

**Ministry of Earth Sciences (MoES)**  
**Summary of Important Developments –October,2019**

1. **Important policy decisions taken and major achievements during the month:** Provided in Annex I.
2. **Important policy aspects / matters held up on account of prolonged Inter- Ministerial consultations/ delays, etc.:** Nil

**3. Compliance of COS decisions:**

S.No.	Number of COS decisions pending for compliance	Proposed action plan/timelines	Remarks
1.	<p>Dt 14/08/2014            PROPOSAL FOR KRILL FISHING</p> <p>MoES, in collaboration with MEA, will study the experience of different countries showing varied interest in krill fishing so that India could learn from their experiences. MEA, in collaboration with MoES, will examine and identify the countries with which India can collaborate for krill fishing. MoES will ascertain the interest of Indian industry in krill fishing and also explore the feasibility of Indian companies collaborating directly with foreign companies. MoES will study legislations enacted by other member countries before finalising the draft legislation as part of international convention obligations.</p> <p>MoES will bring out a paper on krill fishing giving a detailed account of demand analysis, financial viability, interest of industry, experiences of other countries, criteria for fishing license, existing knowledge gap, etc. Thereafter, the CoS will meet again to decide whether India should engage in commercial krill fishing.</p>	<p>The Ministry has examined the aspect of Krill fishing. Japan &amp; Norway have developed expertise and these countries have been tentatively identified for collaboration on Krill fishing. Their experiences have been obtained. Indian Industries have been approached for Krill fishing to ascertain their interests. However, so far we have not received any response. The draft paper is prepared and suggestions of Cabinet Secretariat have been obtained.</p>	<p>A proposal has been received for krill fishing which is under examination.</p>

☐ **Cases of sanction for prosecution pending in the Ministry for more than three months:** Nil

☐ **Particulars of cases in which there has been a departure from the Transaction of Business rules of established policy of the Government:** Nil

☐ **Status of implementation of e-Governance :** Being implemented

☐ **Status of Public grievances:**

No. of Public Grievances redressed during the month	No. of Public Grievances pending at the end of the month
3	15

**8. Information on the specific steps taken by the Ministry/Department for utilization of the Space Technology based tools and applications in Governance and Development:**

Potential Fishing Zone advisories are generated using the satellite derived parameters viz. Sea Surface Temperature, and Chlorophyll. Further, data from Global satellite data are used on continuous basis for generating short range and medium range weather forecasts.

9. (i) **Confirmation that the incumbency details of all posts in the Ministry/Department and its organizations falling under the purview of the ACC have been updated on AVMS:** It is confirmed that the incumbency details of all the posts in the Ministry/Department and its organizations falling under the purview of the ACC have been updated on AVMS and are placed at Annex-II.

(ii) **Status regarding compliance of the directions of ACC:** It is also confirmed that the directions of ACC are complied with.

(iii) **Status of cases where recommendations from PESB have been received but the proposals are yet to be submitted to the ACC Secretariat:** NIL

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#### **Annex-I**

#### **Important policy decision taken and major achievements:**

- (1) National Institute of Ocean Technology(NIOT) celebrated its Silver Jubilee on 3<sup>rd</sup> November 2019 at NIOT, Chennai. Hon'ble Vice President of India Shri.M.Venkaiah Naidu, graced the occasion as the Chief Guest and addressed the gathering. Shri Banwarilal Purohit, Hon'ble Governor of Tamilnadu, Dr.Harsh Vardhan, Hon'ble Union Minister for Science and Technology, Earth Sciences and Health & Family welfare and Shri O.Panneerselvam, Hon'ble Deputy Chief Minister of Tamilnadu, were the Guests of Honour. Shri D.Jayakumar, Minister for Fisheries, Personnel and Administrative Reforms, Tamilnadu and Shri R.B.Udayakumar, Minister for Revenue and Disaster Management and Information Technology also graced the occasion. On this occasion, Coastal Flood Warning System and a special postal cover were released. A Red Atlas Action Plan Map for Chennai, Tamilnadu, developed by MoES & other institutes as part of the initiative by the Principal Scientific Adviser to Govt. of India was handed over to Shri R.B.Udayakumar, Minister for Revenue and Disaster Management and Information Technology.Honorable Vice President of India Shri M. Venkaiah Naidu distributed prizes to student winners of Silver Jubilee competitions conducted by NIOT .
- (2) GAGAN Enabled Mariners Instrument for Navigation & Information (in-house developed Mobile App with specially designed ocean information, advisory and warning messages) to disseminate disaster warnings/alerts and Potential Fishing Zone operationally direct to the open ocean through satellite was inaugurated by Dr. Harsh Vardhan, Hon'ble minister for Science & Technology, Earth Sciences & Health and Family Welfare on 9 Oct 2019 at New Delhi. This instrument will ensure connectivity in high seas.
- (3) Withdrawal of Southwest Monsoon commenced on 9<sup>th</sup> October 2019 against the normal date of 1<sup>st</sup> September. The most delayed commencement of withdrawal in the past years had been on 1<sup>st</sup> October in the year 1961.
- (4) A Mobile application "Co-tidal model for Gulf of Khambhat" as a part of North Indian Ocean Tide developed by NIOT was released on 31<sup>st</sup> October 2019.
- (5) A six monthly review of activities of the Ministry, attached offices, subordinate office and autonomous institutes was undertaken from 31 October- 1<sup>st</sup> November, 2019 at Centre for Marine Living Resources and Ecology, Kochi.

