

MINISTRY OF EARTH SCIENCES

Demand No. 23

1. Ocean Services, Modelling, Applications, Resources and Technology (OSMART) (CS)

FINANCIAL OUTLAY (Rs in Cr)	OUTPUTS 2021-22			OUTCOMES 2021-22		
	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators
436.17	1. Developing infrastructure for monitoring coastal hazards	1.1. No. of buoys commissioned for Marine Observation along Indian Coast - Coastal buoys	1	1. Coastal water monitoring	1.1. No of hotspots under coastal water quality monitoring	1
		1.2. No. of GNSS stations – Operational 24*7	32	2. Increased lead time for enabling timely response on emergency advisories	2.1 Time taken to issue tsunami advisories (in minutes)	12
	2. Coastal monitoring and services	2.1 Number of additional locations for monitoring of coastal pollution	16	3. Monitoring of marine pollution and erosion	3.1 Assessment of health of the coastal waters of India (number of coastal stations)	40
		2.2 No of sensor-based buoys for Monitoring coastal water quality	3		3.2 No. of locations for time series data on coastal water quality	3
		2.3 No of states where Coastal Erosion is being monitored	5		3.3 Assess the shoreline changes of the Indian Coast (sites)	5
		2.4 New system setup for species specific advisory services as well as potential fishing zone assessment services	2	4. Issuance of weather and fishery advisories to support fishing	4.1 No. of additional registered mobile user of fisherman community	10,000

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	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators
		2.5 No. of fisheries advisories issued	300	industry	4.2 Reduction in search time of fishermen for fishing grounds	30%
		2.6 No of Coral reef Alert Services issued	122	5. Health of the coral reef and advisory	5.1 No. of coral reef ecosystems monitored	5
	3. Exploration of Marine resources: Marine living resources -	3.1 No of cruises to be undertaken to assess Biodiversity through classical taxonomy and metabarcoding and Ecosystem Studies.	1	6. Identifying the marine biodiversity hotspots, augmentation of IndOBIS, hatchery rearing of marine wild stocks	6.1 Number of research Papers in peer reviewed journals	10
	4. Exploration of Marine resources: Underwater Non-living resources – eg. minerals	4.1 Area covered under bathymetric data acquisition in exclusive economic zone of India (in sq. km.)	10,000	7. Enhancement of Knowledge and new information	7.1 Number of research Papers in peer reviewed journals	3
		4.2 Number of cruises undertaken	2	8. Exploration of polymetallic nodules and sulfides	8.1 Continuation of work as per the contract with International Seabed Authority (Yes/No)	Yes
	5. Commissioning of two Desalination plants funded by MHA	5.1 Percentage of work completed (Procurement- 30%,	100%	9. Benefit to islanders of Lakshadweep	9.1 Amount of freshwater generated per day per plant (in litres)	1,50,000

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		and being implemented by NIOT.	setting up marine structures 30%, laying of cold-water pipe 20%, Final commissioning 20%)				
	6.	Commissioning of OTEC powered Desalination plant	6.1 Percentage of work completed (Completion of detailed Engineering Design- 25%)	25%	10. Benefit to islanders of Lakshadweep	10.1 Amount of freshwater generated per day per plant (in litres)	0

2. Atmosphere & Climate Research - Modelling Observing Systems & Services (ACROSS) (CS)

FINANCIAL OUTLAY (Rs in Cr)	OUTPUTS 2021-22			OUTCOMES 2021-22			
	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
460	1.	Setting up of District Agro meteorological Field Units	1.1. Number of District Agro meteorological Field Units (DAMU) established	25	1. Issuance of Weather, Climate and Agro meteorological advisories.	1.1. Additional Number of farmers who receive the Agro-meteorological advisories (in lakhs)	50
			1.2. Number of Agromet AWS installed	250		1.2. Additional number of Agromet observatories for observations meant for farmers	250
	2.	Augmentation of the Observation System Network	2.1. Establishment of Aviation Weather Observing Systems at Airports and	10	2. Improved Aviation Services	2.1. Development of State-of-the Art support system at Airports and	10

