm surges, heat waves, thunderstorms etc. As the objective of the ACROSS scheme is to provide a reliable weather and climate forecast for betterment of society, the scheme will aim at improving skill of weather and climate forecast through sustained observations, intensive Research and Development, and by adopting effective dissemination and communication strategies to ensure its timely reach to the end-user of all services like Agro-meteorological Services, Aviation service, Environmental monitoring services, Hydro-meteorological services, climate services, tourism, pilgrimage, mountaineering etc. The Ministry of Earth Sciences has a mandate to carry out research and development activities to develop and improve capability to forecast weather, climate and natural hazard related phenomena. Towards this direction, MoES has taken several initiatives to formulate specific schemes like augmentation of observing systems and infrastructure, understanding processes through special campaigns, weather and climate modelling, monsoon-research, climate change science and climate services etc. These schemes involve multi-institutes wherein each unit has a designated role for accomplishing the aforesaid tasks. As a result, all these schemes with specific objectives and budget are implemented in an integrated manner and are put together under the umbrella scheme ACROSS.

8. **Polar Science and Cryosphere (PACER):** The program is designed to study various aspects relating to Polar and Cryosphere with special emphasis on the Antarctic, Arctic and Glaciers of

Himalayas (i) establishment, sustenance and augmentation of observing system (ii) Expeditions and related activities to the Arctic, Antarctic, Himalayas and Southern Ocean (iii) Establishment/maintenance of Indian stations in the Arctic, Antarctic and Himalayas and (iv) Acquisition of Polar Research vessels.

9. **Seismological and Geoscience (SAGE):** This programme deals with (i) sustaining and strengthening of seismological observation systems to monitor and provide information on earthquake and all related seismological information, microzonation (ii) research related to solid-earth and geoscience (iii) earthquakes inputs for earthquake disasters mitigation (iii) Deep bore holes investigation in Koyna, Warna region (iv) Marine Geo scientific studies, study of largest Geoid low, Deep-sea drilling in the Arabian Sea basin through the Integrated Ocean Drilling Programme and related study for reconstruction of history and climate variations, rate of erosion (v) crustal processes, natural resource management, coastal processes etc.

10. **Research, Education and Training Outreach (REACHOUT):** It extends extra mural support to academic/research organizations in various sectors of Earth System Sciences including technology development (ii) Promoting focused research in areas of national importance through integration of multi institutional and multi-disciplinary scientific expertise (iii) supporting establishment of national facilities (iv) Capacity building including chair professors, M. Tech courses, setting up ESTC cells, knowledge information system, economic benefits, promoting indigenous capability (iv) Advanced school of training for Earth System Science and climate, oceanography, operational meteorology, training for BIMSTEC countries etc. (v) International cooperation and related joint activities (vi) Awareness and Outreach programs through participation in fairs/exhibitions, celebrating specific days, promoting/supporting workshops/seminar/symposia in Earth System Science related areas.

11. **Indian National Centre for Ocean Information Services (INCOIS):** It provides ocean information and advisory services to the society, industry, government and scientific community through sustained ocean observations and constant improvements through systematic and focused research.

12. **National Institute of Ocean Technology (NIOT):** The major aim of starting NIOT under the Ministry of Earth Sciences is to develop reliable indigenous technology to solve the various engineering problems associated with harvesting of living and non-living resources in the Indian Exclusive Economic Zone (EEZ), which is about 2/3 of the land area of India.

14. **National Centre for Polar and Ocean Research, Goa (NCPOR):** National Centre for Polar and Ocean Research (NCPOR) Goa is the premier R&D institution responsible for the Country research activities in the polar and Southern Ocean realms. The main objectives of the Institute are Polar and Ocean Sciences, Geo-scientific surveys, extended continental shelf and Deep Sea Drilling in the Arabian Sea, etc.

15. **Indian Institute of Tropical Meteorology (IITM):** IITM undertakes basic Research on the Ocean-Atmosphere Climate System required for improvement of Weather and Climate Forecasts and development of earth system model for long term prediction and projecting climate change scenarios. These are achieved through advancement of Research in Ocean-Atmosphere by undertaking relevant scientific programmes (involving observations and modelling) and collaborating at National and International level along with continuous process of human resource development of outstanding research and talent.

16. **National Centre for Earth Science Studies (NCESS):** NCESS fosters multidisciplinary research in emerging areas of solid earth science, provide services by utilizing this knowledge for earth science applications and generate leadership capabilities in the selected areas.