



सत्यमेव जयते

PARLIAMENT OF INDIA RAJYA SABHA

DEPARTMENT-RELATED PARLIAMENTARY STANDING COMMITTEE
ON SCIENCE & TECHNOLOGY, ENVIRONMENT, FORESTS AND
CLIMATE CHANGE

THREE HUNDRED THIRTY SECOND REPORT

**DEMANDS FOR GRANTS (2020-2021) OF THE
MINISTRY OF EARTH SCIENCES**

(DEMAND NO. 23)

(Presented to the Rajya Sabha on 6th March, 2020)
(Laid on the Table of Lok Sabha on 6th March, 2020)



**Rajya Sabha Secretariat, New Delhi
March, 2020/ Phalguna, 1941 (Saka)**

Website : <http://rajyasabha.nic.in>
Email: rsc-st@sansad.nic.in

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** To be appended at printing stage*

COMPOSITION OF THE COMMITTEE

(2019-20)

(Constituted on 13th September, 2019)

1. Shri Jairam Ramesh -- **Chairman**

RAJYA SABHA

2. Shri Anil Baluni
3. Shri R.S. Bharathi
4. Shrimati Vandana Chavan
5. Shri Hishey Lachungpa
6. Shri Parimal Nathwani
7. Shri Bhaskar Rao Nekkanti
8. Shri Ashwini Vaishnaw
9. Shri Ravi Prakash Verma
10. Shri Binoy Viswam

LOK SABHA

11. Shri Guharam Ajgalley
12. Shri Pradan Baruah
13. Shri E.T. Mohammed Basheer
14. Shri Jashvantsinh Sumanbhai Bhabhor
15. Shri Sudarshan Bhagat
16. Shri Rameshbhai Lavjibhai Dhaduk
17. Shri Anantkumar Hegde
18. Shrimati Jyotsna Charandas Mahant
19. Dr. Swami Sakshiji Maharaj
20. Shri Asaduddin Owaisi
21. Shri S.R. Parthiban
22. Dr. Ranjan Singh Rajkumar
23. Shri Kotha Prabhakar Reddy
24. Dr. Jayanta Kumar Roy
25. Shrimati Satabdi Roy (Banerjee)
26. Shri Mahesh Sahoo
27. Shri Francisco Cosme Sardinha
28. Shri Anurag Sharma
29. Shri Ram Shiromani
30. Shri Kirti Vardhan Singh
31. Dr. Ramapati Ram Tripathi

SECRETARIAT

Smt. Sunita Sekaran, Joint Secretary
Shri T. N. Pandey, Director
Shri S. Rangarajan, Additional Director
Shri Rajiv Saxena, Under Secretary
Shri Harish Kumar, Committee Officer

INTRODUCTION

I, the Chairman of the Department-related Parliamentary Standing Committee on Science & Technology, Environment, Forests and Climate Change, having been authorised by the Committee to present the Report on its behalf, present this Three Hundred Thirty Second Report of the Committee. This Report deals with the detailed Demands for Grants (2020-2021) of the Ministry of Earth Sciences (Demand No.23).

2. In the meeting of the Committee held on 17th February, 2020, the Secretary and other officers of the Ministry of Earth Sciences gave an overview of the various activities of the Ministry and the Members sought clarifications on various aspects of the performance of the Ministry to enable it to scrutinise the Demands for Grants.

3. The Committee expresses its thanks to the officers of the Ministry for replying to the clarifications sought by the Members and placing before it the required material to enable the Committee to scrutinise the Demands for Grants of the Ministry of Earth Sciences.

4. The Committee considered and adopted the draft report in its meeting held on the 4th March, 2020.

NEW DELHI;
March 4, 2020
Phalguna 14, 1941(Saka)

(JAIRAM RAMESH)
Chairman,
Department-related Parliamentary Standing Committee on
Science & Technology, Environment, Forests and Climate Change,
Rajya Sabha.

REPORT

1. The Department-related Parliamentary Standing Committee on Science & Technology, Environment, Forests and Climate Change considered the Demands for Grants (2020-21) of the Ministry of Earth Sciences in its meeting held on 17th February, 2020.

