



The 20th Session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (FOCRAII), 9-11 May 2024, Qingdao, China

Climate Services Progress in India

O. P. Sreejith

Scientist & Head, Climate Monitoring & Prediction Group

Climate Research & Services, IMD, Pune

Op.sreejith@imd.gov.in, sreejith.op@gmail.com

Contact Number: +91(20)25572224, +919422337077

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT



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INDIA METEOROLOGICAL DEPARTMENT

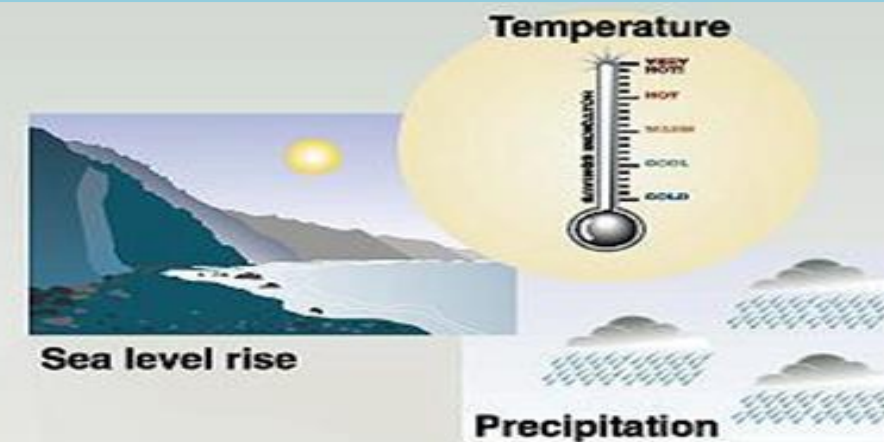
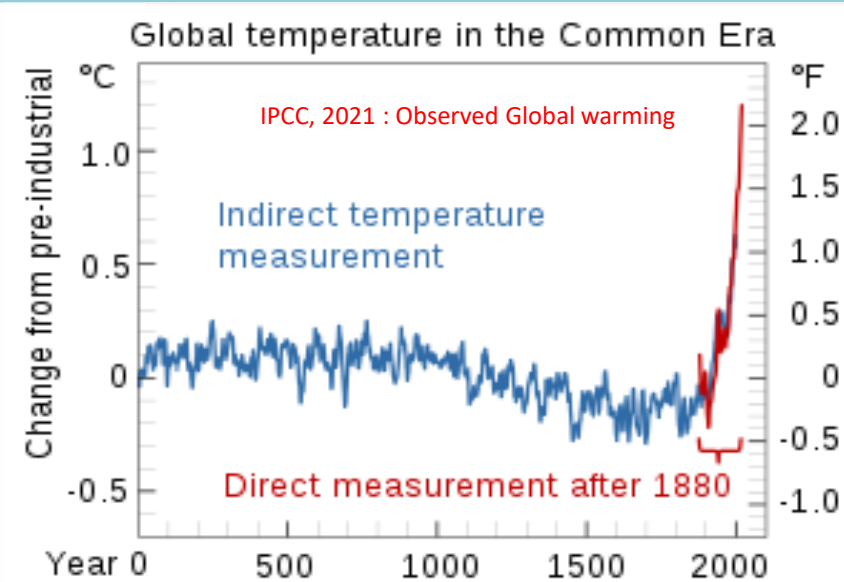


Outline

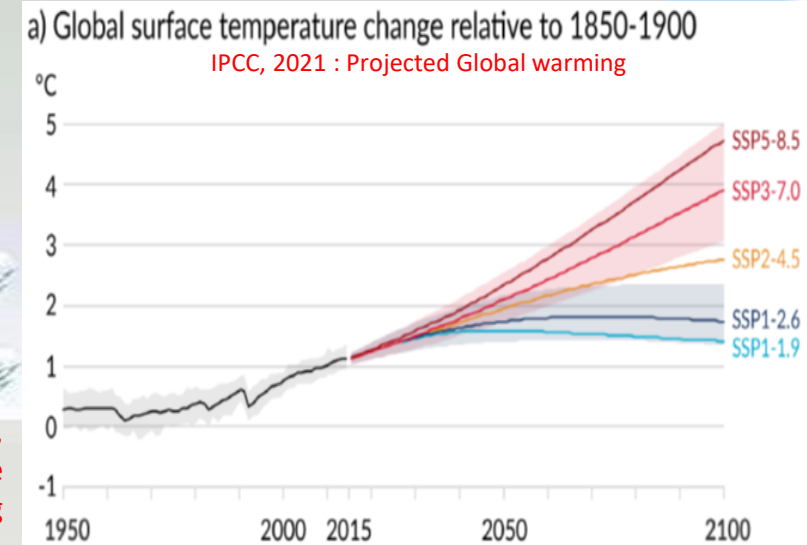
- **What and why are Climate Services?**
- **How does Climate Services works?**
- **Climate Services in India**
- **Sectors and Areas of Climate Services Applications for the Development of Decision Tools**
- **NFCS India**



Introduction: Impact of the Changing Climate



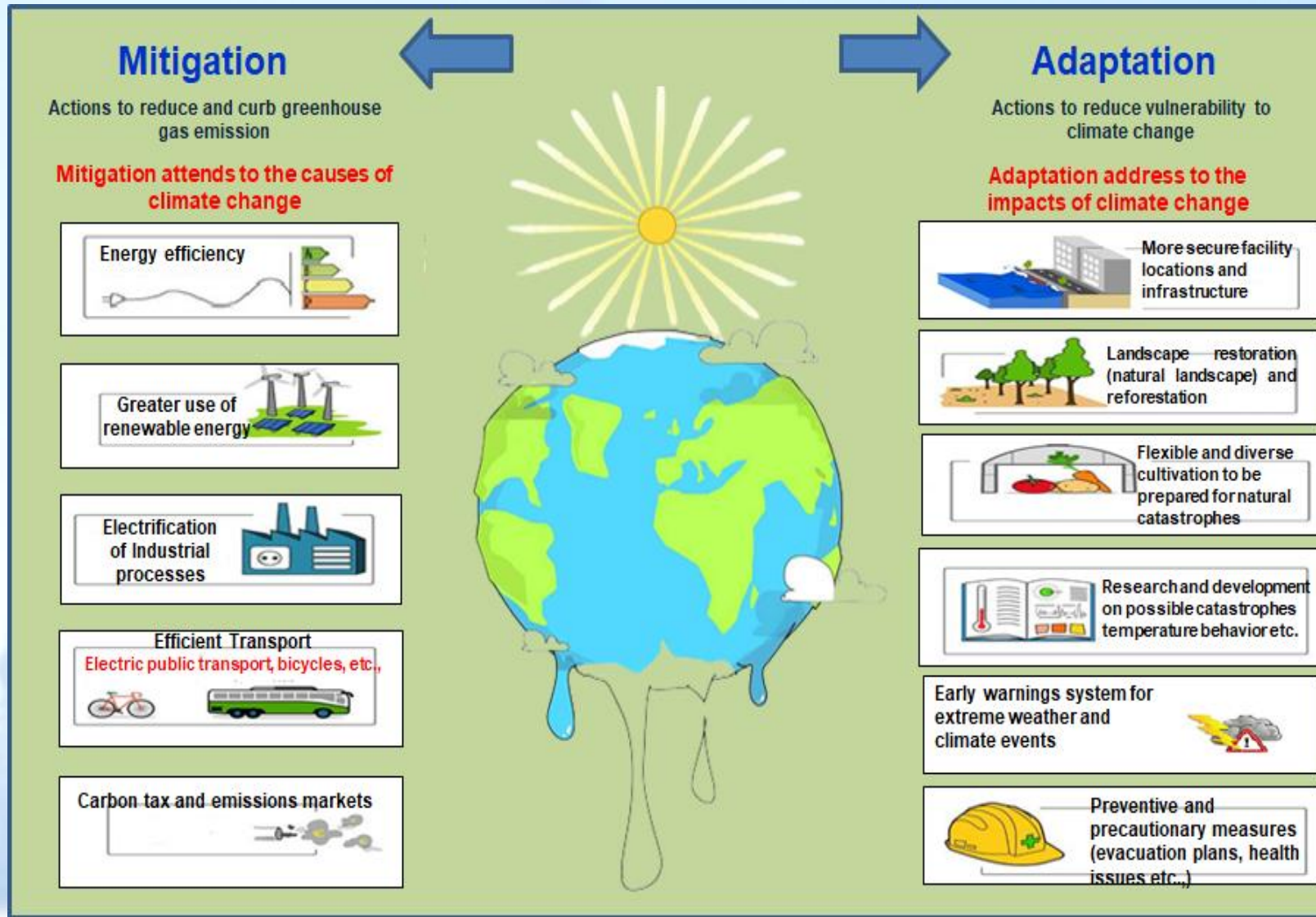
The indication of climate change include warming temperatures, changes in precipitation, The ocean is acidifying, increases in the frequency or intensity of some extreme weather events, and rising sea levels.



Impacts on...



Mitigation and Adaptation of Climate Change



We all have to start preparing ourselves (adapt) for the effects of climate change. But a question that may come to the mind of a decision-maker is **'Adapt to what exactly and how?'**.

