SOUTH ASIA HYDROMET FORUM

CLIMATE SERVICES WORKSHOP

Country Presentation: Overview of Climate Services in South Asia

INDIA

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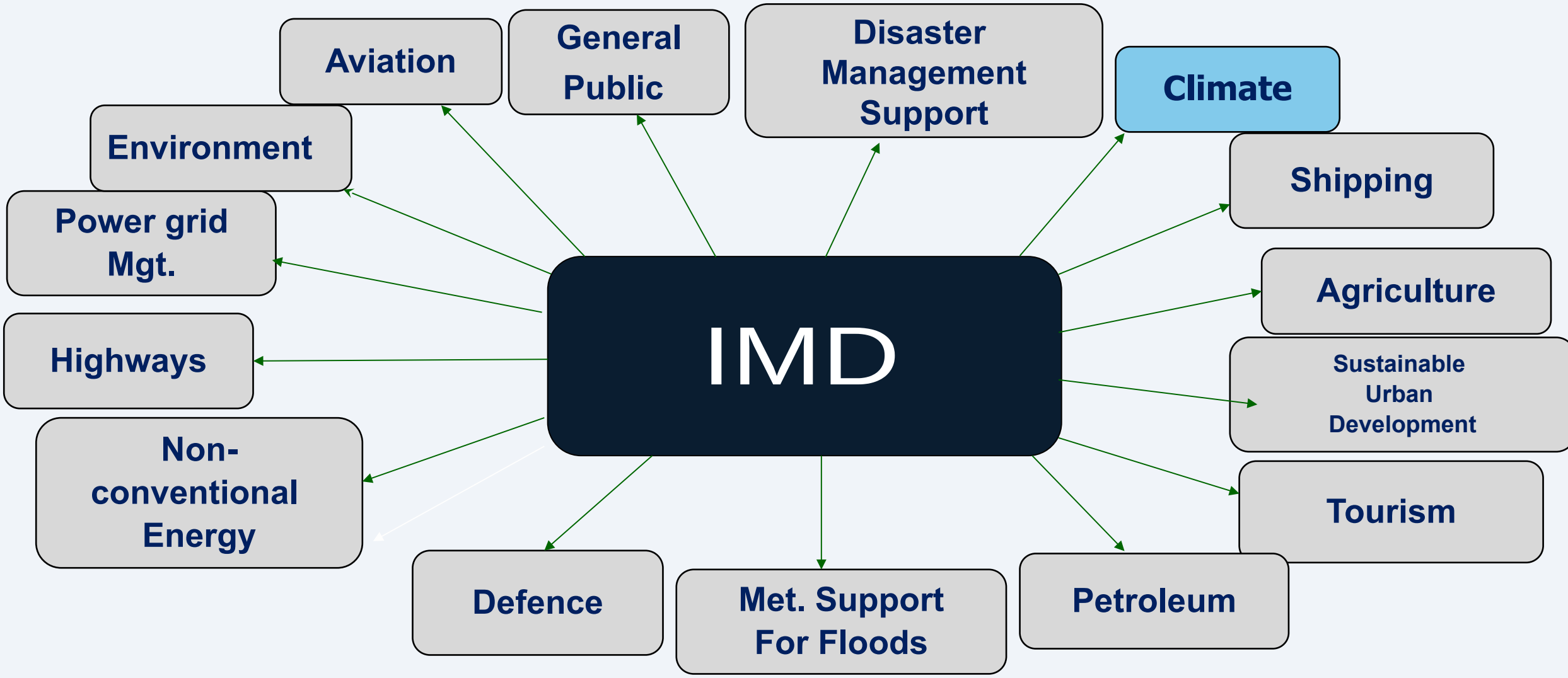
OUTLINE OF PRESENTATION

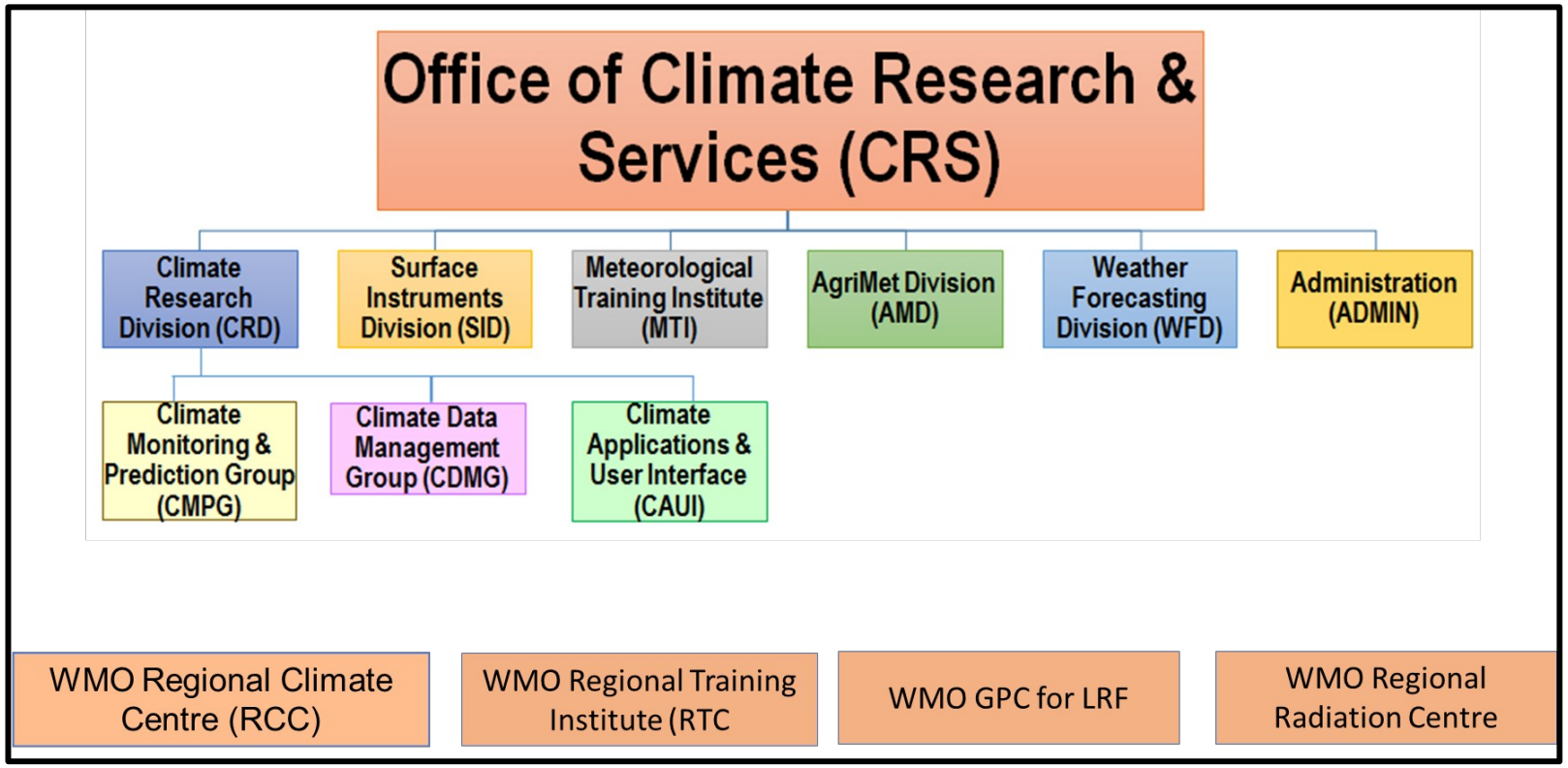
1. Current Status of Climate Services
2. Forecast Products and Delivery
3. Sectoral Advisories and Applications
4. Tools, Platforms and Data Use
5. Capacity and Gaps
6. Expectation from SAHF CS WG

CURRENT STATUS OF CLIMATE SERVICES

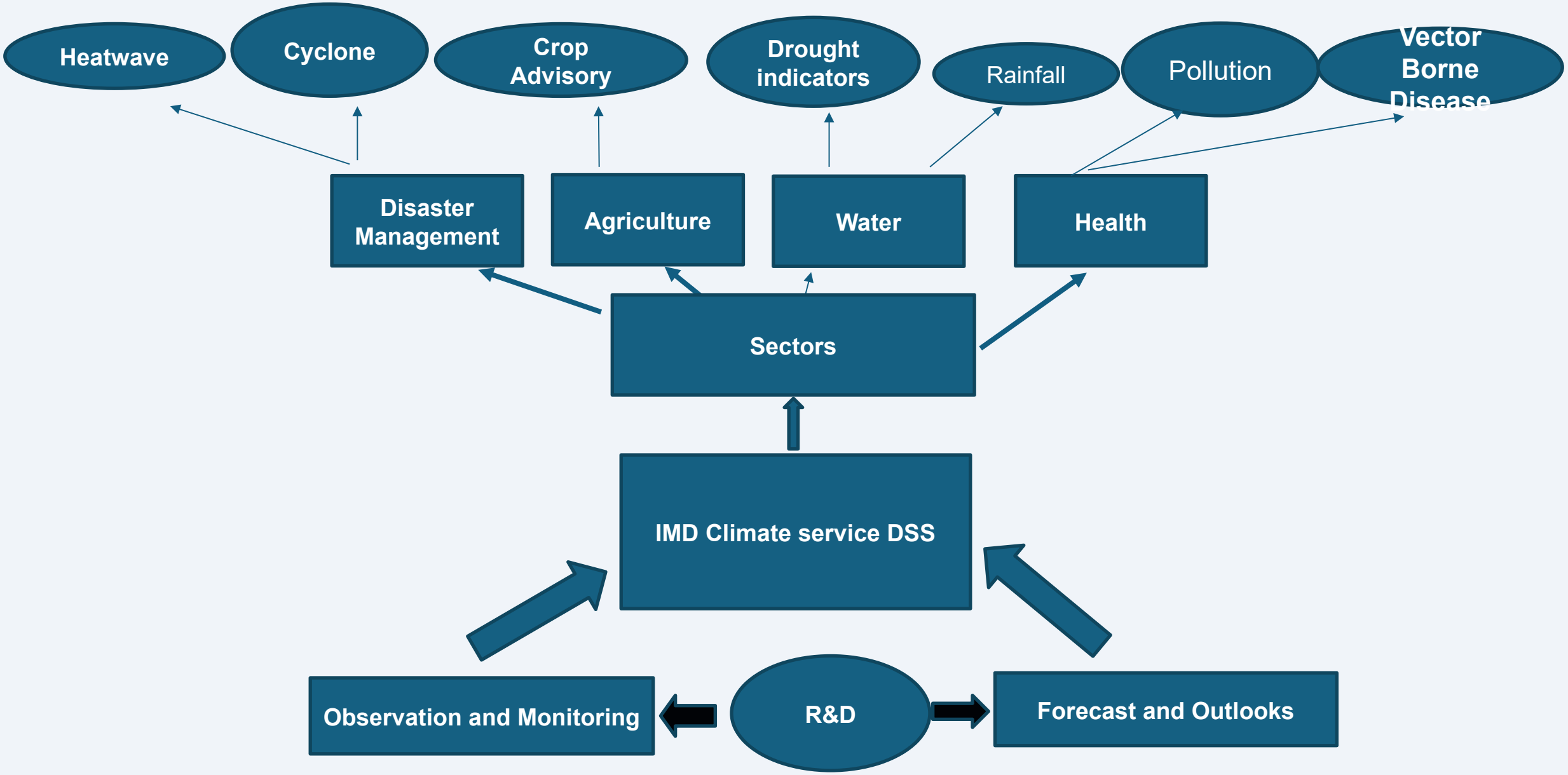
Sectoral applications of weather and climate services as per Demand