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		Heliports				Heliports for aviation (in number)	
		2.2. Installation & commissioning of Doppler Weather Radars	6	3. Better forecasting capability for NW Himalayan region	3.1 Increase in Now casting Stations	100	
		2.3. Installation of Automatic Weather Stations (AWS)	150	4. Monitoring of City weather/ forecasting	4.1 Additional no. of cities/towns covered for rainfall monitoring.	75	
	3. Climate Services	3.1 Establishment of state-of-the-art climate data centre with integrated advanced climate data services portal for rendering national and regional climate services (in %)	50	5. Expansion of Climate Services	5.1 Increase in number of users of data, especially researchers and scientists (in %)	25	
					5.2 Increase in volume of data being supplied to all users through the Climate Data Service Portal (in %)	25	
	4. Development of Multi-Hazard Early Warning system for natural disasters	4.1 Commissioning of Decision Support System (in %)	50	6. Issuance of accurate warnings for natural disasters	6.1 No: of natural disasters for which Impact based forecasting will be issued (cyclone & flash floods)	2	
	5. Double the Resolution of Short-Range Forecast	5.1 Increase the resolution of short-range prediction model (6 kms from 12 kms)	6	7. Generating weather forecasts at a	7.1 Additional No: of blocks where, block-level short-range weather forecast will be initiated (from	1,000	

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				higher spatial resolution (~from 6 kms) for generating forecasts at block level	2000 to 3000)		
					7.2 Reduction in the cyclone track landfall error (in percentage)	10%	
	6. Implement next generation of coupled model for seasonal and extended range forecasts	6.1 Implement and integrate all the new developments/ changes in to next generation coupled model (% of work)	100%	8. Utilization of coupled model forecasts at Extended (up to 4 weeks) and Seasonal (next 3 months) time scales by IMD for various sectors	8.1 Number of homogenous regions for which Seasonal forecasts will be provided	4	
					8.2 Issue the experimental extended range forecasts at district level (No. of districts)	30	
	7. To improve the initial conditions of the operational NWP model	7.1 Assimilation of radar reflectivity in real-time to initialize the operational meso-scale regional models. (No: of Indian Doppler Weather radars)	12	9. Improvement in the quality of initial condition for regional models resulting in better prediction of regional severe weather.	9.1 Real-time use of regional meso-scale model output for normal and severe weather by IMD for various sectors. (Yes/No)	Yes	

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		7.2 Assimilation of Aeolus wind profile data in Global model assimilation system (No: of observations per day)	1,00,000	10. The quality of initial condition for global model will be improved and will be useful for global forecasting.	10.1 Real-time use of global model output for medium range weather forecasts by IMD for various sectors. (Yes/No)	Yes
	8. Development of Earth System model	8.1 No. of Coordinated Climate model experiments under Coupled Model Inter comparison Project (CMIP) of the World Climate Research Programme (WCRP)	2	11. CMIP model simulations are assessed as part of the IPCC Climate Assessment Reports and various national assessments	11.1 Number of years of projections using the high-resolution ESM	50
	9. Observation of long-term Climate parameters	9.1 Number of Climate Reference station set up by IITM/IMD	1	12. Improved observations of long-term climate useful for studying climate change	12.1 Progress in setting up of Climate Reference Station at one site (in percentage)	100
	10. Procurement of High-Performance Computing system –	10.1 Obtain CCEA approval and Complete the tendering process for at	Yes	13. Augmentation of the existing High	13.1 Number of dynamical models with enhanced	No

