

**MINISTRY OF EARTH SCIENCES**

## DEMAND NO. 30

**Ministry of Earth Sciences**

A. The Budget allocations, net of recoveries, are given below:

Major Head	Actual 2011-2012			Budget 2012-2013			Revised 2012-2013			<i>(In crores of Rupees)</i> Budget 2013-2014			
	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	
Revenue	717.82	351.48	1069.30	1073.50	386.66	1460.16	696.95	374.90	1071.85	1080.00	408.89	1488.89	
Capital	100.91	0.06	100.97	207.50	0.34	207.84	123.05	0.10	123.15	201.00	0.11	201.11	
<b>Total</b>	<b>818.73</b>	<b>351.54</b>	<b>1170.27</b>	<b>1281.00</b>	<b>387.00</b>	<b>1668.00</b>	<b>820.00</b>	<b>375.00</b>	<b>1195.00</b>	<b>1281.00</b>	<b>409.00</b>	<b>1690.00</b>	
1. Secretariat - Economic Services	3451	...	19.38	19.38	...	25.54	25.54	...	22.21	22.21	...	24.54	24.54
<b>Oceanographic Research</b>													
2. Oceanographic Research													
2.01 Oceanographic Survey(ORV and FORV) and Marine Living Resources(MLR)	3403	1.39	60.14	61.53	...	56.70	56.70	...	53.82	53.82	...	58.66	58.66
2.02 Polar Science	3403	241.89	...	241.89	...	...	...	...	...	...	...	...	...
2.03 Coastal Research Vessels & Other Research Vessels	3403	6.00	...	6.00	...	...	...	...	...	...	...	...	...
2.04 Polymetallic Nodules (PMN) Programme	3403	1.09	...	1.09	...	...	...	...	...	...	...	...	...
2.05 Other Programmes													
2.05.01 Information Technology	3403	0.44	...	0.44	...	...	...	...	...	...	...	...	...
2.05.02 Ocean Observation and Information System (OOIS)	3403	14.80	...	14.80	...	...	...	...	...	...	...	...	...
2.05.03 Data Buoy Programme / Integrated Sustain Ocean Observation	3403	34.00	...	34.00	...	...	...	...	...	...	...	...	...
2.05.04 National Institute of Ocean Technology (NIOT)	3403	22.00	...	22.00	...	...	...	...	...	...	...	...	...
2.05.05 Delineation of Outer Limits of Continental Shelf	3403	0.48	...	0.48	...	...	...	...	...	...	...	...	...
2.05.06 Comprehensive Topography Survey	3403	...	...	...	...	...	...	...	...	...	...	...	...
2.05.07 Gas Hydrates	3403	11.00	...	11.00	...	...	...	...	...	...	...	...	...
2.05.08 Acquisition of Research Vessels - Sagar Nidhi	3403	26.00	...	26.00	...	...	...	...	...	...	...	...	...
2.05.09 Tsunami and Storm Surge Warning System	3403	28.00	...	28.00	...	...	...	...	...	...	...	...	...

(In crores of Rupees)