Climate service at IMD

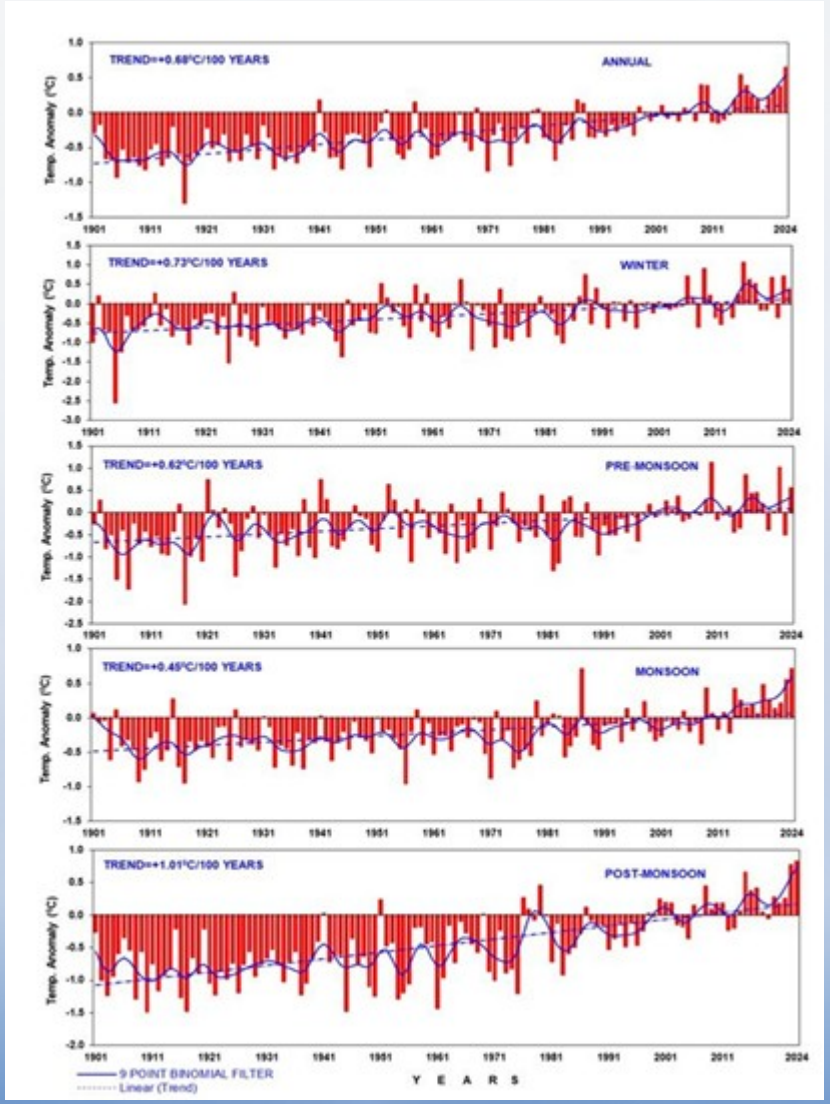


Disseminating climate information in IMD: climate service



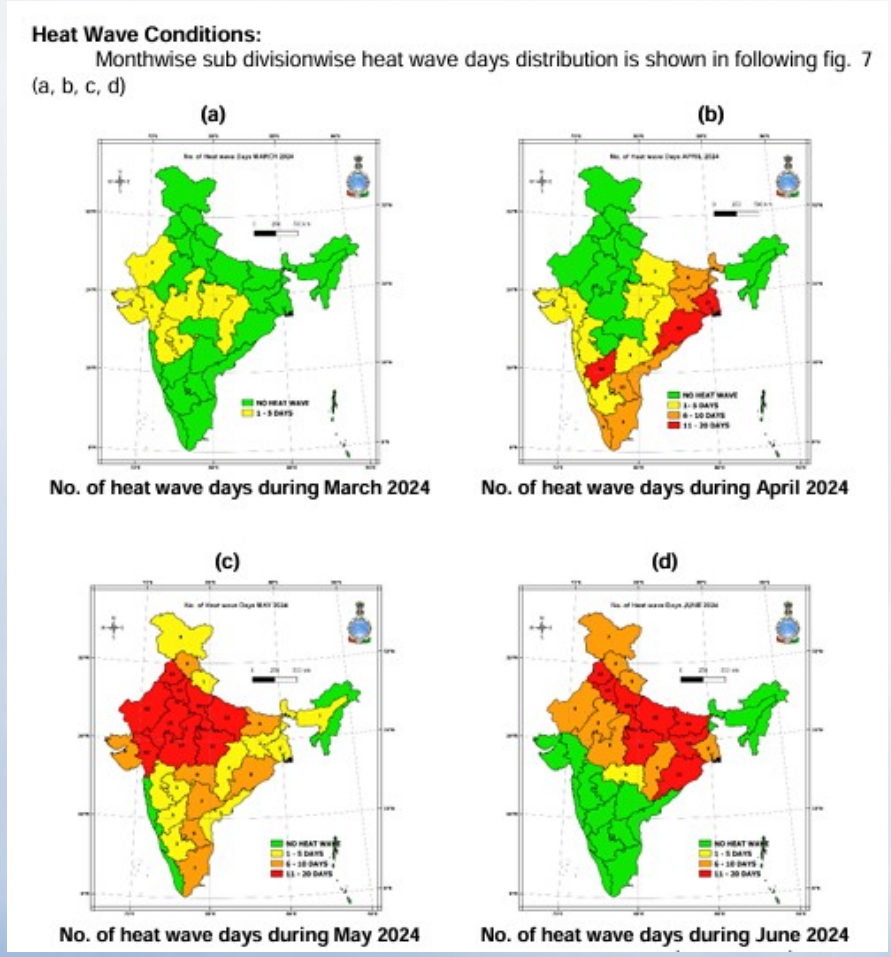
Climate Monitoring

Annual mean land surface air temperature anomalies over India for the period 1901-2024



Heat Wave Conditions:

Monthwise sub divisionwise heat wave days distribution is shown in following fig. 7 (a, b, c, d)

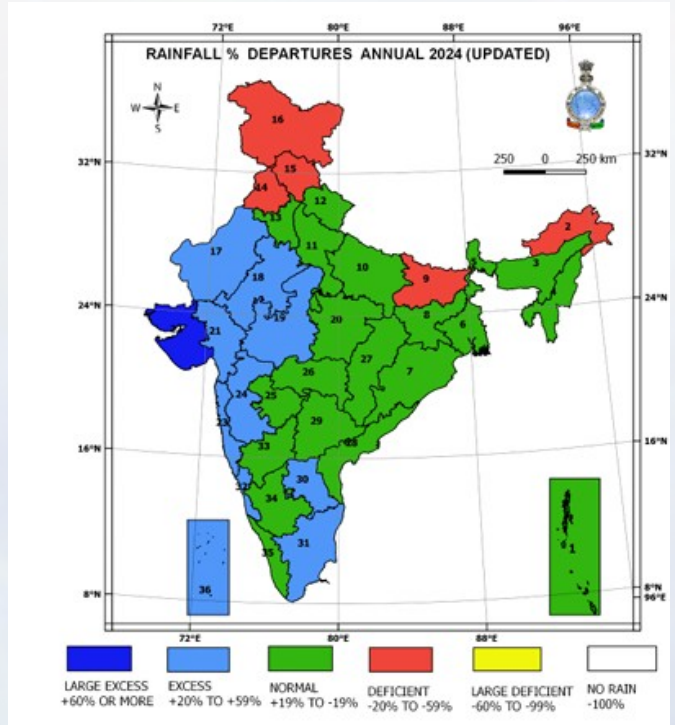


No. of heat wave days during March 2024

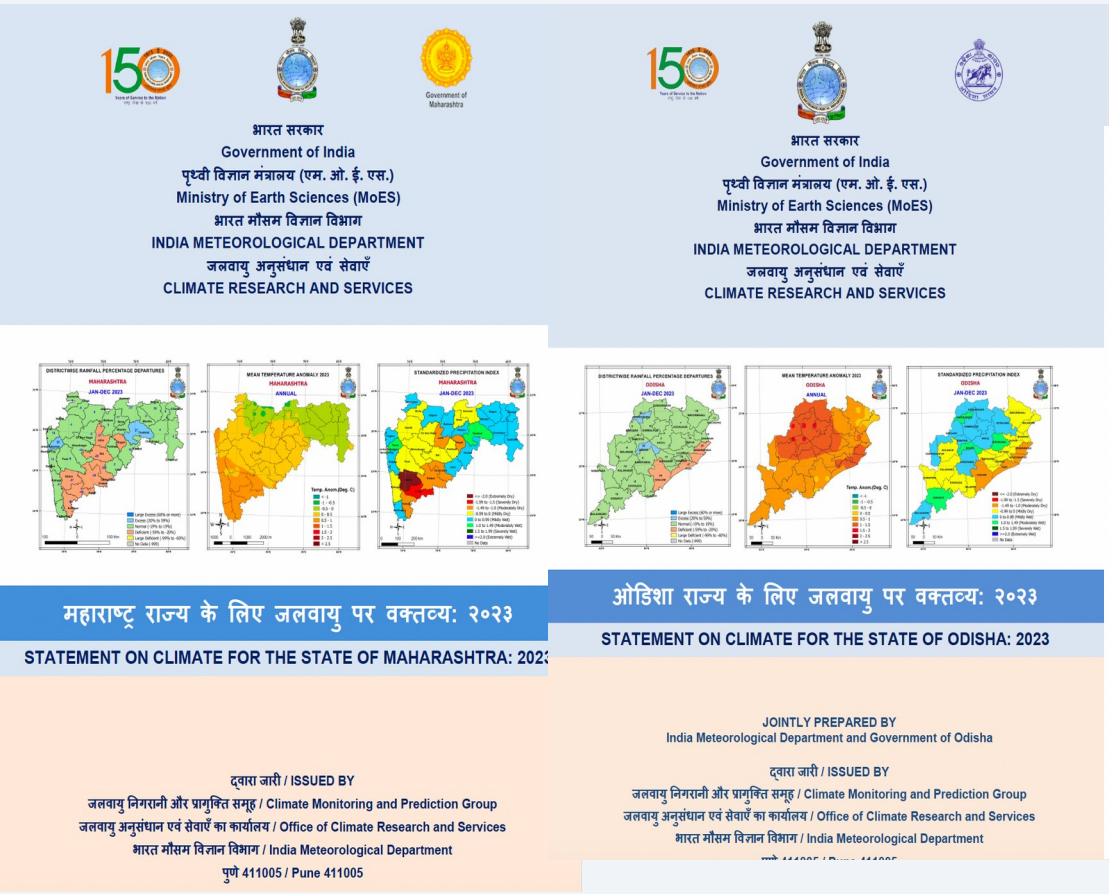
No. of heat wave days during April 2024

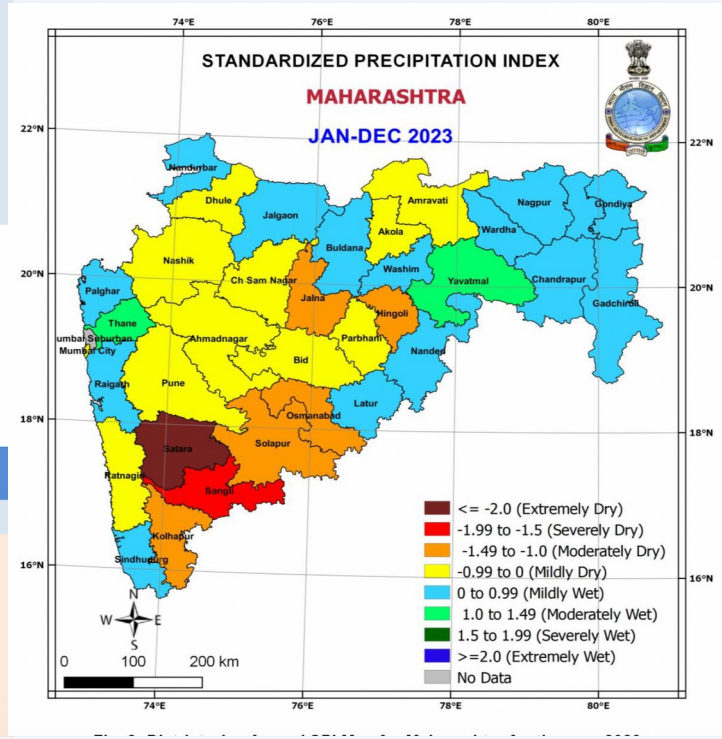
No. of heat wave days during May 2024

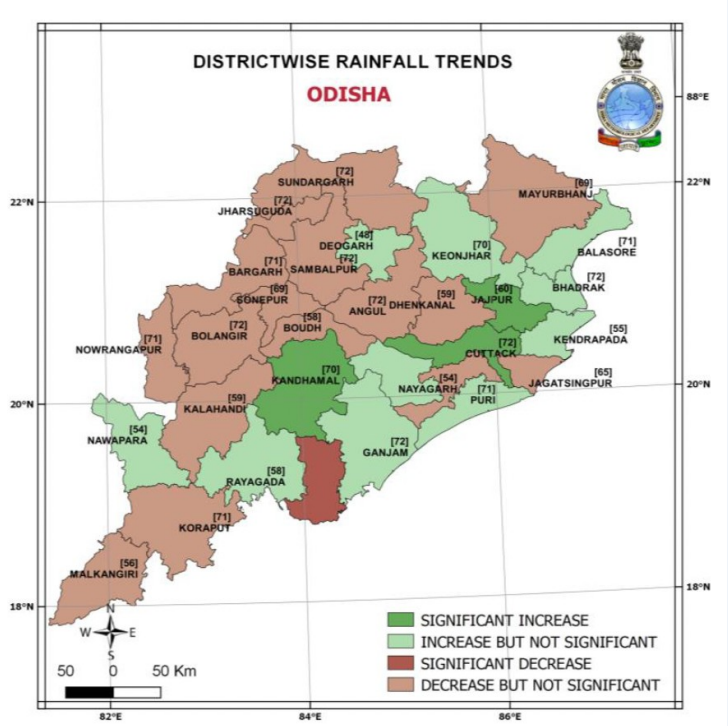
No. of heat wave days during June 2024



Expanding climate services to state- and district-level







State-level annual climate statement prepared for all the states of India

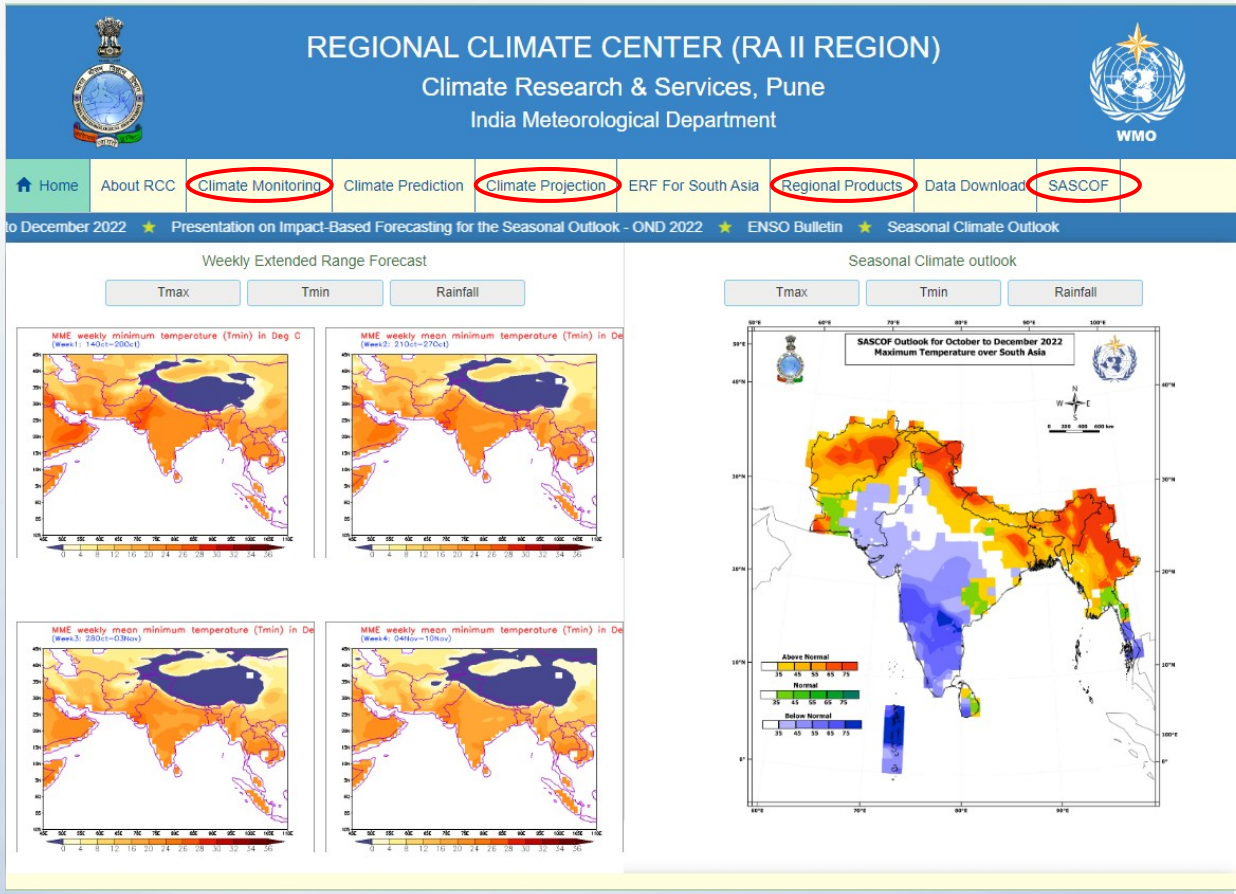
Climate Forecast

Sr. No.	Forecast for	Region for which forecast issued	Issued in	Method/ Model
1	Winter Season (Jan- March) Precipitation	Northwest India	December	Statistical, Dynamical
2	Hot Weather Season Temperature (March to May) & (April to June)	Subdivision wise	February & March	Dynamical
3	SW Monsoon Season (June to September) Rainfall	Country as a whole	April	Statistical, Dynamical & MME
4	SW Monsoon Season (June to September) Rainfall	Country as a whole	June	Statistical, Dynamical & MME
5	South-West Monsoon Onset	Kerala	May	Statistical
6	SW Monsoon Season (June to September) Rainfall	Four broad geographical regions: Northwest India, Northeast India, Central India and South Peninsula & Core Monsoon Zone	May	Statistical, Dynamical & MME
7	SW Monsoon Monthly Rainfall for June	Country as a whole	May	MME
8	SW Monsoon Monthly Rainfall for July	Country as a whole	June	MME
9	SW Monsoon Second half of the Season (August- September) Rainfall	Country as a whole	July	MME
10	SW Monsoon Monthly Rainfall for August	Country as a whole	July	MME
11	SW Monsoon Monthly Rainfall for September	Country as a whole	August	MME
12	NE Monsoon Season (October to December) Rainfall	South Peninsula	September	Statistical, Dynamical & MME
13	Cold Weather Season (December to February) Temperature	Subdivision wise	November	Dynamical