There was no matter pending before the Cabinet requiring decision/approval.

#### Minimum Government, Maximum Governance:

- Dissemination of Agromet Advisories to user communities through SMS and IVR technology is continued in the country through Kisan Portal and under PPP mode. Presently, 40.1 million farmers in the country are getting advisories through SMS directly.
- Adverse-weather SMS warnings are being sent through mobile to the State Government officials / Disaster-related officials / Central Government organizations/common man.
- Daily forecast along with warning and city forecast for many cities are disseminated through email to all users including state authorities, electronic and print media.

## Atmospheric Observation Systems Network

Observation Type	Commissioned so far	Installations during the month	Data Reporting
Automatic Weather Station (AWS)	300	--	204
Automatic Rain Gauge (ARG)	1356	--	358
GPS Sonde based RS/RW Stations	56	--	56
Doppler Weather Radar (DWR)	* 25	--	23
Ozone (Ozone Sonde + Total Ozone)	04	--	04
Surface Ozone ( <a href="#">Electrochemical Concentration Cell</a> method)	07	--	07
Nephelometer	12	--	12
Sky Radiometer	20	--	19
Black Carbon Monitoring Systems (Aethalometer)	25	--	23
Air Quality Monitoring System (SAFAR)	10(Delhi) 10(Mumbai) 10(Ahmedabad)	--	10(Delhi) 10(Mumbai) 10(Ahmedabad)
Hydromet. (IMD & Extra-departmental excluding AWS & ARG)	---	--	3038
Aviation	79	--	79

\* Includes 2 Doppler Weather Radar of ISRO.

## Atmospheric Processes, Modelling and Services

### Major Weather Systems during the Monnth

October witnessed the formation of two Cyclonic Storms over the Arabian Sea, viz., Super Cyclonic Storm **Kyarr** and Very Severe Cyclonic Storm (VSCS) **Maha**. VSCS Maha formed as a Depression over Maldives – Comorin areas on 30th October, intensified into a Cyclonic Storm and crossed Lakshadweep Islands and continued into November (Details of the system will be incorporated in the next month's report).

**Super Cyclonic Storm Kyarr (24<sup>th</sup> October-2<sup>nd</sup> November 2019):** Super cyclonic storm Kyarr developed from a depression which formed over eastcentral Arabian Sea on 24th October, 2019. Under favourable environmental conditions, it intensified into a deep depression on 24th evening and into a cyclonic storm in the early morning of 25th. Moving north-northeastwards, it further intensified into a severe cyclonic storm in the same evening. Thereafter, it recurved west-northwestwards and intensified into a very severe cyclonic storm in the early morning of 26th. Thereafter, it intensified rapidly into an extremely severe cyclonic storm on 26th night and into a Super Cyclonic Storm (SuCS) in the morning of 27th. From 28th night, it entered into unfavourable environment and started weakening. It weakened into an extremely severe cyclonic storm in the morning of 29th. From 29th night, the system recurved and moved initially westwards for some time and west-southwestwards thereafter. The unfavourable conditions like lower sea surface temperatures, lower ocean thermal energy, cold & dry air entrainment into the core of system and increased vertical wind shear persisted over the westcentral Arabian Sea. Under these conditions, the system continued to lose it's strength and gradually weakened into a well marked low pressure area near Somalia in the midnight of 2nd November. This was 7th Super Cyclonic Storm over north Indian Ocean during the period 1965-2019 and 2nd Super Cyclonic Storm over Arabian Sea during the period 1965-

2019 after cyclone Gonu in June, 2007. However, Gonu crossed Oman coast as a very severe cyclonic storm with maximum sustained wind speed of 77 kts while Kyarr weakened over sea.

