MINISTRY OF EARTH SCIENCES

DEMAND NO. 29

Ministry of Earth Sciences

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

(In crores of Rupees)

	Major Head	Actual 2009-2010			Budget 2010-2011			Revised 2010-2011			Budget 2011-2012		
		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
Revenue		557.42	324.48	881.90	718.21	299.50	1017.71	739.21	327.21	1066.42	936.90	345.90	1282.80
Capital		*196.95*	*0.98*	*197.93*	*281.79*	*2.50*	*284.29*	*210.79*	*1.79*	*212.58*	*283.10*	*1.10*	*284.20*
Total		**754.37**	**325.46**	**1079.83**	**1000.00**	**302.00**	**1302.00**	**950.00**	**329.00**	**1279.00**	**1220.00**	**347.00**	**1567.00**
1. Secretariat - Economic Services	3451	...	17.35	17.35	...	22.99	22.99	...	22.40	22.40	...	24.00	24.00
Oceanographic Research													
2. Oceanographic Research													
2.01 Oceanographic Survey(ORV and FORV) and Marine Living Resources(MLR)	3403	...	36.31	36.31	...	39.88	39.88	...	39.88	39.88	...	39.88	39.88
2.02 Polar Science	3403	93.96	...	93.96	145.00	...	145.00	165.00	...	165.00	260.00	...	260.00
2.03 Coastal Research Vessels & Other Research Vessels	3403	5.00	...	5.00	7.00	...	7.00	6.00	...	6.00	7.00	...	7.00
2.04 Polymetallic Nodules (PMN) Programme	3403	11.76	...	11.76	15.00	...	15.00	13.45	...	13.45	18.00	...	18.00
2.05 Other Programmes													
2.05.01 Information Technology	3403	9.84	...	9.84	7.00	...	7.00	8.50	...	8.50	7.00	...	7.00
2.05.02 Ocean Observation and Information System (OOIS)	3403	15.00	...	15.00	23.00	...	23.00	28.00	...	28.00	30.00	...	30.00
2.05.03 Data Buoy Programme / Integrated Sustain Ocean Observation	3403	17.62	...	17.62	15.00	...	15.00	15.00	...	15.00	18.00	...	18.00
2.05.04 National Institute of Ocean Technology (NIOT)	3403	50.00	...	50.00	45.00	...	45.00	45.00	...	45.00	45.00	...	45.00
2.05.05 Delineation of Outer Limits of Continental Shelf	3403	1.00	...	1.00	1.00	...	1.00	1.00	...	1.00	1.00	...	1.00
2.05.06 Comprehensive Topography Survey	3403	5.98	...	5.98	6.00	...	6.00	6.00	...	6.00	5.00	...	5.00
2.05.07 Gas Hydrates	3403	34.90	...	34.90	12.00	...	12.00	12.00	...	12.00	18.00	...	18.00
2.05.08 Acquisition of Research Vessels - Sagar Nidhi	3403	22.00	...	22.00	20.00	...	20.00	24.00	...	24.00	18.00	...	18.00
2.05.09 Tsunami and Storm Surge Warning System	3403	10.56	...	10.56	12.00	...	12.00	10.00	...	10.00	12.00	...	12.00

(In crores of Rupees)