RCC-Pune

- Seasonal South Asia Seasonal Climate Outlook Forum (SASCOF) for various seasons
- Seasonal Climate Outlook for rainfall and temperature over South Asia with monthly update
- ENSO and IOD forecast bulletin with monthly update
- Forecast for SST, rainfall and temperature (Anomaly and Probability) with monthly update
- Gridded Climate Data products (Rainfall and Temperature) and Satellite Merged Rainfall data for South Asia
- Capacity building Training

Website of RCC-Pune

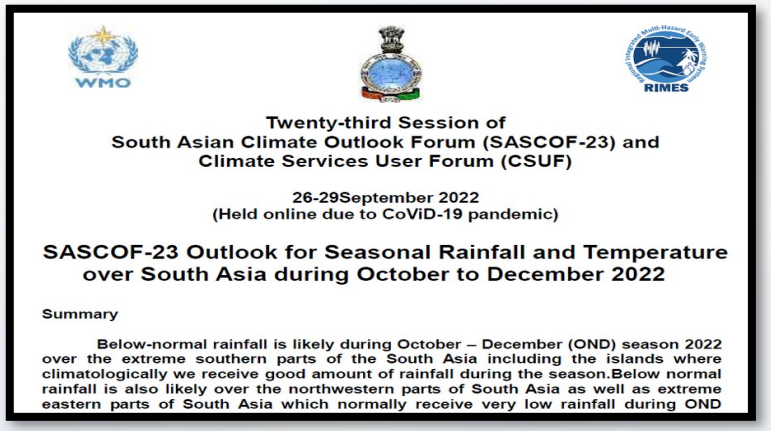


http://rcc.imdpune.gov.in/sascof.php

Examples of RCC-Pune Activities

Training on Seasonal Prediction for Operational Services In South Asia

Operational procedures for preparation of agromet advisories: knowledge and experiences sharing”



WMO

RIMES

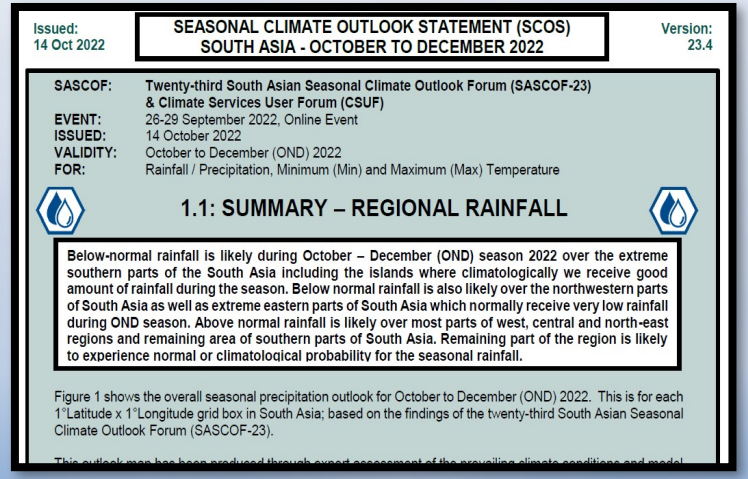
Twenty-third Session of
South Asian Climate Outlook Forum (SASCOF-23) and
Climate Services User Forum (CSUF)

26-29September 2022
(Held online due to CoViD-19 pandemic)

SASCOF-23 Outlook for Seasonal Rainfall and Temperature over South Asia during October to December 2022

Summary

Below-normal rainfall is likely during October – December (OND) season 2022 over the extreme southern parts of the South Asia including the islands where climatologically we receive good amount of rainfall during the season.Below normal rainfall is also likely over the northwestern parts of South Asia as well as extreme eastern parts of South Asia which normally receive very low rainfall during OND



Issued: 14 Oct 2022

SEASONAL CLIMATE OUTLOOK STATEMENT (SCOS)
SOUTH ASIA - OCTOBER TO DECEMBER 2022

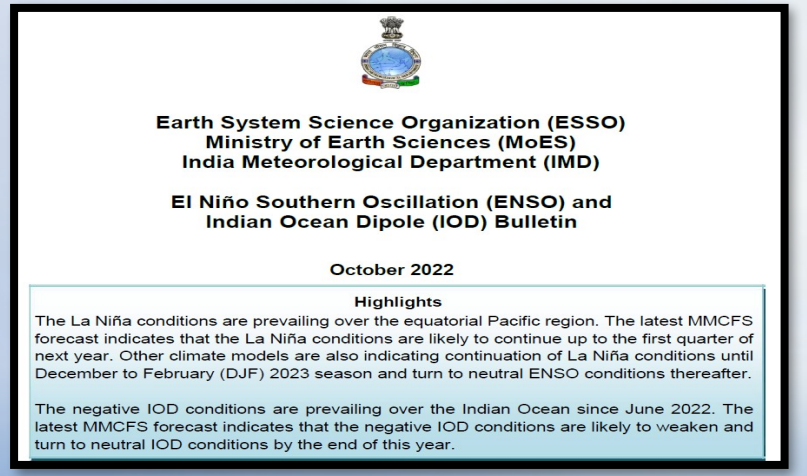
Version: 23.4

SASCOF: Twenty-third South Asian Seasonal Climate Outlook Forum (SASCOF-23) & Climate Services User Forum (CSUF)
EVENT: 26-29 September 2022, Online Event
ISSUED: 14 October 2022
VALIDITY: October to December (OND) 2022
FOR: Rainfall / Precipitation, Minimum (Min) and Maximum (Max) Temperature

1.1: SUMMARY – REGIONAL RAINFALL

Below-normal rainfall is likely during October – December (OND) season 2022 over the extreme southern parts of the South Asia including the islands where climatologically we receive good amount of rainfall during the season. Below normal rainfall is also likely over the northwestern parts of South Asia as well as extreme eastern parts of South Asia which normally receive very low rainfall during OND season. Above normal rainfall is likely over most parts of west, central and north-east regions and remaining area of southern parts of South Asia. Remaining part of the region is likely to experience normal or climatological probability for the seasonal rainfall.

Figure 1 shows the overall seasonal precipitation outlook for October to December (OND) 2022. This is for each 1°Latitude x 1°Longitude grid box in South Asia; based on the findings of the twenty-third South Asian Seasonal Climate Outlook Forum (SASCOF-23).



Earth System Science Organization (ESSO)
Ministry of Earth Sciences (MoES)
India Meteorological Department (IMD)

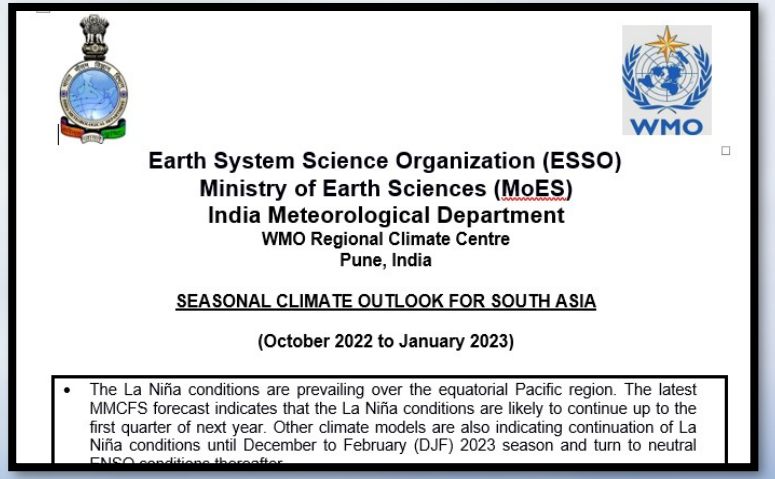
El Niño Southern Oscillation (ENSO) and
Indian Ocean Dipole (IOD) Bulletin

October 2022

Highlights

The La Niña conditions are prevailing over the equatorial Pacific region. The latest MMCFS forecast indicates that the La Niña conditions are likely to continue up to the first quarter of next year. Other climate models are also indicating continuation of La Niña conditions until December to February (DJF) 2023 season and turn to neutral ENSO conditions thereafter.

The negative IOD conditions are prevailing over the Indian Ocean since June 2022. The latest MMCFS forecast indicates that the negative IOD conditions are likely to weaken and turn to neutral IOD conditions by the end of this year.



WMO

Earth System Science Organization (ESSO)
Ministry of Earth Sciences (MoES)
India Meteorological Department
WMO Regional Climate Centre
Pune, India

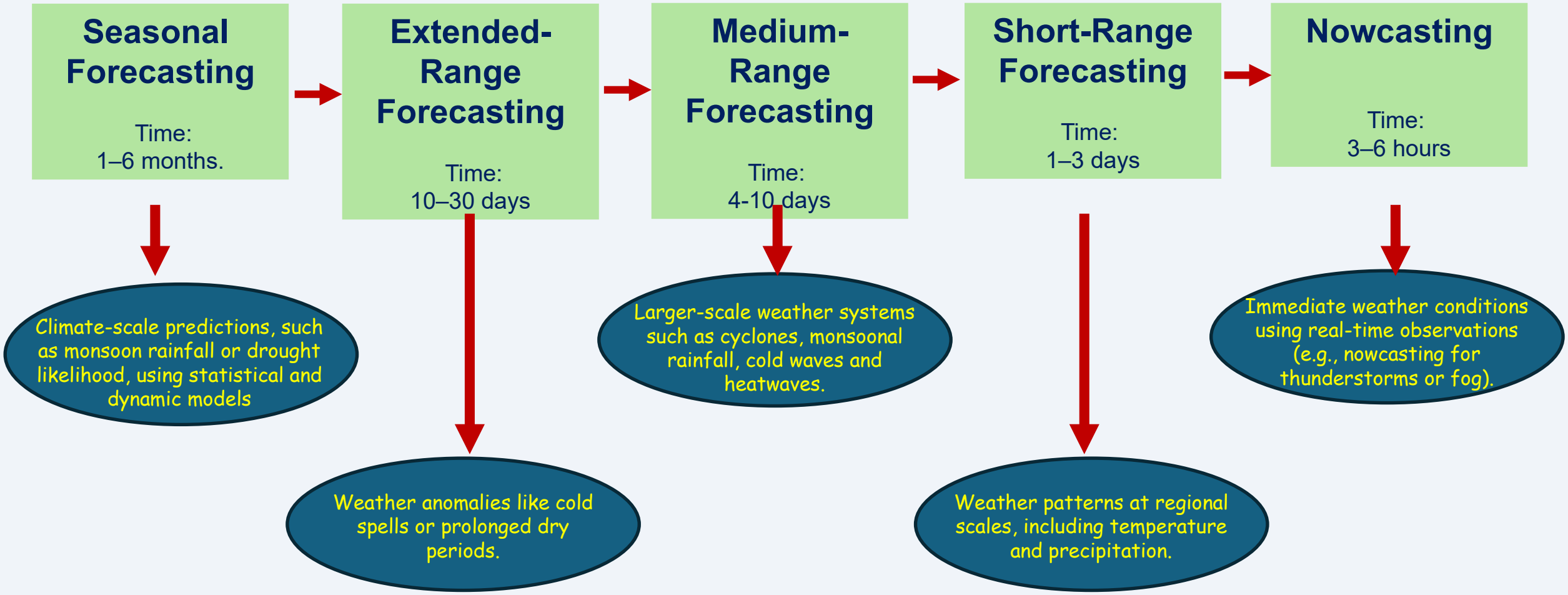
SEASONAL CLIMATE OUTLOOK FOR SOUTH ASIA

(October 2022 to January 2023)

- The La Niña conditions are prevailing over the equatorial Pacific region. The latest MMCFS forecast indicates that the La Niña conditions are likely to continue up to the first quarter of next year. Other climate models are also indicating continuation of La Niña conditions until December to February (DJF) 2023 season and turn to neutral ENSO conditions thereafter

