

**MINISTRY OF EARTH SCIENCES**

## DEMAND NO. 30

**Ministry of Earth Sciences**

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

| <i>(In crores of Rupees)</i>   |                  |               |                |                  |               |                |                   |               |                |                  |               |                |               |
|--|------------------|---------------|----------------|------------------|---------------|----------------|-------------------|---------------|----------------|------------------|---------------|----------------|---------------|
| Major Head   | Actual 2012-2013 |               |                | Budget 2013-2014 |               |                | Revised 2013-2014 |               |                | Budget 2014-2015 |               |                |               |
|  | Plan             | Non-Plan      | Total          | Plan             | Non-Plan      | Total          | Plan              | Non-Plan      | Total          | Plan             | Non-Plan      | Total          |               |
| Revenue  | 692.37           | 361.34        | 1053.71        | 1080.00          | 408.89        | 1488.89        | 814.50            | 382.92        | 1197.42        | 1094.00          | 417.94        | 1511.94        |               |
| Capital  | 118.62           | 0.07          | 118.69         | 201.00           | 0.11          | 201.11         | 110.50            | 0.08          | 110.58         | 187.00           | 0.06          | 187.06         |               |
| <b>Total</b>   | <b>810.99</b>    | <b>361.41</b> | <b>1172.40</b> | <b>1281.00</b>   | <b>409.00</b> | <b>1690.00</b> | <b>925.00</b>     | <b>383.00</b> | <b>1308.00</b> | <b>1281.00</b>   | <b>418.00</b> | <b>1699.00</b> |               |
| 1. Secretariat - Economic Services                                       | 3451             | ...           | 21.71          | 21.71            | ...           | 24.54          | 24.54             | ...           | 24.41          | 24.41            | ...           | 26.67          | 26.67         |
| <b>Oceanographic Research</b>  |                  |               |                |                  |               |                |                   |               |                |                  |               |                |               |
| 2. Oceanographic Research  |                  |               |                |                  |               |                |                   |               |                |                  |               |                |               |
| 2.01 Oceanographic Survey(ORV and FORV) and Marine Living Resources(MLR) | 3403             | ...           | 52.41          | 52.41            | ...           | 58.66          | 58.66             | ...           | 51.00          | 51.00            | ...           | 54.75          | 54.75         |
| 2.02 Ocean Observations  | 3403             | 43.26         | ...            | 43.26            | 45.00         | ...            | 45.00             | 40.00         | ...            | 40.00            | 45.00         | ...            | 45.00         |
| 2.03 Ocean Science Services  | 3403             | 62.44         | ...            | 62.44            | 81.00         | ...            | 81.00             | 62.00         | ...            | 62.00            | 75.00         | ...            | 75.00         |
|  | 5403             | 4.99          | ...            | 4.99             | 5.00          | ...            | 5.00              | 8.00          | ...            | 8.00             | 15.00         | ...            | 15.00         |
| <i>Total</i>   |                  | <i>67.43</i>  | ...            | <i>67.43</i>     | <i>86.00</i>  | ...            | <i>86.00</i>      | <i>70.00</i>  | ...            | <i>70.00</i>     | <i>90.00</i>  | ...            | <i>90.00</i>  |
| 2.04 Ocean Survey and Mineral Resources                                  | 3403             | 49.90         | ...            | 49.90            | 70.00         | ...            | 70.00             | 50.00         | ...            | 50.00            | 80.00         | ...            | 80.00         |
| 2.05 Ocean Technology  | 3403             | 64.98         | ...            | 64.98            | 90.00         | ...            | 90.00             | 83.52         | ...            | 83.52            | 100.00        | ...            | 100.00        |
| 2.06 Ocean Research Vessels  | 3403             | 56.55         | ...            | 56.55            | 135.00        | ...            | 135.00            | 55.48         | ...            | 55.48            | 60.00         | ...            | 60.00         |
| 2.07 Polar Sciences and Cryosphere                                       | 3403             | 190.00        | ...            | 190.00           | 200.00        | ...            | 200.00            | 155.99        | ...            | 155.99           | 200.00        | ...            | 200.00        |
| <i>Total- Oceanographic Research</i>                                     |                  | <i>472.12</i> | <i>52.41</i>   | <i>524.53</i>    | <i>626.00</i> | <i>58.66</i>   | <i>684.66</i>     | <i>454.99</i> | <i>51.00</i>   | <i>505.99</i>    | <i>575.00</i> | <i>54.75</i>   | <i>629.75</i> |
| <b>Meteorology</b>   |                  |               |                |                  |               |                |                   |               |                |                  |               |                |               |
| 3. Meteorology   |                  |               |                |                  |               |                |                   |               |                |                  |               |                |               |
| 3.01 Direction & Administration  | 3455             | ...           | 26.10          | 26.10            | ...           | 31.83          | 31.83             | ...           | 30.40          | 30.40            | ...           | 33.15          | 33.15         |
| 3.02 Training  | 3455             | ...           | 2.87           | 2.87             | ...           | 3.49           | 3.49              | ...           | 3.23           | 3.23             | ...           | 3.23           | 3.23          |
| 3.03 Research & Development Programme                                    | 3455             | ...           | 20.39          | 20.39            | ...           | 26.94          | 26.94             | ...           | 22.91          | 22.91            | ...           | 26.14          | 26.14         |
| 3.04 Satellite Services  | 3455             | ...           | 13.58          | 13.58            | ...           | 17.82          | 17.82             | ...           | 15.10          | 15.10            | ...           | 16.30          | 16.30         |
| 3.05 Observatory and Weather Stations                                    | 3455             | ...           | 129.02         | 129.02           | ...           | 137.77         | 137.77            | ...           | 134.92         | 134.92           | ...           | 146.41         | 146.41        |
|  | 5455             | ...           | 0.07           | 0.07             | ...           | 0.11           | 0.11              | ...           | 0.08           | 0.08             | ...           | 0.06           | 0.06          |
| <i>Total</i>   |                  | ...           | <i>129.09</i>  | <i>129.09</i>    | ...           | <i>137.88</i>  | <i>137.88</i>     | ...           | <i>135.00</i>  | <i>135.00</i>    | ...           | <i>146.47</i>  | <i>146.47</i> |
| 3.06 Other Meteorological Services                                       | 3455             | ...           | 64.24          | 64.24            | ...           | 75.93          | 75.93             | ...           | 69.85          | 69.85            | ...           | 76.79          | 76.79         |

