

**MINISTRY OF EARTH SCIENCES****DEMAND NO.29****Ministry of Earth Sciences**

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

		<i>(In crores of Rupees)</i>								
		Budget 2008-2009			Revised 2008-2009			Budget 2009-2010		
Major Head		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
	Revenue	328.12	218.00	546.12	354.93	267.70	622.63	525.70	307.50	833.20
	Capital	421.88	3.00	424.88	195.07	2.30	197.37	224.30	2.50	226.80
	<b>Total</b>	<b>750.00</b>	<b>221.00</b>	<b>971.00</b>	<b>550.00</b>	<b>270.00</b>	<b>820.00</b>	<b>750.00</b>	<b>310.00</b>	<b>1060.00</b>
1.	Secretariat - Economic Services	3451	...	11.84	11.84	...	16.50	16.50	...	19.00
2.	<i>Oceanographic Research</i>									
2.1	Oceanographic Survey (ORV and FORV) and Marine Living Resources(MLR)	3403	...	41.00	41.00	...	37.89	37.89	...	38.25
2.2.	Polar Science	3403	35.50	...	35.50	57.50	...	57.50	94.00	...
2.3.	Coastal Research Vessels & Other Research Vessels	3403	5.00	...	5.00	5.00	...	5.00	5.00	...
2.4.	Polymetallic Nodules (PMN) Programme	3403	15.00	...	15.00	15.00	...	15.00	12.86	...
2.5.	<i>Other Programmes</i>									
2.5.1	Information Technology	3403	1.00	...	1.00	2.00	...	2.00	3.00	...
2.5.2	Ocean Observation and Information System (OOIS)	3403	13.00	...	13.00	18.00	...	18.00	12.00	...
2.5.3	Data Buoy Programme / Integrated Sustain Ocean Observation	3403	10.00	...	10.00	15.00	...	15.00	18.00	...
2.5.4	National Institute of Ocean Technology (NIOT)	3403	20.00	...	20.00	30.00	...	30.00	47.00	...
2.5.5	Delineation of Outer Limits of Continental Shelf	3403	1.00	...	1.00	1.00	...	1.00	1.00	...
2.5.6	Comprehensive Topography Survey	3403	5.00	...	5.00	5.00	...	5.00	6.00	...
2.5.7	Gas Hydrates	3403	12.00	...	12.00	6.00	...	6.00	20.00	...
2.5.8	Acquisition of Research Vessels "Sagar Nidhi"	3403	12.00	...	12.00	20.00	...	20.00	22.00	...
2.5.9	Tsunami and Storm Surge Warning System	3403	15.00	...	15.00	10.00	...	10.00	10.00	...
2.5.10	National Center for Antarctic and Ocean Research (NCAOR)	3403	15.00	...	15.00	15.00	...	15.00	15.00	...
2.5.11	Indian National Center for Ocean Information Services (INCOIS)	3403	30.00	...	30.00	22.84	...	22.84	15.00	...
2.5.12	Sea front facilities	3403	10.00	...	10.00	0.10	...	0.10	0.50	...
2.5.13	Development of manned submersible	3403	5.00	...	5.00	0.01	...	0.01	0.01	...
2.5.14	Multichannel Seismic System onboard ORV Sagar Kanya	3403	5.00	...	5.00	0.01	...	0.01	0.01	...
2.5.15	Expedition to Arctic Region	3403	2.00	...	2.00	2.00	...	2.00	2.60	...
2.5.16	Desalination Plant	3403	10.00	...	10.00	0.01	...	0.01	0.50	...
2.5.17	National Oceanarium	3403	0.50	...	0.50	0.01	...	0.01	2.00	...
2.5.18	Demonstration of Shore Protection Measure	3403	0.50	...	0.50	0.50	...	0.50	5.00	...
2.5.19	Integrated Ocean Drilling Programme & Geotechnic Studies (IODP)	3403	4.00	...	4.00	5.00	...	5.00	10.00	...
2.5.20	Ice Class Research Vessel	3403	5.00	...	5.00	0.01	...	0.01	0.50	...
2.5.21	Head Quarter Building	5403	20.00	...	20.00	0.01	...	0.01	15.00	...