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	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
	V3.0		least 20 PF HPC (Yes/No)		Performance Computing system	resolution made available for issuing forecasts. (Yes/No)	
	11. Setting up of Atmospheric Research Data Center	11.1	Populating the Atmospheric Research Data center with atmospheric data sets (in Giga Bytes)	10,000	14. Easier Accessibility to observed and modeling data to researchers on a single platform	14.1 Percentage of the data populated to be released to general public after extensive QC/QA (in %)	30%
	12. Establishment of Atmospheric Research Testbed in Central India (ART-CI)	12.1	Progress of work (development of Physical Infrastructure: 20%; commissioning of 1st phase of instrumentation: 30%; commissioning of 2nd phase of instrumentation: 30%; commissioning of final phase of instrumentation: 20%)	30% ¹	15. Improving the understanding of Climate and Monsoon related processes in Central India	15.1 No: of instruments Commissioned in the 1st phase of instrumentation to conduct monsoon observational campaign	4
	13. Establishment of weather radar network over Mumbai Metropolitan region	13.1	Number of X-band radars installed/commissioned	4	16. Providing information to public and to improve	15.2 Data processing, quality control and preparation of first level of campaign data (in %)	100%
						16.1 Develop mosaic of real-time rainfall distribution maps at 500 m resolution	100%

¹ physical infrastructure may extend due to limited funds flow

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	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
					nowcasting capabilities of operational agencies	from radar network for nowcasting and flood warning systems (in %)	
	14. Establish the infrastructure for weather modification research strategy	14.1 Establishment of ground based observational facilities	1	17. Evaluation of weather modification over the northeastern Indian region	17.1 Establishment of surface observing facilities over northeastern Indian region for weather modification research	1	
	15. Integrated Meteorological Services for North-East (NE)	15.1 Establishment of Doppler Weather Radars over NE Region	1	18. Improving weather and climate services over the region	18.1 Increase in Nowcast stations	10	
		15.2 Increase in AWS network	100		18.2 Additional no. of cities/towns covered for rainfall monitoring.	100	
	16. Establishment of a Thunderstorm Testbed	16.1 Establishment of basic observational network including acquisition of land (in %)	15	19. Improvement in understanding of physical process of Thunderstorm (in %)	19.1 Quantitative identification of process of thunderstorm over the site (in %)	0%	
	17. Research Output	17.1 No. of publications emanated under the scheme	225	20. No. of papers published in SCI journals	20.1 No. of papers	215	

3. Polar Sciences Cryosphere (PACER) (CS)

FINANCIAL OUTLAY (Rs in Cr)	OUTPUTS 2021-22			OUTCOMES 2021-22		
	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators
115	1. Scientific Expeditions	1.1 Launching of 14 th Scientific expedition to the Arctic (Yes/No)	Yes	1. Improved understanding of polar regions	1.1.No of parameters recorded in Antarctica, Arctic, and Himalayas	25
		1.2 Launching of 41 st scientific expedition to the Antarctic (Yes/No)	Yes		1.2.No of Publications related to tropic-polar region teleconnections	5
		1.3 Launching of scientific expeditions to Southern Ocean (Yes/No)	Yes	2. Improved understanding of glacier dynamics	2.1 No of glaciers continuously being monitored in the Himalayas	6
		1.4 Launching of scientific expeditions to Himalayas (Yes/No)	Yes			
	2. Initiation of scientific projects in cryospheric, atmospheric and geosciences domain	2.1 No. of scientific projects launched in polar region	50	3. Improved contribution of India to international polar research arena	3.1 No. of scientific research publications with the findings from the cryospheric, atmospheric and geosciences domain related projects in polar region	50
	3. Acquisition of Polar research vessels	3.1 % of work in acquiring Polar Research vessel (PRV)	5%	4. Enhance scientific capability to conduct polar research	4.1 Number of expeditions to polar regions using the newly acquired PRV	NIL
	4. Indian Antarctic Law	4.1 Finalization of draft Indian Antarctic Bill	Yes	5. Indian Antarctic	Enactment of Indian Antarctic Law (Yes/No)	Yes