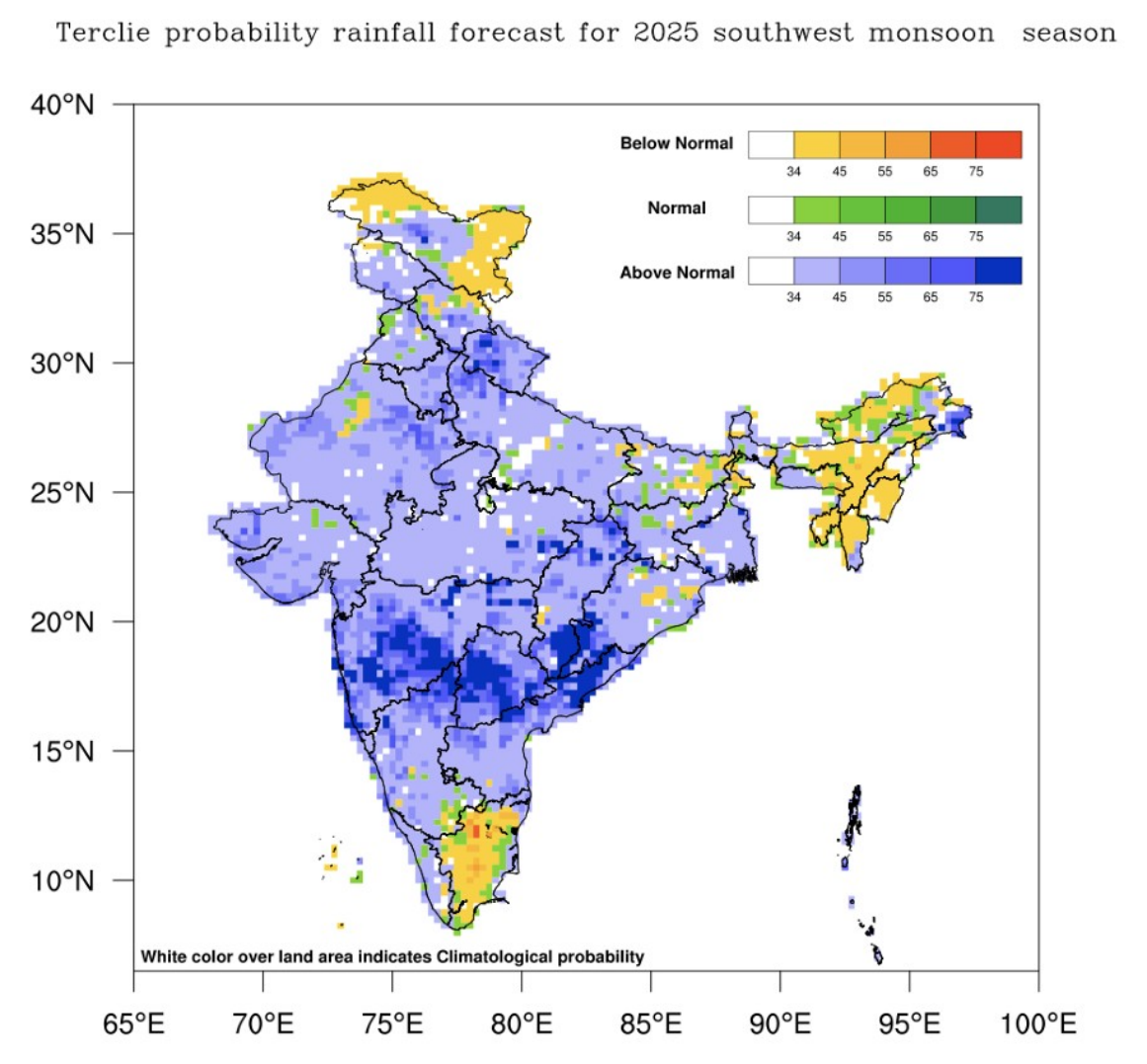
FORECAST PRODUCTS AND DELIVERY

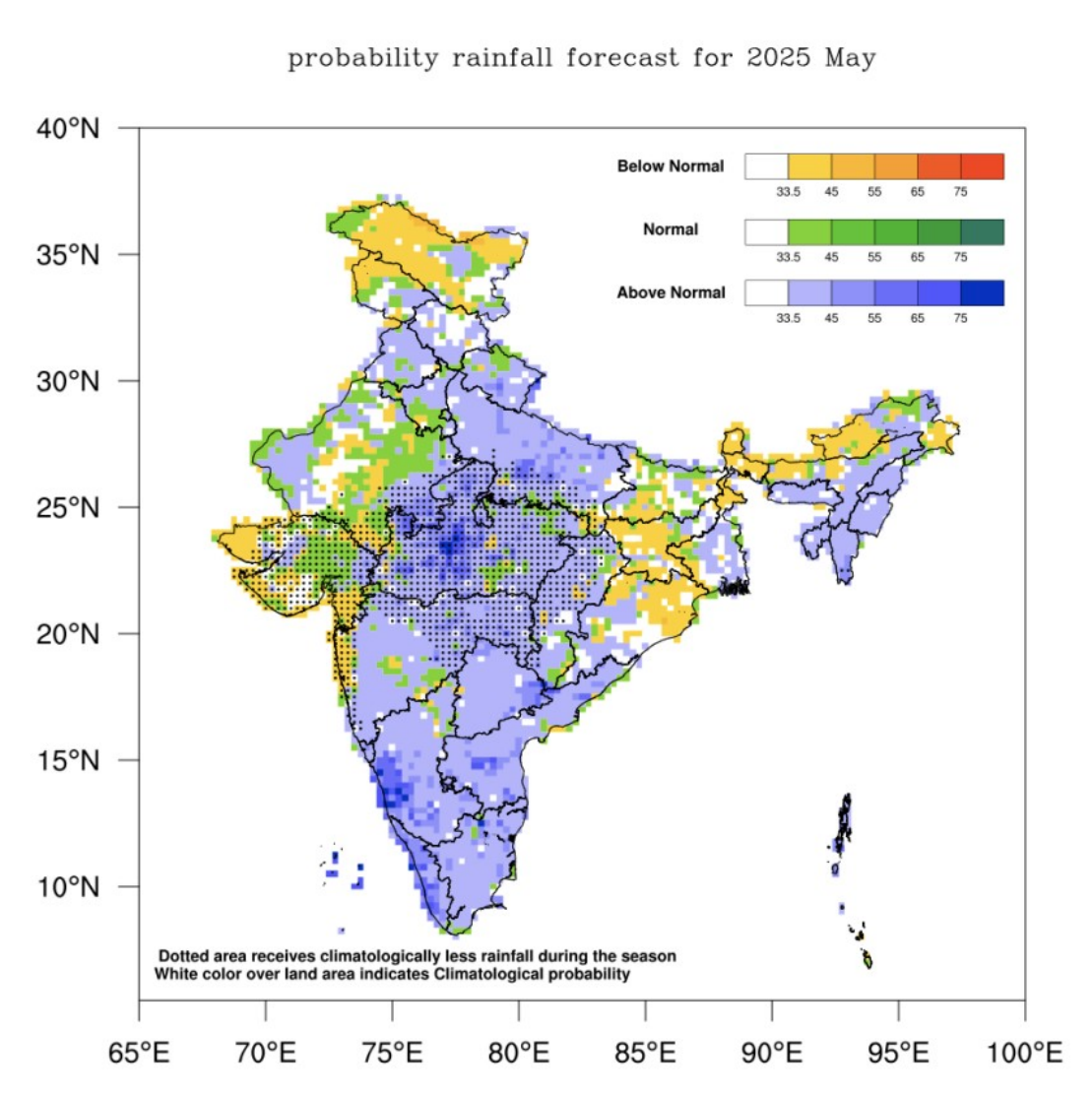
Forecasting on Different Scales



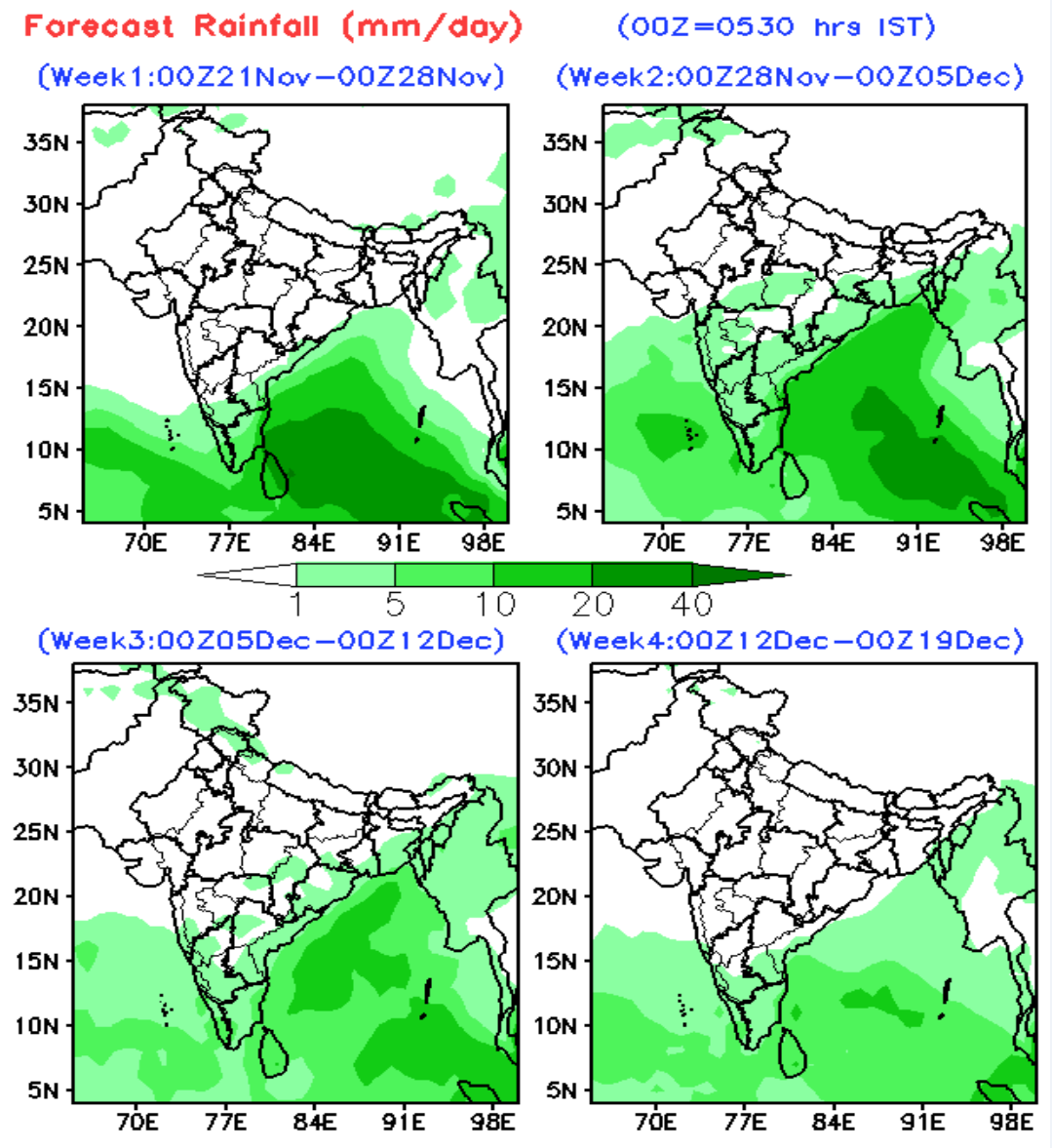
IMD uses a combination of global and regional models with spatial resolutions as fine as 12 km, supported by dense observational networks, satellites, and radar systems.

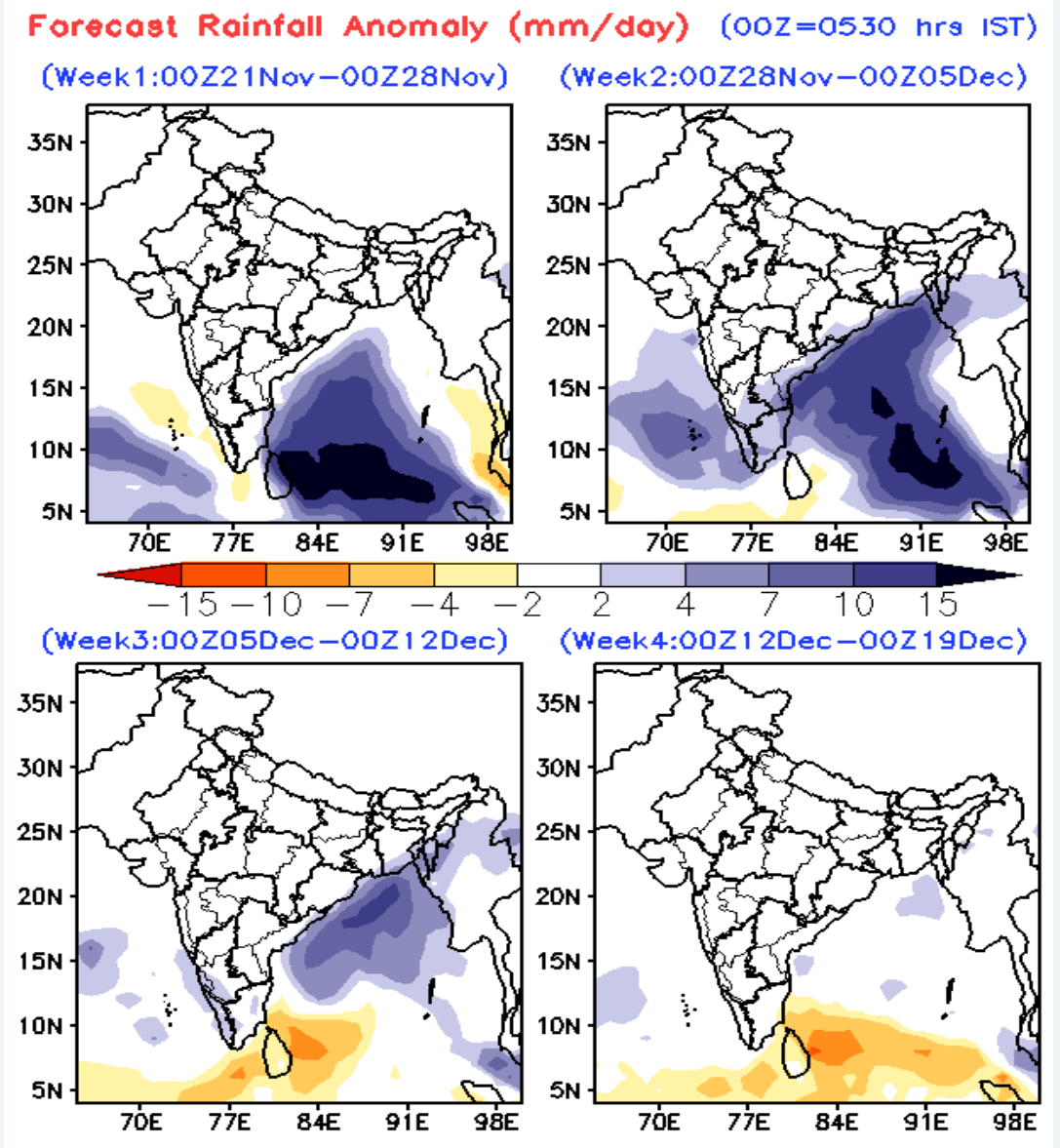
Seasonal and Monthly Forecast





Extended Range Forecast (10-30 days)





Operational ENSO and IOD Forecast (Issued every month)

RCC Pune Forecast

ENSO Forecast

Earth System Science Organization (ESSO)
Ministry of Earth Sciences (MoES)
India Meteorological Department (IMD)

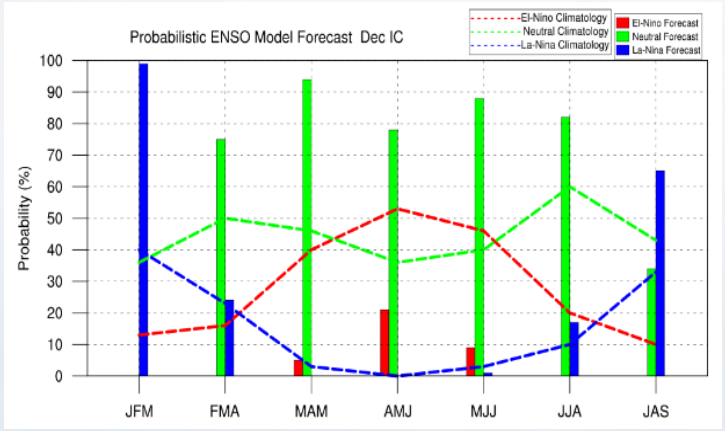
El Niño Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) Bulletin

January 2025

Highlights

Over the equatorial Pacific Ocean, weak La Niña conditions are present and are expected to persist through the first quarter of 2025 (January to March). After that, a transition to ENSO-neutral conditions is likely.