2. BUDGETARY DETAILS FOR THE FINANCIAL YEAR 2019-20 AND ALLOCATION FOR 2020-21

2.1 The following table presents the overall budgetary details for the year 2019-20 and allocation made for the year 2020-21 in respect of the Ministry of Earth Sciences:-

(Rs. in crore)

Sl. No.	Name of the Scheme	BE 20 19-20	RE 20 19-20	Actual Expenditure 2019-20*	BE 2020-21 (Allocated)
(A) Central Sector Schemes					
1.	Ocean Service Modelling Application Resources and Technology (O-SMART)	483.00	445.00	379.90	567.00
2.	Polar Sciences & Cryosphere (PACER)	120.00	110.00	88.96	125.00
3.	Research Education and Training Outreach (REACHOUT)	90.00	65.00	50.99	85.00
4.	Atmosphere & Climate Research-Modelling Observing Systems & Services (ACROSS)	413.00	380.00	271.00	440.00
5.	Seismological & Geosciences (SAGE)	115	130.00	63.81	120.00
	Total	1,221.00	1,130.00	854.66	1337.00
(B) Autonomous Bodies					
1.	Indian National Centre for Ocean Information Services (INCOIS)	28.00	21.80	14.48	26.50
2.	National Institute of Ocean Technology (NIOT)	35.00	50.78	20.49	51.51
3.	National Centre for Polar and Ocean Research (NCPOR)	25.00	19.50	15.83	24.79
4.	Indian Institute of Tropical Meteorology (IITM)	70.00	68.20	61.50	78.00
5.	National Centre for Earth Science Studies (NCESS)	20.00	19.50	15.48	21.00
	Total	178.00	179.78	127.78	201.80
(C) Establishment Expenditure of the Centre					
1.	Oceanographic Survey (ORV & FORV) and Marine Living	30.00	30.00	27.49	35.00

	Resources (MLR)				
2.	National Centre for Medium Range Weather Forecasting (NCMRWF)	10.50	10.50	8.85	13.20
3.	Secretariat Economic Services - MoES (HQ)	34.00	31.50	26.45	35.00
4.	Secretariat Economic Services - DAO (O/o CA)	9.00	7.90	6.36	9.00
5.	Meteorology (IMD)	419.26	420.06	378.79	439.00
	Total	502.76	499.96	447.94	531.20
	Total (A+B+C)	1,901.76	1,809.74	1,430.38	2,070.00

* As on 07.02.2020

2.2. The Committee enquired from the Ministry about the absolute bare minimum increase needed in the budgetary allocations for the year 2020-21 to sustain its key programmes. In response, the Ministry provided the details as under:

Total scheme funds sought :

Continuing Schemes: Rs.1582.90 crore

New Scheme on Deep Ocean Mission (DOM): Rs.300.00 crore

Total scheme funds allocated (without DOM): Rs.1337.00 crore

**Therefore bare minimum required for continuing schemes:
(1582.90 – 1337.00) = Rs 245.90 crore**

The Ministry also informed that the additional funding of Rs.245 crore is required as under:

- (i) Acquisition of Polar Research Vessel (PRV) – Rs.110 crore;
- (ii) Development of manned and unmanned underwater vehicles – Rs.85 crore;
- (iii) Procurement of various machinery and equipment like Doppler Weather Radar, Automated Weather Observation System, Integrated Meteorological services for the North-East region, Ocean Observation System – Rs.50 crore.

2.3. The Committee also desired to know the impact of the difference between the budgetary allocation requested by the Ministry and allocated in the budget 2020-21 on key programmes/schemes/projects of the Ministry. The Committee also asked for the strategy devised by the Ministry to deal with the challenges arising out of a shortfall of funds. The Ministry, in their written reply furnished to the Committee, informed that the key programs/schemes/projects of the Ministry which will be impacted are (a) Acquisition of Polar Research Vessel (ship) under the Scheme PACER (b) Development of manned/unmanned submersible, Autonomous Underwater Vehicle (AUV), Moorings, Deep Sea mining System, (c)

Procurement of various Machinery & Equipment like Doppler Weather Radar, Automated Weather Observation System by IMD; (d) Integrated Meteorological Services in the North-East region and (e) Augmentation of Ocean Observation System and (f) procurement of equipment for Research Test Beds to be established on the 100 acres land in Bhopal.