		(In crores of Rupees)								
Major Head	Budget 2008-2009			Revised 2008-2009			Budget 2009-2010			
	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	
2.5.22 Marine Research and Technology Development (MRTD)	3403	22.50	...	22.50	27.50	...	27.50	53.20	...	53.20
	5403	1.50	...	1.50	1.50	...	1.50	1.80	...	1.80
	<b>Total</b>	<b>24.00</b>	...	<b>24.00</b>	<b>29.00</b>	...	<b>29.00</b>	<b>55.00</b>	...	<b>55.00</b>
2.5.23 NIOT extension Centre, West Bengal	3403	0.50	...	0.50	0.01	...	0.01	0.01	...	0.01
2.5.24 R & D in Earth and Atmospheric Sciences	3403	7.00	...	7.00	19.00	...	19.00	23.00	...	23.00
2.5.25 Centre for Climate Change	3403	5.00	...	5.00	5.00	...	5.00	25.00	...	25.00
2.5.26 Dedicated Weather Channel and Commonwealth Games	3403	5.00	...	5.00	1.00	...	1.00	5.00	...	5.00
2.5.27 Multi-hazards Early Warning Support System	3403	1.00	...	1.00	1.00	...	1.00	0.01	...	0.01
<b>Total Other Programmes</b>		<b>238.50</b>	...	<b>238.50</b>	<b>207.51</b>	...	<b>207.51</b>	<b>313.14</b>	...	<b>313.14</b>
<b>Total Oceanographic Research</b>		<b>294.00</b>	<b>41.00</b>	<b>335.00</b>	<b>285.01</b>	<b>37.89</b>	<b>322.90</b>	<b>425.00</b>	<b>38.25</b>	<b>463.25</b>
<b>3. Meteorology</b>										
3.1 Direction & Administration	3455	...	13.50	13.50	...	18.48	18.48	...	21.00	21.00
3.2 Training	3455	...	1.80	1.80	...	2.41	2.41	...	2.50	2.50
3.3 Research & Development Programme	3455	...	13.50	13.50	...	18.37	18.37	...	21.20	21.20
3.4 Satellite Services	3455	...	7.00	7.00	...	8.96	8.96	...	10.00	10.00
3.5 Observatory and Weather Stations	3455	...	75.50	75.50	...	98.00	98.00	...	117.40	117.40
	5455	...	2.00	2.00	...	1.80	1.80	...	2.00	2.00
	<b>Total</b>	...	<b>77.50</b>	<b>77.50</b>	...	<b>99.80</b>	<b>99.80</b>	...	<b>119.40</b>	<b>119.40</b>
3.6 Other Meteorological Services	3455	...	39.38	39.38	...	50.29	50.29	...	59.50	59.50
	5455	...	1.00	1.00	...	0.50	0.50	...	0.50	0.50
	<b>Total</b>	...	<b>40.38</b>	<b>40.38</b>	...	<b>50.79</b>	<b>50.79</b>	...	<b>60.00</b>	<b>60.00</b>
3.7 Other Programmes	3455	...	1.58	1.58	...	1.80	1.80	...	2.00	2.00
3.8 India Meteorological Department (IMD)										
3.8.1 Modernisation of IMD (Communication, Observation, Cyclone Warning, Forecasting, Aviation Services, Instrumentation, Infrastructural Development)	3455	5.00	...	5.00	5.00	...	5.00	6.00	...	6.00
	5455	359.00	...	359.00	154.99	...	154.99	156.00	...	156.00
	<b>Total</b>	<b>364.00</b>	...	<b>364.00</b>	<b>159.99</b>	...	<b>159.99</b>	<b>162.00</b>	...	<b>162.00</b>
3.8.2 Other Schemes in IMD	3455	32.62	...	32.62	30.43	...	30.43	44.50	...	44.50
	5455	35.38	...	35.38	32.57	...	32.57	43.50	...	43.50
	<b>Total</b>	<b>68.00</b>	...	<b>68.00</b>	<b>63.00</b>	...	<b>63.00</b>	<b>88.00</b>	...	<b>88.00</b>
<b>Total</b>		<b>432.00</b>	...	<b>432.00</b>	<b>222.99</b>	...	<b>222.99</b>	<b>250.00</b>	...	<b>250.00</b>
<b>Total Meteorology</b>		<b>432.00</b>	<b>155.26</b>	<b>587.26</b>	<b>222.99</b>	<b>200.61</b>	<b>423.60</b>	<b>250.00</b>	<b>236.10</b>	<b>486.10</b>
<b>4. Other Scientific Research</b>										
4.1 National Centre for Medium Range Weather Forecast (NCMRWF)	3425	5.00	3.90	8.90	7.00	4.50	11.50	12.00	4.65	16.65
	5425	6.00	...	6.00	6.00	...	6.00	8.00	...	8.00
	<b>Total</b>	<b>11.00</b>	<b>3.90</b>	<b>14.90</b>	<b>13.00</b>	<b>4.50</b>	<b>17.50</b>	<b>20.00</b>	<b>4.65</b>	<b>24.65</b>
4.2 Indian Institute of Tropical Meteorology, Pune	3425	13.00	9.00	22.00	29.00	10.50	39.50	55.00	12.00	67.00
<b>Total Other Scientific Research</b>		<b>24.00</b>	<b>12.90</b>	<b>36.90</b>	<b>42.00</b>	<b>15.00</b>	<b>57.00</b>	<b>75.00</b>	<b>16.65</b>	<b>91.65</b>
<b>Grand Total</b>		<b>750.00</b>	<b>221.00</b>	<b>971.00</b>	<b>550.00</b>	<b>270.00</b>	<b>820.00</b>	<b>750.00</b>	<b>310.00</b>	<b>1060.00</b>
<b>C. Plan Outlay:</b>	Head of Dev	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total
1. Oceanographic Research	13403	294.00	...	294.00	285.01	...	285.01	425.00	...	425.00
2. Meteorology	13455	432.00	...	432.00	222.99	...	222.99	250.00	...	250.00
3. Other Scientific Research	13425	24.00	...	24.00	42.00	...	42.00	75.00	...	75.00
<b>Total</b>		<b>750.00</b>	...	<b>750.00</b>	<b>550.00</b>	...	<b>550.00</b>	<b>750.00</b>	...	<b>750.00</b>

