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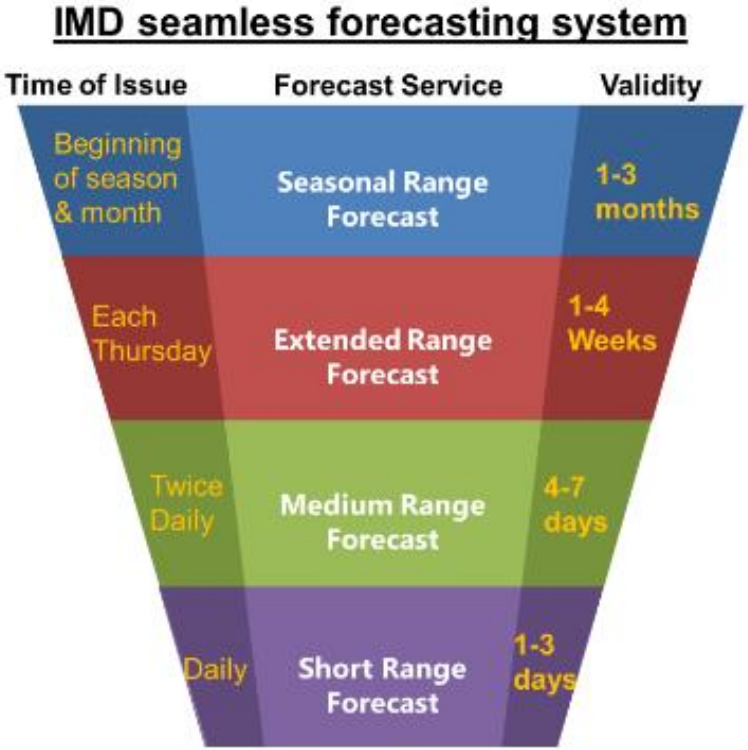
REGIONAL WORKSHOP ON IMPACT-BASED FORECASTING:

IBF OF HEATWAVE & EARLY WARNING SERVICES BY INDIA METEOROLOGICAL DEPARTMENT (IMD)

Radheshyam Sharma, Scientist-D

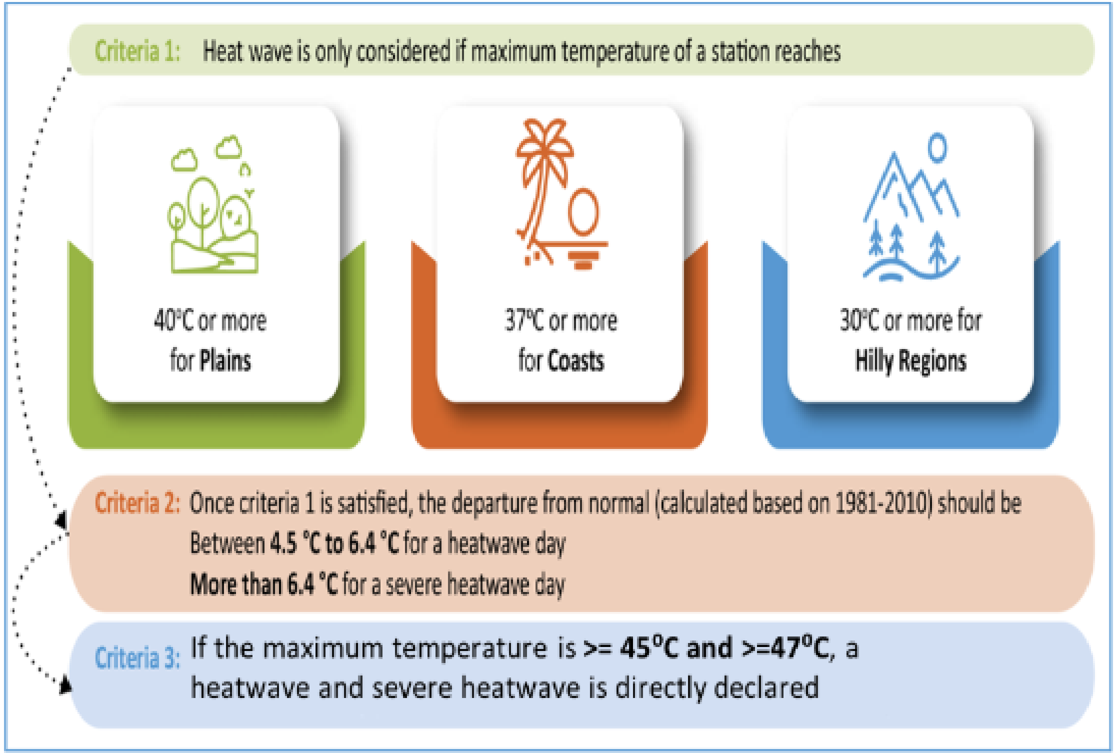
SAHF IBF Working Group Implementation Plan Project

09-13 February 2026 Kathmandu, Nepal



- **IMD monitors and provides impact-based early warning services for various meteorological disaster events at different temporal and spatial scales through NWFC (New Delhi), RMCs, and MCs by using multi-model forecasting. Key heat-related information provided:**
  - **Maximum & minimum temperature**
  - **Relative humidity and winds**
  - **Heat Index and percentile-based thresholds**
  - **Heatwave and extreme temperature warnings**
  - **District-level heat alerts**
  - **IBF for Heatwave and cold wave**

HEAT WAVE CRITERIA



WARM NIGHT

Tmax remains 40° C or more. It is defined based on departures or actual Tmin as follows:

Warm night: minimum temperature departure is 4.5° C to 6.4° C.
Very warm night: minimum temperature departure is >6.4° C.

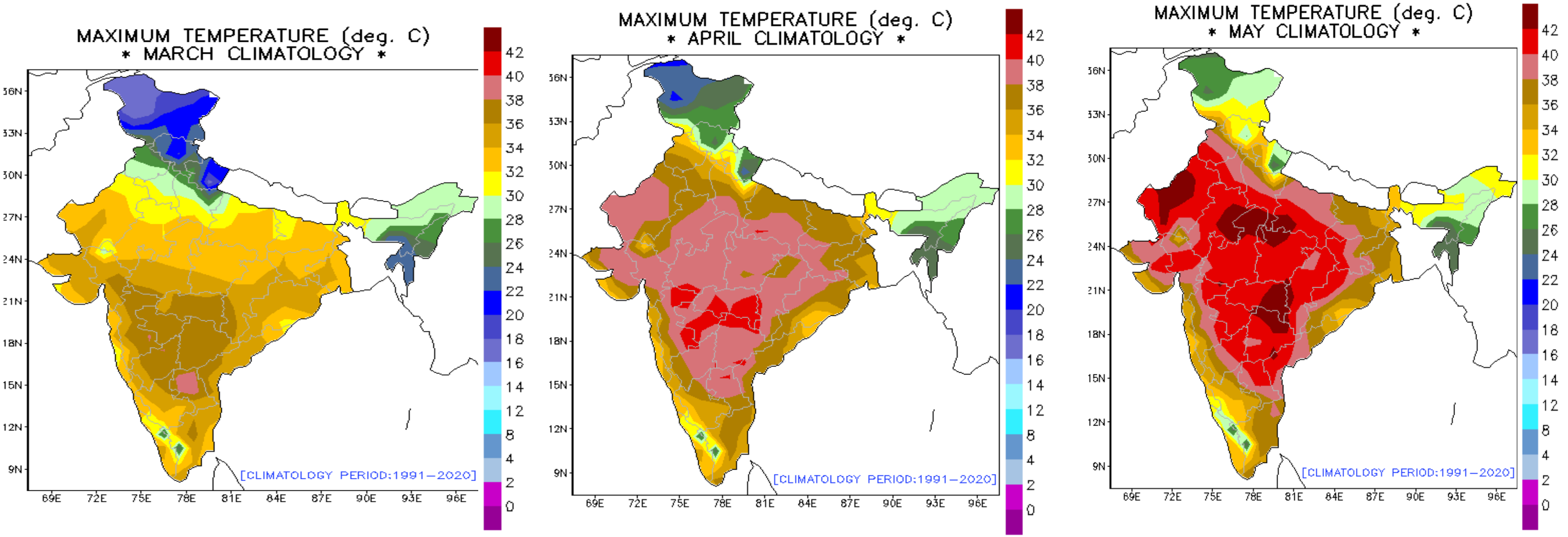
HOT AND HUMID

When Tmax remain 3° C above normal with above normal RH.

