Ministry of Earth Sciences (MoES)
Summary of Important Developments –November, 2018

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.	Dt 14/08/2014 PROPOSAL FOR KRILL FISHING 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. 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.	The Ministry has examined the aspect of Krill fishing. Japan &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.	A proposal has been received for krill fishing which is under examination.

- **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
14	33

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. Severe Cyclonic Storm "Gaja" which crossed Tamilnadu & Puducherry coast between Nagapattinam and Vedaranniyam near with wind speed of 110-120 kmph gusting to 130 kmph during 0030 to 0230 hours IST of 16th November was monitored over Bay of Bengal from 10-19 November, 2018. India Meteorological Department (IMD) provided six hourly advisories during depression stage and three hourly advisories from cyclonic storm stage to the concerned disaster management agencies at central, state and district levels, press and electronic media and other stakeholders like fishermen, fishery officials, ports, ships, railways, surface transport, civil aviation, IAF, India Navy, coast guard etc. As a whole 65 bulletins were issued by IMD at national level. Ocean State Forecasts and warnings/alerts were also issued to the Tamil Nadu, Puducherry, Kerala and Lakshadweep coasts. The maximum wave height observed at Puducherry was 2.9 m against the forecasted wave height of 2.8 m.

2. Indian Institute of Tropical Meteorology (IITM) developed an Android mobile App "**Damini-**Lightning Alert" to disseminate the information on lightning to general public. It provides exact location of current lightning strikes, probable locations of impending lightning around area of 40 sq.km, movement and direction of thunderstorm. The App generates alerts in three colours: i) Green (when there is no lightning threat), ii) Orange (when there is a probability of lightning) and iii) Red (when lightning is imminent). Damini also lists precautionary steps to be undertaken during lightning and some general information about lightning. This app was released by Dr. Vijay Bhatkar, Eminent Scientist and Philosopher, Chancellor of Nalanda University, and National President, Vijnana Bharati (VIBHA) on the occasion of the Foundation day of IITM on 17 November 2018.

3. 2nd GODEX-NWP (Global Data Exchange for Numerical Weather Prediction) meeting was organized by National Centre for Medium Range Weather Forecasting(NCMRWF)under MoES in New Delhi during 27-30 November between operational Global Numerical Weather Prediction centres, (viz., ECMWF(European Centre for Medium-Range Weather Forecasts), UK met office, NOAA-NCEP(National Oceanic and Atmospheric Administration – National Centre for Environmental Protection)-USA, JMA(Japan Met. Agency), KMA(Korea Met. Administration), CMA(China Met. Administration), DW-Germany, MSC-Canada, CPTECH-Brazil and NCMRWF etc) and Meteorological Satellite agencies, (Viz., NESDIS-NOAA, EUMETSAT, JAXA-Japan, CMA-China, Canada, KMA-Korea and ISRO-India etc) on data exchange.

4. WMO International Workshop on Global Review of Regional Climate Centre Operations was jointly organized by World Meteorological Organisation(WMO) and Indian Institute of Tropical Meteorology(IITM) during 12-14 November, 2018. Around 27 foreign participants from countries of Australia, Brazil, Canada, Ecuador, France,

Kenya, Indonesia, Morocco, New Zealand, Niger, Norway, Russia, Singapore, UK, USA, Japan, Switzerland, China, Germany and 6 participants from India were a part of this workshop.

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 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	Data Reporting
Automatic Weather Station (AWS)	682	320
Automatic Rain Gauge (ARG)	1350	525
GPS Sonde based RS/RW Stations	43	39
Doppler Weather Radar (DWR)	25	23
Ozone (Ozone Sonde + Total Ozone)	05	05
Surface Ozone over Delhi (Electrochemical Concentration Cell)	07	07
Nephelometer	12	12
Sky Radiometer	20	16
Black Carbon Monitoring Systems (Aethalometer)	16	15
Air Quality Monitoring System (SAFAR-Delhi)	10	10
Hydromet. (IMD & Extra-departmental excluding AWS & ARG)	---	2455@
Aviation	78	78

@ Data received from various agencies viz. Air Force, Railways, Central Water Commission, State Agriculture, State Irrigation and India Meteorological Department (IMD).

Atmospheric Processes, Modelling and Services

End of Season Report for the 2018 Southwest Monsoon: The seasonal (June-September) rainfall over the country as a whole was 91% of its long period average (LPA). Seasonal rainfall over Northwest India, Central India, South Peninsula and Northeast (NE) India was 98%, 93%, 98% and 76% of respective LPA. Out of the total 36 meteorological subdivisions, 23 subdivisions constituting 68% of the total area of the country received normal season rainfall, 1 subdivision received excess rainfall (1% of the total area), and 12 subdivisions (31% of the total area) received deficient season rainfall. Monthly rainfall over the country as a whole was 95% of LPA in June, 94% of LPA in July, 92% of LPA in August, and 76% of LPA in September. Forecasts for the seasonal rainfalls over three broad geographical regions (NW India, Central India and South Peninsula) and that for July and August rainfall over the country as a whole were correct.