India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean and the cyclone was monitored mainly with the help of available satellite observations from INSAT 3D and 3DR, polar orbiting satellites, and available ships & buoy observations in the region and the Doppler weather radars along the west coast (DWR at Kochi, Goa and Mumbai) since 17th October even before the formation of low pressure area over Arabian Sea. In the extended range outlook issued on 17th October, genesis over eastcentral Arabian Sea was predicted. Various numerical weather prediction models developed by Ministry of Earth Sciences (MoES) institutions and dynamical-statistical models were utilized to predict the genesis, track, landfall and intensity of the cyclone. A digitized forecasting system of IMD was utilized for analysis and comparison of various models guidance, decision making process and warning product generation.

**Heavy Rainfall Activity:** Extremely heavy rainfall(>204.4 mm) had been reported at isolated places over Odisha on two days; over Assam & Meghalaya, Gangetic West Bengal, Konkan & Goa, Coastal Andhra Pradesh, Coastal Karnataka, Nagaland, Manipur, Mizoram & Tripura and Lakshadweep on one day each during the month. No. of Heavy rainfall events and correctness (in %) of spatial distribution in issued warnings during October 2019 is given below:

Lead Time of warning issued	No. of Heavy Rainfall Events (>64.4 mm): 254
	correctness in % (Rainfall >64.4mm)
24 Hour	81%
48 Hour	80%
72 Hour	81%

**Rainfall Scenario:** The rainfall for the country as a whole for the month of October 2019 has been recorded as 109.7 mm which is 44% above to its Long Period Average (LPA) i.e. 76.0 mm.

**Thundersquall & Hailstorm activity:** Thundersquall & Hailstorm activity during the month is given in the table below:

S.No.	Region	TS Days	Maximum TS Activity	Hail	Squall
1	South Peninsular India	30	15-10-19	01 (Madikeri SIK 06-10-19)	Nil
2	Northwest India	13	03-10-19	02 (Srinagar & Kukernag, J&K on 03-10-19) 01 (Bhaderwah J&K on 12-10-19) 01 (Kupwara J&K on 17-10-19) 01 (Kukernag J&K on 19-10-19)	Nil
3	Northeast India	15	07-10-19	Nil	Nil
4	East India	26	06-10-19 & 07-10-19	Nil	02 (Port Blair, Port Blair on 19-10-19)
5	Central India	17	01-10-19	Nil	Nil
6	West India	10	08-10-19 & 15-10-19	Nil	Nil

**Note:** The convective activities mentioned above had been predicted and corresponding warnings were issued about 4-5 days in advance of the occurrence of the event. In addition to that, nowcasts were also given by corresponding RMCs/MCs with respect to these events.

**Temperature Scenerio:** The Mean Temp for the month for the country as a whole was 26.23°C; this was slightly above normal (+0.21°C).

**Bulletins / Operational Reports/ Services**

**Bulletins/Warnings/Press Releases Issued:** All India Weather Bulletins(124), All India inference and severe weather warnings(124), Press Releases related to (a)monsoon and intense rainfall activity over northeast India (2),(b) current weather status and outlook for next two weeks(3),(c)Cyclones and depression(8), Nowcast Guidance Bulletins for severe weather (31), All India Weekly Weather Reports (4), Mountain weather bulletins including severe weather warnings for western and central Himalayan region(62), Mountain Expedition Forecast Bulletins issued for different expeditions(52),Weekly and cumulative Standardized Precipitation Index (SPI) maps supplied for Agrometeorology Advisory Services Bulletin (4).

**Publications & Operational Reports issued:** Daily All India Weather Summary and Weekly Weather Reports, El Nino Southern Oscillation (ENSO) bulletin for the month of October 2019 and Seasonal Climate Outlook for South Asia for the month of October 2019 to January, 2020 (Quick Link: [www.imdpune.gov.in/Clim\\_Pred\\_LRF\\_New/Products.html](http://www.imdpune.gov.in/Clim_Pred_LRF_New/Products.html)). Gridded Standardized Precipitation Index (SPI) & Standardized Precipitation Evapotranspiration Index (SPEI) at 0.5\*0.5 degree resolution at 4 weekly 1, 2, 3 & 4 monthly time scales computed and maps of same timescales are being uploaded at weekly basis on IMD Pune website, Climate Diagnostics Bulletin of India for September 2019 brought out and uploaded on IMD Pune website and Weekly bulletins on “Climate information for Health based on Extended Range Weather Forecast” (on experimental basis) have been prepared for the weeks ending on 3rd, 10th, 17th, 24th and 31st October .