WARM DAY

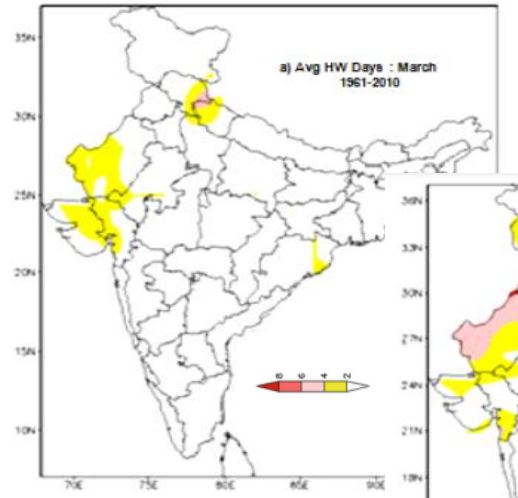
When Tmax > 90th Percentile

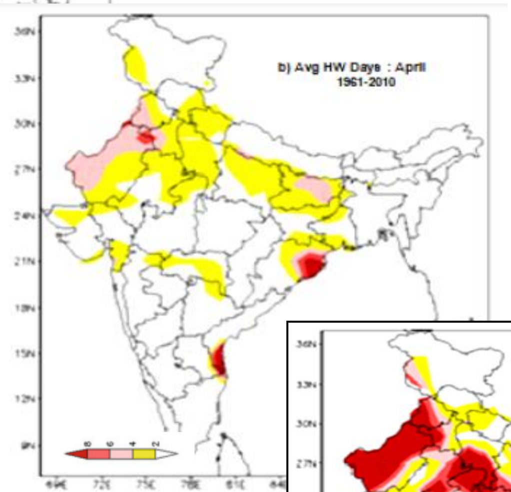
NORMAL MAXIMUM TEMPERATURE (1981-2020)

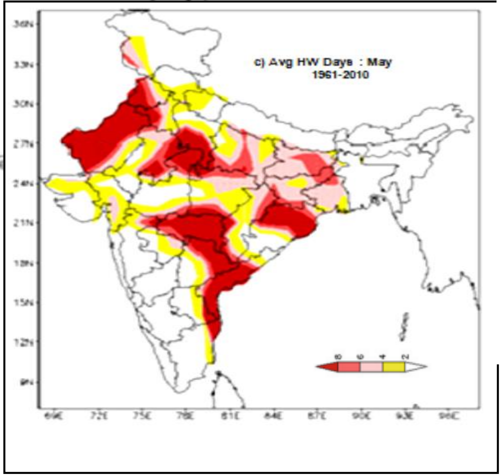


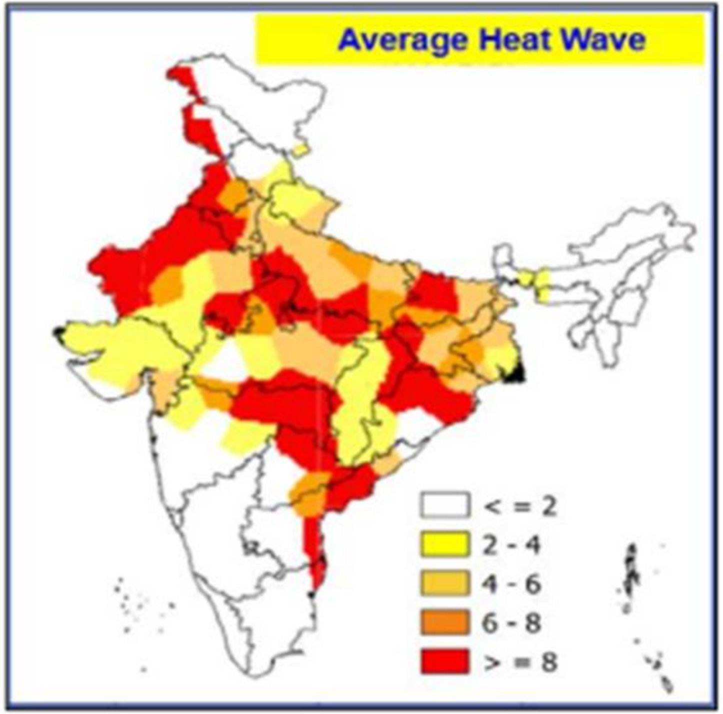
- **March: Maximum temperature is about 36-40 deg. C over north Peninsular and adjoining central India**
- **April: It is 38-42 deg. C over most parts of central and north Peninsular India**
- **May : It is 42-44 deg. C over most parts of northwest, central and north Peninsular India**

NORMAL HEAT WAVES PATTERN

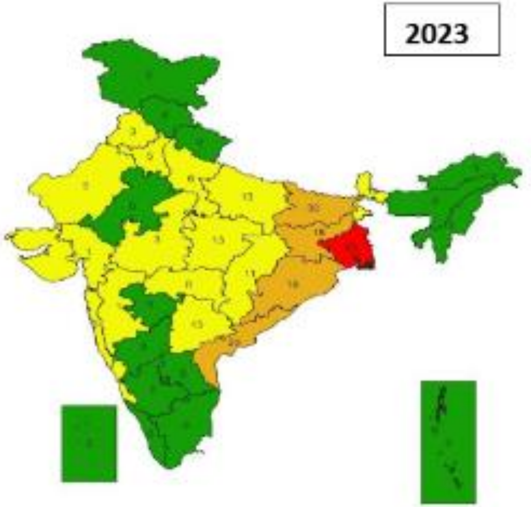


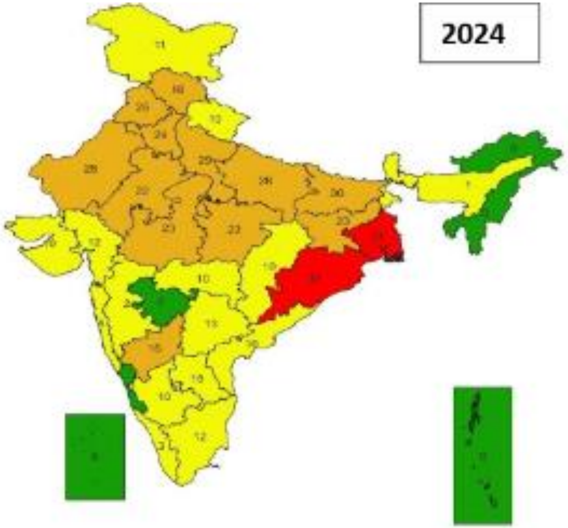


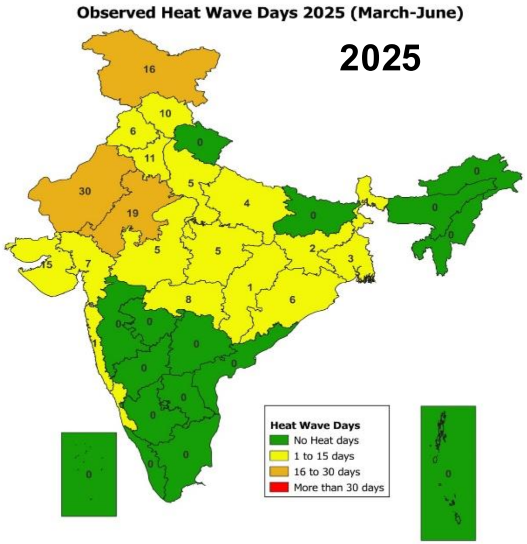




OBSERVED HEAT WAVE DAYS IN RECENT YEARS







High intraseasonal variability in heatwave occurrence is observed

FAVORABLE CONDITIONS FOR HEAT WAVE

a. Transportation / Prevalence of hot dry air over a region (There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region).