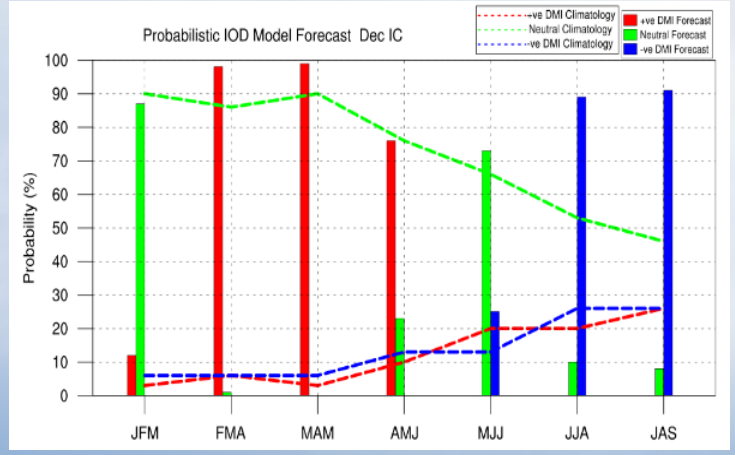
Near-average sea surface temperatures (SSTs) are currently seen across most of the Indian Ocean. Currently, neutral Indian Ocean Dipole (IOD) conditions are observed over the Indian Ocean. The latest MMCFS forecast indicates that the neutral IOD conditions are likely to continue for the next JFM season.



IMD Headquarters
https://mausam.imd.gov.in/imd_latest/contents/enso_bulletin.php

IMD Pune
https://imdpune.gov.in/cmpg/Product/Enso.php

IOD Forecast



RCC Pune
https://rcc.imdpune.gov.in/products/Enso.php

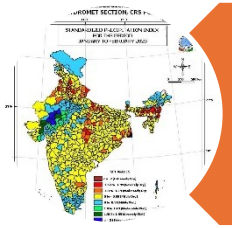
SECTORAL ADVISORIES AND APPLICATIONS

Climate Application

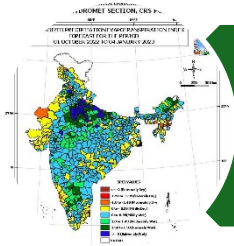
Group Structure- Climate Applications & User Interfaces (CAUI)

1. Hydro Meteorology Section
2. Drought Research Unit
3. Climate Publication Section
4. Sectorial Application of Climate Information Unit(Health, Energy & other Sectors)

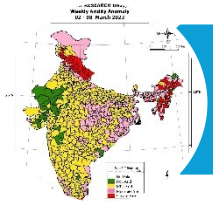
Current Operational Products



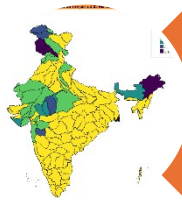
STANDARDIZED PRECIPITATION INDEX (SPI)



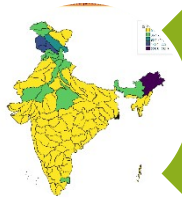
STANDARDIZED PRECIPITATION EVAPOTRANSPIRATION INDEX (SPEI)



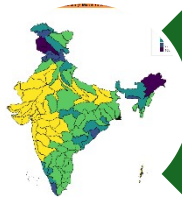
ARIDITY ANOMALY INDEX (AAI)



River Basin Rainfall Realised

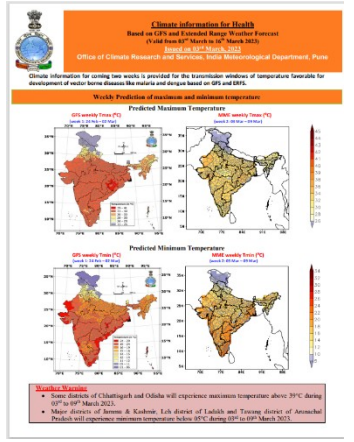


River Basin Actual Volume of Water



River basin forecast for rainfall using ERF

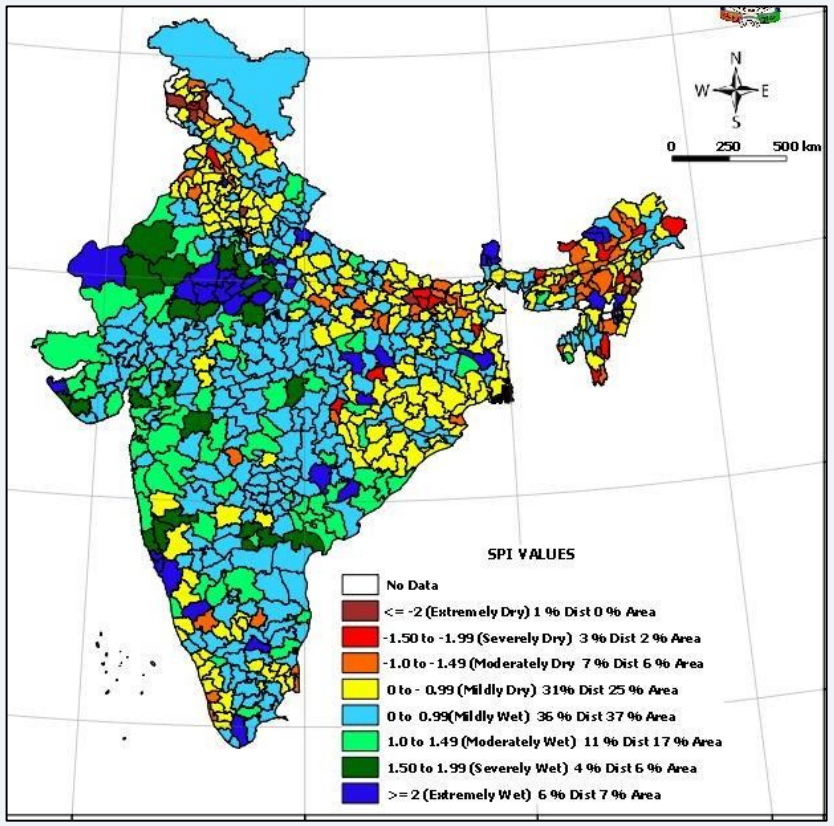
Weekly Health Bulletin



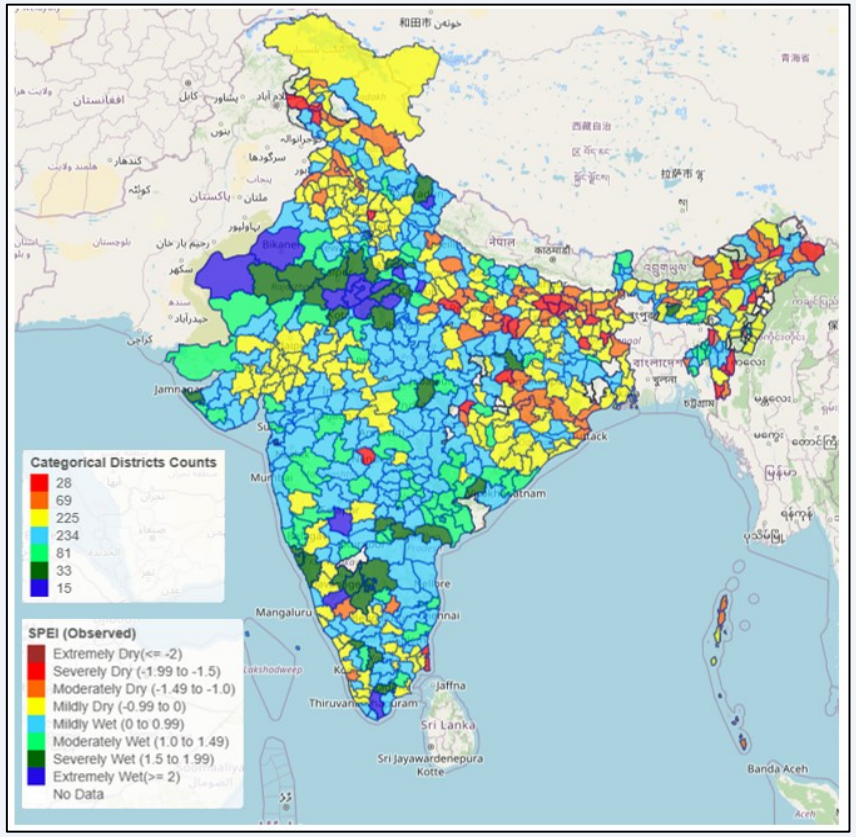
Agriculture Sector

Drought Monitoring Monsoon 2024

SPI

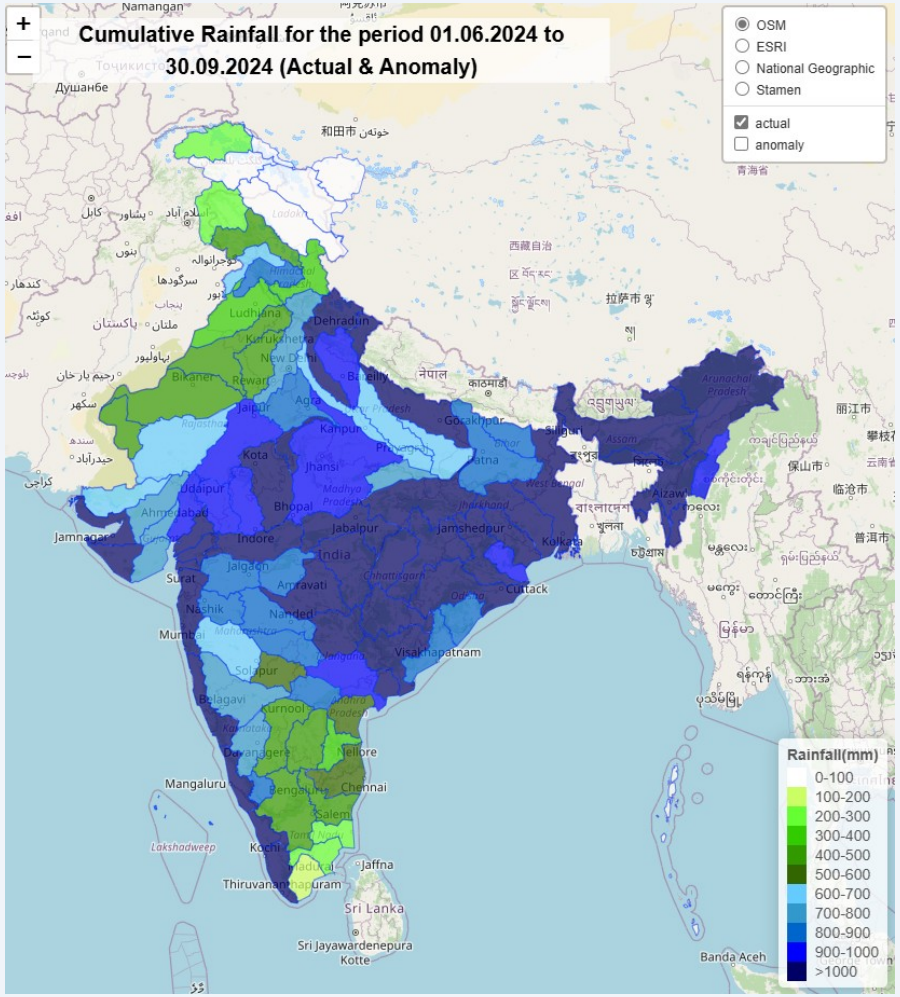


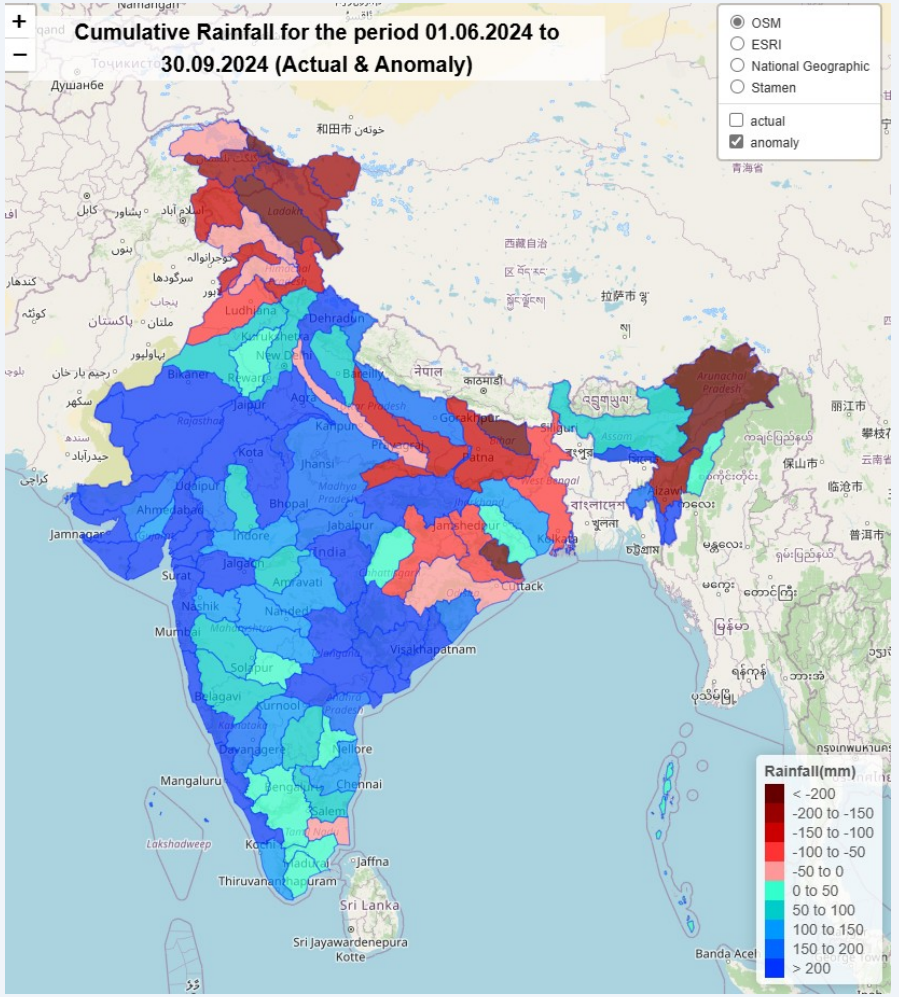
SPEI



SPI (Standardized Precipitation Index) and SPEI (Standardized Precipitation Evapotranspiration Index) are drought indices used to assess water stress and drought severity. SPI uses only precipitation data, while SPEI incorporates both precipitation and potential evapotranspiration (PET), making SPEI more sensitive to the impact of temperature and warming on drought.

