

**Ministry of Earth Sciences (MoES)
Summary of Important Developments –September,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 & 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
37	16

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

Annex-I

Important policy decision taken and major achievements:

Quantitatively 2019 monsoon seasonal rainfall was 110% of its Long Period Average(LPA) of 88 cm. Monsoon rainfall during June, July, August and September were 67%, 105%, 115% and 152% of its Long Period Average respectively. After 1931, this is the first time, the seasonal rainfall is more than LPA even after the June rainfall deficiency was more than 30% of LPA. The highest deficiency is observed for Haryana, Chandigarh and Delhi where the deficiency was 42%. The highest cumulative rainfall during August-September (130% of LPA) has been recorded in 2019 after 1983 (142% of LPA).

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	01 (Delhi)	115
Automatic Rain Gauge (ARG)	1356	--	351
GPS Sonde based RS/RW Stations	56	06	56
Doppler Weather Radar (DWR)	* 25	--	25
Ozone (Ozone Sonde + Total Ozone)	04	--	04
Surface Ozone (Electrochemical Concentration Cell 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)	---	--	3034
Aviation	79	--	79

Out of 563AWS 263 AWS are outlived (more than 12 Years) and beyond economical repairs and hence these are under process of replacement.

* Includes 2 Doppler Weather Radar of ISRO.

Atmospheric Processes, Modelling and Services

Major Weather Systems during the Month:

Very Severe Cyclonic Storm 'Hikaa' over the Arabian Sea (22-25 September): Very Severe Cyclonic Storm (VSCS) "HIKAA" was originated from a low pressure area (LPA) and formed over eastcentral Arabian Sea (AS) off north Maharashtra coast in the morning (0830 IST) of 20th September. It concentrated into a Depression (D) over eastcentral and adjoining northeast AS off Gujarat coast in the morning (0830 IST) of 22nd September. Moving nearly west-northwestwards, it intensified into a Deep Depression (DD) over northeast and adjoining eastcentral AS off Gujarat coast in the same evening (1730 IST). It moved nearly westwards and intensified into Cyclonic Storm "HIKAA" in the early morning (0530 hours IST) of 23rd over northeast and adjoining eastcentral AS. It then moved west-southwestwards and intensified, into a Severe Cyclonic Storm (SCS) in the same afternoon (1430 hours IST) over northeast and adjoining northwest & central AS. Moving nearly westwards, it further intensified into a VSCS in the early morning (0530 hours IST) over northwest and adjoining westcentral AS. It then moved west-southwestwards and crossed Oman coast near latitude 19.7°N and longitude 57.7°E, close to north of Duqm in the same evening (between 1930 and 2030 hours IST of 24th) as a VSCS with maximum sustained surface wind speed of 120-130 kmph gusting to 145 kmph. Moving nearly westwards, it further weakened into a SCS over coastal Oman in the same night (2030 hours IST of 24th). Continuing to move westwards, it weakened into a Cyclonic Storm over Oman in the early hours (0230 hours IST), into a DD over Oman in the morning (0830 hours IST), a D around noon (1130 hours IST) over Oman and into a WML over south Oman and adjoining Saudi Arabia in the afternoon (1430 hours IST) of 25th September.

First information about possible cyclogenesis over eastcentral AS during first half of week (20-26 Sep) with moderate probability (34-67%) was indicated in the extended range outlook issued by IMD on 12th September. The cyclone was monitored & predicted continuously from 12th September onwards by IMD. Warnings for fishermen in deep Seas and State of Sea of central and northern parts of Arabian Sea and along & off Gujarat, Maharashtra coasts were issued both in textual and graphical form. Storm surge guidance was also issued for Oman coast.