1. **Secretariat Economic Services:** Provision is for secretariat expenditure of the Ministry of Earth Sciences.

2. **Oceanographic Research:**

2.1. **Oceanographic Survey (ORV & FORV) and Marine Living Resources (MLR):-** The two major vessels viz. Oceanographic Research Vessel (ORV) - Sagar Kanya and Fisheries and Oceanographic Research Vessel (FORV) - Sagar Sampada are being utilized for conducting oceanographic surveys and exploration of both non-living and living resources in our Exclusive Economic Zone (EEZ) including Central Indian Ocean Basin and Southern Ocean, since 1984.

2.2. **Polar Science (Antarctic Research):-** The main activities under the programme include (i) launching 28<sup>th</sup> Annual Expedition to Antarctica, (ii) setting up of 3<sup>rd</sup> Station (iii) Southern Ocean: The Antarctic Research Programme has been designed to take advantage of the unique location and environment of the icy continent for understanding the key global processes which are manifested and controlled by this Polar cap.

2.3. **Coastal Research Vessels and Other Research Vessel:-** The two indigenously built coastal vessels "Sagar Purvi" and "Sagar Paschimi" of the Ministry of Earth Sciences (MoES) would be utilized for continuous monitoring of pollution levels in the coastal areas to assess the health of the coastal waters of India. These vessels are equipped with appropriate and modern technological equipment. During 2009-10, these vessels would undertake cruises for this purpose. National Institute of Ocean Technology (NIOT) has been operating these vessels.

2.4. **Polymetallic Nodules (PMN) Programme:-** Besides technology development for mining and mineral, the work would also include survey & exploration of existing allocated sites in the central Ocean. The work of survey and exploration is mainly directed towards assessing relative concentration and quality characteristics of nodules as well as seabed topography. Demarcation of grade of nodule deposits in the Central India Ocean Basin is one of the main objectives. Design and development of mining system has been reoriented so that the intermediate applications of the technology could be achieved before developing the ultimate system for a depth of 6,000 m. A joint collaborative programme between NIOT and EDBOE, Russia for design and development of unmanned submersibles capable of operation up to 6,000 m has been taken up under a MOU between MoES and Russian Academy of Sciences. A crawler, in-situ samples, and ROSUB have been developed and tested at 410 m, 5200m and 205 m respectively. Apart from carrying out the experiments in the four components of the programme, an inter-institutional R&D programme will be initiated to develop technology for mining the nodules during 2009-10