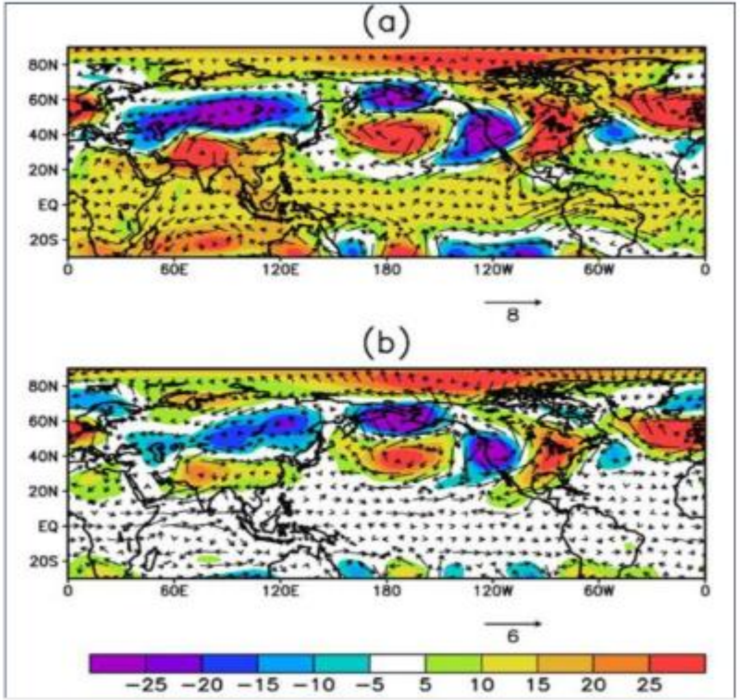
b. Absence of moisture in the upper atmosphere (As the presence of moisture restricts the temperature rise).

c. The sky should be practically cloudless (To allow maximum insulation over the region).

d. Large amplitude anti-cyclonic flow over the area.

Heat waves generally develop over Northwest India and spread gradually eastwards & southwards but not westwards (since the prevailing winds during the season are westerly to northwesterly). But on some occasions, heat wave may also develop over any region in situ under the favorable conditions.

LARGE-SCALE CIRCULATION ASSOCIATED WITH HEATWAVES



Composite anomalies of geopotential height (gpm) and vector winds at (a) 200 hPa level and (b) 500 hPa level during the major heat wave events.

- **Positive geopotential height anomalies** and strong **anticyclonic circulation** observed over northern India at 200 hPa, extending down to 500 hPa associated with HW.

- **Presence of a quasi-stationary Rossby wave pattern across the northern mid-latitudes, alternating anomalous cyclonic and anticyclonic circulations in the mid-latitude belt**

- **Blocking high-pressure systems** **over the North Atlantic and Europe, Associated anomalous low-pressure system over Central Asia, leads to suppress intrusion of cold polar air, leading to enhanced surface warming.**

- **Persistent anomalous high and anticyclonic flow over northern India coincide with dominant heatwave activity**

IMD Met. Monograph 2023

IMPACT BASED HEATWAVE FORECAST BY IMD

- Hot Weather Hazard Analysis for entire country considering different meteorological parameters like Tmax, Tmin, Wet bulb temperature, RH, wind etc.
- Hazard and Vulnerability Atlas with respect to Heat Waves for India.
- Operational Experimental Heat Index
- GIS based Heat Wave forecast and warning Services products
- GIS based Socio Economic exposure products
- Percentile based extreme temperature information

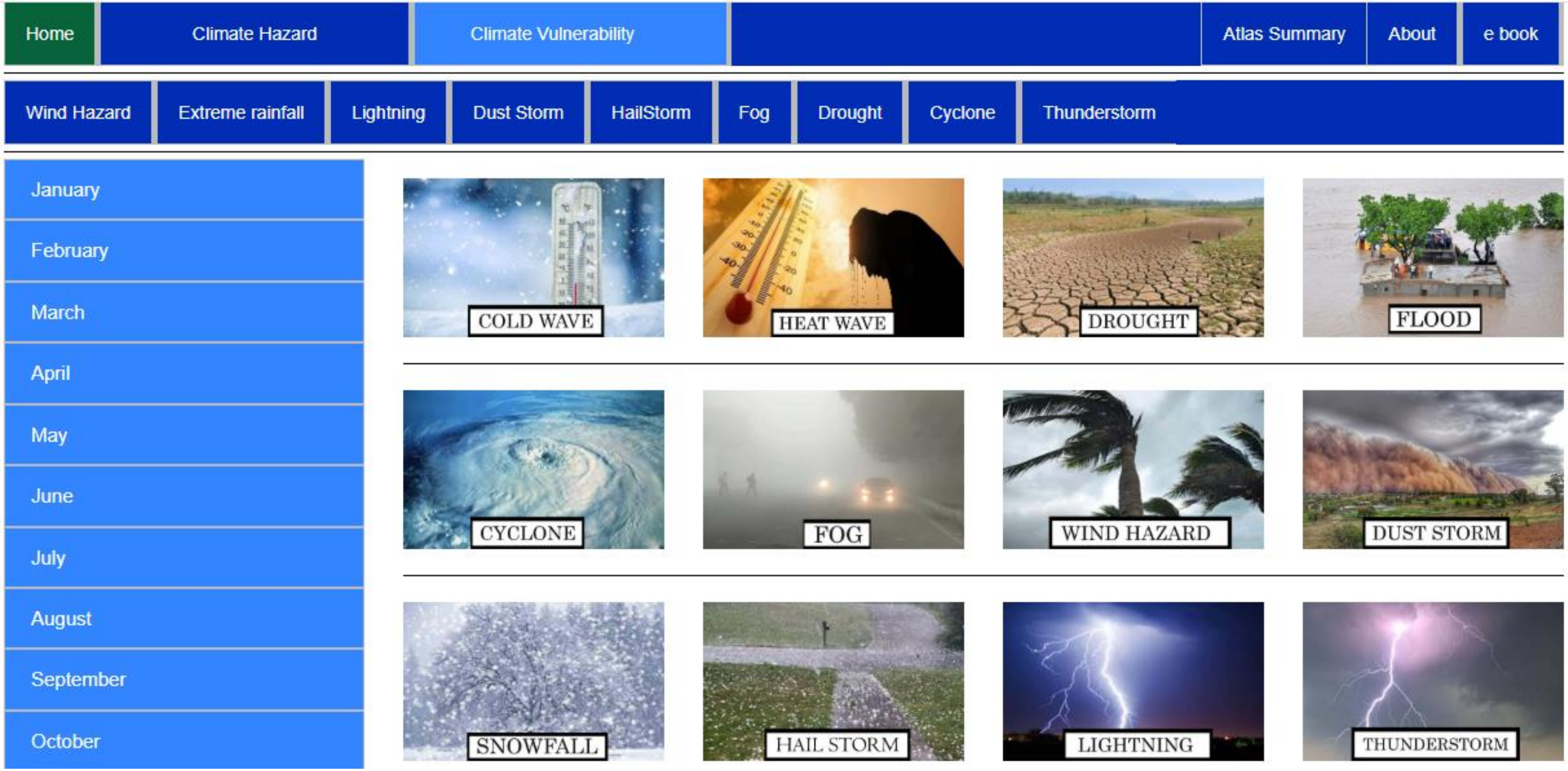
CLIMATE HAZARDS AND VULNERABILITY ATLAS

- The Hazard maps are prepared based on the Historical Meteorological data, census data on population and housing density and using different statistical and mathematical methods.