Land Depression over Kutch and adjoining areas (29 September-01 October): A low pressure area was formed over northeast Arabian Sea & adjoining coastal areas of Saurashtra & Kutch on 28th September, 2019. It concentrated into a Depression over Kutch and neighbourhood and lay centered at 1730 hours IST of 29th September, 2019 near latitude 23.1°N and longitude 70.2°E, close to Kandla (Gujarat). It moved east-northeastwards and weakened into a well marked low pressure area over southeast Rajasthan & neighbourhood at 0830 hours IST of 01st October, 2019. The Probability of formation of the system over this area had been predicted 48 hours in advance. Apart from the India weather Bulletins and severe weather warning Bulletins issued routinely.

Other major weather/Synoptic systems and associated weather:

A low-pressure area was formed over Northwest Bay of Bengal & neighbourhood on 2nd September 2019. It moved inland and lay over coastal Odisha & neighbourhood on 5th till 7th. It lay over north Chhattisgarh & neighbourhood on 8th and shifted over to northeast Madhya Pradesh & neighbourhood on 9th till 13th; it shifted over to northwest Madhya Pradesh & neighbourhood on 14th till 15th; it lay over northern parts of Madhya Pradesh on 16th before getting less marked on 17th.

This system along with its associated cyclonic circulation extending upto mid tropospheric levels with southwestward tilt have caused prolonged spells of intense to very intense rainfall activity over Central India, parts of East India and over northern parts of Peninsular India.

In addition to above, an east - west shear zone across Central India with embedded cyclonic circulations, formation of a cyclonic circulation over West Central & adjoining Southwest bay of Bengal and its movement west-northwestwards across the northern parts of peninsular India before emerging into Arabian Sea, formation of a Low Pressure Area over Arabian Sea under its influence and its intensification further, movement of easterly waves across the south peninsular India have also contributed towards the very intense rainfall activity of the month.

Seasonal rainfall statistics for the southwest monsoon, from 1st June to 30th September 2019

Region	Actual (mm)	Normal (mm)	% Departure of area weighted rainfall from Long Period Average
EAST & NORTHEAST INDIA	1240.7	1410.4	-12%
NORTHWEST INDIA	586.0	599.5	-2%
CENTRAL INDIA	1262.8	976.6	+29%
SOUTH PENINSULAR INDIA	840.9	726.2	+16%
COUNTRY AS A WHOLE	968.3	880.6	+10%

Rainfall Scenario: The rainfall for the country as a whole for the month of September 2019 has been recorded as 259.3 mm which is 52% above to its Long Period Average (LPA) i.e. 170.2 mm.

No. of Heavy rainfall events and (% correct) of spatial distribution of warnings during September 2019 is given below:

Lead Time of warning issued	No. of Heavy Rainfall Events (>64.4 mm): 495
	correctness in % (Rainfall >64.4mm)
24 Hour	72%
48 Hour	66%
72 Hour	67%

Thundersquall(TS) & 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	29	23-09-19	Nil	Nil
2	Northwest India	28	22-09-19	Nil	Nil
3	Northeast India	26	22-09-19	Nil	Nil
4	East India	30	23-09-19	Nil	03 (Port Blair on 04-09-19) 01(Port Blair on 05-09-19) 01(Port Blair on 07-09-19)

					01(Port Blair on 12-09-19)
5	Central India	28	03-09-19 20-09-19 24-09-19	Nil	
6	West India	01	24-09-19	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 Scenario: The Mean Temp for the month for the country as a whole was 27.66°C; this was slightly above normal (+0.35°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 (a)monsoon and intense rainfall activity over northeast India (3),(b) current weather status and outlook for next two weeks(4),(c)Cyclones and depression(5), 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 issued for different expeditions(138),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 September 2019 and Seasonal Climate Outlook for South Asia for the month of September to December 2019 (Quick Link: www.imdpune.gov.in/Clim_Pred_LRF_New/Products.html), Gridded Standardized Precipitation Index (SPI) & Standardized Precipitation Evapotranspiration Index (SPEI) at 0.5 x 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. Disastrous Weather Events 2016 and Climate Diagnostics Bulletin of India for July and August 2019 and uploaded on IMD Pune website, a report on Forecast Demonstration Project (FDP) on landfalling cyclones over the Bay of Bengal during 2018 (available in RSMC website at the link:<http://rsmcnewdelhi.imd.gov.in/images/pdf/publications/fdp-report/fdp-mplementation-report/fdp-2018.pdf>).