2.5. **Other Programmes:**

2.5.1. **Information Technology:-** Provision for expenditure is made to strengthen the Information Technology, computerization as a part of e-governance activities of the Ministry and centres of Ministry of Earth Sciences. IT related communication facilities at Headquarters and other autonomous bodies have been strengthened and office automation software is under implementation.

2.5.2. **Ocean Observations and Information System (OOIS):-** The OOIS consists of two major components namely observation net work and development of coupled ocean atmospheric models. The data acquired through Argo floats, Drifters, XBTs, Current Meter Arrays from the sea around India are being used for various operational and research purposes including forecasting of cyclones and understanding the climate variability. Besides, 163 ARGO profiling floats have also been deployed in the Indian Ocean so far, to acquire real-time measurements of temperature

and salinity profiles up to a depth of 2000 m with a view to improve understanding the monsoon variability. Besides real-time dissemination of data to various users, a set of 12 Argo data products are being made available through INCOIS website. The ocean modeling and dynamics projects being carried out by reputed national agencies would address basic issues on the ocean dynamic, climate variability, ocean state forecast, sea level variations, ocean flux studies etc. Strengthening of observational network by deployment of 50 Argo floats and 30 drifters will be carried out. Indigenous Argo floats will also be put at sea trials.

2.5.3. **Data Buoy Programme:** The programmes include maintenance of 40-buoy network and management of Sagar Manjusha, which is designed for strengthening the Date buoy network in the Indian Ocean to acquire real-time data on surface meteorological and upper ocean parameters for various operational purposes viz., weather forecast, improve monsoon prediction capability, coastal and offshore developmental activities. The programme is expected to deploy 40 moored buoys in selected locations in the seas around India by end of 10th Plan. Under the programme, the buoys would be produced indigenously by NIOT with possible private partnership. The work includes deployment; operation and maintenance of buoy network including dissemination of data in near real time to the potential users.

2.5.4. **National Institute of Ocean Technology (NIOT):-** There are six major activities dealing with Ocean energy, freshwater, Marine sensor, Technical Atlas, Inter-institutional R&D, Offshore structures, Ocean Acoustics etc., NIOT would also continue to undertake consultancy service in ocean related activities, Ocean Science & Technology and enhancement of marine living resources, development for breeding, rearing and fattening of lobsters to begin with for Andaman & Nicobar Islands. Consolidation of deep sea mining technology such as soil tester, ROV and crusher would be carried out, besides developing Marine Sensors and underwater equipment. Besides, in-house research programmes, expenditure will also include operation and maintenance of the centre.

2.5.5. **Delineation of Outer limits of Continental Shelf:-** In accordance with provisions of the Convention on the Law of the Sea, India is entitled to delineate the outer limits of the continental shelf beyond (200 nautical miles) Exclusive Economic Zone (EEZ). The necessary geophysical data (over 33,000 line km) required for submission of claim has been acquired successfully. The delineation of the Continental margin in case of India is likely to give a large continental margin extending beyond EEZ. The work on data interpretation and report preparation in respect of geophysical surveys is completed. The continuation of development of Marine Geo-database and submission of India's claim.

2.5.6. **Comprehensive Topographic Survey:-** The area of our Exclusive Economic Zone is over 2 million sq.km. having various living and non-living resources. This programme entails scientific mapping of this area to have an inventory of potential resources and to identify the causes of hazards. The bathymetric survey beyond 500 mts. depth would be undertaken with chartered vessel.

2.5.7. **Gas Hydrates:-** Gas hydrates have the potential of providing total energy security to our nation. The programme consists of both scientific & technology development for gas hydrates. The Ministry, in association with CSIR and other laboratories, would focus on scientific research with special emphasis on resource extent evaluation and environmental impacts and development of technology for detection and qualification of gas hydrates in sediments. Development and integration of automatic coring system for conducting sea trials would be taken up.