This is where Climate Services comes in.

What is Climate Services?

“Climate services (CS) is the provision of scientifically based climate information and products that assists individuals and organizations in the society to make climate smart decisions”

Climate services allow society to build resilience to future change and take advantage of opportunities provided by favorable conditions.

Climate service prepares the users for the weather they will actually experience.

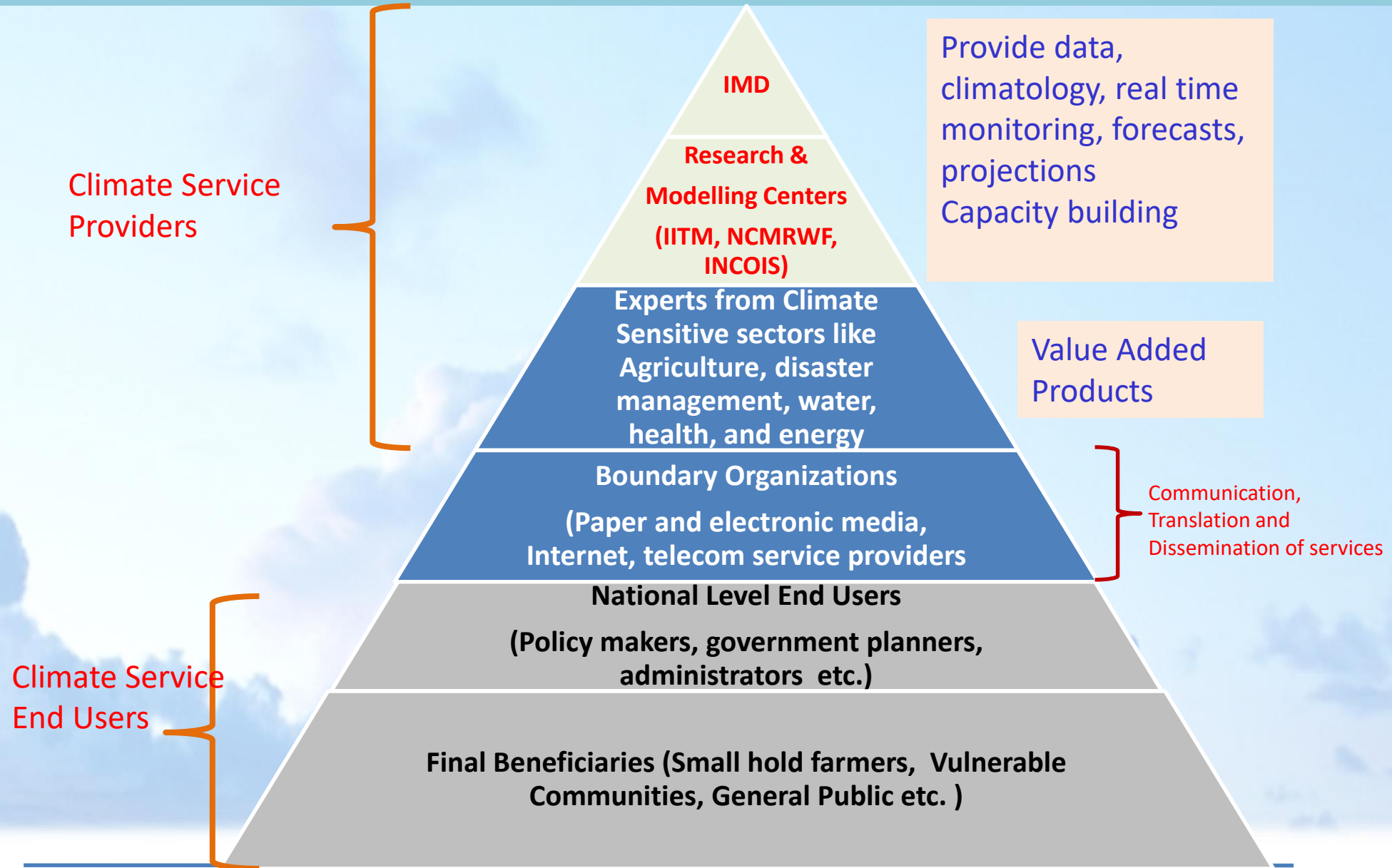
Major Priority Areas:

Agriculture and food security, disaster risk reduction, water, energy, and health.

Climate services are made most effective through collaboration between providers and users.



Stakeholders of the the Climate Services in India



Climate Services Provided by IMD

IMD is the nodal Government agency responsible for providing operational weather and climate services required for the country. IMD provides the following Climate Services through **the Office of Climate Research and Services (CR&S), Pune.**

❖ Climate Monitoring and Analysis

- Monitoring of rainfall and temperature, Climate Diagnostic Bulletins - monthly, seasonal, & annual, Annual Climate statement of the country, Monsoon Reports, ENSO & IOD

❖ Climate Prediction

- Seasonal and Extended Range forecasts, MJO, MISO, ENSO, IOD etc,
- ENSO & IOD Monthly bulletin

❖ Climate Data Management

- Climate Data Centre: Online data reception, quality check, archival, data rescue, Gridded data, Climatology data products

❖ Climate Applications

- Agriculture Sector: drought monitoring based on Aridity anomaly and SPI maps, Agromet Advisory Services
- Water Sector: Rainfall products at different spatial scales like district, subdivision, state, country, river basins, and temporal scale like daily/ weekly/ monthly etc.
- Health sector: Heat action plan, heat index maps and identifying meteorological windows for diseases

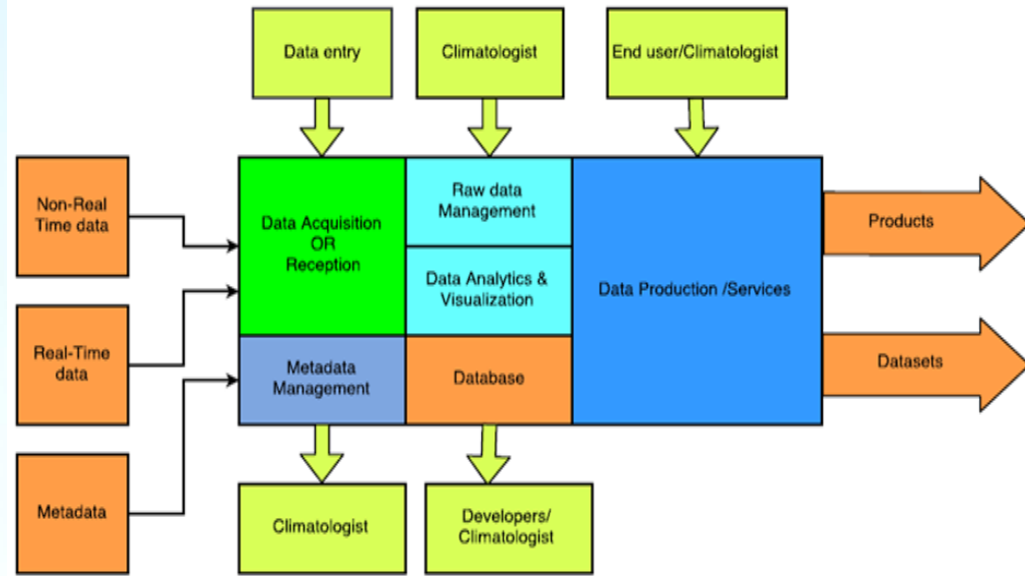
❖ Climate Research & Training

- Research in climate variability, climate change, climate prediction etc.
- WMO RMTC – Training and capacity building in general meteorology, climate science, climate services for participants from IMD and other national and international agencies.



Operational Climate Data Management and Services

Data Reception, Quality Check, Data Archival and Preparation of Data products

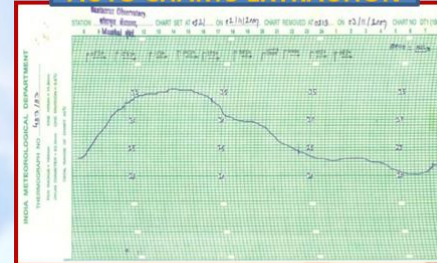


Data Rescue

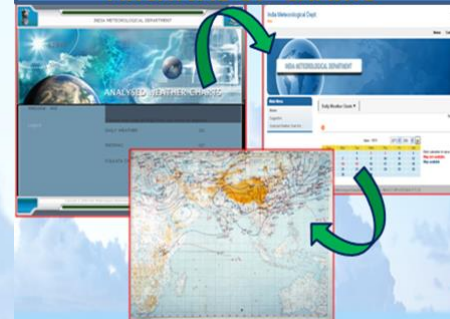
DIGITISE PAST DATA



AUTO CHARTS EXTRACTION

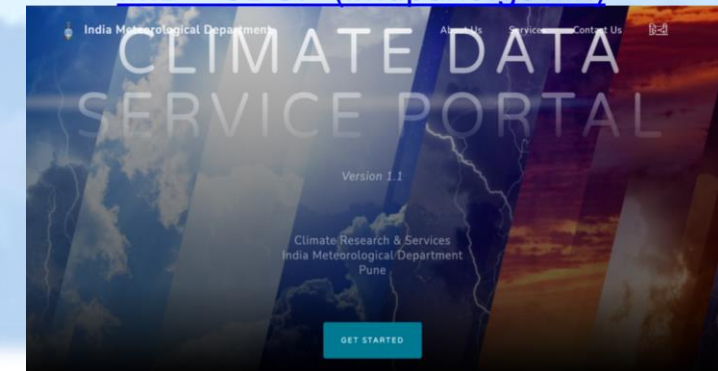


ARCHIVAL OF CHARTS



The screenshot shows the homepage of the Meteorological Data Supply and Procurement portal. It features a red header with the IMD logo and the text "METEOROLOGICAL DATA SUPPLY AND PROCUREMENT". Below this is a blue section for the "DATA SUPPLY PORTAL" with the URL "DSP.IMDPUNE.GOV.IN". The page includes sections for "QUICK SUPPORT", "DOWNLOAD DATA AT YOUR OWN PC", and "SMART HELP DESK SUPPORT". At the bottom, it provides contact information for the Office of Climate Research and Services, Climate Data Management Group (CDMG), India Meteorological Department, Pune.