2.4. The Committee notes that the Ministry requires a bare minimum additional amount of Rs.245.90 crore during 2020-21 to sustain its continuing schemes. The additional amount is required for acquisition of Polar Research Vessel and procurement of machinery and equipments. The Committee also observes that the Ministry's quest for acquisition of Polar Research Vessel has been pending since a very long time. The Committee, therefore, recommends that the Ministry of Finance should positively consider the requirement of Ministry of Earth Sciences for allocation of an additional amount of Rs.245 crore during the current financial year in order to enable it to sustain its key programmes.

2.5. During the meeting of the Committee held on 17th February 2020, the Secretary informed the Committee that the Ministry had proposed Rs.300 crore for Deep Ocean Mission proposed during the year 2020-21. However, no allocation had been made for the Mission during the year. The objective of the mission was underwater exploration and harnessing Ocean Resources. The Mission will have the following six major components:

- (i) Development of Technologies for Deep Sea Mining, Underwater Vehicles and Underwater Robotics
- (ii) Development of Ocean Climate Change Advisory Services
- (iii) Technological and Conservational Innovations of deep sea biodiversity
- (iv) Deep Ocean Survey and Exploration
- (v) Energy and freshwater from Ocean
- (vi) Advanced Marine Biology Station at Goa and Foreign Collaborations.

2.6 The total budget for the mission was Rs.6687.50 Crores. Indian Space Research Organization (ISRO), Department of Biotechnology (DBT), Defence Research and Development Organization (DRDO), Indian Council of Agricultural Research (ICAR) and Council of Scientific and Industrial Research (CSIR) will be involved for joint collaborations. Further, Expenditure Finance Committee (EFC) document had been circulated and resubmitted to Finance Ministry for approval to conduct the EFC meeting. It was further informed by the Secretary that the Finance Ministry had given an in-principle approval to the Mission. Last year, they asked the Department to spend Rs.19 crore out of their Budget, which the Ministry has done, and, for the remaining part of the five year Finance Commission cycle, there was an expectation that the government should fund the Mission.

2.7 During his presentation before the Committee on the 17th February 2020, the Secretary of the Ministry also highlighted that a lot of emphasis needs to be given to ocean research, since other countries were moving ahead of India in this field.

In a written note, the Committee was further informed that the Ministry was planning to have collaborative activities with Woods Hole Oceanographic Institute and the Scripps Institute of Oceanography in United States. The Ministry also has an MOU with JAMSTEC, Japan. However these countries are not ready to share their ocean technology with the Ministry directly.

2.8 The Committee is in agreement with the Ministry that there is an urgent requirement to undertake deep ocean research by India. As stated by the Secretary and acknowledged by the Committee, the monsoon is a critical factor for the livelihood and sustenance of crores of Indians, and it is determined not just by the land and atmospheric factors, but also the ocean. The Ministry has been trying to get funds allocated to the Mission for the past five years. Since the process for the initiation of the Mission has been set in motion after the in-principle approval by the Ministry of Finance, and the Ministry of Earth Sciences has already spent Rs.19 crore out of their own budget, the Committee is of the considered view that the Ministry should now be provided the requisite financial allocation for the Deep Ocean Mission during the current financial year and in future as well.

3. UMBRELLA SCHEMES OF MINISTRY OF EARTH SCIENCES

3.1 The Committee desired to know from the Ministry the mechanisms devised to monitor and review the progress of its ongoing schemes/programmes and the steps taken to further strengthen its monitoring mechanism. In response, the Committee was informed by the Ministry that a robust 3-tier mechanism has been adopted to monitor various schemes of the Ministry. At the apex level, the overall direction for implementation of programs is reviewed on a half-yearly basis (April and October), in the beginning of the financial year and middle of the year. This apex body is chaired by the Secretary of the Ministry. At the level of the institutions, particularly for the autonomous bodies of the Ministry, the scientific programmes are monitored periodically by the Research Advisory Committees. The Governing Council and Financial Committee of the respective centres also provide guidance from both technical and financial angles. In addition, Secretary of the Ministry reviews these projects whenever it is required. The analysis of the Committee regarding the performance of some of the major schemes of the Ministry during the last three years and the financial performance of the autonomous institutions under the jurisdiction of the Ministry have been discussed in the succeeding paragraphs.