(In crores of Rupees)

|                                  | Major Head  | Actual 2012-2013 |               |                | Budget 2013-2014 |               |                | Revised 2013-2014 |               |                | Budget 2014-2015 |               |                |                |
|----------------------------------|---|------------------|---------------|----------------|------------------|---------------|----------------|-------------------|---------------|----------------|------------------|---------------|----------------|----------------|
|                                  |   | Plan             | Non-Plan      | Total          | Plan             | Non-Plan      | Total          | Plan              | Non-Plan      | Total          | Plan             | Non-Plan      | Total          |                |
| 3.07                             | Other Programmes  | 3455             | ...           | 2.33           | 2.33             | ...           | 2.55           | 2.55              | ...           | 2.55           | 2.55             | ...           | 2.55           | 2.55           |
| 3.08                             | Atmospheric Observation Systems Network                       | 3455             | 44.87         | ...            | 44.87            | 70.00         | ...            | 70.00             | 68.00         | ...            | 68.00            | 75.00         | ...            | 75.00          |
|                                  |   | 5455             | 96.57         | ...            | 96.57            | 130.00        | ...            | 130.00            | 61.00         | ...            | 61.00            | 115.00        | ...            | 115.00         |
|                                  | <i>Total</i>  | <i>141.44</i>    | <i>...</i>    | <i>141.44</i>  | <i>200.00</i>    | <i>...</i>    | <i>200.00</i>  | <i>129.00</i>     | <i>...</i>    | <i>129.00</i>  | <i>190.00</i>    | <i>...</i>    | <i>190.00</i>  | <i>190.00</i>  |
| 3.09                             | Atmospheric Processes and Modeling and Services               | 3455             | 12.86         | ...            | 12.86            | 33.00         | ...            | 33.00             | 30.00         | ...            | 30.00            | 78.00         | ...            | 78.00          |
|                                  |   | 5455             | 8.03          | ...            | 8.03             | 37.00         | ...            | 37.00             | 23.00         | ...            | 23.00            | 22.00         | ...            | 22.00          |
|                                  | <i>Total</i>  | <i>20.89</i>     | <i>...</i>    | <i>20.89</i>   | <i>70.00</i>     | <i>...</i>    | <i>70.00</i>   | <i>53.00</i>      | <i>...</i>    | <i>53.00</i>   | <i>100.00</i>    | <i>...</i>    | <i>100.00</i>  | <i>100.00</i>  |
| 3.10                             | Climate Change Research                                       | 3455             | 31.89         | ...            | 31.89            | 65.00         | ...            | 65.00             | 30.00         | ...            | 30.00            | 47.00         | ...            | 47.00          |
| 3.11                             | Airborne Platforms  | 3455             | ...           | ...            | ...              | 30.00         | ...            | 30.00             | 0.01          | ...            | 0.01             | 20.00         | ...            | 20.00          |
|                                  | <i>Total- Meteorology</i>                                     | <i>194.22</i>    | <i>258.60</i> | <i>452.82</i>  | <i>365.00</i>    | <i>296.44</i> | <i>661.44</i>  | <i>212.01</i>     | <i>279.04</i> | <i>491.05</i>  | <i>357.00</i>    | <i>304.63</i> | <i>661.63</i>  | <i>661.63</i>  |
| <b>Other Scientific Research</b> |   |                  |               |                |                  |               |                |                   |               |                |                  |               |                |                |
| 4. Other Scientific Research     |   |                  |               |                |                  |               |                |                   |               |                |                  |               |                |                |
| 4.01                             | National Centre for Medium Range Weather Forecasting (NCMRWF) | 3425             | ...           | 5.15           | 5.15             | ...           | 5.82           | 5.82              | ...           | 5.01           | 5.01             | ...           | 5.95           | 5.95           |