IMD - CDSP (imd pune.gov.in)

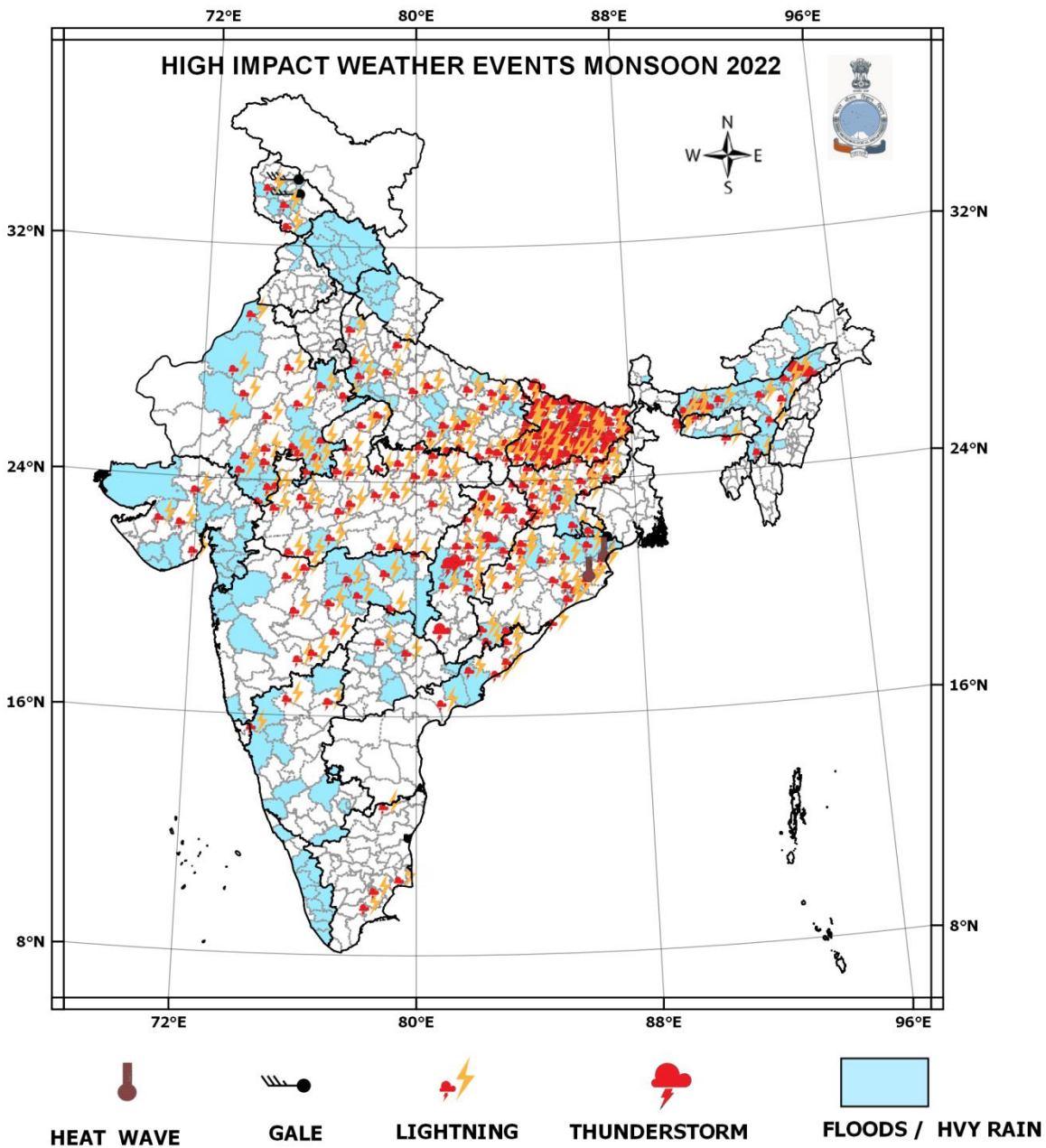


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Significant Weather Events in June-Sep. 2022



	Loss of Life due to Extreme weather events				
State / UT	Floods & Heavy Rains	Gale	Heat Wave	Thunderstorm & Lightning	Grand Total
Andhra Pradesh	7			11	18
Ar. Pradesh	5			0	5
Assam	161			23	184
Bihar				236	236
Chhattisgarh	7			49	56
Gujarat	24			7	31
HP	64			0	64
J&K, LDK	31	3		3	37
Jharkhand	5			45	50
Karnataka	23			9	32
Kerala	26			0	26
MP	1			88	89
Maharashtra	75			43	118
Manipur	56			0	56
Meghalaya	9			1	10
Odisha	12	1	3	49	65
Punjab	3			0	3
Rajasthan	47			61	108
Sikkim	3			0	3
Tamil Nadu				4	4
Telangana	11			4	15
Uttar Pradesh	36			62	98
Uttarakhand	13			1	14
Grand Total	619	4	3	696	1322

Climate Hazard/Vulnerability Atlas

भारत का जलवायु विपत्ति और भेद्यता एटलस
जलवायु अनुसंधान एवं सेवाएं
भारत मौसम विज्ञान विभाग, पुणे
पृथ्वी विज्ञान मंत्रालय



Climate Hazards and Vulnerability Atlas of India

Office of Climate Research and Services

India Meteorological Department, Pune

Ministry of Earth Sciences

----English----

Home

Climate Hazard

Climate Vulnerability

Atlas Summary

About

Wind Hazard

Extreme rainfall

Lightning

Dust Storm

HailStorm

Fog

Drought

Cyclone

Thunderstorm

January

February

March

April

May

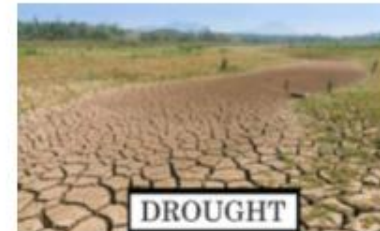
June



COLD WAVE



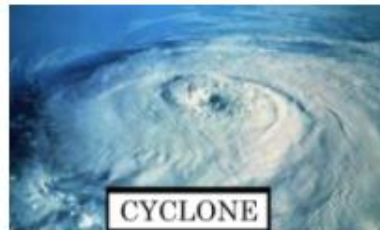
HEAT WAVE



DROUGHT



FLOOD



CYCLONE



FOG



WIND HAZARD



DUST STORM



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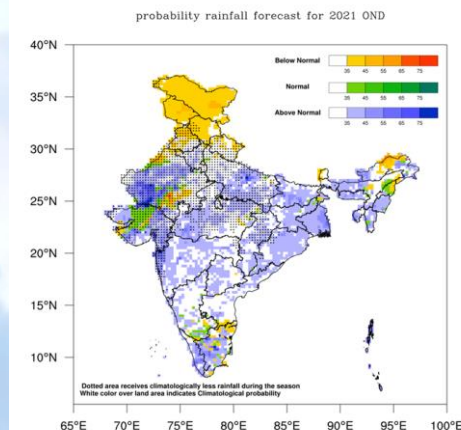
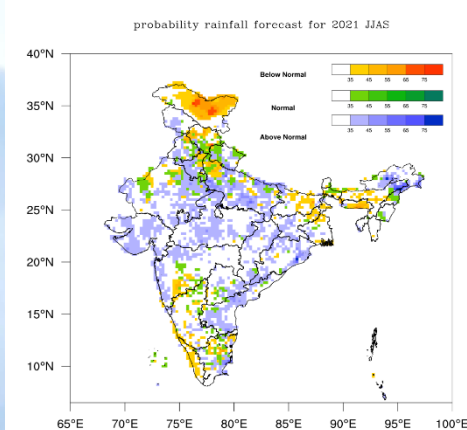
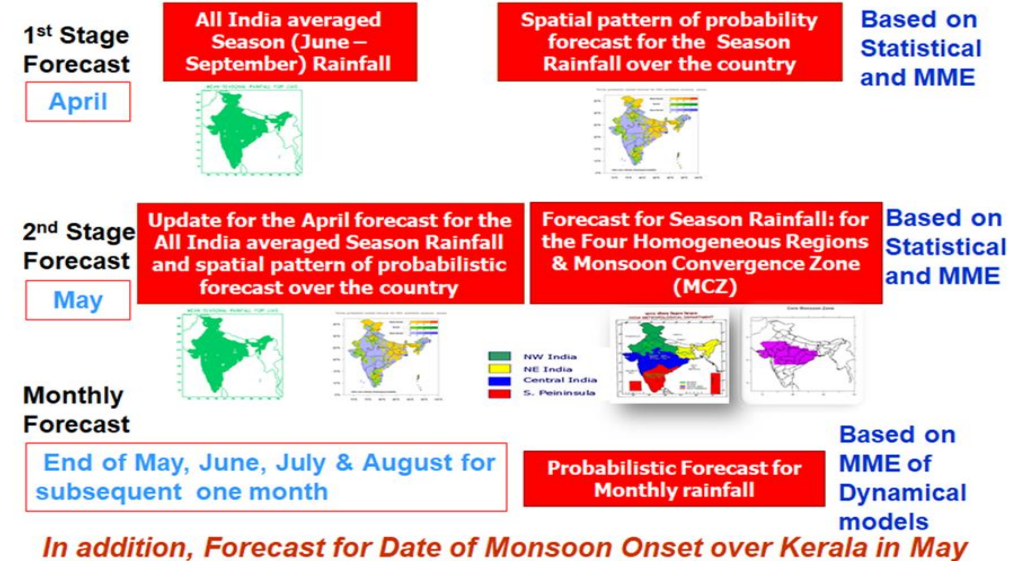