**2.5.8. Acquisition of Research Vessels "Sagar Nidhi":**- The Ministry's focus in the next 5 years will be to develop sustainable technology for the exploitation of various non-living resources. Suitable platform is required to replace the vessels and crafts chartered by the MoES at present for technology services and demonstration. Accordingly, the Ministry had launched a vessel Sagar Nidhi in July, 2007 after completing the construction of sea trials. The vessel was delivered in December, 2007 which will be made operational fully to cater to the ocean developmental activities.

**2.5.9. Tsunami and Storm Surge Warning System:** - The objective of the project is to establish a warning system for the Oceanogenic disasters caused by tsunami and storm surges. The project is being carried out with participation of other concerned departments such as Science and Technology (DST), Scientific and Industrial Research, Space over a period of 30 months. The project is expected to strengthen the 7 seismic observation station of DST, establishment of 8 -10 DART Observation Network, Installation of real time tide gauge monitoring stations, 24 hours monitoring of the systems for generation of timely warning, etc. A full-fledged tsunami warning centre had been set up at INCOIS Hyderabad with deployment of 17 tide gauges and 6 bottom pressure recorders for providing warning on 24X7 basis. This Centre was inaugurated in October, 2007 which has been made fully operational.

**2.5.10. National Centre for Antarctic and Ocean Research (NCAOR):**- NCAOR is an autonomous society of the Ministry which coordinates the Indian Antarctic Research programme. Following the commissioning of a state of the art ice core archival and analytical facility at NCAOR, the Centre has embarked on a major programme on analytical studies of ice-cores retrieved from Antarctica. Carbon and pigment analyses of sediments samples collected from lakes of Antarctica are being done. This was earlier included in the Polar Science Programme. Special studies will be conducted in the southern ocean by strengthening the facilities at NCAOR.

**2.5.11. Indian National Centre for Ocean Information Services (INCOIS):**- The primary mandate of INCOIS is to generate and disseminate user-oriented ocean data/data products on an operational basis. Data products in the form of Sea Surface Temperature maps, Potential Fishing Zone maps, Ocean State Forecast, wind vector maps, mixed layer depth maps, at least on heat-budget are being made available on operational basis. INCOIS is also responsible for implementation of Projects like Early Tsunami Warning System. A suite of ocean related data and data products are being made available through its web site. This was earlier included in the Ocean Observation and Information Services. The dissemination of integrated PFZ with installation of over 20 digital display boards along with coast of India would be carried out.

**2.5.12. Sea Front Facilities:** - The Ministry is implementing various oceanography research related programmes (both scientific and technology development). The technology development work being mainly carried out by NIOT, Chennai needs various sea-front facilities for creation of integration bay, test ponds, test bed for tow vehicles, Mari-culture and research labs, etc. Accordingly, NIOT is proposed to create a sea front facility to meet the research requirements of various programmes. This was earlier included in National Institute of Ocean Technology Programme. The necessary required land will be acquired for development of this facility.

**2.5.13. Development of manned submersible:** - The project is envisaged to develop a tool which will put India at par with developed nations having under water intervention capabilities. The system (manned submersible) would help in scientific research in the area of hydrothermal sulphides, cobalt crust, gas

hydrates, marine living resources and inspection of offshore installation, pipelines, platforms etc. After obtaining the approval of the programme, the tenders will be procured for acquisition of the vessels.

**2.5.14. Multi-channel Seismic System onboard ORV Sagar Kanya:**- The requirement of multi-channel seismic facility has been felt on board over any research vessels due to growing demand of seismic survey for major programmes like Gas-Hydrate Studies, inter ridge Programme, limits of continental shelf programme etc. It is envisaged to procure the same in 2009-10 for installation which would be substantially improving the oceanographic survey. This would act as a vital information for the Earth Scientists to integrate these datasets with the other geophysical datasets

**2.5.15. Expedition to the Arctic Region:** - The understanding of climatic changes in the Arctic region and their consequences on global climate changes has relevance to Indian subcontinent as well. It is therefore proposed that during the ensuing XI Five Year Plan concrete efforts need to be made to launch the First Indian Scientific Expedition to the Arctic was launched in July 2007 and future emphasis would be laid on bi-hemispheric approach in understanding the vital issues related to environment/climatic changes. Accordingly efforts will also be made to initiate scientific programmes in the Arctic realm in consonance with the international endeavours in the Arctic being mounted under the Svalbard Treaty, SCAR etc.