| 4.02                             | Indian Institute of Tropical Meteorology, Pune                | 3425             | ...           | 23.54          | 23.54            | ...           | 23.54          | 23.54             | ...           | 23.54          | 23.54            | ...           | 26.00          | 26.00          |
| 4.03                             | Seismological Research  | 3425             | 20.99         | ...            | 20.99            | 53.00         | ...            | 53.00             | 40.00         | ...            | 40.00            | 70.00         | ...            | 70.00          |
|                                  |   | 5425             | 4.04          | ...            | 4.04             | 27.00         | ...            | 27.00             | 17.00         | ...            | 17.00            | 30.00         | ...            | 30.00          |
|                                  | <i>Total</i>  | <i>25.03</i>     | <i>...</i>    | <i>25.03</i>   | <i>80.00</i>     | <i>...</i>    | <i>80.00</i>   | <i>57.00</i>      | <i>...</i>    | <i>57.00</i>   | <i>100.00</i>    | <i>...</i>    | <i>100.00</i>  | <i>100.00</i>  |
| 4.04                             | Geosciences   | 3425             | 5.51          | ...            | 5.51             | 15.00         | ...            | 15.00             | 15.00         | ...            | 15.00            | 54.00         | ...            | 54.00          |
| 4.05                             | High Performance Computing System                             | 3425             | 77.00         | ...            | 77.00            | 125.00        | ...            | 125.00            | 104.00        | ...            | 104.00           | 90.00         | ...            | 90.00          |
| 4.06                             | Research, Education and Training Outreach                     | 3425             | 32.12         | ...            | 32.12            | 68.00         | ...            | 68.00             | 80.50         | ...            | 80.50            | 100.00        | ...            | 100.00         |
|                                  |   | 5425             | 4.99          | ...            | 4.99             | 2.00          | ...            | 2.00              | 1.50          | ...            | 1.50             | 5.00          | ...            | 5.00           |
|                                  | <i>Total</i>  | <i>37.11</i>     | <i>...</i>    | <i>37.11</i>   | <i>70.00</i>     | <i>...</i>    | <i>70.00</i>   | <i>82.00</i>      | <i>...</i>    | <i>82.00</i>   | <i>105.00</i>    | <i>...</i>    | <i>105.00</i>  | <i>105.00</i>  |
|                                  | <i>Total- Other Scientific Research</i>                       | <i>144.65</i>    | <i>28.69</i>  | <i>173.34</i>  | <i>290.00</i>    | <i>29.36</i>  | <i>319.36</i>  | <i>258.00</i>     | <i>28.55</i>  | <i>286.55</i>  | <i>349.00</i>    | <i>31.95</i>  | <i>380.95</i>  | <i>380.95</i>  |
| <b>Grand Total</b>               |   | <b>810.99</b>    | <b>361.41</b> | <b>1172.40</b> | <b>1281.00</b>   | <b>409.00</b> | <b>1690.00</b> | <b>925.00</b>     | <b>383.00</b> | <b>1308.00</b> | <b>1281.00</b>   | <b>418.00</b> | <b>1699.00</b> | <b>1699.00</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            | 472.12        | ...            | 472.12           | 626.00        | ...            | 626.00            | 454.99        | ...            | 454.99           | 575.00        | ...            | 575.00         |
| 2.                               | Other Scientific Research                                     | 13425            | 144.65        | ...            | 144.65           | 290.00        | ...            | 290.00            | 258.00        | ...            | 258.00           | 349.00        | ...            | 349.00         |
| 3.                               | Meteorology   | 13455            | 194.22        | ...            | 194.22           | 365.00        | ...            | 365.00            | 212.01        | ...            | 212.01           | 357.00        | ...            | 357.00         |
| <b>Total</b>                     |   | <b>810.99</b>    | <b>...</b>    | <b>810.99</b>  | <b>1281.00</b>   | <b>...</b>    | <b>1281.00</b> | <b>925.00</b>     | <b>...</b>    | <b>925.00</b>  | <b>1281.00</b>   | <b>...</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.