Climate Prediction Services: Presently issued Monthly and Seasonal Forecasts for the Country

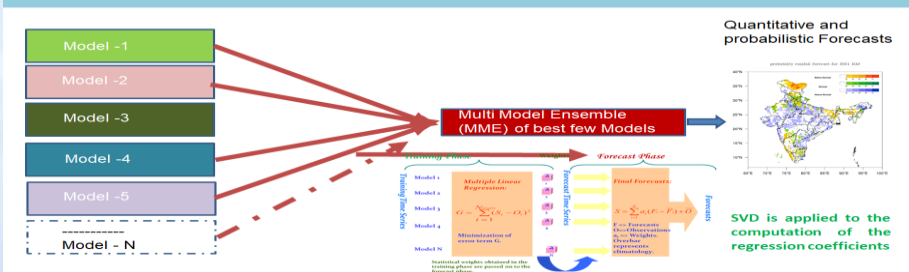
Sr. No.	Forecast Outlook for	Issued in	Method/ Model
1	Rainfall during the Winter Season (Jan-March)	December	Statistical, Dynamical
2	Temperatures during Hot Weather Seasons (March to May) & (April-June)	February & March	Dynamical
3	Rainfall during the SW Monsoon Season (June to September)	April	Statistical, Dynamical
4	Rainfall During the NE Monsoon Season (October to December) Rainfall	September	Statistical, Dynamical
5	Temperatures during the Cold Weather Season (Dec- Feb) Temperature	November	Dynamical

New Seasonal Forecasting System Based on the Multi Model Ensemble (MME): 2021

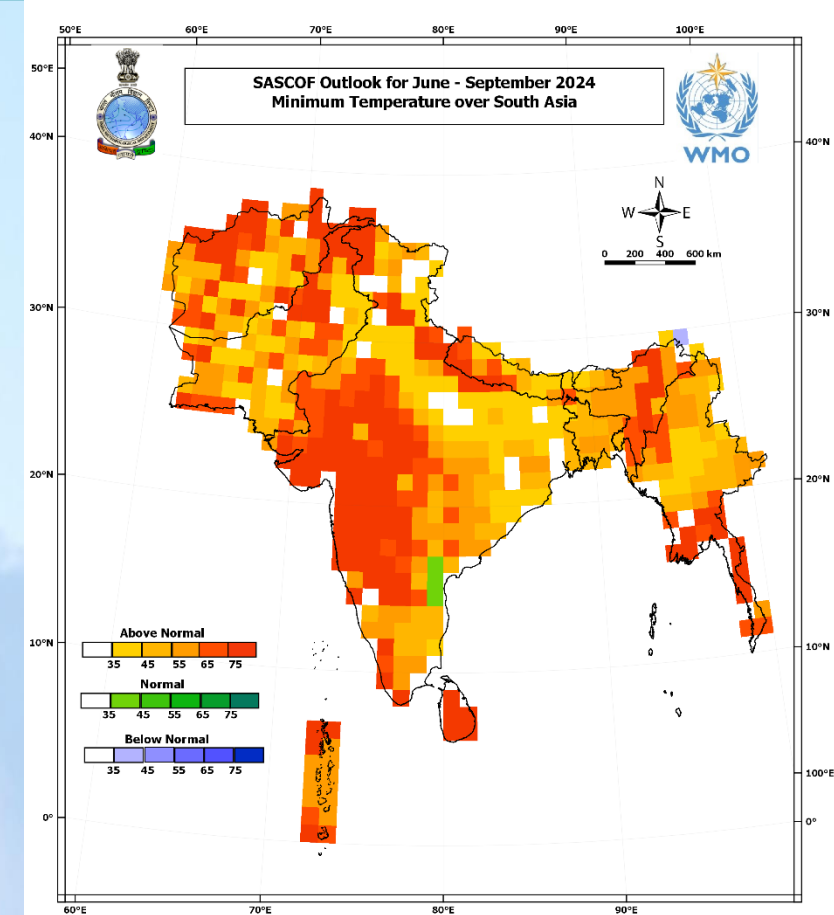
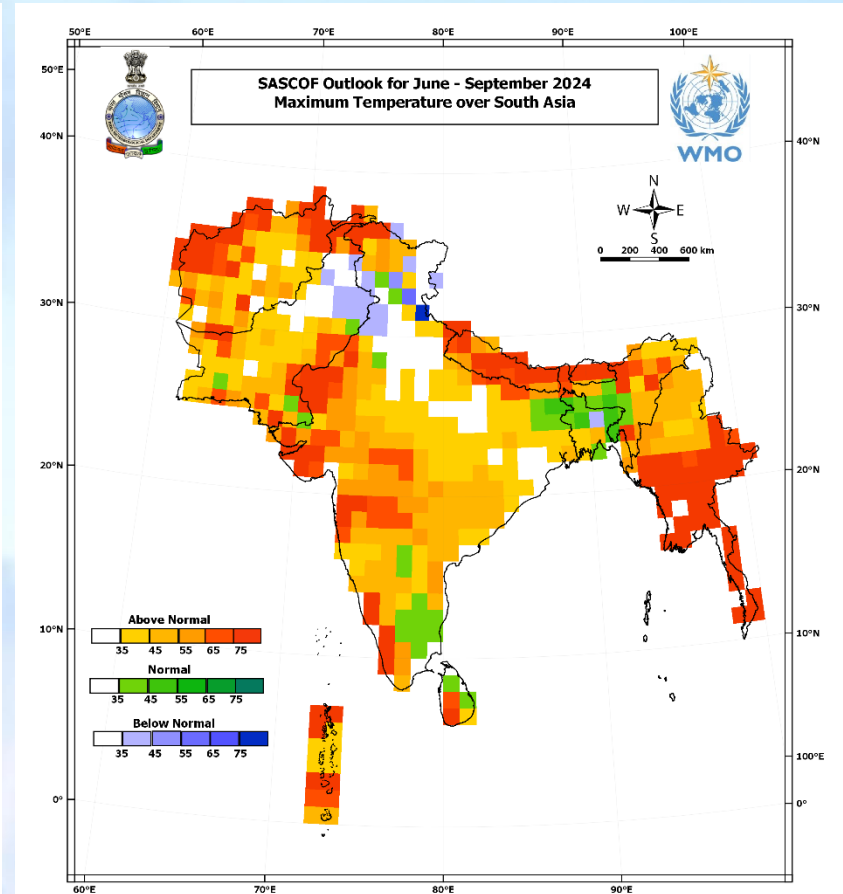
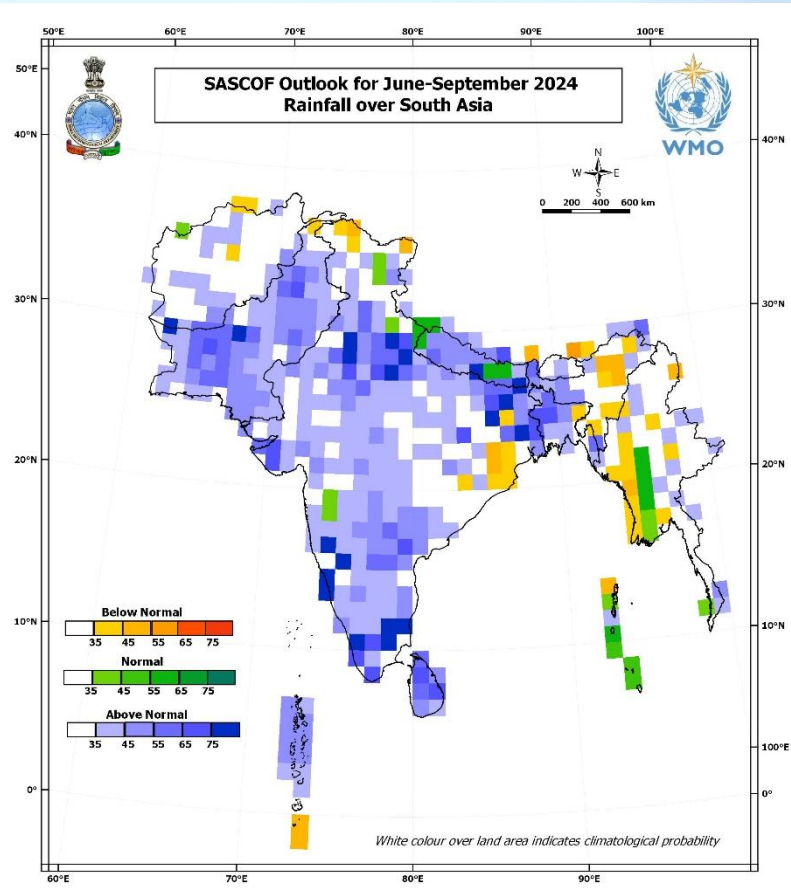
New Strategy for Long Range Forecast