		Major Head	Actual 2009-2010 Plan	Actual 2009-2010 Non-Plan	Actual 2009-2010 Total	Budget 2010-2011 Plan	Budget 2010-2011 Non-Plan	Budget 2010-2011 Total	Revised 2010-2011 Plan	Revised 2010-2011 Non-Plan	Revised 2010-2011 Total	Budget 2011-2012 Plan	Budget 2011-2012 Non-Plan	Budget 2011-2012 Total
2.05.10	National Center for Antarctic and Ocean Research (NCAOR)	3403	15.00	...	15.00	15.00	...	15.00	15.00	...	15.00	15.00	...	15.00
2.05.11	Indian National Center for Ocean Information Services (INCOIS)	3403	20.00	...	20.00	25.00	...	25.00	30.00	...	30.00	25.00	...	25.00
2.05.12	Sea front facilities	3403	...	...	...	0.50	...	0.50	0.50	...	0.50	1.00	...	1.00
2.05.13	Development of manned submersible	3403	...	...	...	5.00	...	5.00	0.01	...	0.01	5.00	...	5.00
2.05.14	Multi-channel Seismic System on board ORV Sagar Kanya	3403	...	...	...	0.50	...	0.50	...	...	...	...	...	...
2.05.15	Expedition to Arctic Region	3403	2.60	...	2.60	3.00	...	3.00	3.00	...	3.00	15.00	...	15.00
2.05.16	Desalination Plant	3403	5.00	...	5.00	5.00	...	5.00	0.04	...	0.04	10.00	...	10.00
2.05.17	National Oceanararium	3403	0.04	...	0.04	1.00	...	1.00	0.50	...	0.50	2.00	...	2.00
2.05.18	Demonstration of Shore Protection Measure	3403	5.00	...	5.00	5.00	...	5.00	5.00	...	5.00	5.00	...	5.00
2.05.19	Integrated Ocean Drilling Programme & Geotechnoic Studies (IODP)	3403	10.00	...	10.00	6.00	...	6.00	6.00	...	6.00	6.00	...	6.00
2.05.20	Ice Class Research Vessel	3403	0.50	...	0.50	25.00	...	25.00	25.00	...	25.00	69.00	...	69.00
2.05.21	Head Quarter Building	5403	25.00	...	25.00	25.00	...	25.00	10.00	...	10.00	5.00	...	5.00
2.05.22	Marine Research and Technology Development (MRTD)	3403	60.31	...	60.31	69.73	...	69.73	55.73	...	55.73	66.00	...	66.00
		3601	...	...	...	1.00	...	1.00	1.00	...	1.00	0.50	...	0.50
		5403	1.53	...	1.53	7.77	...	7.77	12.27	...	12.27	11.50	...	11.50
		Total	*61.84*	*...*	*61.84*	*78.50*	*...*	*78.50*	*69.00*	*...*	*69.00*	*78.00*	*...*	*78.00*
2.05.23	NIOT extension Centre, West Bengal	3403	...	...	...	0.05	...	0.05	...	...	...	...	...	...
2.05.24	R & D in Earth and Atmospheric Sciences	3403	28.83	...	28.83	45.00	...	45.00	65.00	...	65.00	86.00	...	86.00
2.05.25	Centre for Climate Change	3403	24.02	...	24.02	45.00	...	45.00	45.00	...	45.00	50.00	...	50.00
2.05.26	Multi-hazards Early Warning Support System	3403	5.22	...	5.22	5.00	...	5.00	3.00	...	3.00	5.00	...	5.00
	Total- Other Programmes		*369.95*	*...*	*369.95*	*430.55*	*...*	*430.55*	*426.55*	*...*	*426.55*	*531.00*	*...*	*531.00*
Total- Oceanographic Research			*480.67*	*36.31*	*516.98*	*597.55*	*39.88*	*637.43*	*611.00*	*39.88*	*650.88*	*816.00*	*39.88*	*855.88*
Meteorology														
3.	*Meteorology*													
3.01	Direction & Administration	3455	...	22.40	22.40	...	22.41	22.41	...	24.65	24.65	...	26.25	26.25
3.02	Training	3455	...	2.80	2.80	...	2.71	2.71	...	2.71	2.71	...	2.86	2.86

(In crores of Rupees)