**Modelling**

The Probabilistic forecast for all the river basins of India have been developed by Indian Institute of Tropical Meteorology ( IITM).

**Geoscience Research**

**Seismological Observational Network**

Observation Type	Target	Commissioned so far	Data reporting during the month
Seismic stations	115	115	106
GPS stations	40	20#	19

#10 VSATS have been dismantled to shift them to new locations.

**Earthquake and Tsunami monitoring**

**Earthquake:** 17 earthquakes were monitored in the Indian region out of which no event was greater than magnitude (M) of 5.0.

**Tsunami:** 2 seabed earthquakes (M> 6) with a potential to generate tsunami occurred. This information was provided within 12 minutes of occurrence for both the events.

**Ocean Observation System**

Type of Platform	Target	Commissioned till October, 2019	Data received during October, 2019
Argo Floats *	200	367	149
Drifters*	150	108	5
Moored Buoys	16	22	13
Tide Gauges	36	36	30
High Frequency(HF) Radars	10	12	10

Current Meter Array	10	11	0
Acoustic Doppler Current Profiler(ADCP)	20	20	17
Tsunami Buoys	7	9	4
Wave Rider Buoy	16	22	11

\*The remaining floats/drifters have completed their life time and as such no data can be received from them.

### **Ocean Science Services**

No	Types of forecasts	No. of advisories issued during the month
1	Integrated Potential Fishing Zone (PFZ) advisories (Sea Surface Temperature(SST), Chlorophyll., wind)	31
2	Tuna Fishing Advisories	31
2	Ocean State Forecast(OSF)-Wave, Wind, Currents, SST, MLD and D20 forecasts	31
3.	Near Real time global ocean analysis (5-day averaged)	6
4.	Real time global ocean analysis (daily)	31
5.	Coral Bleaching Alert System	10

Information on significant wave height/direction, swell height /direction, wind speed/direction, current speed/direction and maximum wave height, was provided during 15 May to 15 October, 2019, at four locations off Mumbai port for the Maharashtra Maritime Board, Mumbai.

### **Ocean Technology**

A Patent has been granted to MOES – NIOT for its coastal marine surveillance device “An Apparatus and the Functioning of Integrated Marine Surveillance System”.

### **Polar Science and Expedition**

Team member of fourth summer batch of Indian Arctic expedition-2019-20 reached safely to India after successful completion of their research objectives.

Vector flow maps of glacier surface velocity have been prepared over the period of Jan-April, 2019 using GRD(Ground Range Detected ) product of Sentinel-1 data for Polar Record glacier in Antarctica.

During the 9th Indian Scientific Expedition to the Southern Ocean(SO), result of studies shows that the zooplankton biovolume and abundance varied spatially and there were significant differences among the frontal region ( $P < 0.05$ ) and the mean zooplankton biovolume in the surface layer was high in the Polar Front, while the lowest was observed in the Subantarctic Front. The studies revealed that the abundance and distribution of zooplankton in the SO is likely to be controlled by physical and biological characteristics.

### **Delineation of Continental Shelf**

A delegation of experts led by Secretary, Ministry of Earth Sciences attended the meeting of the sub-commission constituted to consider submission of India in the west coast at United Nations, New York from October 14-18, 2019 and made technical presentations.

### **Survey and Exploration**

The molecular studies of cold water sponges from SOUTH West Indian Ridge in Indian Ocean confirms the presence of species *Geodiabarretti* which is up to 80 cm in diameter and identified for the first time from Indian Ocean ridge system.

### **Coastal Research**

Benthic foraminifera was assessed from one of the tropical estuary (Beypore) in southwest coast of India.. The abundance and diversity of *Quinqueloculina lata*, *Textularia agglutinans*, *Haplophagmoides canariensis* and *Quinqueloculina stelligera* were dominated by stress-tolerant taxa such as *Ammonia tepida*, *A. parkinsoniana*, *Nonion grateloupi*, and *N. scaphum* in the estuary. The dominance of stress tolerant benthic foraminifera and absence of *Elphidium* species in the estuary

suggest the prevalence of hypoxic (low-oxygen) conditions. Chemical constituents screening in the benthic foraminiferal shell is a step ahead to identify the capacity of benthic foraminifera in responding to anthropogenic metal contamination in coastal areas.