	Major Head	Actual 2011-2012			Budget 2012-2013			Revised 2012-2013			Budget 2013-2014			
		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	
2.05.10	National Center for Antarctic and Ocean Research (NCAOR)	3403	7.90	...	7.90	...	...	...	...	...	...	...	...	
2.05.11	Indian National Center for Ocean Information Services (INCOIS)	3403	25.65	...	25.65	...	...	...	...	...	...	...	...	
2.05.12	Sea front facilities	3403	...	...	...	...	...	...	...	...	...	...	...	
2.05.13	Development of Manned Submersible	3403	...	...	...	...	...	...	...	...	...	...	...	
2.05.14	Expedition to Arctic Region	3403	8.79	...	8.79	...	...	...	...	...	...	...	...	
2.05.15	Desalination Plant	3403	10.00	...	10.00	...	...	...	...	...	...	...	...	
2.05.16	National Oceanarium	3403	...	...	...	...	...	...	...	...	...	...	...	
2.05.17	Demonstration of Shore Protection Measure	3403	...	...	...	...	...	...	...	...	...	...	...	
2.05.18	Integrated Ocean Drilling Programme & Geotechnic Studies (IODP)	3403	4.95	...	4.95	...	...	...	...	...	...	...	...	
2.05.19	Ice Class Research Vessel	3403	40.00	...	40.00	...	...	...	...	...	...	...	...	
2.05.20	Head Quarter Building	5403	3.76	...	3.76	...	...	...	...	...	...	...	...	
2.05.21	Marine Research and Technology Development (MRTD)	3403	34.60	...	34.60	...	...	...	...	...	...	...	...	
		3601	...	...	...	...	...	...	...	...	...	...	...	
		5403	2.11	...	2.11	...	...	...	...	...	...	...	...	
	<i>Total</i>		<i>36.71</i>	...	<i>36.71</i>	...	...	...	...	...	...	...	...	
2.05.22	R & D in Earth and Atmospheric Sciences	3403	58.51	...	58.51	...	...	...	...	...	...	...	...	
2.05.23	Centre for Climate Change	3403	38.00	...	38.00	...	...	...	...	...	...	...	...	
2.05.24	Multi-hazards Early Warning Support System	3403	...	...	...	...	...	...	...	...	...	...	...	
	<i>Total- Other Programmes</i>		<i>370.99</i>	...	<i>370.99</i>	...	...	...	...	...	...	...	...	
2.06	Ocean Observations	3403	...	...	...	50.00	...	50.00	43.50	...	43.50	45.00	...	45.00
2.07	Ocean Science Services	3403	...	...	...	83.00	...	83.00	62.45	...	62.45	81.00	...	81.00
		5403	...	...	...	8.00	...	8.00	5.00	...	5.00	5.00	...	5.00
	<i>Total</i>		...	...	...	<i>91.00</i>	...	<i>91.00</i>	<i>67.45</i>	...	<i>67.45</i>	<i>86.00</i>	...	<i>86.00</i>
2.08	Ocean Survey and Mineral Resources	3403	...	...	...	68.00	...	68.00	50.00	...	50.00	70.00	...	70.00
2.09	Ocean Technology	3403	...	...	...	89.00	...	89.00	65.00	...	65.00	90.00	...	90.00

(In crores of Rupees)