	Major Head	Actual 2009-2010 Plan	Actual 2009-2010 Non-Plan	Actual 2009-2010 Total	Budget 2010-2011 Plan	Budget 2010-2011 Non-Plan	Budget 2010-2011 Total	Revised 2010-2011 Plan	Revised 2010-2011 Non-Plan	Revised 2010-2011 Total	Budget 2011-2012 Plan	Budget 2011-2012 Non-Plan	Budget 2011-2012 Total
3.03 Research & Development Programme	3455	...	19.74	19.74	...	22.38	22.38	...	22.39	22.39	...	22.41	22.41
3.04 Satellite Services	3455	...	10.74	10.74	...	13.23	13.23	...	14.50	14.50	...	15.00	15.00
3.05 Observatory and Weather Stations	3455	...	133.22	133.22	...	95.14	95.14	...	110.76	110.76	...	119.02	119.02
	5455	...	...	...	...	2.00	2.00	...	1.79	1.79	...	1.10	1.10
	Total	*...*	*133.22*	*133.22*	*...*	*97.14*	*97.14*	*...*	*112.55*	*112.55*	*...*	*120.12*	*120.12*
3.06 Other Meteorological Services	3455	...	61.31	61.31	...	57.64	57.64	...	63.50	63.50	...	68.20	68.20
	5455	...	0.98	0.98	...	0.50	0.50	...	...	...	...	...	...
	Total	*...*	*62.29*	*62.29*	*...*	*58.14*	*58.14*	*...*	*63.50*	*63.50*	*...*	*68.20*	*68.20*
3.07 Other Programmes	3455	...	1.59	1.59	...	2.00	2.00	...	2.00	2.00	...	2.00	2.00
3.08 India Meteorological Department (IMD)													
3.08.01 Modernisation of IMD	3455	7.44	...	7.44	16.00	...	16.00	21.00	...	21.00	23.00	...	23.00
	5455	144.17	...	144.17	149.00	...	149.00	109.80	...	109.80	89.00	...	89.00
	Total	*151.61*	*...*	*151.61*	*165.00*	*...*	*165.00*	*130.80*	*...*	*130.80*	*112.00*	*...*	*112.00*
3.08.02 Other Schemes in IMD	3455	28.86	...	28.86	69.98	...	69.98	53.48	...	53.48	65.80	...	65.80
	5455	26.25	...	26.25	86.02	...	86.02	78.72	...	78.72	174.20	...	174.20
	Total	*55.11*	*...*	*55.11*	*156.00*	*...*	*156.00*	*132.20*	*...*	*132.20*	*240.00*	*...*	*240.00*
Total- India Meteorological Department (IMD)		*206.72*	*...*	*206.72*	*321.00*	*...*	*321.00*	*263.00*	*...*	*263.00*	*352.00*	*...*	*352.00*
Total- Meteorology		*206.72*	*252.78*	*459.50*	*321.00*	*218.01*	*539.01*	*263.00*	*242.30*	*505.30*	*352.00*	*256.84*	*608.84*
Other Scientific Research													
4. Other Scientific Research													
4.01 National Centre for Medium Range Weather Forecasting (NCMRWF)	3425	7.48	4.02	11.50	11.00	4.12	15.12	11.00	4.42	15.42	11.60	4.88	16.48
	5425	...	...	...	14.00	...	14.00	...	...	...	3.40	...	3.40
	Total	*7.48*	*4.02*	*11.50*	*25.00*	*4.12*	*29.12*	*11.00*	*4.42*	*15.42*	*15.00*	*4.88*	*19.88*
4.02 Indian Institute of Tropical Meteorology, Pune	3425	59.50	15.00	74.50	56.45	17.00	73.45	65.00	20.00	85.00	37.00	21.40	58.40
Total- Other Scientific Research		*66.98*	*19.02*	*86.00*	*81.45*	*21.12*	*102.57*	*76.00*	*24.42*	*100.42*	*52.00*	*26.28*	*78.28*
Grand Total		***754.37***	***325.46***	***1079.83***	***1000.00***	***302.00***	***1302.00***	***950.00***	***329.00***	***1279.00***	***1220.00***	***347.00***	***1567.00***