Multi-Model Ensemble (MME)



SASCOF-28 Outlook Rainfall Outlook for 2024 June to September season for South Asia



Above normal Rainfall likely during most parts of the South Asia during 2024 Southwest Monsoon Season

Above normal Temperature (Maximum & Minimum) during most region during 2024 Southwest Monsoon Season



8-May-24

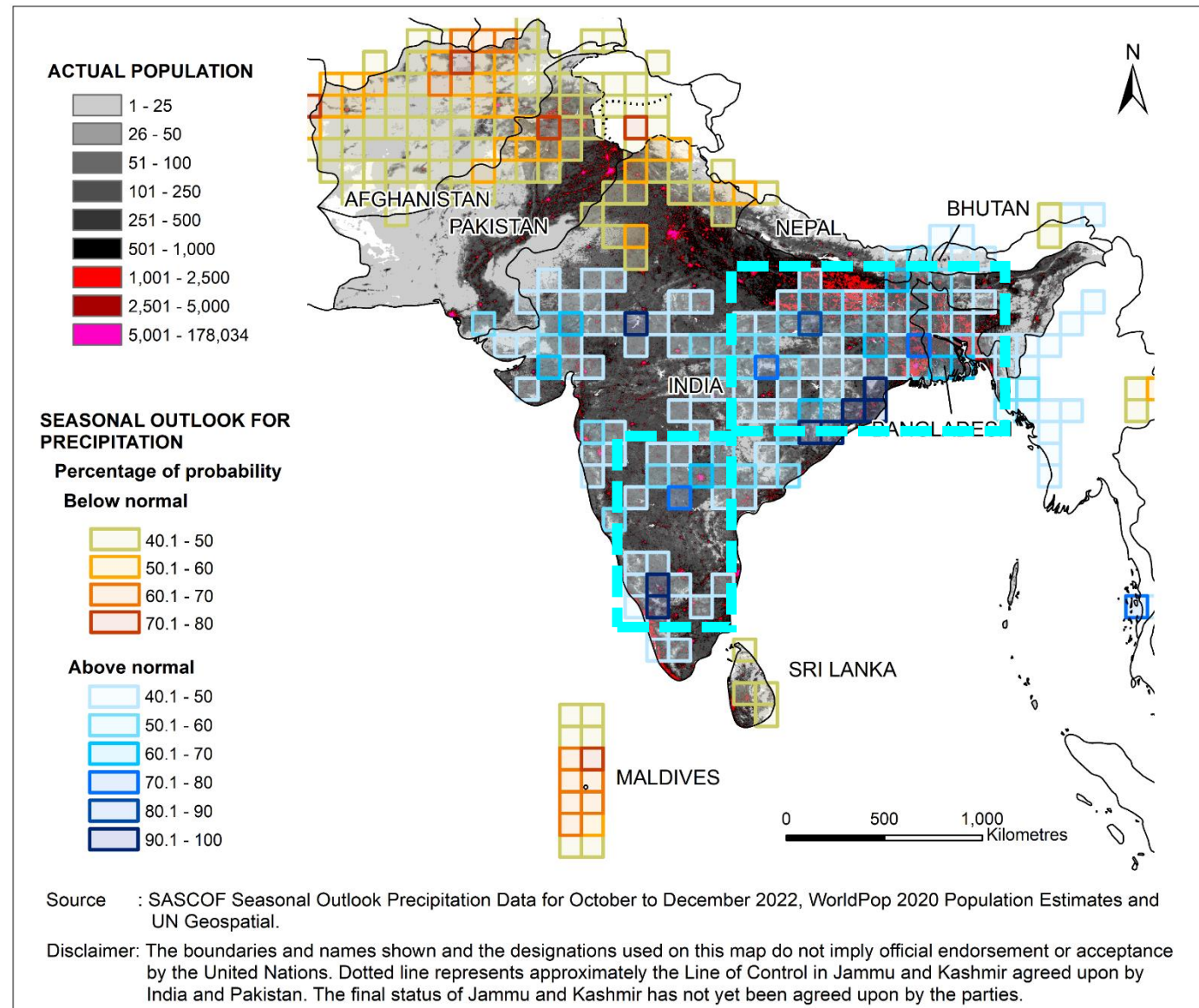
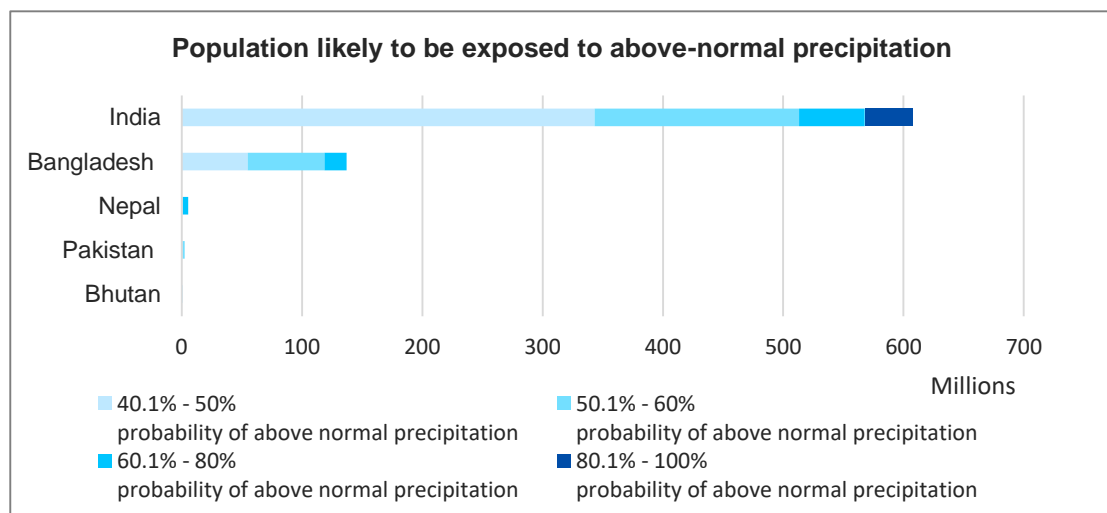
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Estimation of population likely to be exposed to above-normal precipitation

