

**Ministry of Earth Sciences (MoES)**  
**Summary of Important Developments –November,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
24	27

**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) As per the Temperature Outlook for 2019-20 Winter Season (DJF) for India, the upcoming winter season (December to February) is likely to experience warmer than average minimum temperatures over most parts of the country except over northern most parts of India, thus indicating a warmer winter season over the country.

(2) XXXIX Indian Scientific Expedition to Antarctica (39 ISEA) was launched. The team members reached Indian Stations "Maitri" and "Bharati" in Antarctica.

(3) National Centre for Medium Range Weather Forecasting (NCMRWF) has started providing surface weather and Sea-Ice forecasts for Antarctic region to National centre for Polar and Ocean Research (NCPOR), Goa from 19<sup>th</sup> November 2019 onwards for use in 39<sup>th</sup> Indian Scientific Expedition to Antarctica (39-ISEA) planned during November 2019-March 2020. The weather and sea-ice condition forecast are crucial for operations related to the Antarctic Expedition.

(4) His Royal Highness Prince Charles visited the India Meteorological Department (IMD) on 13<sup>th</sup> November, 2019 and interacted with scientists. He appreciated the accurate predictions of cyclones by IMD and its role as Regional Specialised Meteorological Centre, New Delhi for providing the advisory services to the countries in the region to effectively mitigate disaster associated with cyclones.

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	--	211
Automatic Rain Gauge (ARG)	1356	--	352
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	--	20
Black Carbon Monitoring Systems (Aethalometer)	25	--	24
Air Quality Monitoring System (SAFAR)	10(Delhi) 10(Mumbai) 10(Ahmedabad)	--	10(Delhi) 10(Mumbai) 10(Ahmedabad)
Hydromet. (IMD & Extra-departmental excluding AWS & ARG)	---	--	2937
Aviation	79	--	79
Radiation Stations	45	--	45

\* Includes 2 Doppler Weather Radar of ISRO.

Forty One (41) more stations were added on IMD's new stationwise nowcast warning page for issuing three hourly nowcast warnings under location specific nowcast within capital cities, thereby increasing the total number of nowcast stations to 733. Scientists from SAFAR-IITM along with Utkal University have developed the dynamic emission inventory of PM<sub>2.5</sub> due to biomass burning. To further strengthen and validate the emissions, SAFAR Mobile van has been deployed at various stubble burning locations in Punjab and Haryana in a campaign mode from October 2019 to December 2019 to continuously measure pollutants before, during and after stubble burning to improve the understanding and variability of various pollutants. The emission of various pollutants is calculated on daily basis using statistical model cum satellite data to improve the air quality forecasting over Delhi

### **Atmospheric Processes, Modelling and Services**

#### **Major Weather Systems during the Month**

**Extremely Severe Cyclonic Storm MAHA over the Arabian Sea during 30 Oct.-07 November 2019:** The Extremely Severe Cyclonic Storm (ESCS) 'MAHA' originated as a Low Pressure Area (LPA) over Equatorial Indian Ocean off south Sri Lanka coast in the forenoon (0600 UTC) of 28<sup>th</sup> October. It concentrated into a Depression (D) over Maldives-Comorin Area in the early morning (0000 UTC) of 30<sup>th</sup> October. Moving northwestwards, it intensified into a Deep Depression (DD) over Lakshadweep and adjoining Southeast Arabian Sea & Maldives Area in the afternoon (0900 UTC) of 30<sup>th</sup> October and intensified into a Cyclonic Storm (CS) 'MAHA' in the evening (1200 UTC) over Lakshadweep and adjoining Southeast Arabian Sea & Maldives Area. It further intensified into a Severe Cyclonic Storm (SCS) in the forenoon (0600 UTC) of 31<sup>st</sup> October over Lakshadweep and adjoining Southeast Arabian Sea. Moving northwestwards and maintaining intensity of SCS for 75 hours it intensified into Very Severe Cyclonic Storm (VSCS) in the afternoon (0900 UTC) of 03<sup>rd</sup> November over EastCentral Arabian Sea (EC AS). It moved west-northwestwards and further intensified into an Extremely Severe Cyclonic Storm (ESCS) in the early morning (0000 UTC) of 04<sup>th</sup> November over EC & adjoining West Central (WC) AS.

Moving further eastwards, it further weakened into a CS in the evening (1200 UTC) of 06<sup>th</sup> November over EC and adjoining NE AS. Continuing the eastward movement, it further weakened into a DD in the early morning (0000 UTC) of 07<sup>th</sup> November over EC and adjoining NE AS. It occurred simultaneously with VSCS Bulbul over BoB. The track forecast skill was about 71%, 89%, and 83% against the long period average (LPA) of 58%, 70%, and 74% during 2014-18 for 12, 24 and 48 hrs lead period respectively.