Water Sector





River basin/catchment area rainfall products help predict floods, manage water better, plan agriculture, monitor droughts, and understand climate patterns — saving lives, crops, and resources.

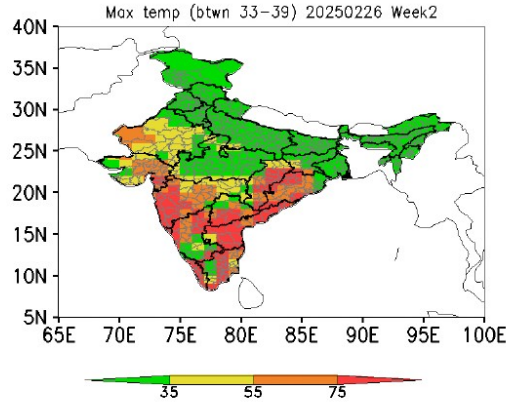
Health Sector

- Based on the Extended Range Forecast, the Health Bulletin (Climate Information for Health) is issued every Friday for the coming two weeks.

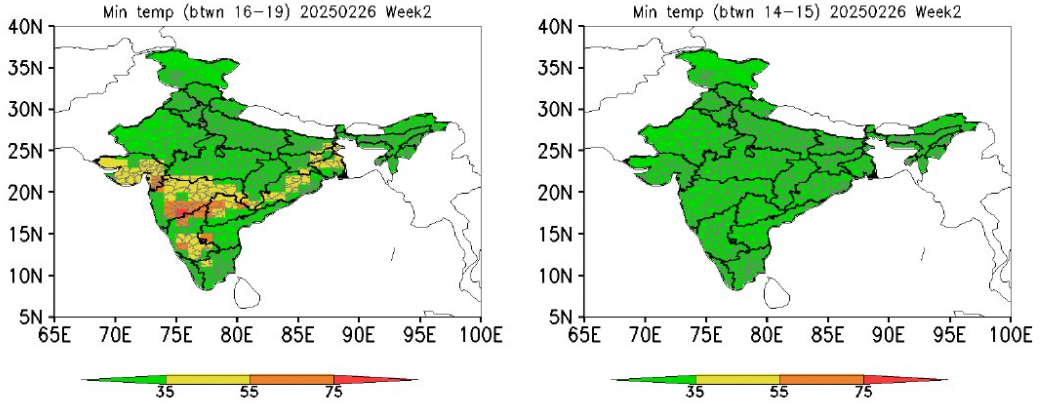
- Transmission windows of temperature are favourable for the development of vector-borne diseases like malaria and dengue are provided based on GFS and ERFS.

Weekly probabilistic outlook for prevalence of transmission window for Malaria

Predicted probabilistic Maximum Temperature map



Predicted probabilistic Minimum Temperature map



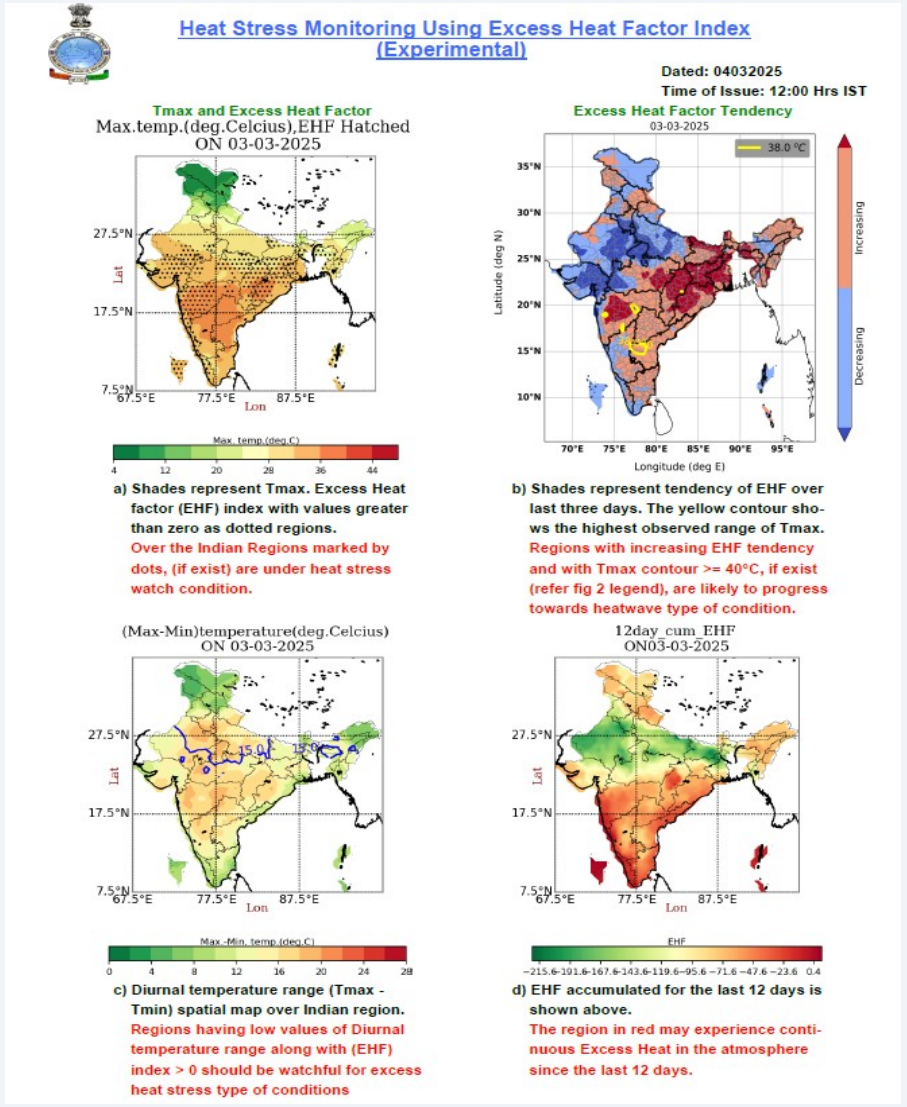
Malaria (Plasmodium falciparum)

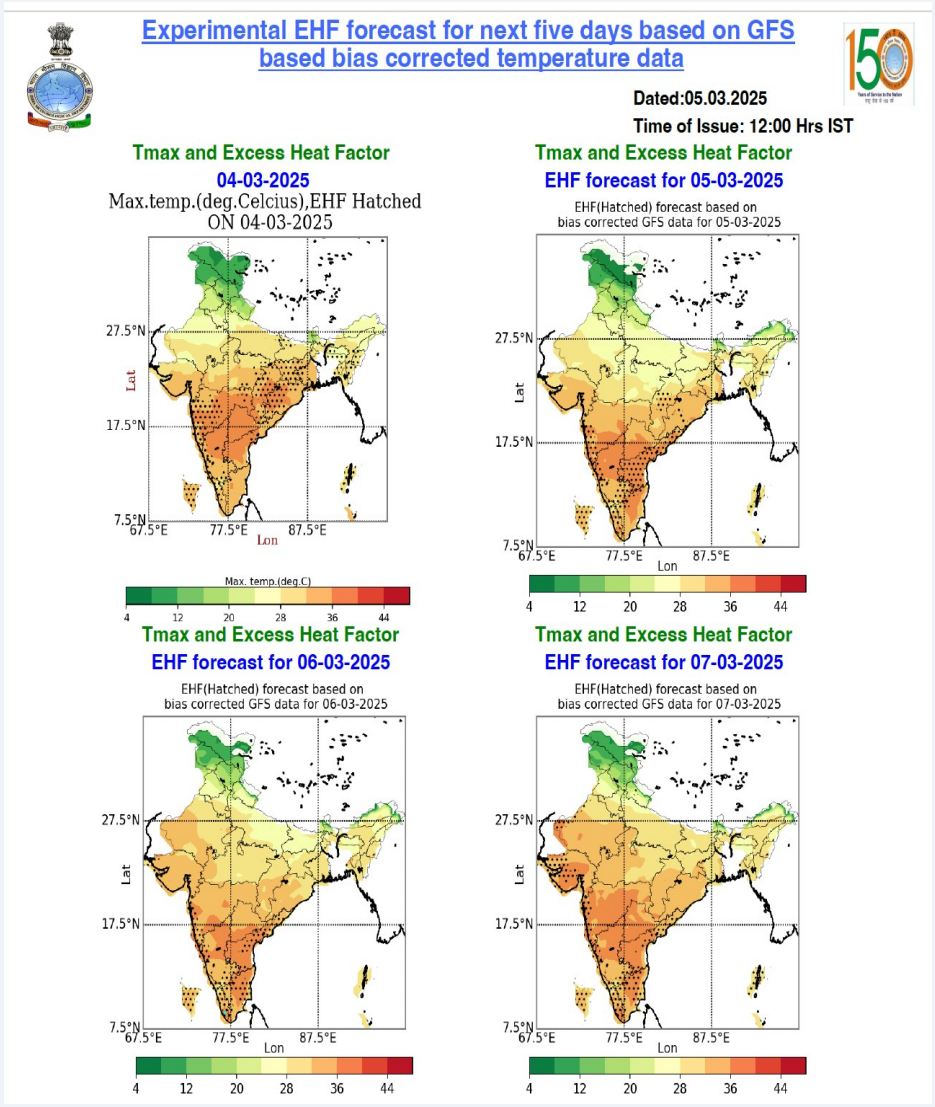
Probabilistic weekly evolution of transmission window for Malaria (*Plasmodium falciparum*).			
Second week (07th Mar to 13th Mar 2025):			
1	**75** probability level		Goa, major districts of Andhra Pradesh, Kerala, some districts of Gujarat, Maharashtra, Karnataka, Telangana, Chhattisgarh, Odisha, Tamil Nadu and few districts of Jharkhand.
2	**55-75** probability level		Major districts of Gujarat, Odisha, some districts of Rajasthan, Maharashtra, Chhattisgarh, Telangana, Karnataka, Tamil Nadu, few districts of Madhya Pradesh, Jharkhand and Andhra Pradesh.
3	**35-55** probability level		Major districts of Rajasthan, Gujarat, Maharashtra, West Bengal, some districts of Madhya Pradesh, Bihar, Jharkhand, Odisha, Chhattisgarh, Telangana, Karnataka, Tamil Nadu, few districts of Uttar Pradesh, Andhra Pradesh and Kerala.
4	**Less than 35** probability level		Major districts in rest of states.

Malaria (Plasmodium vivax)

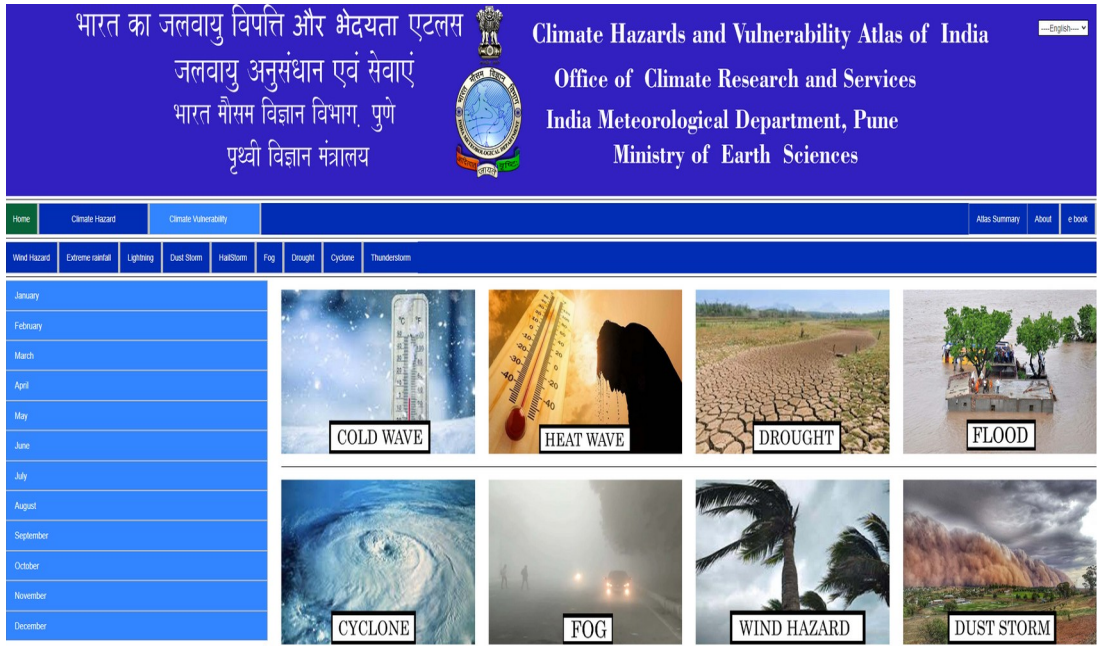
Probabilistic weekly evolution of transmission window for Malaria (*Plasmodium vivax*)			
Second week (07th Mar to 13th Mar 2025):			
1	**75** probability level		Goa, major districts of Andhra Pradesh, Kerala, some districts of Gujarat, Maharashtra, Karnataka, Telangana, Chhattisgarh, Odisha, Tamil Nadu and few districts of Jharkhand.
2	**55-75** probability level		Major districts of Gujarat, Odisha, some districts of Rajasthan, Maharashtra, Chhattisgarh, Telangana, Karnataka, Tamil Nadu, few districts of Madhya Pradesh, Jharkhand and Andhra Pradesh.
3	**35-55** probability level		Major districts of Rajasthan, some districts of Gujarat, Madhya Pradesh, Maharashtra, Chhattisgarh, Karnataka, Tamil Nadu, few districts of Uttar Pradesh, Jharkhand, Telangana, Andhra Pradesh and Kerala.
4	**Less than 35** probability level		Major districts in rest of states.