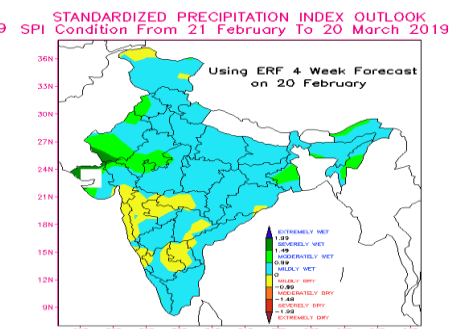
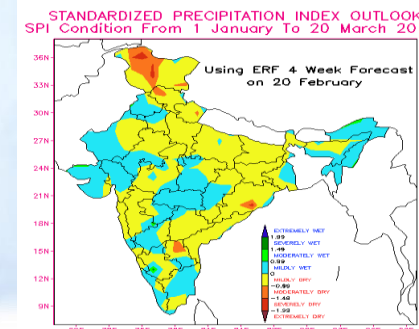
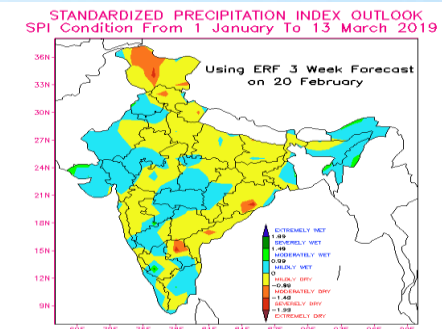
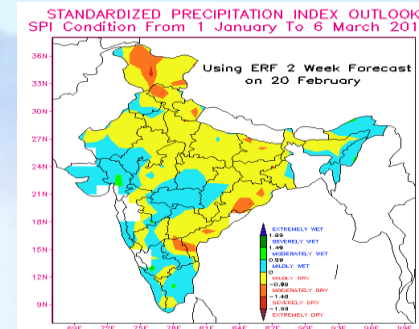
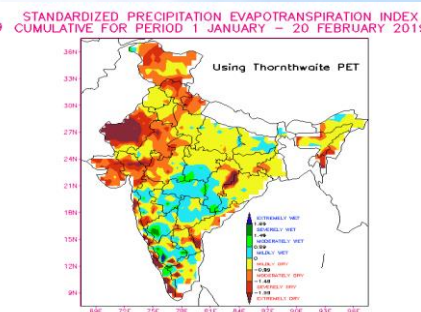
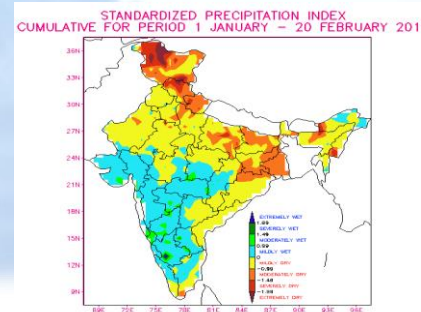
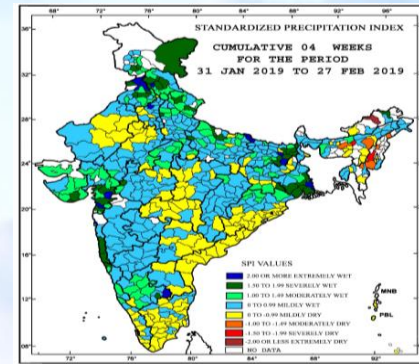
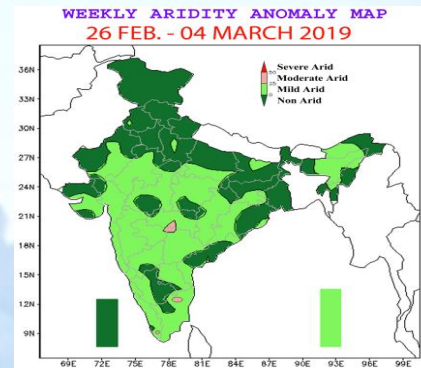
Country	Total population 2020 (thousands)	Percent of population exposure				Above normal precipitation
		40.1% - 50% probability of above normal precipitation	50.1% - 80% probability of above normal precipitation	60.1% - 80% probability of above normal precipitation	80.1% - 100% probability of above normal precipitation	
Afghanistan	38,928	0.0%	0.0%	0.0%	0.0%	0.0%
Bangladesh	164,689	33.5%	39.1%	11.2%	0.0%	83.9%
Bhutan	772	39.2%	21.6%	0.0%	0.0%	60.8%
India	1,380,004	25.2%	12.5%	4.0%	2.9%	44.5%
Maldives	541	0.0%	0.0%	0.0%	0.0%	0.0%
Nepal	29,137	1.8%	1.1%	15.6%	0.0%	18.5%
Pakistan	220,892	0.2%	0.9%	0.0%	0.0%	1.1%
Sri Lanka	21,413	0.0%	0.0%	0.0%	0.0%	0.0%
Total	1,856,376	21.8%	12.9%	4.2%	2.2%	41.1%

In total, **41.1%** of South Asia population are likely to be exposed to **more than 40%** probability of above-normal precipitation.



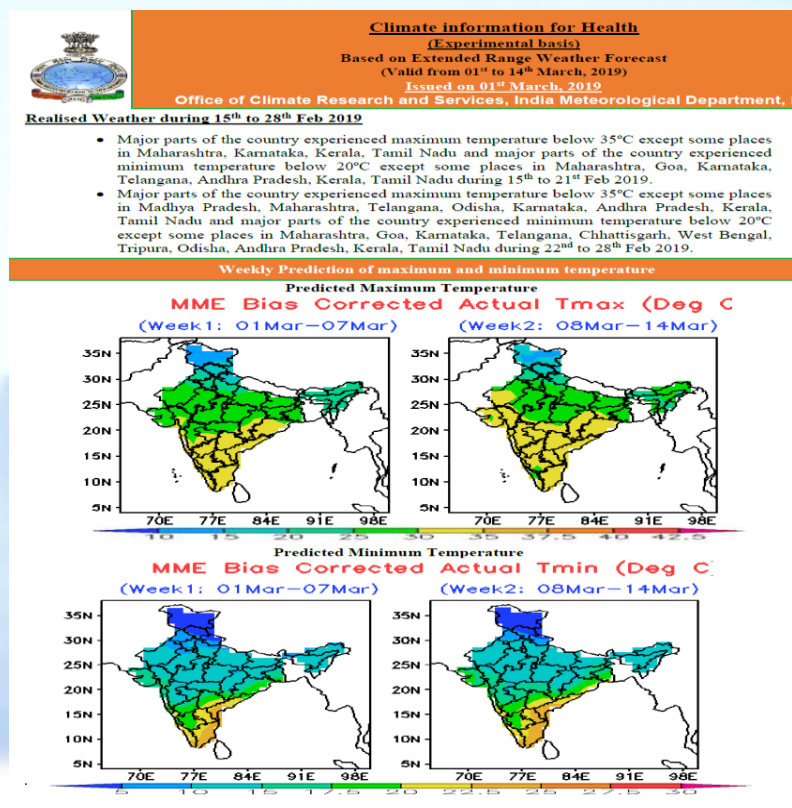
Climate Application for Agriculture: Drought Monitoring and prediction

- ❖ Drought monitoring using Aridity Anomaly Index(AAI), Standardized Precipitation Index(SPI) and Standardized Precipitation Evaporation Index(SPEI) in weekly, biweekly, monthly and seasonal scales. Sending weekly SPI map and values to all the state authorities as demanded by them according to new Drought manual of Ministry of Agriculture.
- ❖ Drought monitoring using Standardized Precipitation Evaporation Index(SPEI) has been started in the year 2018.
- ❖ Generation of one week advance SPI and AAI outlook maps during SW monsoon and NE monsoon using IMD GFS one week district rainfall forecast.
- ❖ Also started generating SPI Forecast maps for one week to four weeks using ERFs in the year 2018.



Climate Application for Health: Weekly Bulletin for Vector Born Deceases

- Initiated to issue bulletin on Climate information for Health for malaria and dengue based on ERF Products on experimental basis on every Friday, since May 2nd week 2017 to till date
- Validations of 'Climate information for Health for malaria and dengue based on ERF Products is completed from May 2017 to October 2017.

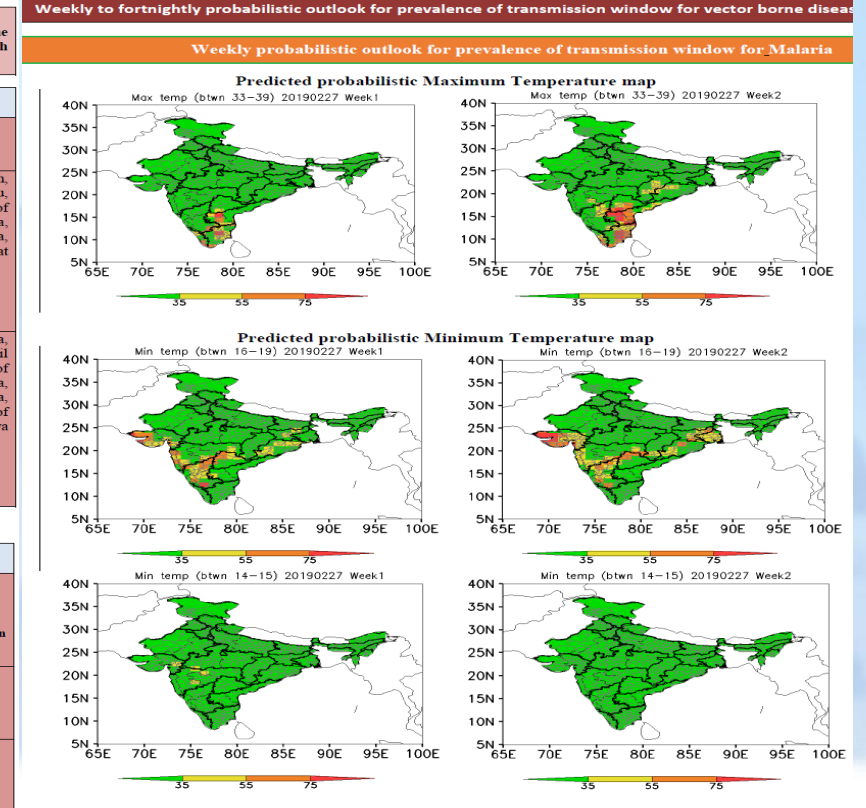


Weather Warning

- Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Punjab, major parts of Haryana, some parts of Rajasthan, Uttar Pradesh, Sikkim, isolated parts of Madhya Pradesh and Chhattisgarh will experience minimum temperature below 10.0 °C during 01st to 07th Mar 2019.