	Head of Dev	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total
C. Plan Outlay													
1. Oceanographic Research	13403	480.67	...	480.67	597.55	...	597.55	611.00	...	611.00	816.00	...	816.00
2. Other Scientific Research	13425	66.98	...	66.98	81.45	...	81.45	76.00	...	76.00	52.00	...	52.00

	Head of Dev	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total
3. Meteorology	13455	206.72	...	206.72	321.00	...	321.00	263.00	...	263.00	352.00	...	352.00
Total		**754.37**	**...**	**754.37**	**1000.00**	**...**	**1000.00**	**950.00**	**...**	**950.00**	**1220.00**	**...**	**1220.00**

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

2. **Oceanographic Research:**

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 since 1984. These vessels equipped with the state - of - the - art technology will be used for conducting multi - disciplinary research on the physical, chemical, geological and biological aspects of the Indian Ocean. The vessels will also be utilized in campaigns for validating satellite oceanographic data, assessment of marine (living) resources and for various technology demonstration activities. Recently, these vessels have been refurbished for providing effective services.

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 that regulate productivity, tropic 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 programmes 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, and also to the Development technology for pilot scale production of Ornamental fishes in hatchery set - up at Lakshadweep. 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. The acquisition of the data will be continued in future also.

2.02. **Polar Science (Antarctic Research):** The Antarctic Research programme has been designed to take advantage of the unique location and environment of the icy continental for understanding the key global processes which are manifested and controlled by this Polar cap. The Antarctic is pristine and natural laboratory, which enables scientists to study, detect and monitor global phenomena, such as the atmospheric patterns and ocean circulations. Glaciological and geophysical research provides clue to the geological history and evolution of the earth. The important activities envisaged during the year 2011 - 12 would be (i) planning, coordination and execution of all scientific and logistics tasks related to the XXXI Indian Scientific Expedition to Antarctica, (ii) First phase of work on 3rd station is under progress at Larsemann Hills after completion of all the ground work, (iii) Deployment of TDV Sagar Nidhi to Southern Ocean. With regard to Arctic programme, the existing India's station 'HIMADRI' will be required with field equipment and processing units and to continue long term scientific projects approved by the expert group. The first scientific expedition was launched to the South Pole in November - December, 2010. The team conducted a number of experiments during the expedition viz., atmospheric aerosol, and short ice cores from pole and GPR survey to study bed rock topography and sub - surface ice structure near the pole. India has been accorded the Chairmanship of Larsemann Hills Management Group and that of Asian Forum for Polar Science (AFoPS) for the two years (2010-12).

2.03. **Coastal Research Vessels (CRV):** The two indigenously built coastal vessels 'Sagar Purvi', '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 2011-12, these vessels would undertake cruises for this purpose. National Institute of Ocean Technology (NIOT) has been managing these vessels.

2.04. **Polymetallic Nodules (PMN) programme:** 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 nodules 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 crawler, in - situ samples, and ROSUB have been developed and tested at 410m, 5,200 m and 205 m respectively. EIA monitoring studies in the pioneer area for assessing the impact of the simulated mining at deep seabed is continuing at the site of nodules occurrences. During 2011 - 12, the sea trials of ROSUB, insitu soil tester demonstration at 6,000 m depth, deployment of submersible with Gas Sensors at Gas Hydrate site in KG basin and in Mahanadi basin, will be conducted as a part of stabilisation of technology. Survey of EEZ with multibeam system and survey of CIOB nodule areas in the first generation mine site with a chartered vessel will be conducted.

2.05. **Other programmes:**

2.05.01. **Information Technology:** The budget 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 HQ and other autonomous bodies have been strengthened and office automation software is under implementation. The major work in 2011 - 12 would be operational of Tele - presence system for the major centres of the Ministry.