ATMOSPHERE & CLIMATE RESEARCH-MODELLING OBSERVING SYSTEMS & SERVICES (ACROSS)

3.2. The budgetary details of the scheme for the last three years and allocation for 2020-21 are as under: -

(Rs. in crore)

2017-18			2018-19			2019-20			2020-21
BE	RE	Actual	BE	RE	Actual	BE	RE	Actual*	BE
496	423	401.3	375	348	337.89	413	380	271	440

* As on 07.02.2020

3.3 The Committee noted that the BE 2019-20 allocation of Rs.413 crore for ACROSS Scheme was reduced to Rs.380 crore at RE stage and desired to know the reasons for underutilisation/reduction of funds under the scheme. In response, the Ministry informed the Committee that the reasons for reduction of funds are (i) Procurement of Instrumented Aircraft delayed due to procedural delays, (ii) Instruments purchase for Bhopal Research Test bed was deferred as procurement of land was delayed and (iii) Tender of 11 C-band radars could not be finalised due to insufficient number of technically qualified bids. The Committee further notes that in 2019-20, out of the reduced RE allocation of Rs.380 crore, the Ministry has been able to spend only Rs.271 crore upto 7th February 2020, which is 71% of the allocated amount. Also, an amount of Rs.440 crore has been allocated under the scheme during the year 2020-21.

3.4 The Committee urges the Ministry, which has been able to spend only 71% of the allocated amount under the ACROSS scheme upto 7th February 2020, to make optimal utilisation of the allocated funds by the end of the financial year.

SEISMOLOGY AND GEOSCIENCES (SAGE)

3.5 The budgetary details of the scheme for the last three years and allocation for 2020-21 are as under: -

(Rs. in Crore)

2017-18			2018-19			2019-20			2020-21
BE	RE	Actual	BE	RE	Actual	BE	RE	Actual*	BE
76.7	88.82	86.66	110	96	87.23	115	130	63.81	120

* As on 07.02.2020

3.6 Regarding the SAGE scheme, the Committee was informed that the following new projects were undertaken during the last 3 years:

- (i) A pilot study on the discharge of groundwater to sea through coastal aquifers (Submarine Groundwater Discharge - SGD) has been initiated, as small volumetrically but significant ecologically SGD, offers an important

pathway of nutrients, carbon and other geochemical constituents to the ocean. Knowledge of the nature of SGD allows us to estimate optimum extraction levels of potable groundwater and provide information on feasible waste disposal sites in coastal zones.

- (ii) Seismic hazard microzonation of selected cities: Investigations related to microzonation of 4 cities namely, Chennai, Bhubaneswar, Mangalore, Coimbatore were taken up.

3.7 The Committee enquired the reasons for the decrease in revenue allocation under the scheme in 2018-19. The Committee was informed by the Ministry that the decrease during 2018-19 at RE stage was due to delay in the initiation of project in North Eastern region and delay in hiring of outsourcing services. The Committee was also informed that the enhancement in the allocation in the Revenue component of SAGE scheme during 2019-20 at RE stage was due to requirement of additional funds for International Geological Congress.

3.8 The Committee observes the declining trend of utilisation of funds under the SAGE scheme. The reasons offered by the Ministry relate to delay in projects. In 2019-20, although the allocation under the head was increased at the RE stage, the Ministry has so far been able to utilise little less than 50% of the allocation made under the head. Therefore, it is unclear how the Ministry will spend the unspent 50% of the allocation in the remaining part of the financial year. The Committee urges the Ministry to take corrective action in this matter.