However, the forecasts for the rainfall over the country as a whole during the season and second half of the monsoon season and forecast for North- East India were overestimated.

Northeast Monsoon: Northeast Monsoon rains commenced over coastal Tamilnadu & Puducherry, south Tamilnadu, adjoining areas of south coastal Andhra Pradesh and south Kerala on 1st November. It covered the remaining parts of Tamil Nadu & adjoining north Kerala, south interior Karnataka and Rayalaseema on 2nd November, 2018.

Rainfall in November, 2018: Rainfall during the month of November, 2018 was large excess in 3, excess in 1, normal in 5, deficient in 6, and large deficient in 19 and no rain in 2 of 36 meteorological sub- divisions. The rainfall for the country as a whole for the month of November, 2018 has been recorded as 21.0 mm which is -29% of its Long Period Average (LPA) of 29.7 mm.

Heavy Rainfall Activity: Fairly widespread to widespread rainfall activity was observed over Tamilnadu & Puducherry and Kerala on a few days of the month and over south Coastal Andhra Pradesh, south Rayalaseema and South Interior Karnataka during one or two days during November. Heavy to very heavy rainfall was also observed at isolated places over sub-divisions of south peninsular India and over Andaman & Nicobar Islands on one or two days during November 2018.

No. of Heavy rainfall events and (% correct) of spatial distribution of warnings during November 2018 is given below:

Lead Time	No. of heavy Rainfall (Events): 36 (Heavy rainfall events: 12, very heavy rainfall: 24)
	Overall (>64.4mm)
24 Hour	97%
48 Hour	97%
72 Hour	97%

Western Disturbances (WDs) and associated weather:

During the period, eight (08) Western Disturbances (WD) affected western Himalayan region i.e. during 8-10, 10-15, 17-21, 20-22, 21-23, 23-27 and 26-29 November, 2018. Out of these eight WDs, only one WD caused fairly widespread to widespread rainfall activity over western Himalayan region and adjoining plains during 10-15 November with isolated heavy precipitation over western Himalayan region on 13th and 14th November. Rest seven WDs caused isolated to scattered rainfall activity over western Himalayan region and isolated rainfall over adjoining plains.

Thundersquall(TS) & Hailstorm activity during the month (till 0830 IST of 30-11-2018) is given in the table below**:**

S.No.	Region	TS Days	Maximum TS Activity	Hail	squall
1.	South Peninsular India	13	18-11-18	Nil	Nil
2.	Northwest India	07	03-11-18	01 (Mukteshwar on 04-11-18)	Nil
3.	Northeast India	06	03 to 06-11-18	Nil	Nil
4.	East India	01	07-11-18	Nil	02 (Port Blair - 10 & 17 Nov.)
5.	Central India	Nil	-	Nil	Nil
6.	West India	Nil		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.

Temperature Scenario: Minimum Temperatures were above normal over most parts of the country during many days of the month. The lowest minimum temperature of 5.0^{0}C was recorded at Mandla (East Madhya Pradesh) over the plains of the country on 26th & 27th November 2018.

Fog: Dense fog was observed at isolated places over Assam & Meghalaya on one or two days and shallow to moderate fog over Assam & Meghalaya and Nagaland, Manipur, Mizoram & Tripura on a few days and over coastal areas of Odisha and Gangetic West Bengal on one or two days during November, 2018.

Bulletins / Operational Reports/ Services

All India Weather Bulletins, all India inference and severe weather warnings 120 each; 9 number of Press Releases issued for enhanced rainfall activity, low pressure systems, withdrawal of southwest monsoon and outlook of rainfall related to northeast monsoon 2018; Current weather outlook and forecast for next two weeks (5); All India weekly weather reports (5) each were issued during the month.

Sixty (60) mountain weather bulletins including severe weather warnings for western and central Himalayan region were issued during the month.

A total of 30 Nowcast Guidance Bulletins were issued (daily once) during the month.

Daily All India Weather Summary and Weekly Weather Reports are being brought out on routine basis.

Climate Diagnostics Bulletin of India for October 2018 was brought out.

ENSO bulletin for November 2018 and Seasonal Climate Outlook for South Asia for the months of November 2018 to January 2019 were issued. (www.imdpune.gov.in/Clim_Pred_LRF_New/ Products.html).

Geoscience Research

Seismological Observational Network

Observation Type	Target	Commissioned so far	Data reporting during the month
Seismic stations	116	115	106
GPS stations	40	30	27

Earthquake and Tsunami monitoring

Earthquake: 15 earthquakes were monitored in the Indian region out of which 3 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 minutes of occurrence in respect of both events.