	Major Head	Actual 2011-2012			Budget 2012-2013			Revised 2012-2013			Budget 2013-2014		
		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
2.10 Ocean Research Vessels	3403	...	...	...	68.00	...	68.00	57.00	...	57.00	135.00	...	135.00
2.11 Polar Sciences and Cryosphere	3403	...	...	...	290.00	...	290.00	190.00	...	190.00	200.00	...	200.00
<i>Total- Oceanographic Research</i>		<i>621.36</i>	<i>60.14</i>	<i>681.50</i>	<i>656.00</i>	<i>56.70</i>	<i>712.70</i>	<i>472.95</i>	<i>53.82</i>	<i>526.77</i>	<i>626.00</i>	<i>58.66</i>	<i>684.66</i>
<b>Meteorology</b>													
3. <i>Meteorology</i>													
3.01 Direction & Administration	3455	...	25.13	25.13	...	29.30	29.30	...	27.88	27.88	...	31.83	31.83
3.02 Training	3455	0.40	2.64	3.04	...	3.26	3.26	...	3.18	3.18	...	3.49	3.49
3.03 Research & Development Programme	3455	...	20.94	20.94	...	24.91	24.91	...	20.91	20.91	...	26.94	26.94
3.04 Satellite Services	3455	4.87	13.45	18.32	...	16.50	16.50	...	14.72	14.72	...	17.82	17.82
3.05 Observatory and Weather Stations	3455	20.34	118.73	139.07	...	127.14	127.14	...	137.21	137.21	...	137.77	137.77
	5455	...	...	...	...	0.34	0.34	...	0.10	0.10	...	0.11	0.11
	<i>Total</i>	<i>20.34</i>	<i>118.73</i>	<i>139.07</i>	...	<i>127.48</i>	<i>127.48</i>	...	<i>137.31</i>	<i>137.31</i>	...	<i>137.88</i>	<i>137.88</i>
3.06 Other Meteorological Services	3455	...	63.65	63.65	...	71.55	71.55	...	63.61	63.61	...	75.93	75.93
3.07 Other Programmes	3455	...	2.09	2.09	...	2.44	2.44	...	2.37	2.37	...	2.55	2.55
3.08 India Meteorological Department (IMD)													
3.08.01 Modernisation of IMD	3455	15.37	0.10	15.47	...	...	...	...	...	...	...	...	...
	5455	48.03	...	48.03	...	...	...	...	...	...	...	...	...
	<i>Total</i>	<i>63.40</i>	<i>0.10</i>	<i>63.50</i>	...	...	...	...	...	...	...	...	...
3.08.02 Other Schemes in IMD	3455	10.96	0.14	11.10	...	...	...	...	...	...	...	...	...
	5455	44.91	0.06	44.97	...	...	...	...	...	...	...	...	...
	<i>Total</i>	<i>55.87</i>	<i>0.20</i>	<i>56.07</i>	...	...	...	...	...	...	...	...	...
	<i>Total- India Meteorological Department (IMD)</i>	<i>119.27</i>	<i>0.30</i>	<i>119.57</i>	...	...	...	...	...	...	...	...	...
3.09 Atmospheric Observation Systems Network	3455	...	...	...	71.00	...	71.00	45.00	...	45.00	70.00	...	70.00
	5455	...	...	...	135.00	...	135.00	97.00	...	97.00	130.00	...	130.00
	<i>Total</i>	...	...	...	<i>206.00</i>	...	<i>206.00</i>	<i>142.00</i>	...	<i>142.00</i>	<i>200.00</i>	...	<i>200.00</i>
3.10 Atmospheric Processes and Modeling and Services	3455	...	...	...	27.00	...	27.00	13.00	...	13.00	33.00	...	33.00
	5455	...	...	...	52.00	...	52.00	12.00	...	12.00	37.00	...	37.00
	<i>Total</i>	...	...	...	<i>79.00</i>	...	<i>79.00</i>	<i>25.00</i>	...	<i>25.00</i>	<i>70.00</i>	...	<i>70.00</i>
3.11 Climate Change Research	3455	...	...	...	66.00	...	66.00	34.00	...	34.00	65.00	...	65.00
3.12 Airborne Platforms	3455	...	...	...	50.00	...	50.00	0.50	...	0.50	30.00	...	30.00
<i>Total- Meteorology</i>		<i>144.88</i>	<i>246.93</i>	<i>391.81</i>	<i>401.00</i>	<i>275.44</i>	<i>676.44</i>	<i>201.50</i>	<i>269.98</i>	<i>471.48</i>	<i>365.00</i>	<i>296.44</i>	<i>661.44</i>