2.05.02. **Ocean Observation and Information System (OOIS):** OOIS is designed to acquire time - series data and develop a wide range of ocean atmospheric models. The data acquired through Argo floats, drifters, 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. The observational network includes deployment and maintenance of various platforms including Argo profiling floats (temperature and salinity up to 2000 m depth) Moored buoys (wide spectrum of surface met - ocean parameters) (12 buoys are active out of 12 buoys deployed) Drifting buoys (surface met - ocean parameters and surface currents) (12 buoys are active) Current meter mooring arrays (time serious measurement of currents at fixed locations and depths) - 6 moorings,

expandable bathythermographs (temperature profiles along the shipping routes) - 4 line, Tide gauges (measurement of sea level at selected locations along the coast and at islands) - 23 gauges, CODARs (measurement of sea level, specially the changes triggered due to tsunami) 8 deployed, ADCP moorings (time series measurement of currents at several depth levels on the shelf and slope regions) (5 pairs) Autonomous weather stations on board ships 1 Calval sites (for the calibration and validation of satellite data and algorithms) (1) Bay of Bengal Observatory - one in Head Bay. Besides, 126 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. Some models generated under the programme have already been made operational at INCOIS.

2.05.03. **Data Buoy programme/ Integrated Sustain Ocean Observation:** The programme is designed for strengthening the Data 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 restructured to deploy 12 moored buoys in selected locations in the seas around India for continuous reception of the time - series data. 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. NIOT would explore the possibility of deployment, operation & maintenance of buoy network through private partnership.

2.05.04. **National Institute of Ocean Technology (NIOT):** The NIOT was established in November, 1993 with a view to develop technology in ocean sector. In addition to the four core mission activities of Ocean Energy, Deep Sea Mining, Coastal and Environmental Engineering and Marine Instrumentation, 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. Under ocean technology, a set of 8 in-house R&D programmes (Energy, Ocean Acoustics, Marine Sensor, offshore structures, inter-institutional R&D, etc) of NIOT would be carried out. Desalination plants would be established in four major islands of Lakshadweep and work would be initiated for the remaining islands, for which partial support has been received from Lakshadweep Administration. Using Hydrodynamic model and Wave model, extreme value estimates will be determined which would be useful for coastal projection. As a part of island development, open sea cage farming of fin fishes mainland and Andaman and Nicobar Island, demonstration of mass culture of Micro algae in photo bioreactor at Kavaratti islands. Lakshadweep utilizing deep ocean water upwelled by the Low Temperature Thermal Desalination plant. Digitization of island resource information for A&N islands would be carried out.

2.05.05. **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. India submitted part claim on the basis of scientific analysis. The second part submission has already been forwarded to MEA for submission to UN.

2.05.06. **Comprehensive Topographic Survey:** This programme entails scientific mapping of Exclusive Economic Zone (over 2 million sq.km.) area to have a comprehensive geomorphology of seabed.

2.05.07. **Gas Hydrates:** Gas Hydrates have the potential of providing total energy security to our nation. The programme consists of both scientific and 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 at Gas Hydrates site in KG basin and in Mahanadi basin, deep water testing of ACS in Indian waters site will be conducted.

2.05.08. **Acquisition of Research Vessels 'Sagar Nidhi':** the Ministry's focus 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. The vessel has been made fully operational.

2.05.09. **Tsunami and Storm Surge Warning System:** The objective of the project is to establish a warning system for the oceanographic disasters caused by Tsunami and storm surges. A full fledged Tsunami warning centre had been set up at INCOIS, Hyderabad with deployment of 18 tide gauges and 6 bottom pressure recorders for providing warning on 24X7 basis. This centre has been recognized as Regional Tsunami Warning System for the Indian Ocean.

2.05.10. **National Centre for Antarctic and Ocean Research (NCAOR):** NCAOR is an autonomous society of the Ministry which coordinates with 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 are conducted in the southern ocean by strengthening the facilities at NCAOR. A dedicated expedition has been launched to the southern ocean for conducting multidisciplinary research. Expedition of south - pole by a eight member team successfully completed. Construction of 3rd Antarctic station at Larsemann Hills is under progress. NCAOR has also initiated work for acquisition of ice class research vessel.