Ocean Observation System

Type of Platform	Target	Commissioned till November, 2018	Data received during November, 2018
Argo Floats *	200	323	139
Drifters*	150	108	2
Moored Buoys	16	22	19
Tide Gauges	36	35	25
High Frequency(HF) Radars	10	10	10
Current Meter Array	10	11	2
Acoustic Doppler Current Profiler(ADCP)	20	20	17
Tsunami Buoys	7	9	5
Wave Rider Buoy	16	19	9

*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	30

	Surface Temperature(SST), Chlorophyll., wind)	
2	Tuna Fishing Advisories	30
2	Ocean State Forecast(OSF)-Wave, Wind, Currents, SST, MLD and D20 forecasts	30
3.	Near Real time global ocean analysis (5-day averaged)	6
4.	Real time global ocean analysis (daily)	28
5.	Coral Bleaching Alert System	10

Polar Expedition and Science

42 members of the Indian Antarctic Expedition attended briefing lectures, underwent fire-fighting training in 3 batches in November 2018 before departure for Antarctica.

In a joint international research publication of National Centre for Polar and Ocean Research(NCPOR), an autonomous institute of MoES, three warming periods were detected, corresponding to the time intervals of 0 to 440 CE (the later part of the Roman Warm Period), 1200 to 1420 CE (the final part of the Medieval Climate Anomaly) and 1730 CE to present (including the Recent Warming), based on the diatom distribution. The various micropalaeontological proxies used in this study and other publications describe the Roman Warm Period and, especially, the Recent Warming as the most pronounced warm events in the area during the last 2000 years.

A two day meeting jointly organized by Ministry of Earth Sciences, Government of India, National Centre for Polar and Ocean Research, Delegation of the European Union to India, Royal Norwegian Embassy in India and the Research Council of Norway was held at NCPOR, Goa on 'Exploring shared experiences and upcoming opportunities for Indo-European polar science collaboration H2020 call on Arctic'. This was inaugurated by Secretary, Ministry of Earth Sciences, in presence of Ambassador of Norway in India.

Ocean Technology

Deep ocean ambient noise measurement system was successfully incorporated in the OMNI buoy mooring and deployed at AD09 location in the Arabian sea.

Sensors to collect deep Ocean data up to 4000 m depth was successfully installed in AD07 mooring in Arabian Sea.

Preliminary design report on design and development of electrical systems, control, navigation and communication system, for the deep water manned submersible has been completed.

The Vector Sensor Array along with CTD and tilt sensor, has been deployed as an autonomous system in coastal waters off Chennai for source localization applications.

Capacity Building and Outreach

A two day meeting was held at NCPOR, Goa on 'Exploring shared experiences and upcoming opportunities for Indo-European polar science collaboration H2020 call on Arctic' jointly organized by Ministry of Earth Sciences, Government of India, National Centre for Polar and Ocean Research, Delegation of the European Union to India, Royal Norwegian Embassy in India and the Research Council of Norway, This was inaugurated by Secretary, Ministry of Earth Sciences, in presence of Ambassador of Norway in India

A National Oceanography Workshop (NOW)-2018 was organized by Indian National Centre for Ocean Information Services(INCOIS) during 14-16 November, 2018 at Hyderabad. The three day workshop had 56 invited and 43 contributed presentations. About 130 researchers from various national institutes and universities participated in the workshop.

The 3rd World Tsunami Awareness Day on 5th November 2018 was observed by organizing the activities like (i) Open day for school children and public (around 760 children visited INCOIS, Hyderabad from 9 schools/colleges), (ii) Screening Tsunami awareness movies at INCOIS Auditorium, (iii) Tsunami Science Models exhibition by school children at INCOIS campus and (iv) a special lecture on "Science of Tsunamis by Professor C.P. Rajendran, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore.

A field campaign on 12 November, 2018 was conducted, together with Vidyasagar University, in the coastal waters of West Bengal and collected data on water nutrients, phytoplankton, zooplankton to understand the ecological preferences of Hilsa species.

INCOIS imparted training on the Search And Rescue Aid Tool (SAR) and impact-based ocean state forecast, advisory and information services during search and rescue seminar on “Efficacy of Maritime search and rescue in India: A relook" and also participated in a meeting conducted by the Coast Guard Region (North East) Headquarters at Kolkata on 13 November, 2018. Twenty (20) officers of the Coast Guard attended the training.

An user interaction workshop was conducted for the fishermen at Namkhana together with Vidyasagar University on November 14, 2018.

Dr.M.A.Atmanand, Director,NIOT was selected as a member of the Executive Planning Group (EPG) to support the development of the UN Decade of Ocean Science for Sustainable Development by Intergovernmental Oceanographic Commission (IOC) of UNESCO.

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	1
Sagar Manjusha	19	11	2
Sagar Purvi	6	24(maintenance, bad weather)	1
Sagar Kanya	23	7	2
Sagar Sampada	6	24(dry dock)	2

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

Subject	Publications			Ph.Ds		
	April - October, 2018	November, 2018	Total	April - October, 2018	November, 2018	Total
Atmospheric Sciences	105	13	118	3	1	4
Ocean Science and Technology	35	2	37	1	-	1
Polar Sciences	14	4	18	-	-	--
Geosciences and resources	3	3	6	-	-	-
Total	157	22	179	4	1	5