2.02. **Ocean Observation System(OOS):** To strengthen the observational networks for acquisition of time-series data from the seas around India useful for validation satellite data and ocean atmospheric models besides improve understanding ocean dynamic, climate variability, ocean state forecast, sea level variations, ocean flux studies etc. Campaign mode research on ocean biogeochemistry and bioactivities compounds from the marine organisms will also be taken up.

2.03. **Ocean Science and Services (OSS):** Envisages to provide 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 24x7 basis for issue of bullents for India and to the countries of the Indian Ocean region, recognized as a Regional Tsunami Service Provider for the Indian Ocean Region.

2.04. **Ocean Survey and Mineral Resources:** 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 crusts which contain valuable noble metals available along the mid oceanic regions of the Indian Ocean.

2.05. **Ocean Technology:** Encompass four core missions as Ocean Energy, Deep Sea Mining, Coastal Environmental Engineering and Marine Instrumentation including development of unmanned submersible. 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. The 3-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.

2.06. **Ocean Research Vessels:** Operation and maintenance of fleet of ocean research vessels (Sagar Nidhi, Sagar Manjusha, Coastal Resarch vessels) to support ocean survey and research. And initiate preparation of detailed project report for acquisition of new vessels.

2.07. **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-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 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 & periphers.

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.

3.08. **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 including setting up of a dedicated forecasting system for the entire Himalayan region with a much focused objective of integrating and improving the weather related services.

3.09. **Atmospheric Processes and Modeling and Service:** This endeavour mainly focuses on development of a suite of atmospheric models required for prediction of monsoon weather and climate in India on different time scales ranging from short and medium range to seasonal mean including specific forecast of severe weather, such as cyclones, heavy rains, storms, floods, heat-waves, fog and air-quality.

3.10. **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 besides, conducting research to enhance understanding of the changing water cycle and paleoclimatic studies

3.11. **Airborne Platforms:** Acquisition of airborne platform would help in collecting a wealth of atmospheric, aerosol and cloud microphysics data.

4.03. **Seismological Research:** To provide thrust to the earthquake related studies and to generate inputs for earthquake disasters mitigation. Besides, setting up of dedicated centre on Seismology, works on Deep bore holes investigations in Koyna, Warna region, and Marine Geo scientific Studies, study of largest Geoid low would be continued.

4.04. **Geoscience:** 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. Support focused research in areas of National importance through integration of multi institutional and multi disciplinary scientific expertise through research and academic institutions and a newly acquired Centre of Earth System Science (CESS) and foster bi-lateral, regional and global partnership in relevant fields of earth science.