OCEAN SERVICES, MODELLING, APPLICATION, RESOURCES AND TECHNOLOGY (OSMART)

3.9 The budgetary details of the scheme for the last three years and allocation for 2020-21 are as under:-

(Rs. in Crore)									
2017-18			2018-19			2019-20			2020-21
BE	RE	Actual	BE	RE	Actual	BE	RE	Actual*	BE
336	326	320.59	399	440.5	434.49	483	445	379.9	567

* As on 07.02.2020

3.10 The Committee further noted that Rs.567 crore has been allocated for O-SMART in BE 2020-21 and desired to know the reasons for 27% increase in funds for the scheme over RE 2019-20 and how the Ministry intends to utilise the allocation made. The Ministry informed the Committee that the allocation of Rs.567 crore falls short of bare minimum requirement of Rs.850 crore for this scheme. The allotted funds will be utilised for (i) outstanding contractual payments for past years and increased expenditure on operation and maintenance of growing fleet of aged vessels Sagar Kanya and Sagar Sampada, and new coastal research vessels Sagar Tara and Sagar Anveshika, and other contractual obligations; (ii) maintenance of ocean observation network; (iii) procurements of approved major items like HPC (for INCOIS), satellite data reception ground station and deployment of deep ocean observation platforms/sensors; (iv) pollution hotspot monitoring, coastal monitoring, marine living resources; (v) The contractual

obligation in respect of 2 exploration contracts on polymetallic nodules and polymetallic sulfides with International Seabed Authority; and (vi) contractual payment for Bathymetric survey of EEZ.

3.11 The Committee noted that against the BE allocation of Rs.483 crore, the Ministry was allocated Rs.445 crore in RE 2019-20 for O-SMART Scheme. The Committee desired to know the reasons for the reduced allocation at RE stage. The Ministry in their written reply informed the Committee that the reasons for reduced allocation are (i) delay in procurement of manned submersible for a depth of 6000m by NIOT Chennai; (ii) delay in recruitment of Manpower/ Scientists; and (iii) less expenditure by CPWD against authorisation for building of NCCR compound wall.

3.12. The Committee notes that the reasons for the reduction of funds under OSMART scheme are once again related to administrative delays. The Committee urges the Ministry to avoid such delays in the future so as to be able to justify increased allocation of funds for its plans and upcoming programmes, that are important.

RESEARCH, EDUCATION, OUTREACH AND TRAINING (REACHOUT)

3.13 The budgetary details of the scheme for the last three years and allocation for 2020-21 are as under:-

(Rs. in Crore)									
2017-18			2018-19			2019-20			2020-21
BE	RE	Actual	BE	RE	Actual	BE	RE	Actual*	BE
44	46	45.9	74.23	94.50	93.08	90	65	50.99	85

* As on 07.02.2020

3.14 The Committee observed that the allocation under the scheme had been reduced from Rs.90 crore at BE to Rs.65 crore at RE in 2019-20 and desired to know the reasons for the reduction at RE stage. The Ministry informed the Committee that the reduction from Rs.90 crore at BE to Rs.65 crore at RE in 2019-20 under REACHOUT scheme is due to (i) deferred payment towards construction of ITCOcean training center due to pending work with contractor; (ii) research proposals received were less than envisaged; and (iii) delay in selection of JRFs.

3.15. The Committee observes that the utilisation of funds under the scheme during 2017-18 and 2018-19 had been satisfactory. However, in 2019-20, the allocation of Rs.90 crore at BE was reduced by nearly 28 per cent.

3.16. The Committee notes that the existing monitoring mechanism of the Ministry has not ensured overall effective utilisation of funds under the various schemes of the Ministry, which resulted in reduction of allocations at RE stage in these schemes. The Committee recommends that the Ministry needs to review its financial performance under the various schemes and programmes, analyse the reasons for underutilisation, identify the administrative bottlenecks and take corrective measures to ensure that funds allocated under various schemes are not underutilised in future.

4. AUTONOMOUS BODIES

4.1. In order to assess the financial performance of the autonomous institutions under the Ministry of Earth Sciences, the Committee desired to know the details of the budgetary assistance provided by the Ministry to each of the autonomous institutions under its jurisdiction. The Committee asked the Ministry to provide details of funds utilised vis-a-vis funds allocated to each of these institutions, institution-wise, during the last three years, viz. 2017-18, 2018-19, 2019-20, alongwith the reasons for underutilisation, if any. The Ministry furnished the information as under:

(Rs. in crore)