Modelling

A new observation decoder for BUFR packed high resolution radiosonde observations available through GTS has been developed. This has enabled use of many radiosonde stations over Europe and additional information of sonde drift, in the NCMRWF data assimilation system of National Centre for Medium Range Weather Forecasting(NCMRWF).

NCMRWF prepared and provided real-time daily weather forecasts for Indian Army's 'Vasuki Parbat Expedition' (6792 m) in the Gangotri, Chaturangi Glacier area of the Garhwal Himalayas during 5 August to 12 September 2019. This was one of the longest period Himalayan Expedition NCMRWF has supported Indian Army.

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: 27 earthquakes were monitored in the Indian region out of which 2 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 for one event and between 12 to 15 minutes of occurrence for the other event.

Ocean Observation System

Type of Platform	Target	Commissioned till September, 2019	Data received during September, 2019
Argo Floats *	200	367	149
Drifters*	150	108	5
Moored Buoys	16	22	13
Tide Gauges	36	36	28
High Frequency(HF) Radars	10	12	11
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)	10
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

Dr. Purnima Jaliha, Scientist G and Head Energy and Freshwater, was awarded the Uehara Prize for the long term contribution to Ocean thermal Energy Conversion(OTEC), during the OTEC symposium held at Korea.

Marine Living Resources (MLR)

Taxonomic studies of anomuran crabs collected from the Terrace of Trivandrum region off the southwest coast of India, 7.79°N, 76.46°E revealed 1 female specimen of a previously unidentified species of the lithodid genus *Neolithodes* A. Milne-Edwards & Bouvier, 1894 at a depth 1338 m. . This species is provisionally named as *Neolithodes indica*.

Topographic Survey of Exclusive Economic Zone

Area covered during the month: About 16023 sq. km

Capacity Building and Outreach

Four students from India won 3 Gold medals, 4 Silver Medals and 3 Bronze Medals in the 13th International Earth Science Olympiad (IESO)2019 held at Daegu, Republic of Korea during 26 August-03 September 2019. A total number of 181 students from 41 countries participated in IESO.

“Swachhta Hi Seva” campaign was organised in Ministry of Earth Sciences and its organisations and attached/subordinate offices from mid-September to 02 October 2019 with cleaning of the campus and surrounding area with tree plantations.

A campaign was flagged off by Centre for Marine Living Resources and Ecology(CMLRE), Kochi for 10 days cruise onboard the ship FORV Sagar Samapada from Porbander in Gujarat, touching main ports like Karwar and Mangalore to

create awareness on plastic pollution. At each ports, several School students including officials from Govt Departments visited the ship. During the final destination at Kochi, the ship was visited by more than 400 students. The visitors interacted with the scientists and got acquainted with the scientific activities on-board as well and were given mementos and takehome messages to curb plastic pollution. In addition, cleaning has been done with the involvement of all the scientists and other staffs at New campus of CMLRE at Kochi.

'World Ozone Day' was celebrated with 'Swatchhata Hi Seva' Campaign during 16-24 September 2019. On the occasion, Indian Institute of Tropical Meteorology(IITM) has conducted drawing competition in selected schools of Pune for spreading awareness of ozone layer. The Theme for the Competition was 1) 'Ozone as Pollutant & Our Health' 2) 'Protection of Ozone layer' & 3) 'Plastic Waste Free India'. Approximately 250 students had participated in this event.

Launch of SAFAR School Flag Awareness Program in Pune: For spreading awareness to young minds, under the System of Air Quality and Weather Forecasting And Research (SAFAR) and ENVIS of IITM School flagship Awareness program in collaboration with Pimpri Chinchwad Municipal Cooperation (PCMC) was initiated. Under this program, colour flags corresponding to Air quality index levels assigned colour for each day will be hosted in school during morning assembly, and will be kept for the whole day, along with the Health advisory for the day on their notice boards so that the children are reminded of the present Air quality.

