

MINISTRY OF EARTH SCIENCES

DEMAND NO. 24

Ministry of Earth Sciences*(In ₹ crores)*

	Actual 2020-2021			Budget 2021-2022			Revised 2021-2022			Budget 2022-2023		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
Gross	1218.26	69.70	1287.96	1738.69	163.00	1901.69	2150.10	224.00	2374.10	2207.94	450.00	2657.94
Recoveries	-13.36	-0.06	-13.42	-4.56	...	-4.56	-4.56	...	-4.56	-4.43	...	-4.43
Receipts	...	...	...	...	...	...	...	...	...	...	...	...
Net	1204.90	69.64	1274.54	1734.13	163.00	1897.13	2145.54	224.00	2369.54	2203.51	450.00	2653.51
A. The Budget allocations, net of recoveries, are given below:												
CENTRE'S EXPENDITURE												
Establishment Expenditure of the Centre												
1. Secretariat	34.96	...	34.96	42.00	...	42.00	562.81	...	562.81	46.60	...	46.60
2. Meteorology	415.44	...	415.44	442.72	...	442.72	469.75	...	469.75	514.03	...	514.03
	-3.27	...	-3.27	-4.56	...	-4.56	-4.56	...	-4.56	-4.43	...	-4.43
<i>Net</i>	412.17	...	412.17	438.16	...	438.16	465.19	...	465.19	509.60	...	509.60
3. Oceanographic Survey (ORV and FORV) and Marine Living Resources (MLR)	9.00	...	9.00	25.00	...	25.00	24.56	...	24.56	9.00	...	9.00
4. National Centre for Medium Range Weather Forecasting (NCOMRWF)	11.13	...	11.13	12.80	...	12.80	12.40	...	12.40	14.00	...	14.00
Total-Establishment Expenditure of the Centre	467.26	...	467.26	517.96	...	517.96	1064.96	...	1064.96	579.20	...	579.20
Central Sector Schemes/Projects												
5. Ocean services, Modelling, Application, Resources and Technology (O-SMART)	227.60	5.85	233.45	421.17	15.00	436.17	384.00	10.00	394.00	435.00	25.00	460.00
6. Atmosphere and Climate Research - Modelling Observing Systems and Services (ACROSS)	166.98	50.86	217.84	337.00	123.00	460.00	180.00	159.00	339.00	260.00	200.00	460.00
7. Polar Science and Cryosphere (PACER)	109.64	...	109.64	115.00	...	115.00	108.00	...	108.00	140.24	...	140.24
8. Seismological and Geoscience (SAGE)	25.75	12.99	38.74	85.00	25.00	110.00	47.17	25.00	72.17	75.00	25.00	100.00
9. Research, Education and Training Outreach (REACHOUT)	34.52	...	34.52	60.00	...	60.00	58.00	...	58.00	65.00	...	65.00
10. Deep Ocean Mission (DOM)	...	...	...	...	...	...	120.00	30.00	150.00	450.00	200.00	650.00
Total-Central Sector Schemes/Projects	564.49	69.70	634.19	1018.17	163.00	1181.17	897.17	224.00	1121.17	1425.24	450.00	1875.24
Other Central Sector Expenditure												
Autonomous Bodies												
11. Indian National Centre for Ocean Information Services (INCOIS)	22.60	...	22.60	24.50	...	24.50	22.81	...	22.81	25.80	...	25.80

(In ₹ crores)