**2.5.16. Desalination Plant:** - NIOT has developed, and demonstrated commercial scale Low Temperature Thermal Desalination plant. A land based 0.1 million liters per day (MLD) LTTD desalination plant was commissioned at Kavarratti, in May 2005. In order to meet demand of major coastal cities of India, it is important to upgrade LTTD technology to develop larger scale plants up to 500 MLD capacities, which could be multiples of several basic modules of 25 – 50 MLD plants. Towards this end a 1 MLD barge mounted demonstration plant was taken up and commissioned in April 2007 off Chennai. The plant was run successfully for a period of over 3-weeks demonstrating the technology. During the XI plan, NIOT would take up a scheme to design, develop, and demonstrate the large scale desalination plants 10 MLD. The ultimate goal of the endeavour will be to establish such desalination plants along the coast and island territories of India to alleviate drinking water problem of coastal region.

**2.5.17. National Oceanarium:** - The main objective of this programme is to make learning about the oceans a family experience by means of promoting science tourism so that young children are motivated to opt for an ocean career later on as adults. The government would provide seed capital and the expertise to the interested parties under this scheme. Efforts are underway to acquire the land for this purpose.

**2.5.18. Demonstration of Shore Protection measure:** - The project will be implemented through pilot project at selected sites along the Indian Coast and its performance is monitored.

**2.5.19. Integrated Ocean Drilling Programme & Geotechnical Studies (IODP):**- The objective is to develop a science plan and initiation of deep drilling through the IODP, in at least three scientifically significant sites, one each in the Arabian Sea, the Bay of Bengal and in the western Andamans.

**2.5.20. Ice Class Research Vessel:** With the proposed plans for undertaking multidisciplinary scientific programmes in the Southern Ocean, initiation of activities during establishment of a new permanent Indian base in the Larsemann hills and plans to expand Indian scientific endeavors to the Arctic region/northern hemisphere, it is felt that it's time for India to have her own Ice class research vessel which will (a) serve as a medium for transportation of men and material to Antarctica; (b) serve as a platform for the Indian scientists to undertake oceanographic



studies in the sub Arctic and sub Antarctic regions and (c) serve the needs of the Indian scientific community year-round in the tropical waters as well as in the sea-ice conditions of the polar regions. The complete technical specification and design would be taken up after obtaining the approval of the Government.

**2.5.21. Head Quarter Building:** The present requirement is of full-fledged Building with a campus in Central Delhi of about 15000 sq. m. The necessary approval of construction of the building has been obtained which is scheduled to start next year.

**2.5.22. Marine Research and Technology Development (MRTD):-**

**Marine Living Resources:-** Marine Living Resources (MLR) programme was initiated during IX Plan towards assessment of the fishery resources and explaining the physical and biological interactions that regulate productivity, trophic structure of Indian continental slope area and international waters, with a view to understand and predict the inter-annual, decadal and long-term fluctuations in the marine fishery. These assessment surveys and monitoring activities under the programme are essential to harvest exploitable resources from the Indian EEZ. The provision of this sub-programme forms part of the programme on Marine Research and Technology Development. The CMLRE is functioning at present from an central pool building of the CPWD at Kakkanad.

**Drugs from Sea:** - The major thrust would be induction of six new Centres for development of new leads and product development phases. Successful completion of clinical trial, the systematic collection, extraction and biological evaluation of sea weeds, sea grasses, mangroves, anemones, sponges, corals starfish, seahorses, poisonous fin-fish and associated organisms etc. would be carried out to identify novel molecule(s) for developing potential drugs. More number of Institutions have been inducted for carrying out the studies during 2009-10

**Assistance for Research Projects:** - The objectives of this programme are to strengthen the infrastructure facilities in selected universities/ institutions to carry out basic research in marine science to create centre for excellence on Ocean, Atmospheric Science & Technology. Nine Ocean Science and Technology centres were set up in universities/IIT. More than 80 projects are continuing to be funded through OSTCs, which are expected to receive funding during the year 2009-10. In addition, projects outside the OASTC system are expected to be taken up on case-to-case basis.