**Very Severe Cyclonic Storm Bulbul over Bay of Bengal (05-11 November):** The Very Severe Cyclonic Storm (VSCS) BULBUL originated from the remnant of Severe Tropical Storm 'MATMO' (28<sup>th</sup> October - 2<sup>nd</sup> November) over west Pacific Ocean emerged into north Andaman Sea. It formed as a low pressure area over north Andaman Sea in the early

morning (0000 UTC) of 04<sup>th</sup> November. It lay as a well marked low pressure area (WML) over north Andaman Sea & neighbourhood in the afternoon (0900 UTC) of 04<sup>th</sup> November. Moving west-northwestwards, under favourable environmental conditions it concentrated into a Depression (D) over east central and adjoining southeast Bay of Bengal (BoB) in the early morning (0000 UTC) of 05<sup>th</sup> November. Continuing to move north-northwestwards it further intensified into a severe cyclonic storm (SCS) in the evening of 07<sup>th</sup> November (1200 UTC) over westcentral and adjoining eastcentralBoB. Moving nearly northwards, it further intensified into a VSCS in the early morning (0000 UTC) of 08<sup>th</sup> November over westcentral and adjoining eastcentral BoB. It continued to move nearly northwards until the afternoon (0900 UTC) of 09<sup>th</sup> November and then started to re-curve northeastwards from the evening (1200 UTC) of the same day. Subsequently, it weakened into a SCS and crossed West Bengal coast, close to SunderbanDhanchi Forest during the night (1500 to 1800 UTC) of 09<sup>th</sup> November as SCS with maximum sustained surface wind speed of 110-120 kmph gusting to 135 kmph. The track forecast errors for 24, 48 and 72 hrs lead period were 67, 77, and 131 km respectively against the average track forecast errors of 86, 132, and 178 km during last five years (2014-18) respectively.

India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean and both the systems were predicted well in advance with the help of available satellite observations from INSAT 3D and 3DR, polar orbiting satellites and available ships & buoy observations in the region and radar along the west coast. . Various numerical weather prediction models developed by Ministry of Earth Sciences (MoES) institutions and dynamical-statistical models and A digitized forecasting system of IMD were utilized to predict the genesis, track, landfall and intensity of the cyclone. Tropical cyclone advisory bulletins for WMO & WMO/ESCAP Panel member countries were issued for both the cyclones. The State Governments of Odisha and West Bengal (respective Disaster management Agencies) and Bangladesh Meteorological Department appreciated the timeliness and accuracy of the Cyclone Warning bulletins issued by IMD.

**Heavy Rainfall Activity:** No. of Heavy/Very Heavy Rainfall Events (>64.4 mm) and Warning Skill (correctness in %) of spatial distribution in issued warnings during the month is given below:

**Rainfall Scenario:**  
The rainfall for the country as a

Lead Time of warning issued	No. of Heavy Rainfall Events (>64.4 mm): 51
	correctness in % (Rainfall >64.4mm)
24 Hour	95%
48 Hour	94%
72 Hour	94%

whole for the month of November 2019 has been recorded as 31.4 mm which is 3% above to its Long Period Average (LPA) i.e. 30.4 mm.

**i) 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	24	12-11-19	Nil	Nil
2	Northwest India	15	28-11-19	01 (Amritsar, Punjab 07-11-19) 01 (Ludhiana, Punjab 26-11-19) 01 (Jammu, J&K 27-11-19)	Nil
3	Northeast India	02	04-11-19 & 05-11-19	Nil	Nil
4	East India	02	09-11-19	Nil	Nil
5	Central India	03	01-11-19	Nil	Nil

6	West India	0	Nil	Nil	Nil
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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.

- ii) **Temperature Scenario:** The Mean Temperature for the month for the country as a whole was 23.93°C; this was slightly above normal (+0.72°C).

### **Bulletins / Operational Reports/ Services**

**Bulletins/Warnings/Press Releases Issued:** All India Weather Bulletins(120), All India inference and severe weather warnings(120), Press Releases related to related to (a)visit of Prince Charles(1), (b) intense rainfall activity(4),(c)seasonal temperature and outlook for Dec, Jan & Feb 2019(1),(d)current weather status and outlook for next two weeks (4),(e)Cyclones/Depressions/Low Pressures(12), Nowcast Guidance Bulletins for severe weather (30), All India Weekly Weather Reports (4), Mountain weather bulletins including severe weather warnings for western and central Himalayan region(60), Mountain Expedition Forecast Bulletins 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 November 2019 and Seasonal Climate Outlook for South Asia for the month of November, 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 October 2019 brought out and uploaded on IMD Pune website.

### **Geoscience Research**

#### **Seismological Observational Network**

Observation Type	Target	Commissioned so far	Data reporting during the month
Seismic stations	115	115	107
GPS stations	40	20#	19

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

#### **Earthquake and Tsunami monitoring**

**Earthquake:** 39 earthquakes were monitored in the Indian region out of which 5 events were 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 to 15 minutes of occurrence for one event and after 20 minutes for another event.