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	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
12. National Institute of Ocean Technology (NIOT)	43.00	...	43.00	49.25	...	49.25	42.90	...	42.90	49.40	...	49.40
13. National Centre for Polar and Ocean Research, Goa (NCPOR)	21.72	...	21.72	24.00	...	24.00	21.60	...	21.60	23.67	...	23.67
14. Indian Institute of Tropical Meteorology (IITM)	83.42	...	83.42	84.25	...	84.25	83.10	...	83.10	86.30	...	86.30
15. National Centre for Earth Science Studies (NCESS)	12.50	...	12.50	16.00	...	16.00	13.00	...	13.00	13.90	...	13.90
Total-Autonomous Bodies	183.24	...	183.24	198.00	...	198.00	183.41	...	183.41	199.07	...	199.07
Others												
16. Actual Recoveries	-10.09	-0.06	-10.15	...	...	...	...	...	...	...	...	...
Total-Other Central Sector Expenditure	173.15	-0.06	173.09	198.00	...	198.00	183.41	...	183.41	199.07	...	199.07
Grand Total	1204.90	69.64	1274.54	1734.13	163.00	1897.13	2145.54	224.00	2369.54	2203.51	450.00	2653.51
B. Developmental Heads												
Economic Services												
1. Oceanographic Research	432.89	...	432.89	658.92	...	658.92	723.87	...	723.87	1133.11	...	1133.11
2. Other Scientific Research	44.50	...	44.50	72.80	...	72.80	70.40	...	70.40	79.00	...	79.00
3. Secretariat-Economic Services	34.95	...	34.95	42.00	...	42.00	562.81	...	562.81	46.60	...	46.60
4. Meteorology	692.56	...	692.56	960.41	...	960.41	788.46	...	788.46	944.80	...	944.80
5. Capital Outlay on Oceanographic Research	...	5.85	5.85	...	15.00	15.00	...	40.00	40.00	...	225.00	225.00
6. Capital Outlay on Meteorology	...	63.79	63.79	...	148.00	148.00	...	184.00	184.00	...	225.00	225.00
Total-Economic Services	1204.90	69.64	1274.54	1734.13	163.00	1897.13	2145.54	224.00	2369.54	2203.51	450.00	2653.51
Grand Total	1204.90	69.64	1274.54	1734.13	163.00	1897.13	2145.54	224.00	2369.54	2203.51	450.00	2653.51

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 Meteorology, Seismology 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, 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 Vessels (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 under the Exclusive Economic Zone (EEZ) including Central Indian Ocean Basin and Southern Ocean. The Marine Living Resources (MLR) Programme

was initiated towards assessment of the deep sea fishery resources and explaining the physical and biological interactions. The assessment surveys and monitoring activities under these programmes are essential to estimate the harvest and exploitable resources from the Indian EEZ. The Centre for Marine Living Resources and Ecology (CMLRE) has estimated systematically fish potential in Indian 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. NCMRWF real-time data assimilation system produces initial conditions for running real-time seamless weather prediction models that caters to forecasts from days-to-season, and provides valuable guidance to IMD forecasters. The high resolution global and regional ensemble predictions models being run at NCMRWF are used operationally for providing probabilistic forecasts for severe weather warning.

5. **Ocean services, Modelling, Application, Resources and Technology (O-SMART):** The programmes relating to Ocean Sector encompass (i) Sustaining and Strengthening a suite of

Ocean Observational Networks for acquisition of time-series data from the seas around India. This is useful for regular monitoring, validating satellite data and important input for Ocean Atmospheric Models. They help in improved understanding of ocean dynamics, climate variability, ocean state forecast, sea level variations, ocean flux studies, etc. (ii) provide a suite of Ocean Information Services, assessment of biodiversity of Marine Living Resources, periodical monitoring of health of the coastal waters of India, Management of Coastal Marine Area, Operational Tsunami Warning System on 24X7 basis for issue of bulletins for India and to the countries of the Indian Ocean Region, (iii) conducting topographic surveys in EEZ and exploration of deep sea mineral resources of the Indian Ocean. These include gas hydrates, poly-metallic nodules, hydrothermal sulfide minerals, cobalt crusts which contain valuable noble metals available along the mid oceanic regions of the Indian Ocean, (iv) operation and maintenance of Research Vessels for undertaking research and developmental activities, (v) development of Ocean technology for Ocean Energy, Deep Sea Mining, Coastal Environmental Engineering and Marine Instrumentation, sea front facility, and operations of unmanned submersible. The Remotely Operable Subsea In-situ Soil Tester (ROSIS) and Submersible have been developed.