Institute	2017-18			2018-19			2019-20		
	BE	RE	Actual	BE	RE	Actual	BE	RE	Actual (as on 7.2.2020)
Indian National Centre for Ocean Information Services (INCOIS)	30.05	23.17	23.17	25.00	25.00	25.00	28.00	21.80	14.48
National Institute of Ocean Technology (NIOT)	29.40	28.10	28.10	32.00	49.18	48.18	35.00	50.78	20.49
National Centre for Polar and Ocean Research (NCPOR)	19.74	14.35	14.35	20.00	25.00	25.00	25.00	19.50	15.83
Indian Institute of Tropical Meteorology (IITM)	65.90	60.36	60.36	65.00	93.30	93.25	70.00	68.20	61.50
National Centre for Earth Science Studies (NCESS)	20.84	19.09	16.32	20.00	13.50	13.13	20.00	19.50	15.48

4.2. The Committee notes that the financial performance of all the autonomous institutions under the Ministry has been satisfactory during the years 2017-18 and 2018-19. As regards 2019-20, the Committee observed that the allocation of all the autonomous bodies had been reduced at RE stage, except NIOT, Chennai. The reasons furnished for this reduction are deferment of maintenance work on existing building and upgradation of existing IT infrastructure, delay in start of contractual work of lab, postponement of some civil work etc. The Committee feels that the reasons furnished are mostly procedural and administrative, and could have been avoided. The Committee recommends that the Ministry should take up the

matter with all the concerned agencies and ensure that such underutilisation of funds is avoided in the future.

4.3. In the case of NIOT, Chennai, the allocation was increased from Rs.25 crore (BE) to Rs.50.78 crore (RE) and the Committee desired to know the reasons for the same. The Committee was informed that the increase is to cater to payment towards terminal benefits of the regular employees of NIOT which includes creation of corpus fund with LIC for leave encashment and gratuity of NIOT employees. **However, the Committee notes that out of the increased allocation of Rs.50.78 crore, NIOT could spend only Rs.20.49 crore upto 7th February 2020, which is 40 percent of the allocated amount. The Committee recommends that the Ministry impress upon NIOT, Chennai to take necessary action to ensure that the funds are utilised within the current financial year for the purpose for which additional funds were granted at RE stage.**

4.4. During its study visit to Chennai in December 2019, the Committee visited the establishment of National Institute of Ocean Technology (NIOT) on the 28th December, 2019 and held detailed discussion with the representatives of National Institute of Ocean Technology and Ministry of Earth Sciences on its functioning. During the discussion, the Committee was informed that NIOT has undertaken demonstration studies along two shorelines (Puducherry and Kadalur Fishing villages (near Kalpakkam, Tamil Nadu) facing severe erosion and loss of beach. The entire project has been designed and implemented with appropriate sustainable environmentally friendly shore protection measures suitable to each of these two locations in-house using NIOT's experience. Based on the successful beach restoration at these two sites by NIOT, several coastal stakeholders from the coastal States of India have approached NIOT to undertake Shoreline Management (SM) Studies and provide recommendations on Sustainable Coastal Protection Measures.

4.5 The Committee was further informed that NIOT had requested regular manpower for executing various projects during the period 2017-20 under the Cabinet approved project O-SMART. The same was approved with direction to engage persons on contract till regular posts are created. Since the projects are of a continuing nature, a proposal for the creation of 90 posts, which includes creation of senior level administrative positions to cater the needs of Finance and Purchase sections that involve high value contracts/purchases of equipment was sent through the Ministry of Earth Sciences. However, the same is yet to materialise. Additionally, creation of 35 permanent posts are required to expand the activities of Coastal protection, EIA studies and render assistance to all the Coastal States and the Union Territories of Andaman and Nicobar and Lakshadweep.

4.6 The Committee is of the view that our long coast line is the lifeline of coastal communities and therefore sustainable management and restoration of the coastal zone and shorelines is essential. The success of the demonstration studies carried out shows that such projects of the National Institute of Ocean Technology must be encouraged in all states along the coastline. The Committee recommends that the Government should pay adequate attention

to the needs of NIOT and equip NIOT with the promised manpower at the earliest to enable it to carry out its mandated activities.