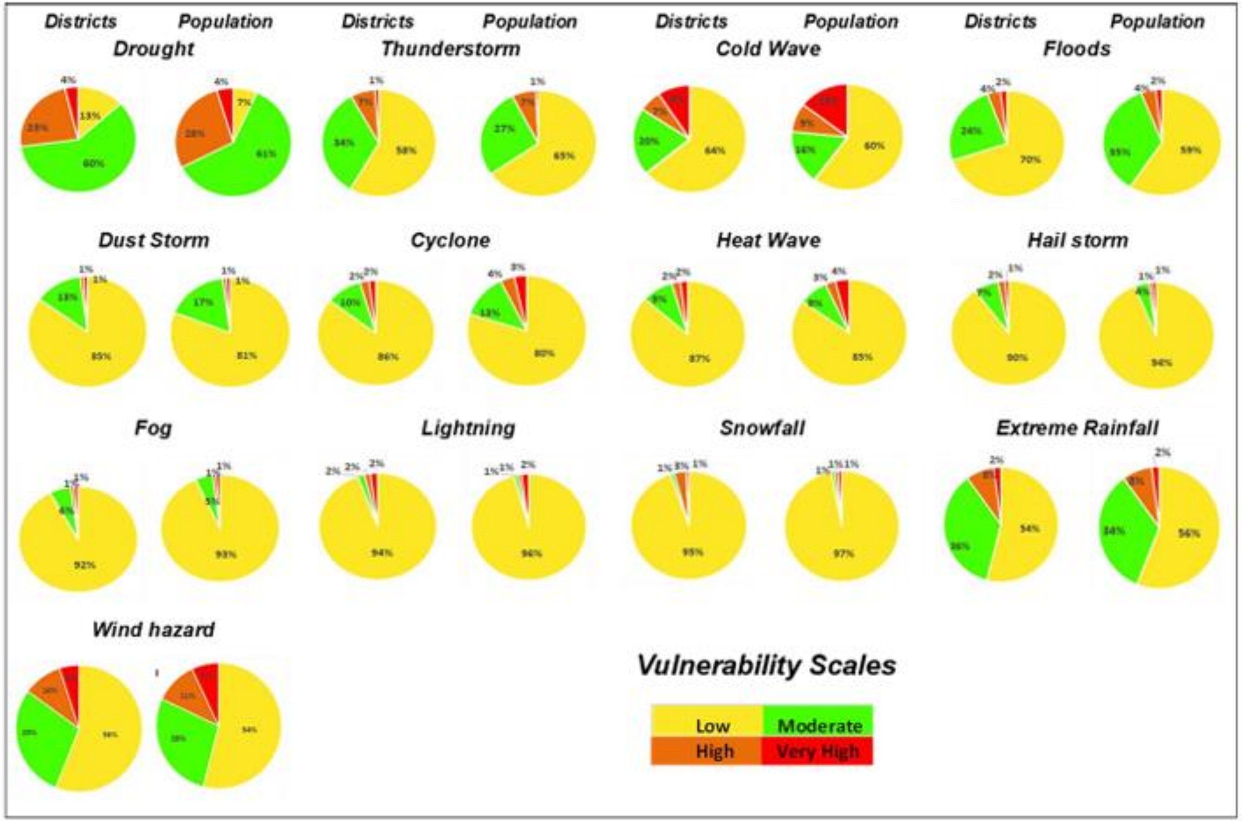
- Climate vulnerability maps are prepared based on the disaster data from the annual publication of India Meteorological Department "Annual Disastrous Weather Reports" for the climate hazardous events that cause casualties in terms of death and other losses. https://imdpune.gov.in/hazardatlas/index.html

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

HAZARD AND CLIMATE VULNERABILITY ATLAS



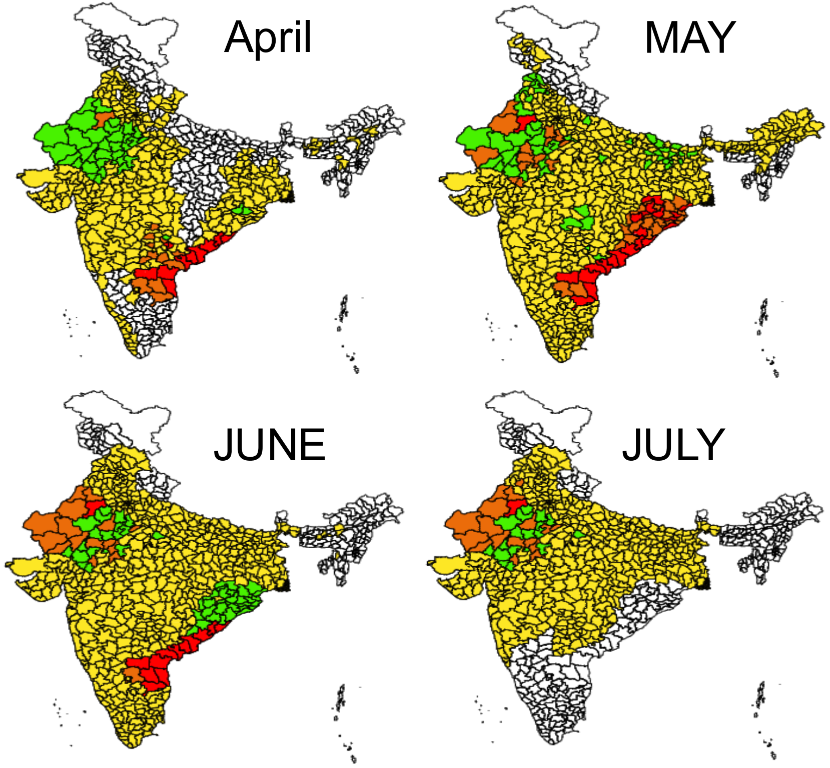
Percentage of districts and population affected by disastrous weather events in different vulnerability scales based on normalized vulnerability index



HAZARD ANALYSIS HEAT WAVE & COLD WAVE

Hazard	% of Districts (Moderate to Very Highly Vulnerable)	% of Population (Moderate to Very Highly Vulnerable)	% of Districts (Highly Vulnerable)	% of Population (Highly Vulnerable)	Most Vulnerable State(s)	No. of Vulnerable Districts
Heat Wave	13%	15%	4%	7%	Rajasthan, Andhra Pradesh	Rajasthan – 15 Andhra Pradesh – 13
Cold Wave	36%	40%	16%	24%	Uttar Pradesh	Uttar Pradesh – 75

VULNERABLE ZONES OF HEAT WAVE



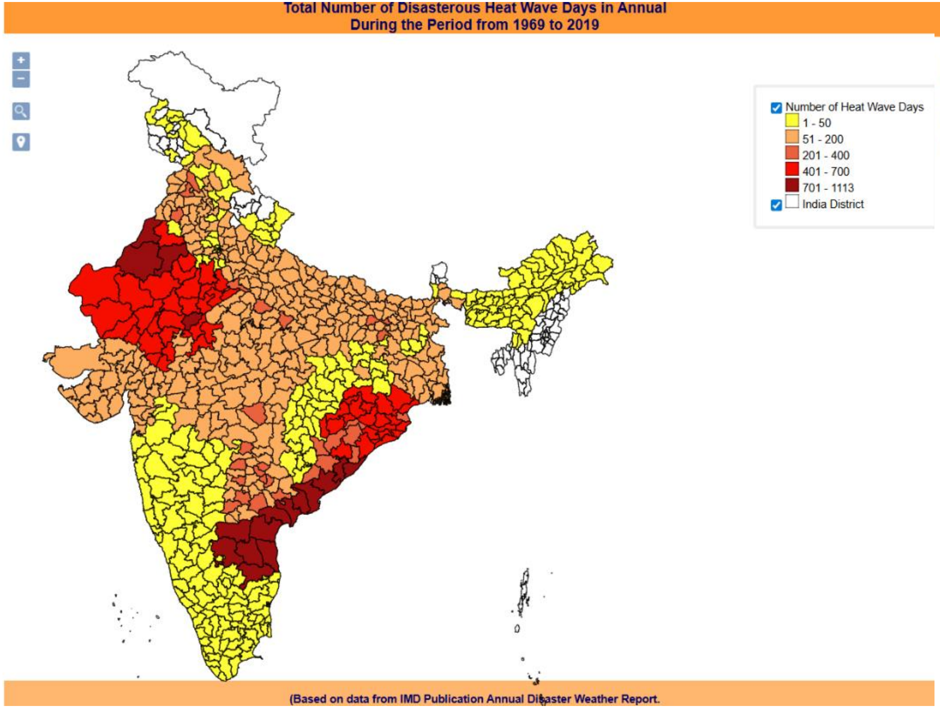
The Normalized Vulnerability Index (NVI) standardizes the disaster values to the range between 0.0 to 1.0.