**Topographic Survey of Exclusive Economic Zone**

Area covered during the month: About 17280 sq. km

**Capacity Building and Outreach**

Several curtain raiser events to India International Science Festival (IISF-2019) were organised in various MoES institutes. In National Centre for Polar and Ocean Research(NCPOR), Director and a Scientist of NCPOR addressed the students and motivated the teachers to teach students beyond the windows of the classroom and books. During the programme, special interactive talks were delivered by NCPOR Polar scientists on India's Polar Research and Challenges, Southern Ocean Research initiatives and Expedition. For enhanced involvement of students, a Fun Science activity- A Dry-Ice show was also organised for the participants. More than 200 students from different schools participated in the program. In Indian National Centre for Ocean Information Services(INCOIS), Hyderabad, a Special Public Guest Lecture on "Earth Sciences for Sustainable Development Goals (SDGs)- Major Water Issues in India " was delivered by Director, National Geophysical Research Institute with Secretary, VIBHA (Vijnana Bharati) as Guest of Honour. The lecture was attended by over 60 students from Malla Reddy Women's Engineering College, Hyderabad, 22 state development officers from Tami Nadu, Kerala and Telangana and few individual visitors, in addition to INCOIS staff members. In National Centre for Earth Science Studies (NCESS ), lab visits for the school/college students were arranged . NCESS also organized an invited talk on "Integrated River Basin Management" by Prof. K. P. Sudheer, Principal Secretary, S&T Department and Executive Vice President, KSCSTE. At NIOT and NCCR, senior scientists from Structural Engineering Research Centre and Central Leather Research Institute and officials from Doordharshan, Press Information Bureau participated in the programme.

IMD in association with Indian Meteorological Society (IMS) and Climate Resilient Observing-Systems Promotion Council (CROPC) organised a National Seminar on "Lightning Early Warning: It's Operationalisation and Safety Cum Awareness" in India Meteorological Department (IMD), Delhi during 3-4 October, 2019.

World Meteorological Organisation(WMO)'s Tropical Cyclones Forecasters Training was organised at IMD during 14-25 October 2019. Twenty (20) scientists including 3 forecasters from Oman and Bangladesh, 1 from Indian National Centre for Ocean Information Services participated in the training.

With a view to create awareness about vigilance, various activities were organised during Vigilance Awareness Week on the theme "Integrity – A way of life" from 28 October - 2 November, 2019 in Ministry of Earth Sciences, its attached and subordinate offices and autonomous institutes.. On this occasion, integrity pledge was administered and several competitions viz. Slogan Competition, Debates, Quiz and Essay Competitions were organised. Various talks by eminent personalities were arranged.

**Rashtriya Ekta Diwas** was celebrated on 31<sup>st</sup> October 2019 by undertaking a pledge at Ministry of Earth Sciences, its attached and subordinate offices and autonomous institutes.

**Utilization of Ocean Research Vessels during the month**

Vessel	Days at Sea / Utilization	Maintenance/ Inspection /Scientific Logistics / Cruise Preparation	No. of Cruise
Sagar Nidhi	26	4	2
Sagar Manjusha	0	31(Dry dock)	0
Sagar Purvi	8	24( maintenance)	1
Sagar Tara	21	10	2
Sagar Kanya	24	7	1
Sagar Sampada	27	4	1

**Publications in Science Citation Index(SCI) journals and PhDs awarded**

Subject	Publications			Ph.Ds		
	April-September, 2019	October, 2019	Total	April-September, 2019	October, 2019	Total
Atmospheric Sciences	89	17	106	-	--	-
Ocean Science and Technology	43	16	59	1	-	1
Polar Sciences	11	4	15	-	-	-
Geosciences and resources	6	8	14	2	-	2
Total	149	45	194	2	-	3

## Annex - II

No.MoES/20/01/2017-Estt.  
Government of India  
Ministry of Earth Sciences

Prithvi Bhavan, Lodhi Road  
New Delhi-110 003

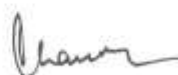
Dated, the 04<sup>th</sup> November, 2019

### CERTIFICATE

(FOR THE MONTH OF OCTOBER, 2019)

It is certified that the detailed status regarding all the posts pertaining to Ministry of Earth Sciences have been updated on AVMS as on last day of the month of October, 2019. A summary of the status is given below:-

- |     |   |      |
|-----|---|------|
| (a) | The total number of posts required to be entered on AVMS        | - 13 |
| (b) | Number of posts filled as on date                               | - 12 |
| (c) | Number of posts totally vacant as on date                       | - 01 |
| (d) | Number of posts under additional charge arrangement             | - 00 |
| (e) | Number of posts that would fall vacant during the next 6 months | - 00 |

  
( Dr. Vipin Chandra )  
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