**Coastal Ocean Monitoring and Prediction System (COMAPS):-** The COMAPS programme has been in operation at 76 locations for collection and analysis of 25 parameters relating to physical, chemical and biological characteristics of water and sediments. Based on the data collected through this project, the areas of concern have been identified and steps are being taken to prevent and control the causes of pollution by supplying the information to the State Pollution Control Boards. The need for strengthening this long term programme arises in wake of the expanding areas of work relating to environmental concern, for example, hazardous substances, management of the marine environment including the risk assessment and environmental impact assessment etc. and emerging areas like mitigation strategies, regulatory toxicology, eutrophication and hypoxia, organics, etc. New initiatives like development of models for oil spill modeling will be taken up during 2009-10 besides carrying out the routine monitoring.

**Exhibition and Fairs:** - Provision has been made for promoting awareness in general public towards oceans around India and to highlight India's effort in the endeavor to explore and exploit these resources for sustainable growth.

**Assistance for Research Seminar & Symposia:** - The Ministry would continue to provide funds for organizing seminars, conferences, workshops, etc. for creating public awareness on oceans and atmospheric sciences.

**Manpower Training:** - Provisions have been made to meet the objectives of the programme relating to the manpower training in Ocean and Atmospheric Sciences.

**Marine Non-Living Resource Programme (MNLR):-** This year the major initiatives would be Cobalt crust and Hydrogen sulfides with a view to explore possible mineral deposits in the active volcanic region and mid oceanic ridges.

**Integrated Coastal and Marine Area Management (ICMAM):-** The programme has two components, namely (i) Capacity building and ii) Development of Infrastructure for R&D, Survey and Training for ICMAM. The component has four activities, namely, i) Development of GIS based information system for 11 critical habitats in the coastal and Marine Areas in India, ii) Determination of Waste Assimilation Capacity at selected estuaries along coastal areas of India iii) Development of Guidelines for Environmental Impact Assessment, iv) Preparation of Model Integrated Coastal and Marine Area Management Plans. Under the component on infrastructure, training, laboratory and other facilities have been established in the NIOT Campus, Chennai. Ecotoxicological studies and ecosystem modeling at selected locations will be carried out in addition to the above.

**2.5.23. NIOT ext. Centre West Bengal:** The Centre in the eastern region will be to develop science, technologies and resources management specific to the regions of West Bengal and Orissa.

**2.5.24. R & D in Earth and Atmospheric Sciences:** In order to strengthen the basic research in the field of Atmospheric Earth Science, the Ministry proposes to take up a separate activity by leveraging the expertise available at various Universities and Research Organizations. This will be done through signing a separate MoU with the participating agencies to achieve the proposed targets. Ministry would continue to represent India in various International & Intergovernmental organization/ bodies such as Antarctic Treaty System, Scientific Committee on Antarctic Research (SCAR), Council of Managers of National Antarctic programme (COMNAP), Standing Committee on Antarctic Logistic Operations, (SCALOP), Commission for Conservation of Antarctic Marine Living Resources (CCAMLR), Intergovernmental Oceanography Commission (IOC), Regional Seas Programme, International Sea Bed Authority and International Tribunal on Law of the Sea and Indian Data Buoy Programmes, Partnership for Observation of Global Ocean, etc.

**2.5.25. Centre for Climate Change:** The Program has three main components, namely, the Program Office, the Centre for Climate Change Research at IITM, Pune and the network of national research institutions that are already working on different aspects of climate change. In addition to this there are a number of departments, ministries and international agencies that require to be linked to both support the program and to get research inputs. After obtaining the government approval, the project will be launched during the year 2009-10.

**2.5.26 Dedicated Weather Channel and Commonwealth Games 2010:** The IMD will work in collaboration with several other government operational and research agencies such as National Centre for Medium Range Weather Forecasting (NCMRWF), Indian Air Force, Indian Navy, Indian Institute of Tropical Meteorology (IITM), Pune, Department of Science & Technology, Department of Space and Centre for Atmospheric Sciences, Indian Institute of Technology (IIT), Delhi, Indian Institute of Technology, Kharagpur and Centre for Atmospheric and Ocean Sciences, Indian Institute of Sciences, Bangalore to plan and implement the project.