<i>(In crores of Rupees)</i>														
	Major Head	Actual 2011-2012			Budget 2012-2013			Revised 2012-2013			Budget 2013-2014			
		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	
<b>Other Scientific Research</b>														
4. Other Scientific Research														
4.01	National Centre for Medium Range Weather Forecasting (NCMRWF)	3425	4.74	4.56	9.30	...	5.78	5.78	...	5.45	5.45	...	5.82	5.82
		5425	2.10	...	2.10	...	...	...	...	...	...	...	...	...
	<i>Total</i>		<i>6.84</i>	<i>4.56</i>	<i>11.40</i>	...	<i>5.78</i>	<i>5.78</i>	...	<i>5.45</i>	<i>5.45</i>	...	<i>5.82</i>	<i>5.82</i>
4.02	Indian Institute of Tropical Meteorology, Pune	3425	45.65	20.53	66.18	...	23.54	23.54	...	23.54	23.54	...	23.54	23.54
4.03	Seismological Research	3425	...	...	...	43.00	...	43.00	21.00	...	21.00	53.00	...	53.00
		5425	...	...	...	12.00	...	12.00	4.05	...	4.05	27.00	...	27.00
	<i>Total</i>		...	...	...	<i>55.00</i>	...	<i>55.00</i>	<i>25.05</i>	...	<i>25.05</i>	<i>80.00</i>	...	<i>80.00</i>
4.04	Geosciences	3425	...	...	...	8.00	...	8.00	6.00	...	6.00	15.00	...	15.00
4.05	High Performance Computing System	3425	...	...	...	100.00	...	100.00	77.00	...	77.00	125.00	...	125.00
4.06	Research, Education and Training Outreach	3425	...	...	...	60.00	...	60.00	32.50	...	32.50	68.00	...	68.00
		5425	...	...	...	...	...	...	5.00	...	5.00	2.00	...	2.00
	<i>Total</i>		...	...	...	<i>60.00</i>	...	<i>60.00</i>	<i>37.50</i>	...	<i>37.50</i>	<i>70.00</i>	...	<i>70.00</i>
4.07	National Geographical Information System (NGIS)	3425	...	...	...	0.50	...	0.50	...	...	...	...	...	...
		5425	...	...	...	0.50	...	0.50	...	...	...	...	...	...
	<i>Total</i>		...	...	...	<i>1.00</i>	...	<i>1.00</i>	...	...	...	...	...	...
<i>Total- Other Scientific Research</i>			<i>52.49</i>	<i>25.09</i>	<i>77.58</i>	<i>224.00</i>	<i>29.32</i>	<i>253.32</i>	<i>145.55</i>	<i>28.99</i>	<i>174.54</i>	<i>290.00</i>	<i>29.36</i>	<i>319.36</i>
<b>Grand Total</b>			<b>818.73</b>	<b>351.54</b>	<b>1170.27</b>	<b>1281.00</b>	<b>387.00</b>	<b>1668.00</b>	<b>820.00</b>	<b>375.00</b>	<b>1195.00</b>	<b>1281.00</b>	<b>409.00</b>	<b>1690.00</b>
	Head of Dev	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total	
<b>C. Plan Outlay</b>														
1.	Oceanographic Research	13403	621.36	...	621.36	656.00	...	656.00	472.95	...	472.95	626.00	...	626.00
2.	Other Scientific Research	13425	52.49	...	52.49	224.00	...	224.00	145.55	...	145.55	290.00	...	290.00
3.	Meteorology	13455	144.88	...	144.88	401.00	...	401.00	201.50	...	201.50	365.00	...	365.00
<b>Total</b>			<b>818.73</b>	...	<b>818.73</b>	<b>1281.00</b>	...	<b>1281.00</b>	<b>820.00</b>	...	<b>820.00</b>	<b>1281.00</b>	...	<b>1281.00</b>

1. **Secretariat Economic Services:** The budget provision is for secretariat expenditure of the Ministry of Earth Sciences including Departmental Accounting organisation of Ministry of Earth Sciences.

2.01. **Oceanographic Survey (ORV & FORV):** 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 non - living and living resources under the Exclusive Economic Zone (EEZ) including Central Indian Ocean Basin and Southern Ocean.

Marine Living Resources - The Marine Living Resources (MLR) programme was initiated during IX plan towards assessment of the fishery resources and explaining the physical and

biological interactions. The assessment surveys and monitoring activities under the programmes are essential to harvest exploitable resources from the Indian EEZ. The Centre for Marine Living Resources and Ecology (CMLRE) has estimated systematically for the first time fish potential in the Indian EEZ of 4.32 MTA, using satellite and in-situ data.