Heat Stress Monitoring and Forecast





Disaster Risk Reduction Sector



- ❑ **The Climate Hazard & Vulnerability Atlas of India has been prepared for the thirteen most hazardous meteorological events, which cause extensive damages, economic, human, and animal losses.**
- ❑ **The primary purpose of the Climate Vulnerability maps is for the users of disaster management sectors to identify the vulnerable districts for taking preventive and adaptive measures. The thirteen most hazardous meteorological events are as follows:**

- ✔ Drought
- ✔ Thunderstorms
- ✔ Cold wave
- ✔ Floods
- ✔ Dust storm

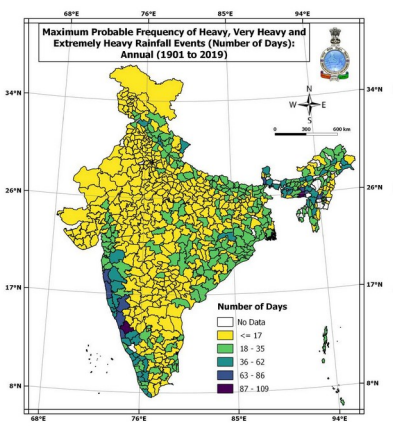
- ✔ Cyclones
- ✔ Heat wave
- ✔ Hail Storm
- ✔ Fog

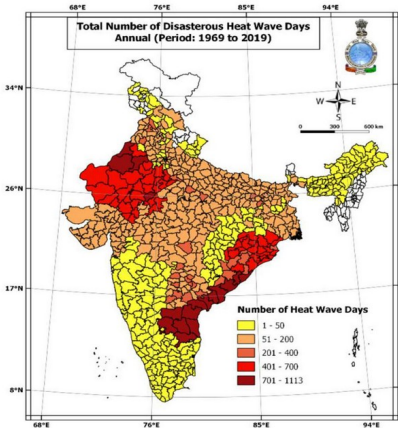
- ✔ Lightning
- ✔ Snowfall
- ✔ Wind Hazards
- ✔ Extreme Rainfall

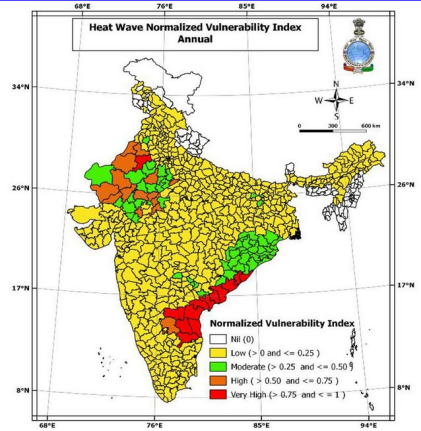
The Hazard and Vulnerability Atlas provides districts maps on Hazard events and vulnerability for all the calendar months and at annual scale.

https://imdpune.gov.in/hazardatlas/index.html

Extreme Rainfall maximum probable frequency	Heatwave days and Normalized Vulnerability Index

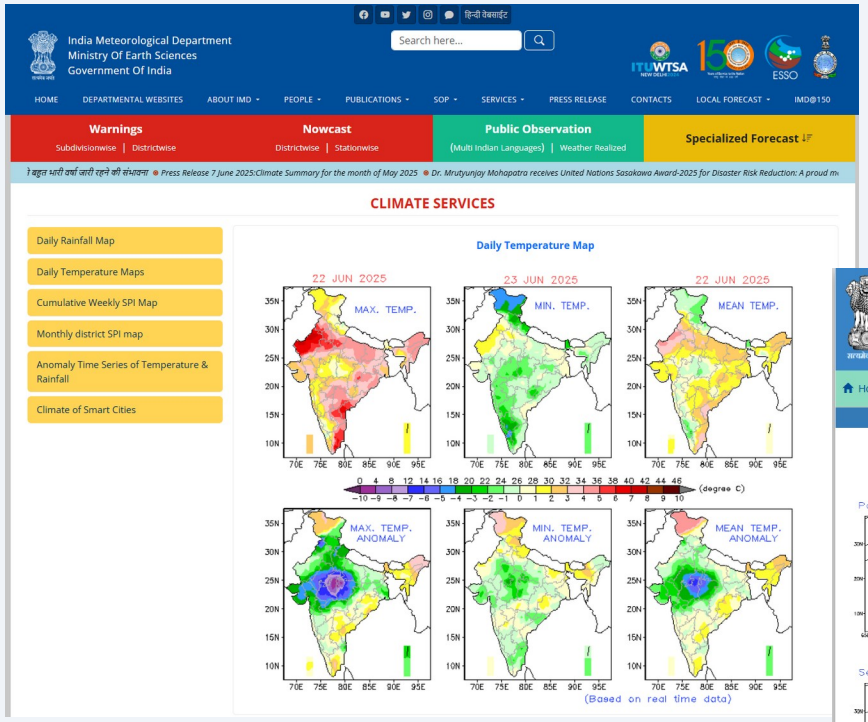




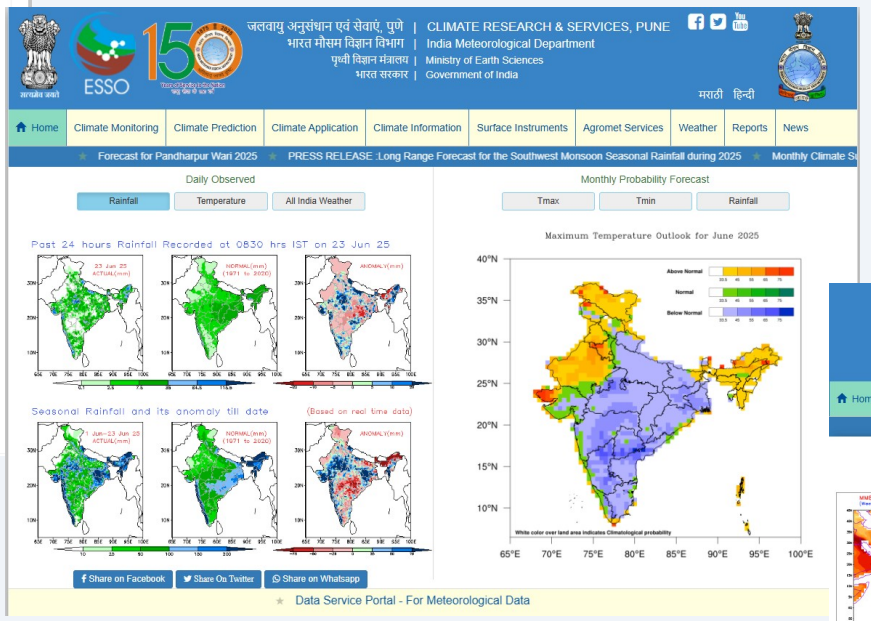


TOOLS, PLATFORMS AND DATA USE

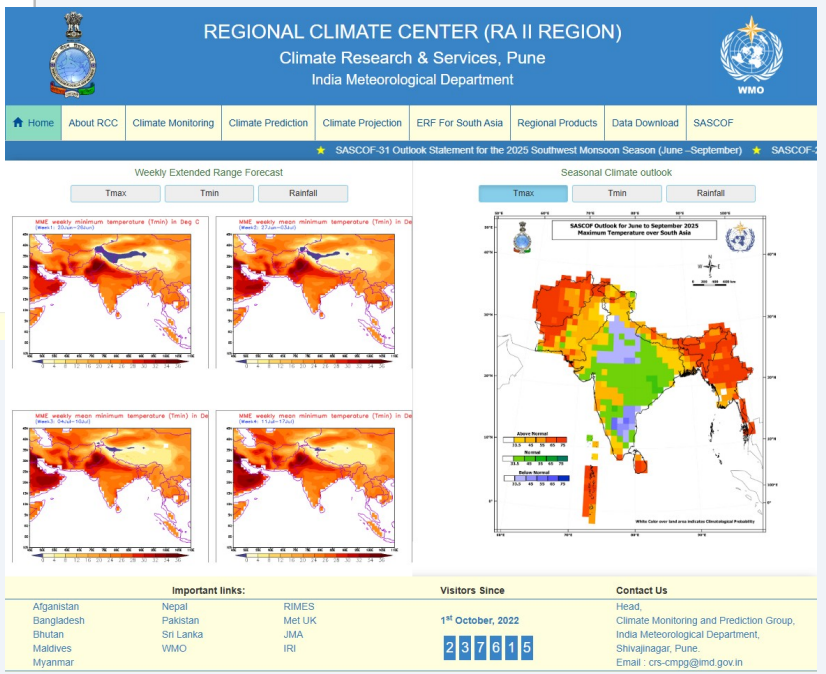
IMD HQ



CRS Pune, IMD



RCC Pune, IMD



CAPACITY AND GAPS

Towards the establishment of the NFCS in India

Ministry of Earth Sciences
Government of India

GFCS
GLOBAL FRAMEWORK FOR CLIMATE SERVICES

WMO

Stakeholder Consultation Workshop on

National Framework for Climate Services for India (NFCS–India)

5-6 October 2023

Organized & Coordinated by

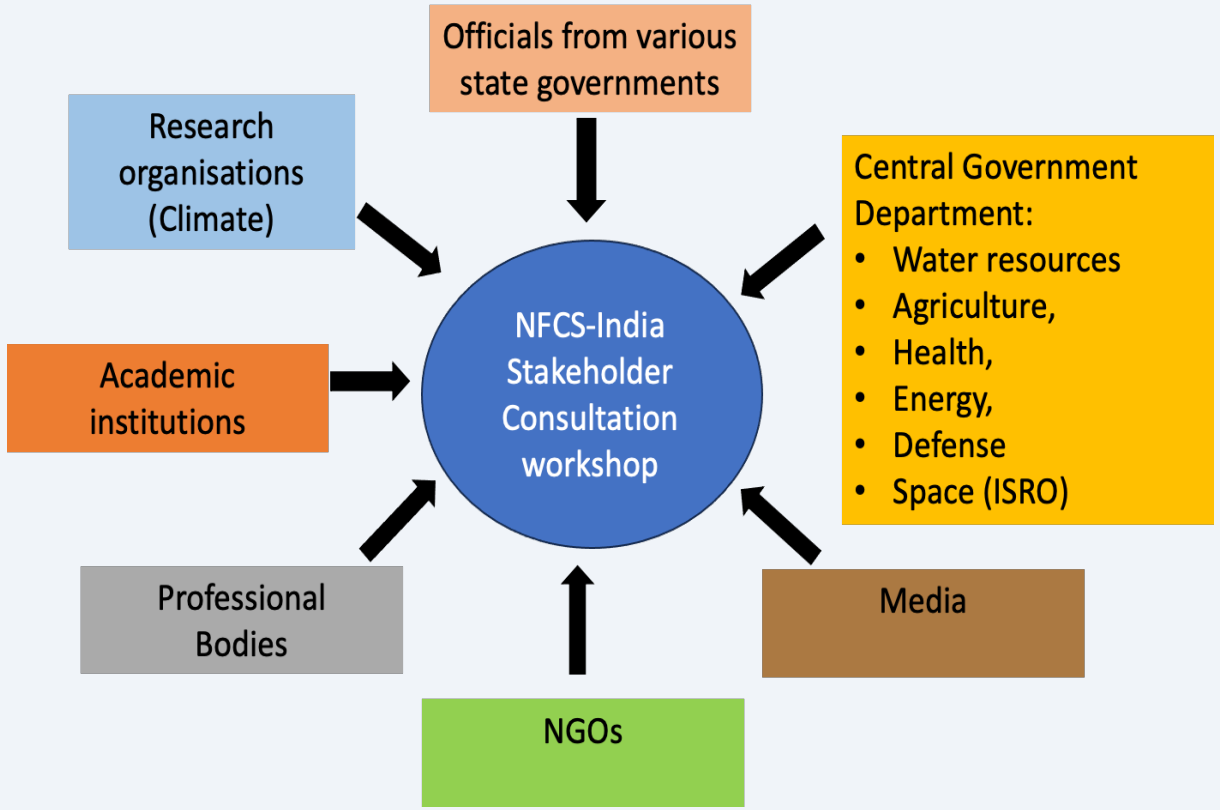
O/o Director General of Meteorology, India Meteorological Department, New Delhi & O/o Climate Research & Services, India Meteorological Department, Pune