2.05.11. **Indian National Centre for Ocean Information Services (INCOIS):** The objective 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 (PFZ) maps, Ocean State Forecast, wind vector maps, mixed layer depth maps, at least on heat - budget are being made available on operational basis. Integrated PFZ advisory mission and prioritized PFZ advisories (High, medium, low) has been provided and operation of advisories for Tuna fishing. The facility for dissemination of PFZ information has been extended to island territories of India through installation of Electronic Display Boards in Lakshadweep islands as a part of Integrated islands. Development project has been made operational which will be useful for a number of ocean sectors. During the year, an Integrated Indian Ocean Forecast System (INDOFOS), which is a 5 day forecast of vital ocean parameters useful for various marine sectors including defence has been strengthened through various national and international efforts including development of wave rider buoys, moored buoy network (12),

Argo (50), Drifters (15) Current meter arrays (7). All the MoES research vessels have been equipped with Automated Weather stations including integration of INSAT based communication system in waver rider buoys. A High Performance Computing Facility has been installed to improve the services.

2.05.12. **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, mariculture 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.

2.05.13. **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. Action has been initiated by NIOT for a collaborative partner.

2.05.15. **Expedition to 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 XI Five Year plan, concrete efforts need to be made to launch the First Indian Scientific Expedition to the Arctic. 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 endeavors in the Arctic being mounted under the Sulvbad Treaty, SCAR, etc.

2.05.16. **Desalination plant:** NIOT has developed, and demonstrated commercial scale Low Temperature Thermal Desalination Plant. During the XI plan, NIOT has taken up a scheme to design, develop and demonstrate the large scale desalination Plants. The ultimate goal of the endeavor will be to establish such desalination plants along the coast and island territories of India to alleviate drinking water problem of coastal region. The commissioning of 2 LTTD plants one each at Minicoy and Agatti are in advanced stage of commission, which is likely to be completed during the current financial year. Work will be initiated for setting up of Desalination plant of 2 MLD capacity at Coastal Power Plant projects like Tuticorin Power plant.

2.05.17. **National Oceanararium:** 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. Currently, the Ministry is exploring the possibility for setting up R&D components as a part of research endeavor for oceanarium in Kerala & Goa.

2.05.18. **Demonstration of Shore Protection Measures:** Beach profile would be carried out in selected sites. Wave current & tide measurement also to be carried out at selected sites for a year before designing solution for engineering intervention.

2.05.19. **Integrated Ocean Drilling programme & Geotechnoic 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. Science plan for consideration of Arabian Sea has been submitted for IODP Council for deep drilling.

2.05.20. **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 is 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. A consultant has been appointed for detailed design of the proposed vessel. The vessel will be acquired by NCAOR, Goa. The complete technical specification and design would be taken up after obtaining the approval of the Government.

2.05.21. **Head Quarter Building:** The present requirement is of a 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 and more than 90% work on construction has been completed. The building is likely to be commissioned during the year (July, 2011).

2.05.22. **Marine Research and Technology Development (MRTD):** The scheme consists of well defined programmes addressing specifically various R&D aspects of marine science and technology. Besides Marine Living Resources, the scheme covers programmes like Assistance for Research projects, Coastal Ocean Monitoring and Prediction System (COMAPS), Exhibition & Fairs, Seminar & Symposia, Manpower Training, Marine Non - Living Resource progrmme and Integrated Coastal and marine Area Management (ICMAM). The details are:

(i) 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 & Technology Centres (OSTC) were set up in universities/IITs. In addition, projects outside the OASTC system are expected to be taken up on case-to-case basis,

(ii) 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. In order to strengthen the assessment of health of coastal water, 23 stations have been identified for monitoring closely. State-of-the-art facilities are being proposed to collect & analyze the sample for better data quality. The data collected under the progrmme is being made available for research & operational purpose,

(iii) 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 explicit these resources for sustainable growth. Besides, the work would also be participation in a number of national and international workshops showcasing the activities of this Ministry.