6. **Atmosphere and Climate Research - Modelling Observing Systems and Services**

(ACROSS): The programme deals with (i) sustaining and strengthening of atmospheric observation systems to meet the needs of monitoring as well as providing wide range of services viz. agriculture, aviation, city forecasts, defence and sports, and disaster preparedness including setting up of a dedicated forecasting system for the entire Himalayan region with a much focused objective of integrating and improving the weather and climate related services in the country (ii) assimilation of both conventional and non-conventional data for development of a suite of atmospheric models required for prediction of monsoon weather and climate in India on different time and space scales ranging from short and medium range to seasonal scale including specific forecast of severe weather, such as cyclones, heavy rains, storms, floods, heat-waves, fog and air-quality, micro physical characteristics of aerosols and clouds and associated environmental conditions. (iii) conduct climate change research to generate a number of historical and regional scenarios of water and other climate services due to climate Long-term (multi-decadal) simulations, conducting research to enhance understanding of the changing water cycle and paleoclimatic studies (iv) operation and maintenance on 24X7 basis of critical infrastructure for undertaking all modelling activities, forecast generation, data centre and data analytics, air borne platform facilities for environmental observations.

7. **Polar Science and Cryosphere (PACER):** This program is designed to study various aspects relating to Polar and Cryosphere with special emphasis on the Antarctic, Arctic, Southern Ocean and Himalayas. The program deals with (i) ensuring the country strategic and scientific interests in the Polar Region and the surrounding oceans (ii) continuing the long-term frontline scientific programmes in Antarctica, Arctic, Himalaya and Southern Ocean (iii) planning, coordination and implementation of the annual Indian Antarctic, Arctic, Himalayan, Southern Ocean expeditions (iv) maintenance of Indian Research bases at Antarctica, Arctic and Himalaya and (v) establishing a state-of-the-art polar research and logistic facilities in the country.

8. **Seismological and Geoscience (SAGE):** This programme deals with (i) sustaining and strengthening of seismological observation systems to monitor and provide information on earthquake and related issues, seismic hazard assessment and microzonation (ii) research related to Seismology, solid-earth and geoscience (iii) Geodynamics and surface processes (iv) Deep bore holes investigation in Koyna-Warna region (v) Marine Geo scientific studies, study of largest Geoid low, Deep-sea drilling through the Integrated Ocean Drilling Programme and related study for reconstruction of history and climate variations, rate of erosion etc. (vi) Setting up of Geochronology facility.

9. **Research, Education and Training Outreach (REACHOUT):** 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, assessing the economic

benefits of MoES services (iv), training for member countries of The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) organization (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. (vii) Development of Skilled Manpower in Earth System Sciences, MoES Research Fellow program (ix) International Training Centre for Operational Oceanography and (x) Creation of Earth System Science Knowledge Resource System and establishment of Knowledge Resource Centre (KRC) at MoES and all its institutes.

10. **Deep Ocean Mission (DOM):** The Deep Ocean Mission aims to explore deep-oceanic resources and develop technologies for their sustainable use. The Mission consists of six major themes, namely (i) Development of Technologies for Deep Sea Mining, Manned Submersible, and Underwater Robotics; (ii) Development of Ocean Climate Change Advisory Services; (iii) Technological innovations for exploration and conservation of deep-sea biodiversity; (iv) Deep Ocean Survey and Exploration; (v) Energy and freshwater from the Ocean and (vi) Advanced Marine Station for Ocean Biology. The mission involves mapping of floors of Deep Oceans and development of technologies like a manned submersible with 6000m water depth rating, mining system for deep sea mining, sustainable utilization of deep-sea bio resources and developing engineering designs for offshore thermal energy-driven desalination plants. Human capacity will be developed in ocean biology and engineering through the translation of research into industrial applications.

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 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.

13. **National Centre for Polar and Ocean Research, Goa (NCPOR):** NCPOR is the premier R and 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, Geoscientific surveys, extended continental shelf and Deep Sea Drilling in the Arabian Sea, etc.

14. **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 investments in human resource development for conducting cutting edge research.

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