Orientation Programme of Emission Inventory, Pune: The emission inventory campaign was led by Indian Institute of Tropical Meteorology(IITM)-Environmental Information System (ENVIS) in association with researchers / experts from Environmental Science Department of Savitribai Phule Pune University, Utkal University, and from various colleges on 24 September 2019. Around 150 college students under the supervision of group of scientists are involved to map all possible local sources of air pollution to develop the inventory of pollutants.

International Training centre on Operational Oceanography(ITCOOcean) at Indian National Centre for Ocean Information Services(INCOIS) conducted a course on "Tides and its applications in Oceanography" during 23 - 27 September, 2019. Eleven (11) participants from various national institutes attended the course. ITCOOcean conducted a one day training course on "Operational Services Training" on 5 September 2019. Five officers from the Indian Navy Eastern Naval Command, Visakhapatnam attended the course. The course provided exposure on products and services developed by INCOIS mainly ocean state forecasts (winds, waves, currents, tides) covering the geographical region of their interest, Marine Met Atlas (MaMeAt), Sound Velocity Atlas (SoVeAt) and the Search And Rescue Aid Tool (SARAT) for supporting search and rescue operations at sea.

During 14-28 Sept, 2019 "Hindi Pakhawada" was observed in Ministry of Earth Sciences and its organisations and attached/subordinate offices. The officials /staff participated enthusiastically in various competitions viz. slogan writing, debates, quiz, note drafting, Hindi vocabulary, essay writing, general knowledge test, poem recitation etc.

Stakeholder consultative meeting on "Fisheries including Polar Krill, infrastructure and knowledge sharing" as part of the Blue economy was held at Centre for Marine Living Resources and Ecology(CMLRE), Kochi on 5th Sept 2019. Around 35 experts from various public, academia, industries attended the meeting to draw three year systemic action plan.

MoES-NOAA (National Oceanic and Atmospheric Agency, USA collaborative workshop (Series 8) has been conducted during 16-20th September at Atal Bhavan campus, CMLRE with participation of scientists from NOAA, CMLRE and INCOIS. The workshop has primarily discussed on the development and predictive capabilities for Sardine fishery over the Kerala coast.

A Satellite Seminar on SDG 14 which is also a Curtain-raiser for Swasraya Bharat-19 (The Kerala Science Fest-2019) focusing on Climate change and Extreme Weather Events" was conducted by CMLRE on 21st Sept 2019. The seminar included invited lectures and Group Discussions involving graduate and post-graduate students.

Utilization of Ocean Research Vessels during the month

Vessel	Days at Sea / Utilization	Maintenance/ Inspection /Scientific Logistics / Cruise Preparation	No. of Cruise
Sagar Nidhi	24	1	2
Sagar Manjusha	0	30(Dry dock)	0
Sagar Purvi	8	24(maintenance)	1
Sagar Tara	18	12	4
Sagar Kanya	28	2	1
Sagar Sampada	25	5	1

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

Subject	Publications			Ph.Ds		
	April- August, 2019	September, 2019	Total	April- August, 2019	September, 2019	Total
Atmospheric Sciences	77	12	89	-	--	-
Ocean Science and Technology	42	1	43	-	1	1
Polar Sciences	11	-	11	-	-	-
Geosciences and resources	6	-	6	2	-	2
Total	136	13	149	2	-	3

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

Prithvi Bhavan, Lodhi Road
New Delhi-110 003

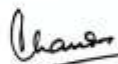
Dated, the 01st October, 2019

CERTIFICATE

(FOR THE MONTH OF SEPTEMBER, 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 September, 2019. A summary of the status is given below:-

- | | | |
|-----|---|------|
| (a) | The total number of posts required to be entered on AVMS | - 09 |
| (b) | Number of posts filled as on date | - 08 |
| (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)
Joint Secretary
js@moes.gov.in