#### **Ocean Observation System**

Type of Platform	Target	Commissioned till November, 2019	Data received during November, 2019
Argo Floats *	200	368	150
Drifters*	150	108	5
Moored Buoys	16	22	14
Tide Gauges	36	36	28
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	24	12

\*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)	25
2	Tuna Fishing Advisories	23
2	Ocean State Forecast(OSF)-Wave, Wind, Currents, SST, MLD and D20 forecasts	30
3.	Near Real time global ocean analysis (5-day averaged)	5
4.	Real time global ocean analysis (daily)	30
5.	Coral Bleaching Alert System	10

### **Ocean Technology**

A tripartite agreement for transfer of technology “Lutein production from marine microalgae” was signed between NIOT, M/s. Vectrogen Biologicals Pvt. Ltd, Hyderabad and NRDC on 19<sup>th</sup> November 2019.

A Memorandum of Understanding was signed between NIOT and BARC, Mumbai for “Lipid Hyperaccumulation in microalgae employing radiation and induced mutation selection for Biodiesel production” on 19.11.2019.

### **Topographic Survey of Exclusive Economic Zone**

Area covered during the month:= 19,838 sq km

### **Capacity Building and Outreach**

*International Workshop on Prediction Skill of Extreme Precipitation Events and Tropical Cyclones: Present Status and Future Prospect (IP4)&Annual Climate Change* was organized at Indian institute of Tropical Meteorology(IITM) at Pune during 25-28 November 2019. Around 100 participants from India and abroad viz., Canada, USA, UK, Italy, Korea and Japan attended the workshop.

International training centre on Operational Oceanography (ITCOOcean) conducted a training course on "Ocean Colour Remote Sensing - Data, Processing and Analysis" during 25-29 November 2019. This training course focused on the basics of marine optics, ocean colour remote sensing, and related applications. Thirty eight (38) participants including 11 from 9 other countries (Philippines, Indonesia, Egypt, Bangladesh, Vietnam, Malaysia, Timor- Leste, Kenya, Sri Lanka, Iran) attended the programme.

Weather and Climate Science for Service Partnership India: Impact-based Forecasting Workshop (for working partner 3: WP3) was held at IITM, Pune during 29-30 November at IITM, Pune.

A documentary film of 30 minutes duration was released in "DISHA" on Naxatra News highlighting experiences of Dr. Mrutyunjay Mohapatra, Director General, IMD & future plans of IMD. The same is available at the link [https://www.youtube.com/watch?v=V5gA8N4\\_a90&feature=share&fbclid=IwAR2K4vax2K3mSDnjKy1cgh-3qUI62XVKuWRiMLOQJVgSBk-GDtNJ0FDtIRo](https://www.youtube.com/watch?v=V5gA8N4_a90&feature=share&fbclid=IwAR2K4vax2K3mSDnjKy1cgh-3qUI62XVKuWRiMLOQJVgSBk-GDtNJ0FDtIRo)

4<sup>th</sup> Upper Air Network Performance (UANP) Workshop was held at New Delhi from 18-20 November, 2019..

A training program on Interpretation and application of NWP in Weather Forecasting was conducted during 11<sup>th</sup> – 15<sup>th</sup> November 2019 at IMD, New Delhi.

Hands-on training regarding installation, maintenance, calibration and operation of surface meteorological instruments was imparted to 15 number of Airforce officers.

World Tsunami Awareness Day was celebrated on 5 November. Four hundred fifty (450) students from local schools and college visited the Tsunami Early Warning Centre. Forty (40) students from 7 local schools participated in a drawing/painting, essay writing and model exhibition competitions. Prizes were distributed for the winners. Constitution Day was observed on 26th November, 2019 at Delhi HQ and at all sub-offices across India.

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

Vessel	Days at Sea / Utilization	Maintenance/ Inspection /Scientific Logistics / Cruise Preparation	No. of Cruise
Sagar Nidhi	29	1	2
SagarManjusha	14	16	0
SagarPurvi	8	22( maintenance)	1
Sagar Tara	18	12	2
Sagar Kanya	23	7	2
SagarSampada	21	9	1

Subject	Publications			Ph.Ds		
	April- October, 2019	November, 2019	Total	April- October, 2019	November, 2019	Total
Atmospheric Sciences	106	15	121	-	--	-
Ocean Science and Technology	59	11	70	1	-	1
Polar Sciences	15	3	18	-	-	-
Geosciences and resources	14	--	14	2	-	2
Total	194	29	223	2	-	3

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

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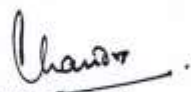
Dated, the 2<sup>nd</sup> December, 2019

CERTIFICATE

(FOR THE MONTH OF NOVEMBER, 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 November, 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 |

  
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