2.5.27. *Multi-hazards Early Warning Support System* : The objective of the programme is to develop disaster specific adaptable management frameworks by integrating local scale lead-time impact assessment based on early warning, hazard mapping and risk management decision support systems (DSSs) with customized emergency preparedness mechanisms and to develop critical and fail-safe communication and customized systems of protocols [by integrating technologies for evolving emergency response strategies linked to improved multi-hazard early warning]

The programming will be launched by seeking the necessary clearances and acquire systems for development of the decision support System during the year 2009-10.

### 3. Meteorology

3.1 **Direction & Administration:** It provides expenditure for Administration of India Meteorology Department (IMD).

3.2. **Training:** The training sections at Pune, New Delhi and Calcutta impart training in meteorology and in operation, maintenance and servicing of radio meteorological instruments and telecommunications. The meteorological training unit at Civil Aviation Training Center, Bamrauli serves the training requirements of the air traffic personnel of the Civil Aviation Department.

3.3. **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.

3.4. **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 & cloud imageries are being received since then. With the deployment of second generation INSAT II A in August 1992 there has been much improvement in the quality of data and cloud imageries. Secondary data utilization center have been established to receive and process satellite cloud imageries directly at the other main forecasting offices from Main Data Utilization Centre, New Delhi. A total of 250 numbers disaster warning receivers under different programmes using INSAT had been deployed so far at the cyclone prone coastal stations to forewarn public & other agencies against impending bad weather including cyclones. Another 100 Disaster Warning Receivers utilizing digital transmission technology installed during 2002- 03 have been fully functional.

3.5. **Observatories and Weather Stations:** The activities consist of recording of observatories and equipping ships, maintenance of inland and overseas meteorological telecommunication network for quick exchange of weather information reception of satellite weather. Information to user interests like aviation, shipping, agriculture and flood control, issue of warnings against cyclones, etc. for protection of life and property.

3.6. **Other Meteorological Services (Including Agro-Meteorology):** 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 observatories. Provision also includes expenditure for agro metrological units and facilities.

3.7. **Other Programmes (Seismology & Seismic Hazard & Risk Evaluation and Externally Aided Projects):-** These include payments of India's annual contribution to World Meteorological Organization and the International Seismological Center, Earthquake Risk Evaluation Centre and External Aided Projects.

### 3.8. India Meteorological Department (IMD):

3.8.1. *Modernisation of IMD (Communication, Observation, Cyclone Warning, Forecasting, Aviation Services, Instrumentation, Infrastructural Development):-* The objective is improvement of weather forecast and climate prediction including the Indian monsoon. It is proposed to break the project of Modernization of IMD into various sub projects such as Doppler Weather Radars, Automatic Rain Gauge Network, Automatic Weather System, MFI, etc. The necessary approvals for launching of the Phase-I Programme have been obtained and the Ministry is in advanced stage of placing the order for acquisition of the various components towards modernization of IMD. IMD has been geared up for implementation of this programme.

### 4. Other Scientific Research:

4.1 **National Centre for Medium Range Weather Forecasting (NCMRWF):** The aim of the programme is to develop global circulation model for preparing weather forecasts up to three days in advance. Towards this objective a National Centre for Medium Range Weather Forecasting with super-computing facilities has been established. This institute will work on various atmospheric modeling aspects such as Global Modeling and Data Assimilation System, Mesoscale Prediction System, Extended- Range/Seasonal Prediction System, Computer/Network Infrastructure and Services, Satellite Radiance Data Assimilation System, Climate Modeling System, Environmental Prediction System and Computer/Network Infrastructure Up gradation.

The major activities proposed for implementation during the year 2009-10 are conducting assimilation experiments on satellite data for improvement in the operational weather forecast.

4.2. **Indian Institute of Tropical Meteorology, Pune:** This institute will carry out primarily the research in atmospheric sciences including long range prediction of seasonal mean monsoon and extended range prediction of active/break spells, regional climate model, quantification of uncertainty in estimation of monsoon climate under climate change scenarios and study of sensitivity of the estimate of monsoon climate under climate change. The activities proposed to be taken up are strengthening, computing facility at IITM and conducting Cloud Aerosol Interaction Experiments during 2009-10.