5. WEATHER FORECASTS/RAINFALL VARIABILITY AND CHANGES

5.1 The Committee enquired from the Ministry about the steps taken by the Ministry to improve the accuracy of weather forecasts and to bring it at par with the International standards. The Committee was informed by the Ministry that India Meteorological Department (IMD) is dedicated for monitoring, detection and forecasting of weather and climate including early warning for severe weather events such as cyclones, heavy rainfall etc. The weather forecasting and early warning systems in the country are comparable to most of the developed countries in the world in terms of accuracy, lead time and associated impact. Over the past few years, the quality of weather & climate services provided by the Ministry has improved due to systematic efforts in augmenting atmospheric observations developing adequate modelling strategy, conducting cutting edge research and investing in human resources development. IMD continuously expands its infrastructure for meteorological observations, data exchange, monitoring & analysis, forecasting and warning services using contemporary technology. IMD uses a suite of quality observations from Indian and International satellites, radars and conventional & automatic weather stations for monitoring and prediction of weather. The High Performance Computing (HPC) systems have been recently upgraded by 6.8 petaflops so as to support the ongoing efforts on modelling. Operational implementation of improved suite of prediction models has enhanced the weather forecasting capability through assimilation of all available global satellite radiance & Radar data for the generation of forecast products at 12 km grid globally and 3 km grid over India/regional/mega city domains.

5.2 The Committee was further informed that under the National Monsoon Mission program, advanced dynamical prediction systems have been developed for Seasonal prediction of Monsoon; Extended range prediction (for next 20 days) and Short & medium range (up to 10 days) weather prediction. In addition, a high resolution (12 km grid scale) state of the art Global Ensemble Prediction System (EPS) was commissioned on 01 June 2018, which is one of the best in the world. The Ensemble forecasts will enhance the weather information being provided by the current models by quantifying the uncertainties in the weather forecasts and generate probabilistic forecasts.

5.3 During the meeting of the Committee held on the 17th February 2020, many Members of the Committee raised serious concerns about the changing rainfall pattern in their respective constituencies/States, which had adversely affected the local population and the crops of farmers. The members observed that sometimes, their respective areas suffer from dry days and there is not enough water for the farmers. At other times, there is heavy rainfall, which damages the crops. Both these situations are harming farmers significantly. Members also noted the rise of sudden downpours or cloudbursts in their respective states. The Secretary of the Ministry, informed the Committee that the Ministry has prepared a report on

Observed Rainfall Variability and Changes to find recent changes in the rainfall pattern over 28 states and one UT i.e. Jammu & Kashmir based on the data of the last 30 years (1989-2018), as desired by the Committee in its last meeting held with the representatives of Ministry of Earth Sciences in September 2019. The rainfall pattern of monsoon months, south west monsoon season, and annual rainfall of the State and its districts as well as extreme rainfall event of different intensity of stations have been analysed in the report. While apprising the Committee of the significant trends in the State Rainfall, the Secretary of the Ministry brought out the following:

- Five States viz. Bihar, Meghalaya, Nagaland, West Bengal and Uttar Pradesh have shown statistically significant decreasing trends in Southwest monsoon rainfall.
- All these five states along with two more states viz. Arunachal Pradesh and Himachal Pradesh have also shown statistically significant decreasing trends in annual rainfall.
- However in the district rainfall, significant changes have been noticed for most of the states.

5.4 The Ministry also informed the Committee that there had been significant changes in the frequency of dry days, rainy days (daily rainfall of 2.5 mm or more but less than 7 cm) and heavy rainfall events (rainfall greater than equal to 7cm). Further, it was also pointed out that the situation for agriculture or water recharges in the states in the Ganga basin viz. Delhi, Uttar Pradesh, Bihar and West Bengal and some states of extreme south peninsula is alarming, as the number of dry days during southwest monsoon is significantly increasing and also the frequency of rainfall of lower intensities (less than 7 cm) favourable for soil and ground water recharges is decreasing over these regions.

5.5 The Committee desired to know whether the Ministry could predict sudden cloudbursts. In response, the Secretary responded that they can make prediction two hours before such extreme events. He also stated that they termed cloudbursts as heavy rains with ten centimeters or more in one hour. However, it does not happen very often. In their written reply on the subject, the Ministry further stated that cloudbursts are being predicted in Nowcast mode, i.e, 2-3 hours in advance in terms of heavy rainfall using Doppler Weather Radars and Satellite Data.