2.06. **Ocean Observation System (OOS):** The objective is to acquire time-series data from the seas around India and to develop a wide range of ocean atmospheric models towards augmentation of services. This would be useful for addressing issues on the ocean dynamic, climate variability, ocean state forecast, sea level variations, ocean flux studies etc. Besides, a campaign mode research on ocean biogeochemistry and bioactivities compounds from the marine organisms will also be taken up.

2.07. **Ocean Science and Services (OSS):** These are providing a suite of Ocean Information services assessment of marine Living Resources, periodical monitoring of health of the coastal waters of India Management of Coastal Marine Area operational of Tsunami Warning system by 24/7 basis for issue of bulletins for India and to the countries of the Indian Ocean region. The centres of the Ministry INCOIS ICMAM CMLRE are primarily responsible for providing the information. The INCOIS centre had been recognized as a Regional Tsunami Service Provider for the Indian Ocean Region and started operation to the Indian Ocean Rim countries.

2.08. **Ocean Survey and Mineral Resources:** This program primarily aimed at conducting surveys for harnessing the marine non living resources in a sustainable way, available in EEZ and deep sea region of the Indian Ocean. These include gas hydrates, poly metallic nodules, hydrothermal sulfide minerals, cobalt crust. All ongoing projects of the ministry and new initiatives of Twelfth Plan have been integrated into the major program Besides, continuing the some of the activities of ongoing schemes like gas hydrate PMN the major emphasis would be taken the research activities relating to Hydrothermal sulfides containing valuable noble metals available along the mid oceanic regions of the Indian Ocean.

2.09. **Ocean Technology:** The ocean technology program of India encompass four core missions as Ocean Energy, Deep Sea Mining, Coastal Environmental Engineering and Marine Instrumentation. A Remotely Operable Subsea In situ Soil Tester (ROSI) and Submersible had been developed and was tested at a water depth of 5400 m in the Central Indian Ocean Basin. This test is a significant milestone in India's R&D efforts towards demonstration of mining of poly metallic nodules from the deep oceans. An open sea cage farming of fin fishes mainland and A&N island. The desalination plants established in Lakshadweep have been contributing significantly to the drinking water needs of the local population of these islands. Activities will be continued to scale up the capacity of these plants.

2.10. **Ocean Research Vessels:** With the increasing demand for coverage of vast areas of oceans, it is necessary to plan for new vessels, as the lead time to commission a vessel is around 4 to 5 years. Proposed new vessels will be greater than 100m, Ice class, with speed of 20 knots and fitted with winches and systems for exploration of deep sea living resources. Sagar Sampada had the limitation of undertaking these studies only up to 1000 to 1500m depths. These vessels will be acquired.

2.11. **Polar Sciences and Cryosphere:** The research work includes study of the Antarctic Arctic and Glaciers of Himalayas that are important to understand the climate change and climate variability in the Indian region. The First Scientific expedition was launched to the South Pole in November and December 2010. The third Antarctic Station Bharati is in advanced stage of commission.

It is expected to ready for operation which will give significant boost to India's research in the Antarctic sector.

3.01. **Direction & Administration:** It provides expenditure for administration of India Meteorological Department (IMD)

3.02. **Training:** The training sections at Pune, New Delhi and Kolkata impart training in meteorology and in operation, maintenance and servicing of radio meteorological instruments and telecommunications.

3.03. **Research and Development programme:** The Research and development activities of the department cover experimental work and research on basic and applied meteorology and seismology including design and development of the instruments.

3.04. **Satellite Services (Space Meteorology):** IMD participated in space programme since the launching of the first Indian National Geo-stationary Satellite IA by ISRO in 1982. Valuable data and cloud imageries are being received since then. Ground receiver for INSAT - 3D to be commissioned for receiving & processing of high resolution data and also to establish of more 50 GPS & peripheres.

3.05. **Observatory and Weather Stations:** The activities consist of recording of observations and equipping ships, maintenance of inland and overseas meteorological telecommunication network for quick exchange of weather information.