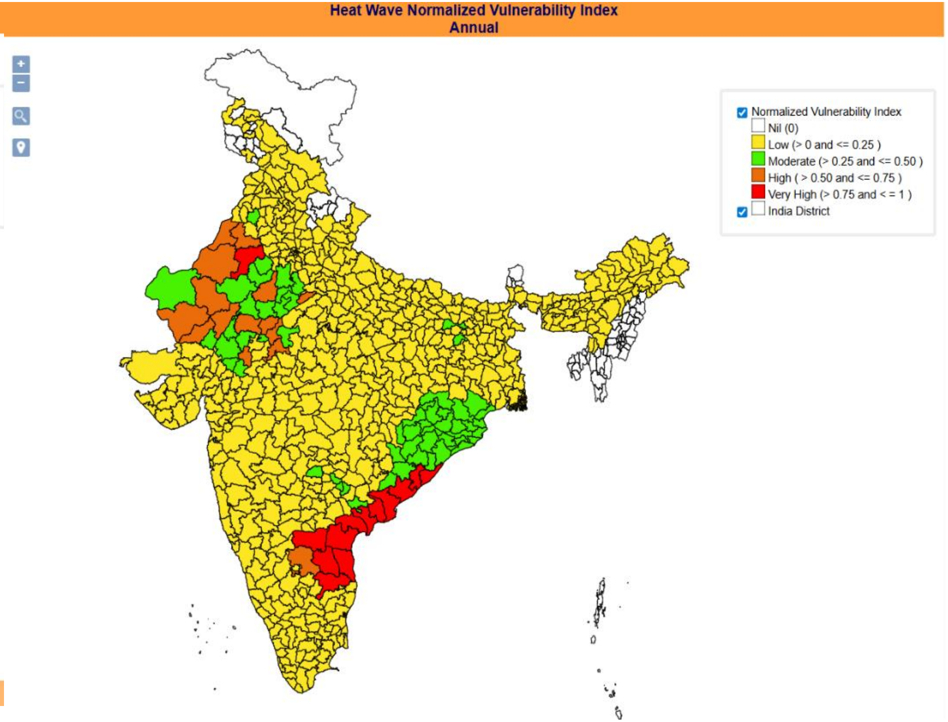
$$\text{Normalized Value} = \frac{\text{Actual Indicator Value} - \text{Minimum Indicator Value}}{\text{Maximum Indicator Value} - \text{Minimum Indicator Value}}$$

- Normalized Vulnerability Index
  - Nil (0)
  - Low (> 0 and <= 0.25)
  - Moderate (> 0.25 and <= 0.50)
  - High (> 0.50 and <= 0.75)
  - Very High (> 0.75 and < = 1)
- India District

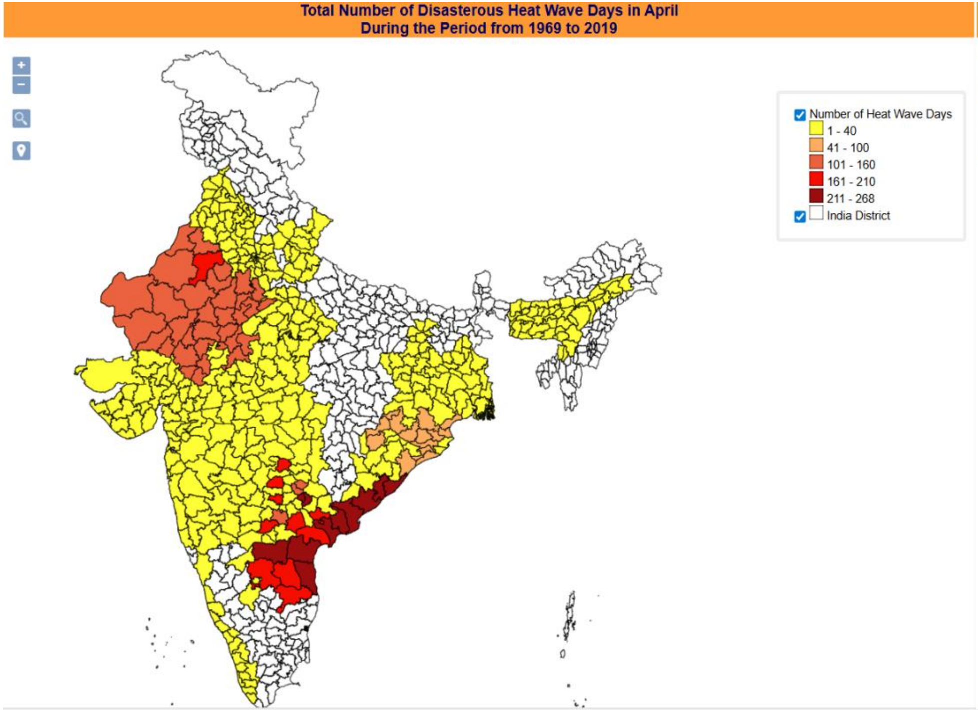
(Ref. Wu et al. 2002, Karmakar et al. 2010, Raskar-Phule and Choudhury, 2015, O'Brien et al. 2004, Leichenko, R. et al. 2004 etc.).