5.6 The Committee further desired to know from the Ministry that if the Ministry received requisite funds, whether it is possible to predict a cloudburst 3 days in advance. The Ministry stated that with the existing super computer, they are able to run global weather prediction models with a horizontal resolution of 12km. The proposed supercomputing system will be able to reduce the 12km grids down to 5 km, giving far more detailed predictions. It was further stated that unlike cyclones, forecasting a cloudburst is very difficult due to the dynamics of the rapidly developing clouds over a very small area. However, they could make a

probabilistic forecast on possibility of cloudburst events over a specific area 48 hours in advance with enhanced computing facility.

5.7 The Committee and the Chairman enquired the amount of expenditure allocated to the overall study and prediction of the monsoon and its changing patterns. The Secretary informed the Committee that approximately 30 percent of the Budget is allocated to study the monsoon. The Committee further enquired as to how many supercomputers the Ministry had and the requirement of the Ministry for upgrading their computing facilities, the Ministry informed the Committee that they have a total High-Performance Computing (HPC) system with a capacity of 10 PFlops. The Ministry plans to augment the current HPC from 10 PFlops to 40 PFlops by 2022 and to 100 PFlops by 2024. In response to a further query on the subject, the Ministry noted that normally they procure these computers by global tenders. In India, such high performance computers are not available in the private sector for Weather and Climate applications. In fact, the Ministry has the largest supercomputer in India. It was also informed that the Ministry needed Rs.1600 crores to upgrade their computing facilities.

5.8 The Committee underlines the importance of the monsoon for India and its people, and finds that a 30 percent allocation of the Ministry's budget to study the monsoon is a low figure. Further, the Committee is of the considered view that given the alarming nature of changing rainfall patterns in various parts of the country, which adversely affects the local population, and especially the farmers and their crops; there is an urgent need to provide advance information about such events to all stakeholders, especially to farmers and fisherfolks in the country.

5.9 Although the Ministry has stated that it may be able to make predictions 24 hours before such events, the Committee is of the view that there is a need for the country to know the forecast about rains, heavy rains and cloudbursts, sufficiently in advance, in order to be able to take any pre-emptive action in the matter.

5.10 The Committee is of the view that the Ministry of Earth Sciences, being the nodal Ministry of the Government of India in this field, must prioritise study of the monsoon. The Committee strongly recommends that the Ministry must make significant investments to expand the network of radars, High-Performance Computing systems etc. for predicting rainfall, cloudbursts, and natural disasters. The Committee further recommends that the Ministry must be allocated adequate additional funds towards setting up of observational facilities to improve the predictability of monsoon at the national level on a mission mode, including studying the link between the monsoon and the ocean through deep ocean research.

6. RESOURCE GENERATION BY THE MINISTRY

6.1. During the meeting of the Committee held on 17th February 2020, the Committee enquired the Secretary about the generation of their own resources by the Ministry. In response, the Committee was informed that they provide services to about 70 airports and earned about ₹ 120 crores from the Airports Authority of

India. The Committee further enquired to know whether the Ministry would be able to raise additional funds by monetising some of the data and information generated by them. The Committee was informed by the Secretary of the Ministry as under:

“We are planning that, Sir. Presently, we are giving most of the data free of cost. That is the Government policy. All weather data is given free of cost. Even for forecasting, we do not charge anything except in commercial cases. We don’t generate much money. But we can think about it. For example, while sharing our weather forecasting data with a private company or a startup or something, we can make use of our forecast. It can further make tailor made forecast applications and sell the data.”

6.2 The Secretary also informed the Committee that bulk of the users of their data were government departments. Also, they were charging a very nominal amount for selling the data to the private companies.

6.3 The Committee is of the view that the Ministry of Earth Sciences should explore monetisation of the data and information generated through a well-thought out policy, which does not compromise the public interest nature of its original mandate. Although the Ministry is carrying out a public service, if the data is utilised by private users, especially large entities like private insurance companies, such private users must pay commensurately for the data and information provided by the Ministry. Such a policy will help the Ministry to generate additional resources for augmenting important programmes and also help the Ministry, to some extent, to tide over the financial crunch the Ministry faces every year in financing some of its important projects/schemes.