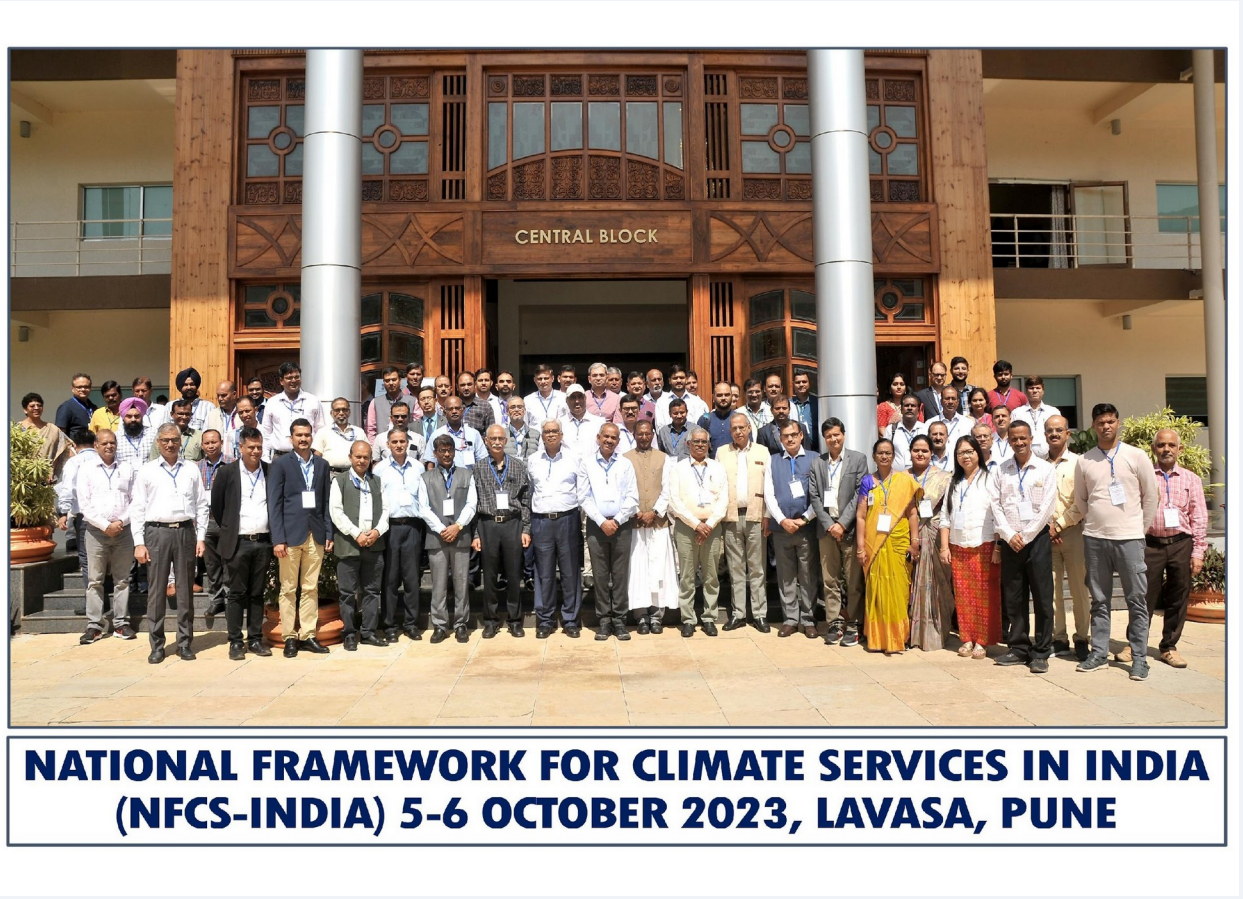
Co-hosted by

CHRIST University, Lavasa Campus, Pune

In lines with WMO's Global Framework for Climate Services (GFCS), to further strengthen the climate services among all user sectors in India, with a special focus on the five initial priority areas: (i) Disaster risk reduction, (ii) Agriculture and food security, (iii) Water resources, (iv) Public health and (v) Energy

NFCS-India Stakeholder consultation workshop





Including WMO, RIMES, and others….

"Workshop Statement" was prepared by the participants.

Guidelines for NFCS Implementation

3. Implementing an NFCS

Overview of steps 0-6

This guidance recommends a 7-step process (Figure 7), starting from the initial planning through to the launch and implementation of the NFCS, and the subsequent development and ongoing evaluation of the NFCS after launch. While it is recommended to read the steps in this order; they can be followed in any order that suits the specific context of a given country. Some steps may require iteration and revisiting of earlier steps (for instance repeating Step 2: Engage Stakeholders) to progress effectively. This chapter introduces each of the recommended steps.

Step 0: Planning Phase

- Evaluate the rationale for NFCS development with key stakeholders and seek support for next steps.

Step 1: Assess Baseline

- Assess the baseline on climate services at national level, to identify users and their needs, providers and their capacities and map existing services.

Step 2: Engage Stakeholders

- Undertake national stakeholder consultation activities to gain stakeholder perspectives and further identify gaps and key priorities for climate services.

Step 3: Develop an Action Plan

- Develop an action plan for establishing an NFCS, with defined activities, roles, timelines, budgets and evaluation methods.

Step 4: Gain Endorsement

- Gain high-level endorsement of the action plan for climate services.

Step 5: Launch NFCS

- Launch and implement the National Framework for Climate Services.

Step 6: Review and Evolve

- Conduct regular evaluation of the framework's effectiveness in addressing it's aims and objectives and evolving to incorporate emerging climate service needs.

Figure 7: Steps for implementing a National Framework for Climate Services.

NFCS-India workshop statement was recently included as a template in WMO's new guidelines

NFCS Step 2: Engage Stakeholders

A2.3. Provide written report of outcomes of national stakeholder consultation

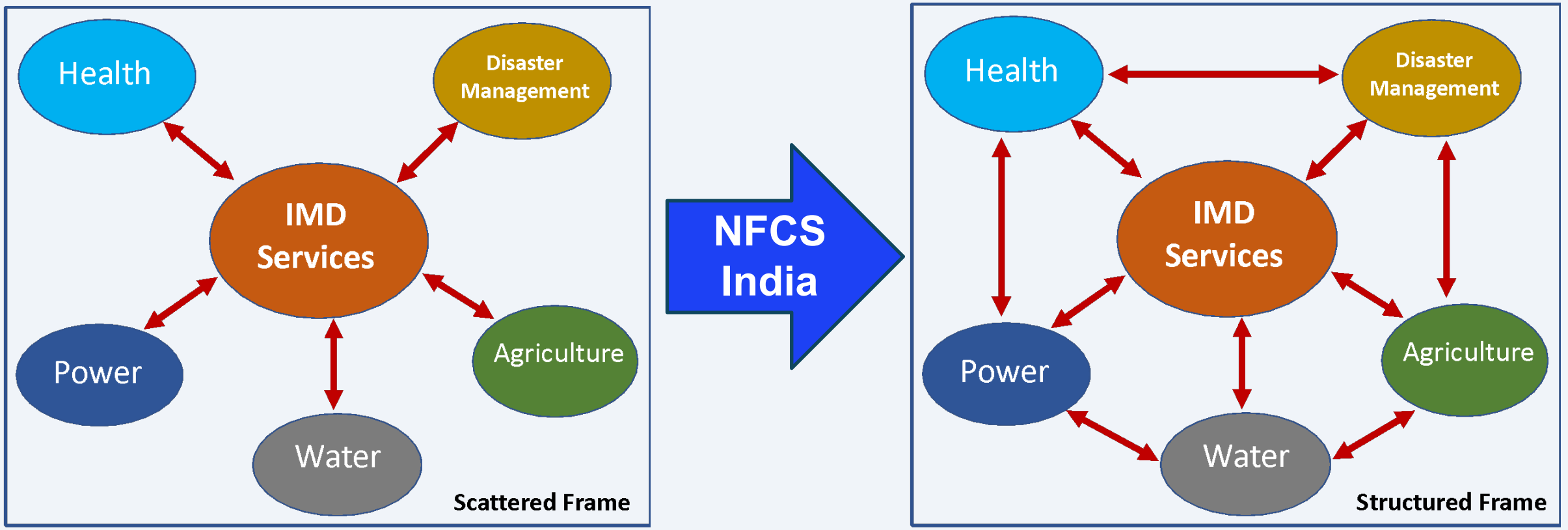
The template for a post-consultation report in Table 5 is based on a version used for the Development of a National Framework for Climate Services in India (NFCS-India) in October 2023[10][11].

Table 5: Summary consultation workshop summary template.

Section	Description
Background	This section may highlight the value of climate services and the benefits of an NFCS. This may draw on the Summary for Stakeholders in the NFCS guidelines. Climate-sensitive sectors in the country may be introduced.
Overview of workshop participants	This section introduces the range of representatives in attendance at the workshop, including different sectors and organisation types.
Summary of workshop agenda	This may include brief details of the presentations, interactive activities and discussion sessions included within the agenda.
Priorities agreed by participants during the workshop	This may include highlighting key gaps and respective priority actions that participants have identified to facilitate NFCS progress.
Agreements made by participants during the workshop	This section could include top level agreements, including a commitment to work towards establishing an NFCS.
Agreed next steps towards NFCS establishment	This may include further consultation of relevant stakeholders, an outline of responsibilities for progressing the NFCS, and a need for integration with national climate change adaptation and mitigation planning, and Sustainable Development Goals.
Immediate post-workshop actions	A list of actions to complete following the workshop, with owners/responsibilities assigned.

[10] https://www.imdpune.gov.in/NFCS_India_workshop.html
[11] https://imdpune.gov.in/NFCS/proceedings.pdf

What will NFCS-India do?



- NFCS-India is expected to be helpful in terms of co-production and delivery of climate services
- NFCS-India will lead to improved coordination between service providers and user sectors

NFCS for South Asian Countries

28th South Asian Climate Outlook Forum (SASCOF-28) and Climate Services User Forum (CSUF)

29th April - 1st May 2024

Venue: Conference Hall, Sheraton Grand Bund Garden Hotel, Pune, India

Session on National Framework for Climate Services (NFCS)

A session on the National Framework for Climate Services (NFCS) was organised as part of the 28th South Asian Climate Outlook Forum (SASCOF-28) and Climate Services User Forum (CSUF) in Pune, India, during 29th April - 1st May 2024. The objectives of this session were:

(a) To raise awareness of National Frameworks for Climate Services (NFCSs) and the WMO support available through the guidelines.
(b) Enable participants to share their country's progress on an NFCS and their experience of NFCS implementation across the region.
(c) Identify common challenges/barriers to NFCS implementation.
(d) Identify how the WMO NFCS guidelines may be developed to guide how to overcome these challenges/barriers.
(e) Identify whether there is a need for regional coordination and support for NFCS development.

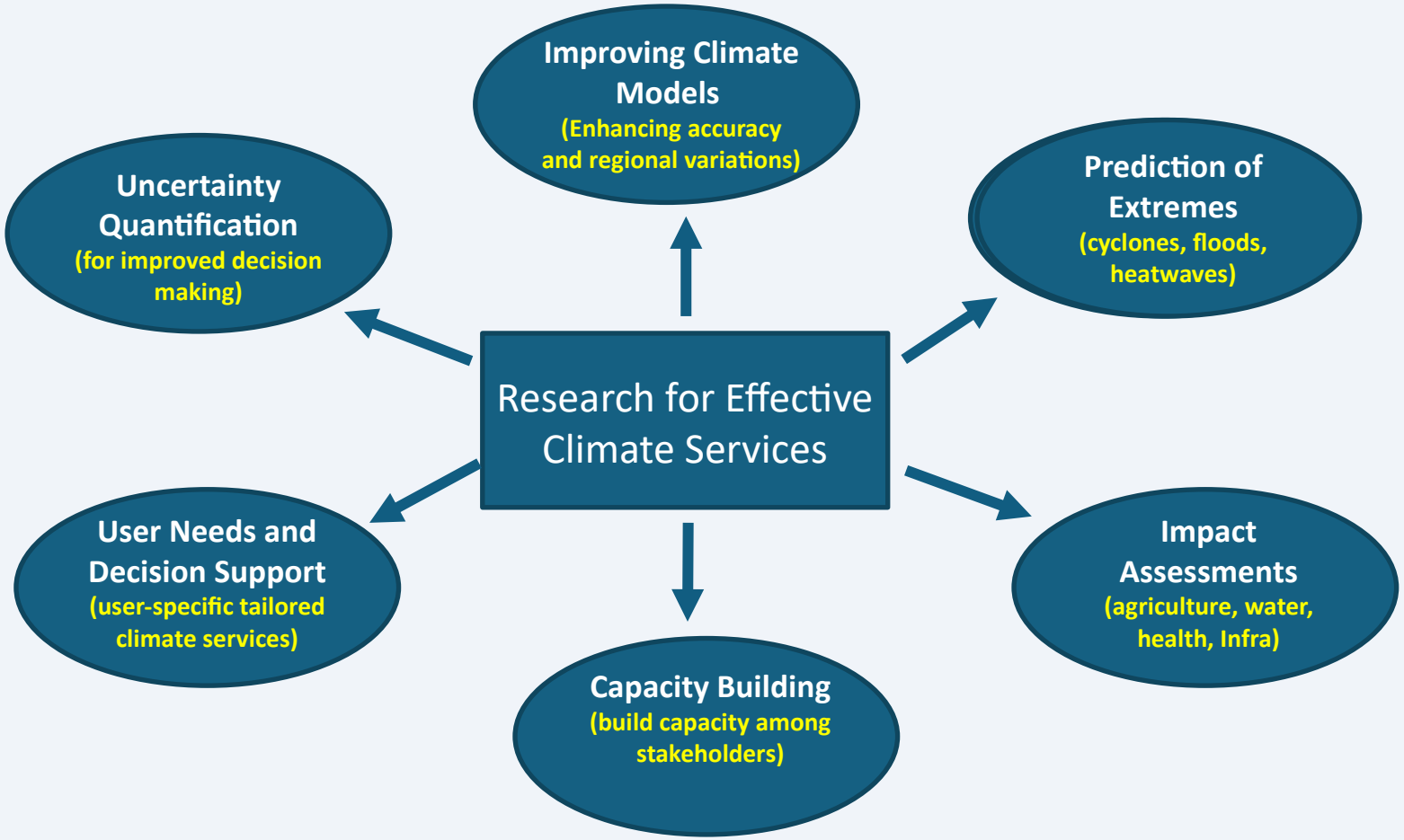
Jointly with IMD, UKMO, RIMES and participants from South Asian Countries

National and International Collaboration

- National Meteorological & Hydrological Services (NMHSs) and representatives from various sector users
- India Meteorological Department (IMD)
- Indian Institute of Tropical Meteorology (IITM).
- NCMRWF
- INCOIS
- 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).

EXPECTATIONS FOR SAHF CS WG

Research and Innovation for Effective Climate Services



Way Forward

- Foster partnerships among government bodies, academic institutions, stakeholders, and the private sector.
- Create collaborative platforms to share data, research findings, and best practices.
- Real-time data exchange for climate monitoring for the South Asia region and to set up a Data Portal collectively with South Asian countries (NMHSs)
- Analysing loss and damage data helps understanding the economic, social, and environmental costs, enabling better risk management
- Engage end-users early to tailor services to specific sectoral needs (agriculture, water, health, energy).
- Develop feedback loops and user forums to improve service delivery continuously.
- Train stakeholders in climate science, forecasting, and risk management. Conduct workshops, webinars, and educational programs to raise awareness of climate services.
- Establishing a Regional Framework for Climate Services

THANK YOU!

satyaban.ratna@imd.gov.in