ERFS based weekly evolution of transmission window for Malaria					
Week	VBD	Threshold minimum temp (Th-Tmin)	Region(s) with Predicted Tmin within range of Th-Tmin	Threshold maximum temp (Th-Tmax)	Region(s) with Predicted Tmax within range of Th-Tmax
01 st to 07 th Mar 2019	Malaria (<i>Plasmodium falciparum</i>)	16-19°C	Major parts of Gujarat, Odisha, West Bengal, Telangana, Karnataka, some parts of Maharashtra, Goa, Chhattisgarh and isolated parts of Jharkhand.	33-39°C	Goa, Andhra Pradesh, Kerala, Tamil Nadu, major parts of Chhattisgarh, Odisha, Telangana, Karnataka, some parts of Gujarat and Maharashtra.
	Malaria (<i>Plasmodium vivax</i>)	14-15°C	Bihar, major parts of Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, North-eastern states, Maharashtra, some parts of Haryana, Gujarat, West Bengal and Odisha.		
08 th to 14 th Mar 2019	Malaria (<i>Plasmodium falciparum</i>)	16-19°C	Major parts of Gujarat, Maharashtra, Karnataka, Telangana, Odisha, West Bengal, Jharkhand, some parts of Chhattisgarh and isolated parts of Bihar.	33-39°C	Goa, Odisha, Telangana, Andhra Pradesh, Tamil Nadu, major parts of Gujarat, Maharashtra, Chhattisgarh, Karnataka, Kerala, some parts of Rajasthan, Madhya Pradesh and Jharkhand.
	Malaria (<i>Plasmodium vivax</i>)	14-15°C	Rajasthan, Madhya Pradesh, all North-eastern states, major parts of Haryana, Uttar Pradesh, Bihar, Chhattisgarh, some parts of Gujarat, Maharashtra, Jharkhand, Sikkim, isolated parts of Punjab and Odisha.		

ERFS based weekly evolution of transmission window for Dengue					
Week	VBD	Threshold minimum temp (Th-Tmin)	Region(s) with Predicted Tmin within range of Th-Tmin	Threshold maximum temp (Th-Tmax)	Region(s) with Predicted Tmax within range of Th-Tmax
01 st to 07 th Mar 2019	Dengue virus	11.9°C	Bihar, major parts of Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, North-eastern states, Maharashtra, some parts of Haryana, Gujarat, West Bengal and Odisha.	Not known	-
08 th to 14 th Mar 2019	Dengue virus	11.9°C	Rajasthan, Madhya Pradesh, all North-eastern states, major parts of Haryana, Uttar Pradesh, Bihar, Chhattisgarh, some parts of Gujarat, Maharashtra, Jharkhand, Sikkim, isolated parts of Punjab and Odisha.	Not known	-



Agromet Advisory Generation

- ❖ District level = ~700 Districts
- ❖ Block level = ~3100 Blocks
- ❖ State Level = 30
- ❖ National Agromet Advisory Service (AAS) bulletin by Agrimet Div. IMD Pune on every Friday.
- ❖ National AAS Bulletin based on Two weeks Extended range weather forecast (ERFS) in collaboration with ICAR-CRIDA.

Gramin Krishi Mausam Sew
Experimental Block Level Agromet Advisory Bulletin
(A Joint Initiative of IMD & ICAR)

Agromet Advisory Bulletin

Date : 21-06-2022

Weather Forecast of DAHANU Block in PALGHAR(Maharashtra) Issued On: 2022-06-21(Valid Till 08:30 IST of the next 5 days)

Parameter	2022-06-22	2022-06-23	2022-06-24	2022-06-25	2022-06-26	
Rainfall	0.6	10.2	15.9	3.6	6.1	
Temp(°C)	31.8	32.7	33.0	32.1	33.1	
Temp(°C)	27.2	28.3	27.2	27.2	27.0	
RH-H(%)	80	83	87	83	86	
RH-L(%)	62	58	61	68	64	
Wind Speed(kmph)	19.0	14.0	14.0	17.0	24.0	
Wind Direction(Degrees)	199	259	250	160	203	
Cloud Cover(Octa)	7	6	8	7	6	

Weather Summary/Alert:

As per the forecast given by BMC, Mumbai, there is a possibility of Heavy rainfall at isolated places during 22nd to 26th June 2022. Sky may remain cloudy during next five days.

General Advisory:

Due to Heavy rains at isolated places during 19 to 20 June 2022, Drain out excess water from all fruit crop orchards and paddy seed nursery beds.

SMS Advisory:

During next five days there is forecast of light to moderate rainfall, hence it is advice to complete nursery sowing of Kharif crops like rice and finger millet.

Crop Specific Advisory:

Crop/Varieties	Crop Specific Advisory
RICE	There is forecast for heavy rainfall at isolated places during 22 to 26 June, 2022, hence it is advice to complete nursery sowing of rice. Farmers are suggested to sow the kharif paddy seed on nursery beds. Application of 1 kg urea and 3 kg of single super phosphate with sufficient quantity of FYM per 1 R area of nursery advocated. Seed treatment to paddy seed with Thiram 2 gm per kg is advised. If possible, sow the seed on raised beds. Seed rate for paddy is 50 kg per ha for bold varieties, 40 kg per ha for fine varieties and 20 kg per ha for hybrid varieties is recommended.

Horticulture Specific Advisory:

Horticulture Varieties	Horticulture Specific Advisory
MANGO	Due to the possibility of heavy rains in some places between 22nd to 26th June 2022, support should be given to avoid breaking of mango cuttings which are generally two years old. The amount of fertilizer given in the bag should be postponed.
COCONUT	Due to the possibility of heavy rains in some places between 22nd to 26th June 2022, the soil should be well supplied to the two years old seedlings and care should be taken not to accumulate water near the seedlings. The amount of fertilizer given in the bag should be postponed.

AAS Bulletin for
Dahanu block

Agromet Advisory Service Bulletin for Palghar District (Issued jointly by IMD, New Delhi and ICAR, New Delhi, Krishi Vigyan Kendra, Kothrud Hill, Palghar)						
No.49/2022						
Date: 21/06/2022						
5 Days						
Significant past weather for the preceding week (Period : 15/06/2022 to 20/06/2022)						
15/06	16/06	17/06	18/06	19/06	20/06	21/06
2.0	6.0	2.5	1.5	1.5	72.9	106.0
24.1	33.1	33.1	33.4	34.1	31.9	25.7
26.4	26.7	21.8	26.8	26.3	24.8	24.8
Weather Parameters						
Weather forecast from 08:30 hrs of 21/06/2022 to 26/06/2022						
22/06	23/06	24/06	25/06	26/06		
45	20	40	106	04		
32	33	30	29	29		
34	33	33	33	33		
34	33	33	33	33		
Rainfall (mm)						
Maximum temperature (°C)						
Minimum temperature (°C)						
Cloud cover (Octa)						
Relative Humidity Max (%)						
Relative Humidity Min (%)						
Wind speed (km/hr)						
Wind direction						
SSE	ESE	SE	ESE	W	SSE	E
SSW	SSW	WSW	WSW	WSW	WSW	SSW
Rainfall (mm) in last week						
Total Rainfall (mm) in last year						
230.8						
Agromet Advisory Based on Weather Forecast Prediction						
Weather summary As per the forecast given by BMC, Mumbai, there is a possibility of Heavy rainfall at isolated places during 22 nd to 26 th June 2022. Sky may remain cloudy during next five days. Maximum temperature will remain between 33 to 39 °C and Minimum temperature may remain between 25 to 23 °C during next five days. As per Extended range forecast for Konkan division for the period of 26 June to 02 July 2022 above normal rainfall expected.						
General advisory Due to Heavy rains at isolated places during 19 to 20 June 2022, Drain out excess water from all fruit crop orchards and paddy seed nursery beds.						
SMS During next five days there is forecast of light to moderate rainfall, hence it is advice to complete nursery sowing of kharif crops like rice and finger millet.						
Crop						
Stage						
Agromet Advisory						
Kharif Rice	Nursery Sowing	There is forecast for heavy rainfall at isolated places during 22 to 26 June, 2022, hence it is advice to complete nursery sowing of rice. Farmers are suggested to sow the kharif paddy seed on nursery beds. Application of 1 kg urea and 3 kg of single super phosphate with sufficient quantity of FYM per 1 R area of nursery advocated. Seed treatment to paddy seed with Thiram 2 gm per kg is advised. If possible, sow the seed on raised beds. Seed rate for paddy is 50 kg per ha for bold varieties, 40 kg per ha for fine varieties and 20 kg per ha for hybrid varieties is recommended.				
Finger millet	Nursery Sowing	For raising finger millet nursery select the well drain soil. Plough the nursery area and bring the soil to fine tilth, add FYM/250 kg per guntha area. Prepare raised bed of 120 cm. breadth at bottom and 90 cm. on top along the slope of land. Convenient length of raised bed				

AAS Bulletin for
Palghar block

राष्ट्रीय कृषि मौसम परामर्श सेवा बुलेटिन
National Agromet Advisory Service Bulletin

शुक्रवार दि. 17 जून, 2022
(अवधि : 17 से 21 जून, 2022)

Friday 17 June, 2022
For the period 17 to 21 June, 2022

कृषि मौसम विज्ञान प्रभाग,
भारत मौसम विज्ञान विभाग, पुणे
द्वारा जारी

Issued by
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based on
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National AAS Bulletin based
on ERFS