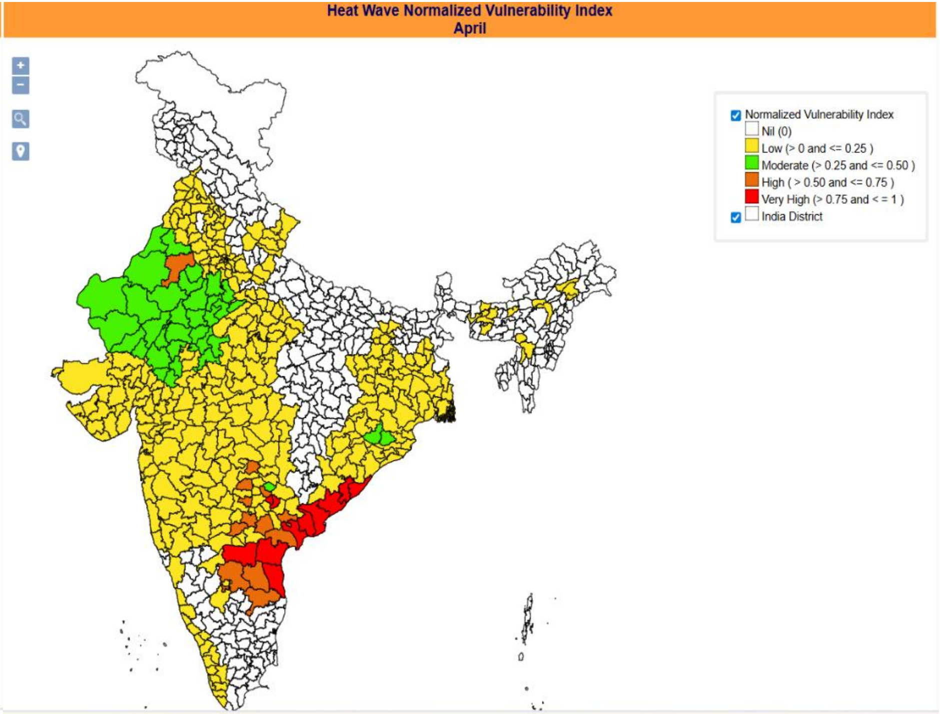
ANNUAL HEATWAVE FREQUENCY AND NORMALISED VULNERABILITY INDEX



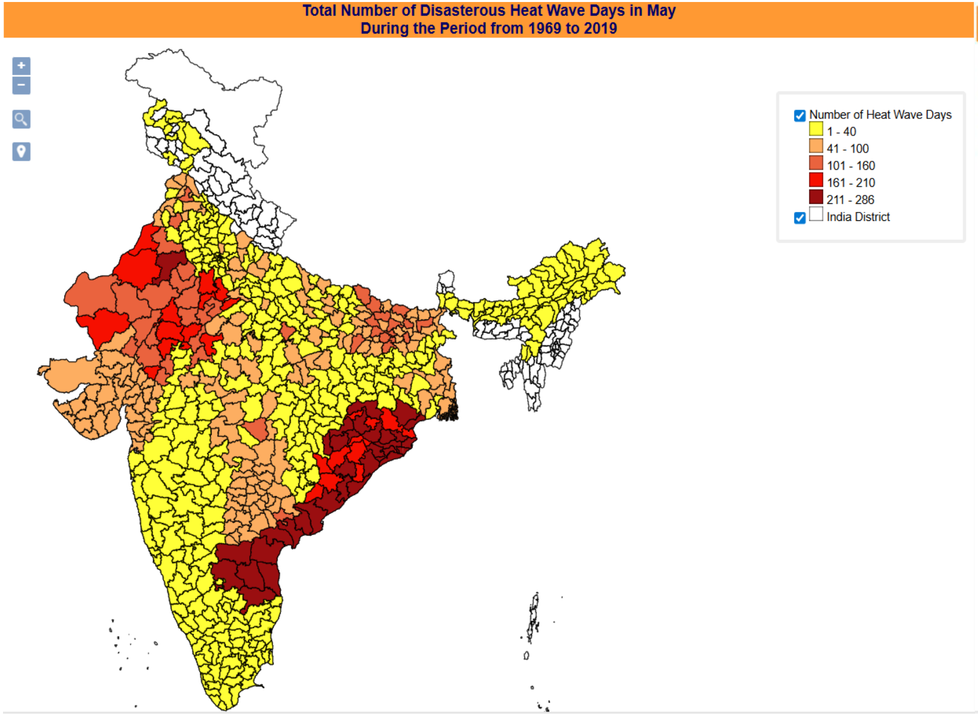


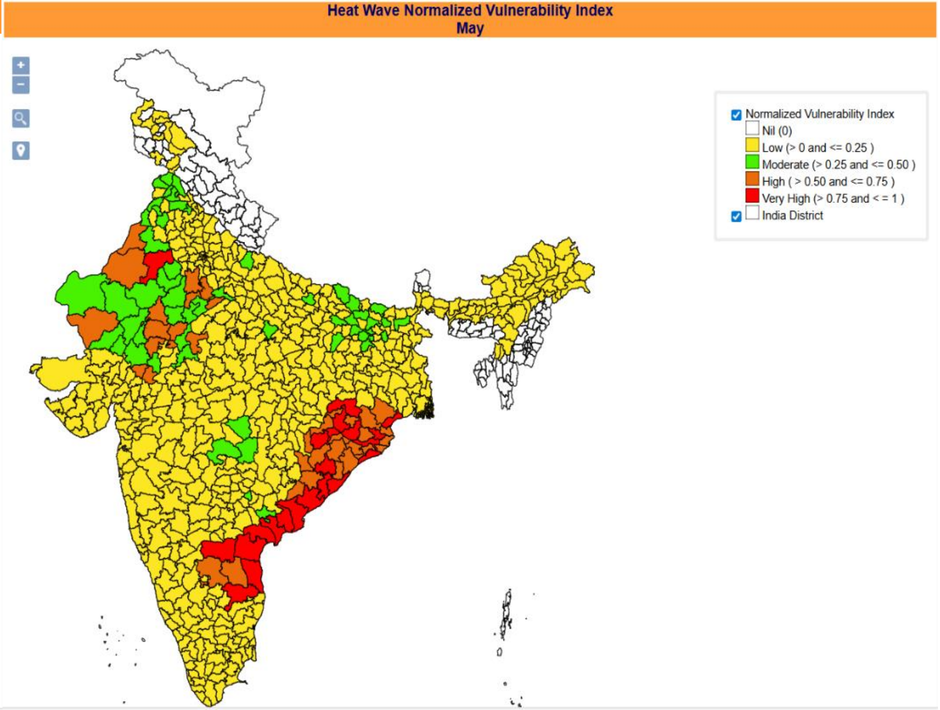
HEATWAVE FREQUENCY AND NORMALISED VULNERABILITY INDEX : APRIL



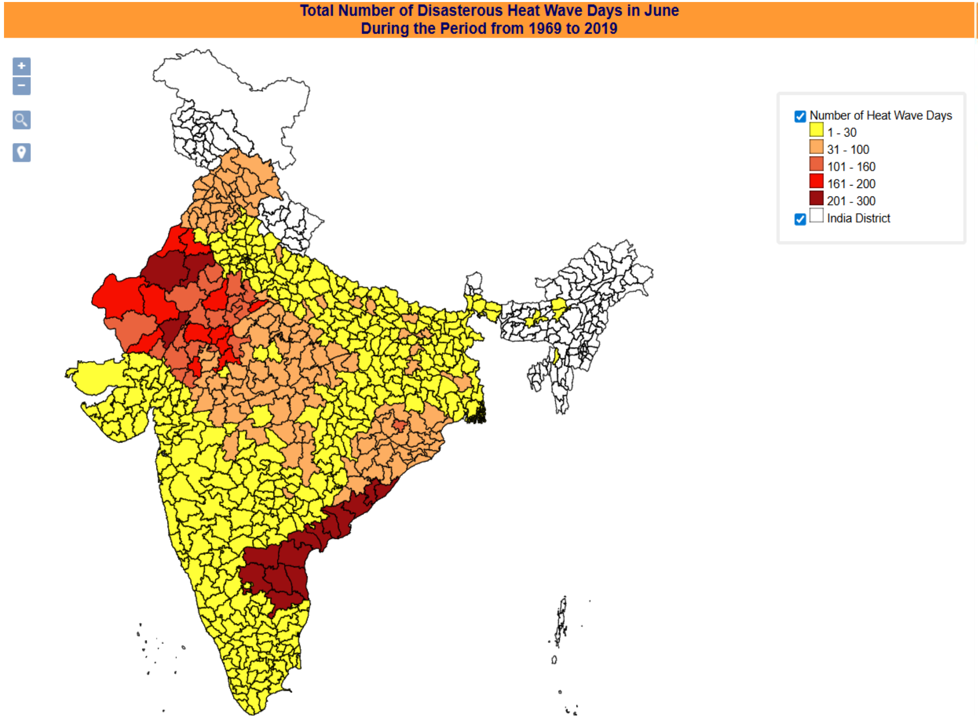


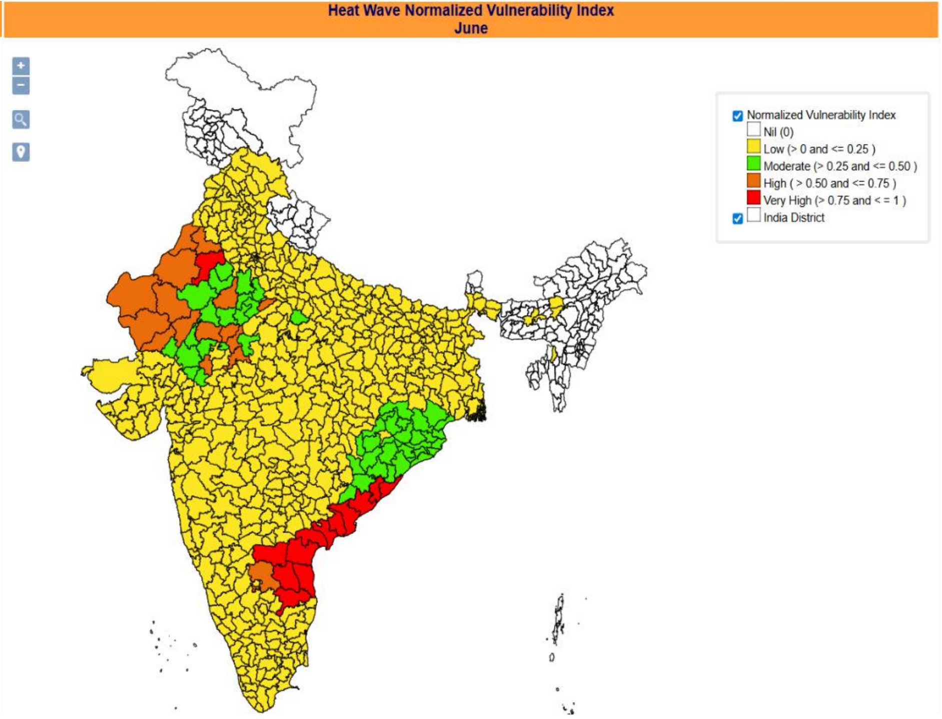
HEATWAVE FREQUENCY AND NORMALISED VULNERABILITY INDEX : MAY





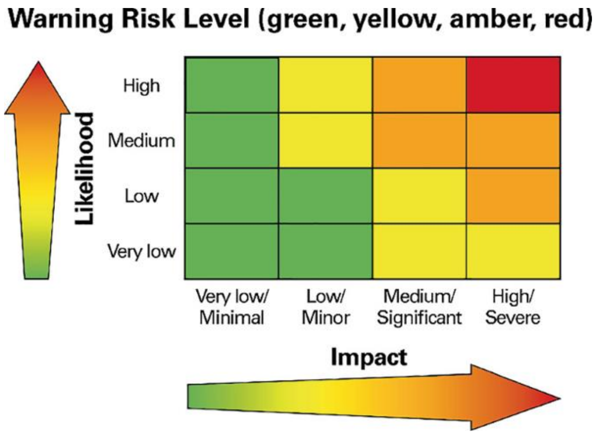
HEATWAVE FREQUENCY AND NORMALISED VULNERABILITY INDEX : JUNE



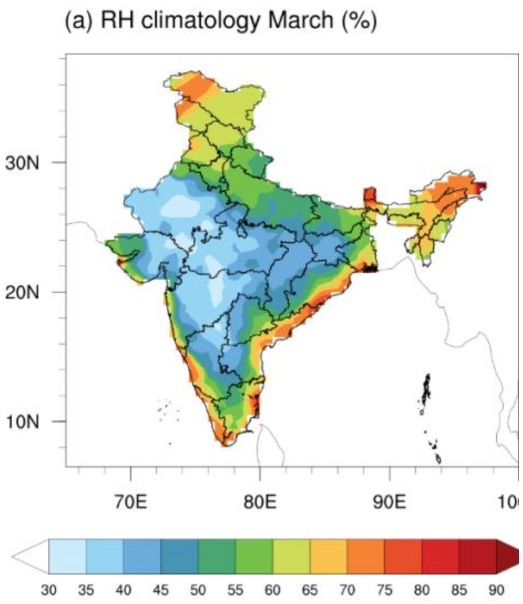


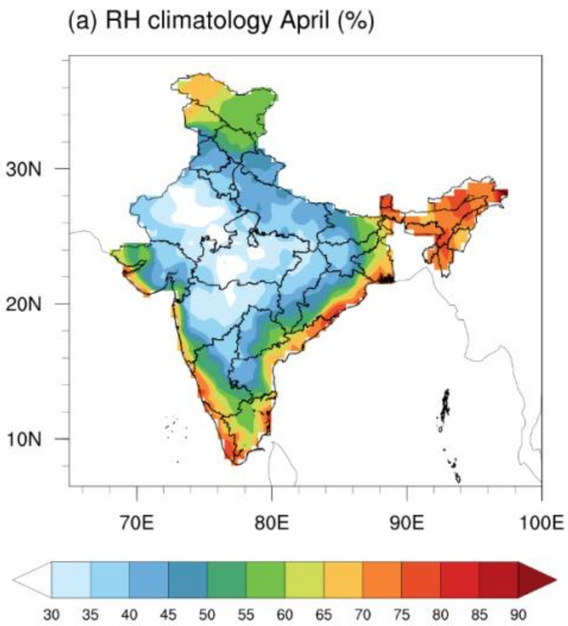
IMPACT BASED HEAT WAVE WARNING

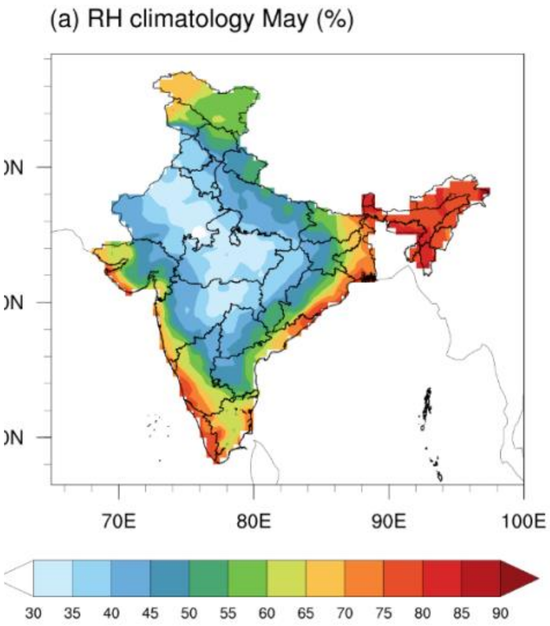
Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No action)	Normal Day	Maximum temperatures are near normal	Comfortable temperature. No cautionary action required.	Nil
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists on 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases	(a) Avoid heat exposure. (b) Wear lightweight, light-coloured, loose, cotton clothes. (c) Cover your head: Use a cloth, hat or umbrella
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i) Severe heat wave conditions persists for 2 days (ii) Through not severe, but heat wave persists for 4 days or more	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g. infants, elderly, people with chronic diseases.	(b) Avoid heat exposure– keep cool. Avoid dehydration. (b) Drink sufficient water- even if not thirsty. (c) Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated
Red Alert (Take Action)	Extreme Heat Alert for the day	(i) Severe heat wave persists for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 6 days.	Very high likelihood of developing heat illness and heat stroke in all ages.	Extreme care needed for vulnerable people.