3.06. **Other Meteorological Services:** The activities consist of manufacture, supply and maintenance of meteorological instruments and production of hydrogen gas at Departmental Workshops and supply of these to the upper air observations. Provision also includes expenditure for agro meteorological units and facilities.

3.09. **Atmospheric Observation Systems Network:** Mainly aimed at augmentation of atmospheric observation systems to meet the needs of a wide range of services, Agriculture, Aviation, Metrocities, mountain regions, defense, and sports, disasters in the country. An Atmospheric Technology Institute is also planned to coordinate development of instruments, calibrate instruments including satellite based, and provide overall technology support to atmospheric sciences, besides validation of satellite data. It is proposed to set up a dedicated forecasting system for the entire Himalayan region with a much focused objective of integrating and improving the weather related services.

3.10. **Atmospheric Processes and Modeling and Service:** This endeavor mainly focuses on development of a suite of atmospheric models for providing weather and climate forecasting services to various sectors by integrating all the process studies and models, essential to work out a modeling framework and put it in use to predict monsoon weather and climate in India on different time scales ranging from short and medium range to seasonal mean. Attempt will also made to make specific forecast of severe weather, such as cyclones, heavy rains, storms, floods, heat and cold waves, etc. cause huge damages.

3.11. **Climate Change Research:** This entails generation of a number of regional scenarios of water and other climate services due to climate. Long-term (multi-decadal) simulations of Monsoon are carried out using coupled ocean-atmospheric models upon the commissioning of the HPC

system upgrade for climate change research. The development of seasonal and intra-seasonal prediction of monsoon through coupled model is to be taken up. The research projects would be taken up to enhance our understanding of the changing water cycle. Besides, paleoclimatic studies will be conducted to understand the past variations of climate for possible projections of climate scenarios.

3.12. **Airborne Platforms:** A wealth of atmospheric, aerosol and cloud microphysics data will be monitored through acquisition of instrumented aircraft. The proposed program will be useful in air pollution assessment and associated impacts over India (health, visibility, climate), hydrological and water resources studies, and enhancement of research infrastructure (human resources and technology).

4.03. **Seismological Research:** The primary objective of the endeavour is to provide thrust to the earthquake related studies and to generate inputs for earthquake disasters mitigation. Efforts are also being made towards generation of long term, comprehensive multi parametric geophysical observations in seismically active areas which include i) Deep crustal studies across the Indian continental margin and the interior, ii) Andaman subduction zone, iii) Active faults of India. Besides, this program also envisages reconciling the constraints from available geophysical and geological data along a series of transects across the Indian peninsula into a consistent model of the Indian lithosphere to conduct studies on Deep bore holes investigations in Koyna, Warna region, and Marine Geo scientific Studies, study of largest Geoid low.

4.04. **Geosciences:** Deep sea drilling in the Arabian Sea basin through the Integrated Ocean Drilling Program is the main activity under this program. The integrated Ocean Drilling Programme provides the opportunity to explore these sediment records and reconstruct the history of climatic variations and rate of erosion. The

Sedimentation records from the Indus and Bengal Fans, both of which can be obtained from IODP cores, should present erosional histories of different parts of the Himalaya.

4.05. **High Performance Computing System:** With the increasing scope of research activities, the computational demand has increased manifold over the years for undertaking various climate related problems that involve running of coupled models for hundreds of years and utilizing data from the global land, ocean and atmosphere. It is proposed to augment computing power from existing 124 Tflops to 1500 to 2000 Tflops during Twelfth Five year plan

4.06. **Research Education, Training and Outreach:** Considering the advantage of hands on training in capacity building of trained manpower, the ministry has set up Centre for Advanced Training (CAT) with world class teaching courses and good hostel facilities to serve for the region. The other main activities would be setting up an Institute for Operational Oceanography for training and capacity building in operational oceanography, training centre in operational oceanography. Focused research in areas of National importance through integration of multi institutional and multi disciplinary scientific expertise will be encouraged.