NFCS-India



सत्यमेव जयते
Ministry of Earth Sciences
Government of India







GFCS
GLOBAL FRAMEWORK
CLIMATE SERVICES



Stakeholder Consultation Workshop
For the Establishment of National Framework for Climate Services in India (NFCS-India)
5-6 October 2023

Organized and coordinated by
India Meteorological Department (Delhi and Pune)
Ministry of Earth Sciences, Govt. of India

Co-Hosted by and Venue
CHRIST University, Lavasa Campus, Pune



**NATIONAL FRAMEWORK FOR CLIMATE SERVICES IN INDIA
(NFCS-INDIA) 5-6 OCTOBER 2023, LAVASA, PUNE**

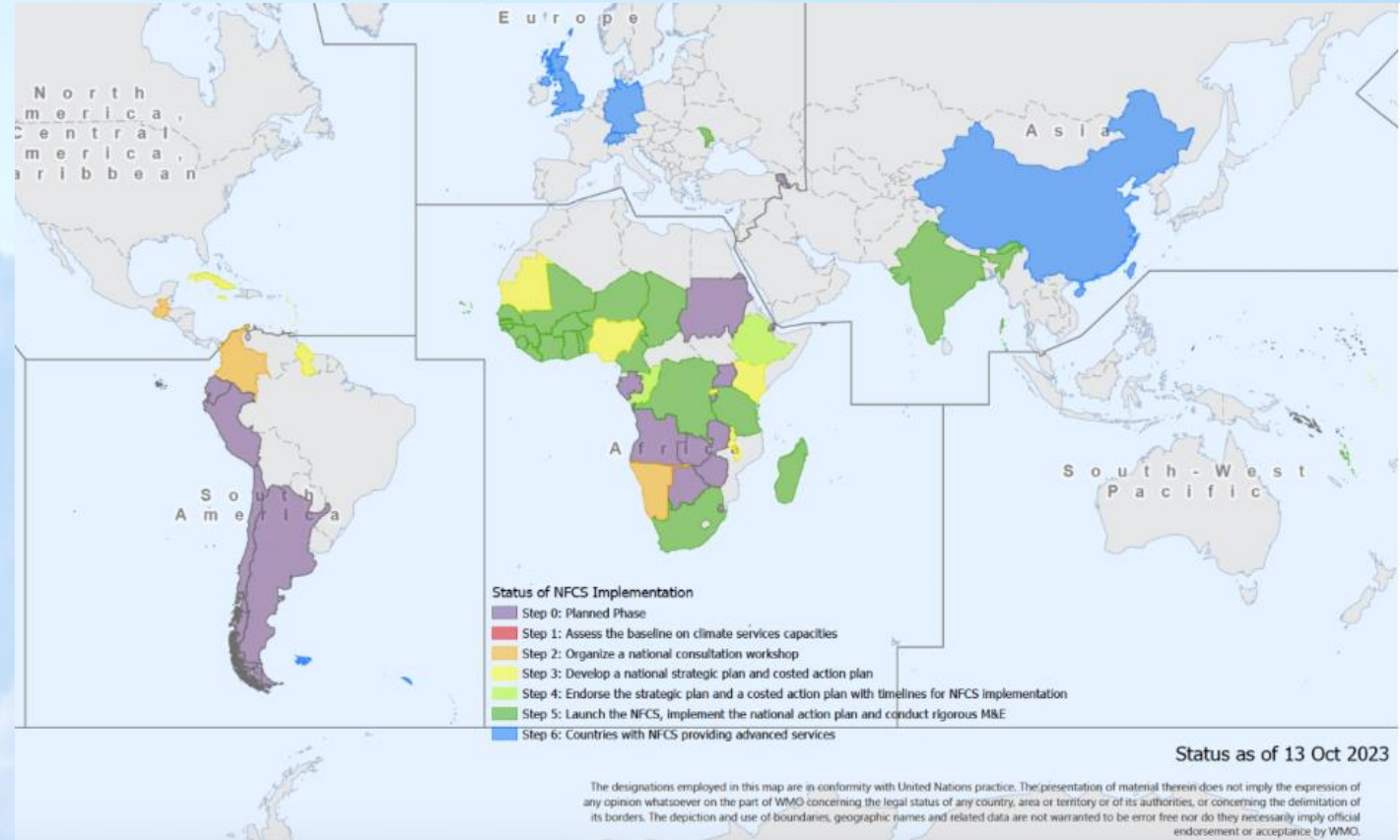
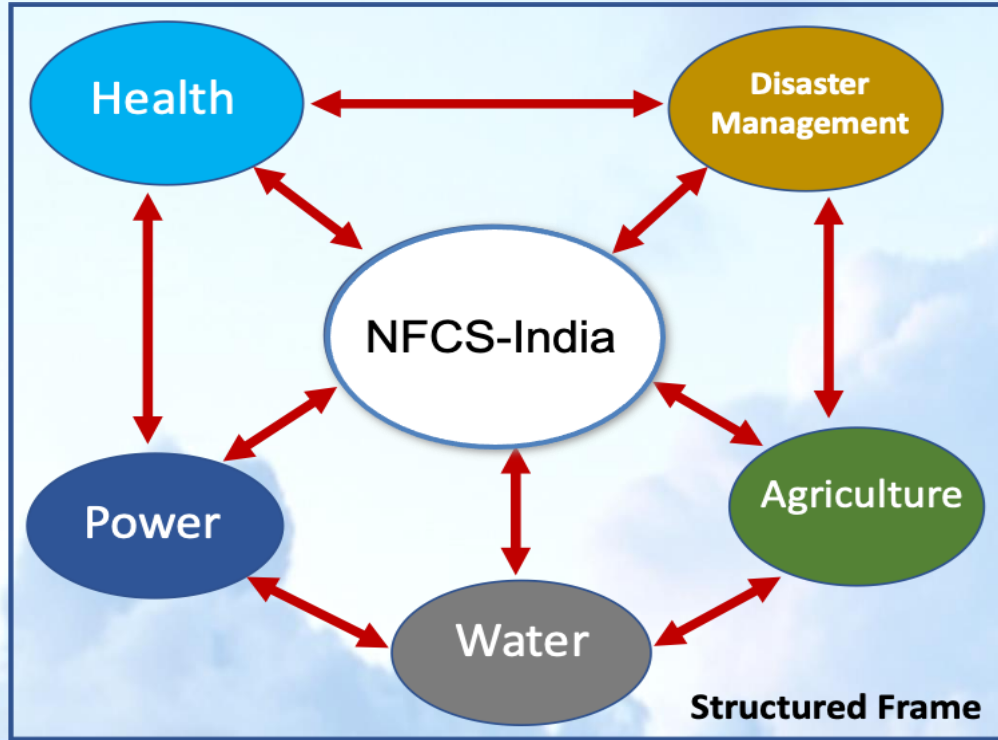
The stakeholders included: representatives from various central ministries (including water resources, agriculture, health, energy, defense and ISRO), officials from various state governments, research organizations, academic institutions, professional bodies, NGOs, and media have participated in this event.

At the end “NFCS-India workshop statement” was prepared by the participants

**भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT**



NFCS-India



Organizations Supporting & Contributing to the SASCOF Forum



- National Meteorological & Hydrological Services (NMHSs) and representatives from various sector users
- India Meteorological Department (IMD)
- Indian Institute of Tropical Meteorology (IITM).
- World Meteorological Organization (WMO).
- UK Met Office (UKMO)
- Regional Integrated Multi-hazard Early-warning System (RIMES).
- Japan Meteorological Agency (JMA).
- Korea Meteorological Administration (KMA).
- International Research Institute for Climate and Society (IRI).
- WMO Global Producing Centres of Long Range Forecasts (GPCs-LRF) and the WMO Lead Centre for Long Range Forecast Multi-Model Ensemble (LC-LRFMME).
- Food and Agriculture Organization (FAO)
- United Nations Economic and Social Commission for Asia and the Pacific



Progress on the WMO NFCS Implementation Guidelines: Special Session during SASCOF28 session with UKMO

Session II: National Framework for Climate Services	
Session Chair: <u>Dr. Rupa Kumar, IITM</u>	Rapporteurs: Ms Smitha Nair, Mr. Prasad <u>Bhor</u> , Ms. <u>Madhuri Musale</u>
11:50 – 12:00	Introduction to the session and to the Global Framework for Climate Services and National Framework for Climate Services: <u>Dr. Jane Strachan, UKMO</u>
12:00 – 12:10	Progress on the WMO NFCS Implementation Guidelines: <u>Dr. Maricel Williams, UKMO</u>
12:10 – 13:00	NFCS Status and Barrier Activity: Led by <u>Dr. Jane Strachan</u> with Support from <u>Dr. Satyaban B. Ratna</u> and <u>Dr. Rupa Kumar Kolli</u>
13:00 – 13:10	Example NFCS Journey from Ireland: <u>Dr. Jane Strachan, UKMO</u>
13:10 - 13:30	NFCS Visioning Activity: Led by <u>Dr. Maricel Williams</u> with Support from <u>Dr. Satyaban B. Ratna</u> and <u>Dr. Rupa Kumar Kolli</u>





Thank you