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	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
			(Yes/No)		Law		
		4.2 Cabinet Approval of Indian Antarctic Bill (Yes/No)		Yes			
		4.3 Introduction of Indian Antarctic Bill in Parliament (Yes/No)		Yes			

4. Seismological & Geosciences (SAGE) (CS)

FINANCIAL OUTLAY (Rs in Cr)	OUTPUTS 2021-22			OUTCOMES 2021-22			
	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
110	1. Strengthening of seismological observations	1.1. Procurement of broadband seismographs (BBS) systems with software		35	1. Improvement in the earthquake detection capabilities with increased accuracy in earthquake parameters	1.1. Maintaining the minimum threshold magnitude of 3.0 earthquake in most part of the country (Yes/No)	Yes
		1.2. Site preparation to enable installation of BBS systems		20			
	2. Creation of geochronology facility	2.1 Setting up of a national facility for geochronology i.e., creation of required infrastructure to set up		20%	2. Quality data generation of specific sample	2.1 No. of papers/ publication/findings	10

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			the Lab and procure ancillary equipment in % terms				
	3. Setting up of borehole observatory in Koyna region	3.1 Site characterization through integration of geological, geophysical and rock mechanical datasets in % terms	60%	3. Improved understanding of earthquake processes in Koyna region	3.1 No. of reports/publications/findings	4	
		3.2 Instrumentation of pilot borehole and installation of broadband seismic stations (nos.)	5				
		3.3 Planning of main borehole (Yes/No) (Depending upon the site clearance)	Yes				
	4. Creation of Geoscience Data Center	4.1 Setting up of a National Geoscience Data Center in % terms	100%	4. Quality geoscience data generation	4.1 Data availability to Scientific community (in Tera Bytes)	2	
	5. Research Output	5.1 No. of publications emanated under the scheme	40	5. No. of papers published in SCI journals	5.1 No. of papers	30	

5. Research Education & Training Outreach (REACHOUT) (CS)

FINANCIAL OUTLAY (Rs in Cr)	OUTPUTS 2021-22			OUTCOMES 2021-22			
	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
60	1. Extramural funding	1.1. Number of proposals funded for undertaking R&D activities in various academic and research institutes of the country		20	1. Nurturing the R&D activities in Earth Sciences being undertaken in the various academic and research institutes of the country	1.1. No. of publications based on research conducted through extramural funding	40
	2. Outreach and awareness	2.1 No. of conferences/seminars/and symposium to be organized for improving the awareness about the activities of the Ministry		10	2. Providing support for seminars, conferences, workshops, field programmes, training activities etc. in the area of Earth System Science	2.1 No. of people participating in the conferences, workshops, field programs etc	300
				1		2.2 No of schools where the outreach and awareness events are held	30
		2.2 Number of International Earth Science Olympiad (IESO) conducted annually		1		2.3 Number of students appearing for the All-India level Entrance Test for IESO.	2,000
3. Training courses conducted (online) at MoES Institutes {BIMSTEC centre for Weather and climate (BCWC), Noida; UNESCO	3.1 No. of courses conducted in Earth Sciences (Atmospheric Sciences, Oceanography,		10	3. Develop skilled and trained manpower in Earth Sciences with the support	3.1 No. of people who attended the training programmes	300	

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	2021-22	Output	Indicators	Targets 2021-22	Outcome	Indicators	Targets 2021-22
		Category-2 centre of ITCOcean at Hyderabad; Development of Skilled Manpower in Earth System Sciences (DESK), IITM Pune }	Geosciences etc.) in 3 training centres		of academic institutions in the country and abroad.		
	4.	KRC Net portal	4.1 Integrating 3 MoES Institutes in the KRCNet portal	100%	4. KRC Net portal usage	4.1 Visitor counts	10,000
	5.	DERCON	5.1 Subscription to e- resources (journals and databases)	135	5. DERCON usage	5.1 No of e-resources accessed	1,20,000