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,

(iv) Manpower Training: Provisions have been made to meet the objectives of the programme relating to the manpower training in Ocean and Atmospheric Sciences. Ministry would continue to support fellowships to develop specialized manpower,

(v) Marine Non - Living Resource programme: A cruise has been conducted on investigations of hydrothermal sulphide mineral in Indian Ocean. A cruise is to be undertaken and investigations of cobalt rich seamount crust deep sea mineral exploration are to be carried out,

(vi) Integrated Coastal and Marine Area Management (ICMAM): The programme has three components, namely, ecosystem modeling, shoreline management and Ecotoxicology. Under the component on infrastructure, training, laboratory and other facilities have been established in the NIOT Campus, Chennai. Under the programme on Ecosystem modeling, hydrodynamic modeling of Chilka and Kochi backwaters completed. Field investigations for ecosystem modeling for Sundarbns will be completed. Ecotoxicological studies and ecosystem modeling at selected locations will be continued in addition to the above,and

(vii) Drugs from Sea: The progrmme is an ongoing project for supporting research in different participating R&D laboratories and inducting new institutions for exploratory and product development phases. After 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.

2.05.24. **R&D in Earth and Atmospheric Sciences:** In order to strengthen the basic research in the field of Atmospheric Earth Science programme, the Ministry proposes to encourage focused reference 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.

Advance Training Centre in Earth Science & Climate: This will be the world class state - of - the - art training centre & will be aimed to address the scarcity of trained and skilled scientists required for quality weather & climate forecast in the country. The Centre will start functioning under the guidance of IITM, Pune,

2.05.25. **Centre for Climate Change:** The programme has three main components, namely, the programme 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 programme and to get research inputs.

2.05.26. **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 system (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 improve multi - hazard early warning.

3. **Meteorology:**

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. Establishment of more 50 GPS & peripher also.

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 reception of satellite weather

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

3.07. **Other programmes:** These include payments of India's annual contribution to World Meteorological Organization and the International Seismological Center.

3.08. **India Meteorological Department (IMD):**

3.08.01. **Modernization 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. Modernization of IMD Phase - I: One of the major programmes launched by the Ministry during 11th plan is Upgradation of Weather Forecasting in India, which has 4 components viz., Atmospheric Observational Network, two DWR, 393 AWS and 364 ART have been deployed so far. Out of 13, two DWR have been deployed one each in Hyderabad and Mumbai. A set of GPS based radiosonde and 65 Optical Theolites have been deployed so far. Out of 13, two DWR have been deployed one each in Hyderabad and Mumbai. A set of 10 GPS based radiosonde and 65 Optical Theolies have been completed. Efforts are underway to complete deployment of 13 DWR, 550 AWS and 1350 ARGs by end of 11th plan as a part of 1 phase of modernization. Besides, ten of the upper air stations have been upgraded with the GPS sondes.

3.08.02. **Other Schemes in IMD:** This includes Seismic hazard and Risk evaluation and Commonwealth Games & Dedicated Weather Channel. 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, Bengaluru to plan and implement the project. The project envisages of private entrepreneurs working on high - end computing, meteorological instrumentation, audio - visual equipments, GIS and GPS systems, etc. will be taken as done by NWS and UKMO in the past for other sport events.

4. **Other Scientific Research:**

4.01. **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. Experimental parallel runs with the UKMO (NS12 - 25 km. resolution) forecast system and regional forecast system (8 km) & plan to operationalize forecast from January, 2012, will implement lower resolution N 96 UKMO coupled ocean atmosphere model at NCMRWF. Compute/ network infrastructure and services, satellite radiance data assimilation system, climate modeling system, environmental prediction system and computer/ network infrastructure upgradation.

4.02. **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 2011 - 12.