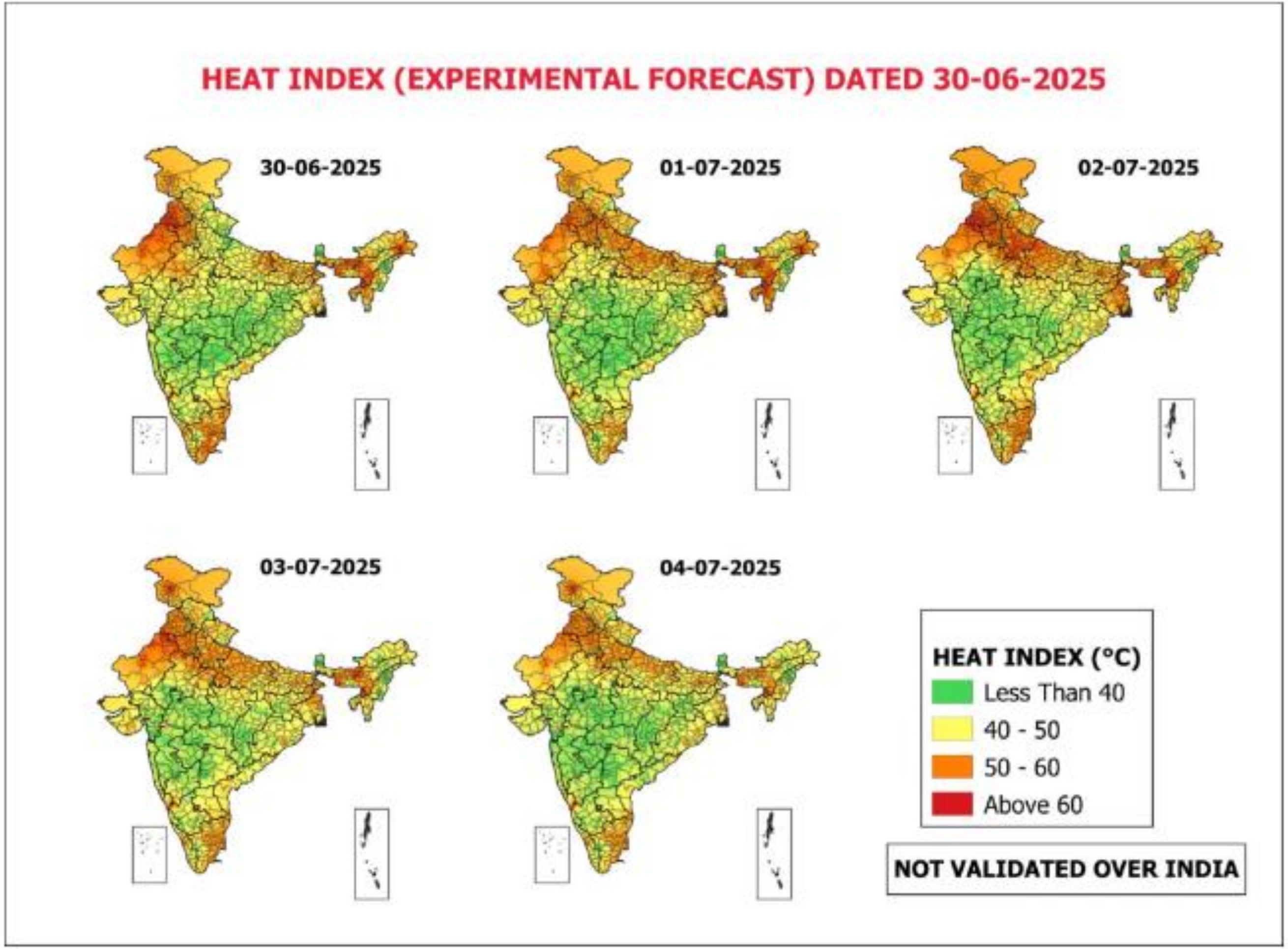


NORMAL RH @ 2.30 PM IST/0900 UTC









HEAT INDEX (EXPERIMENTAL FORECAST) DATED 30-06-2025
30-06-2025
01-07-2025
02-07-2025
03-07-2025
04-07-2025
HEAT INDEX (°C)
Less Than 40
40 - 50
50 - 60
Above 60
NOT VALIDATED OVER INDIA

SPECIAL IBF PRESS RELEASE : SEVERE HEATWAVE

Government of India
Ministry of Earth Sciences
India Meteorological Department
Meteorological Centre Jaipur

भारत सरकार
पृथ्वी विज्ञान मंत्रालय
भारत मौसम विज्ञान विभाग
मौसम विज्ञान केंद्र जयपुर

दिनांक: 17 मई 2024, 1300 IST

To,

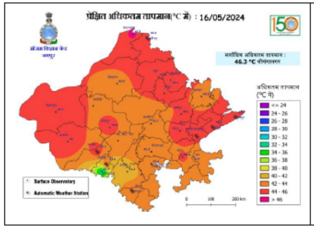
Chief Secretary, Govt. of Rajasthan
Secretary, Disaster management & Relief Department
Secretary, Medical Health & Family Welfare Department,
DD Rajasthan, AIR Jaipur

विषय : राज्य में आगामी दिनों में हीटवेव से तीव्र हीटवेव (Severe heat wave) अलर्ट I

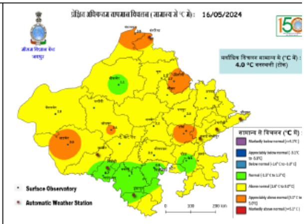
1. वर्तमान तापमान परिस्थितियां / Current temperature conditions :

घटित मौसम (REALISED WEATHER)
• राज्य में मौसम शुष्क रहा I राज्य के कुछ भागों में उष्णलहर दर्ज की गयी I
• पिछले 24 घंटों में राज्य के अधिकांश भागों में अधिकतम तापमान 41 - 46 डिग्री सेल्सियस दर्ज किए गए हैं।
• राज्य में सर्वाधिक अधिकतम तापमान श्रीगंगानगर में 46.3 डिग्री सेलसियस दर्ज किया गया I
• आज 0830 IST पर दर्ज प्रेक्षण के अनुसार राज्य के अधिकांश भागों में हवा में औसत आर्द्रता की मात्रा 20 से 40 प्रतिशत के मध्य दर्ज की गई है I

16 MAY को दर्ज अधिकतम तापमान



Departure of Maximum Temperature



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Contact Number: 0141-2790194 / 2793254, email: mcjaipur@rediffmail.com

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Ministry of Earth Sciences
India Meteorological Department
Meteorological Centre Jaipur

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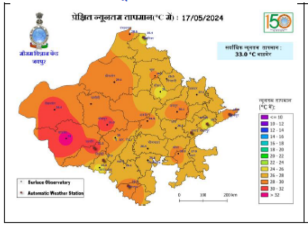
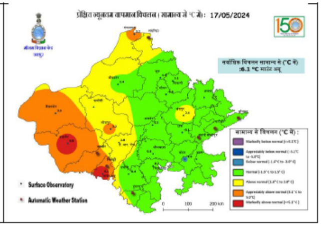
17 MAY को दर्ज न्यूनतम तापमान



Departure of Minimum Temperature



2. अधिकतम तापमान पूर्वानुमान / Maximum temperature forecast :

- ➢ आगामी दिनों में राज्य में मौसम मुख्यतः शुष्क रहने तथा आगामी 48 घंटों में अधिकतम तापमान में 1-2 डिग्री से. बढ़ोतरी होने व हीटवेव का दौर आगामी एक सप्ताह तक जारी रहने की संभावना है।
- ➢ जोधपुर, बीकानेर संभाग व शेखावाटी क्षेत्र में आगामी 4-5 दिन कहीं-कहीं तीव्र उष्णलहर (Severe Heat wave) चलने की संभावना है।
- ➢ जयपुर, भरतपुर व कोटा संभाग के कुछ भागों में आगामी 48 घंटों में अधिकतम तापमान 43-46 डिग्री से. दर्ज होने कुछ भागों में उष्णलहर / लू चलने की प्रबल संभावना है।
- ➢ जोधपुर संभाग के कुछ भागों में आगामी 72 घंटों के दौरान न्यूनतम तापमान सामान्य से 2-5 डिग्री ऊपर दर्ज होने व उष्णरात्री (warm night) दर्ज होने की संभावना है।

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Contact Number: 0141-2790194 / 2793254, email: mcjaipur@rediffmail.com

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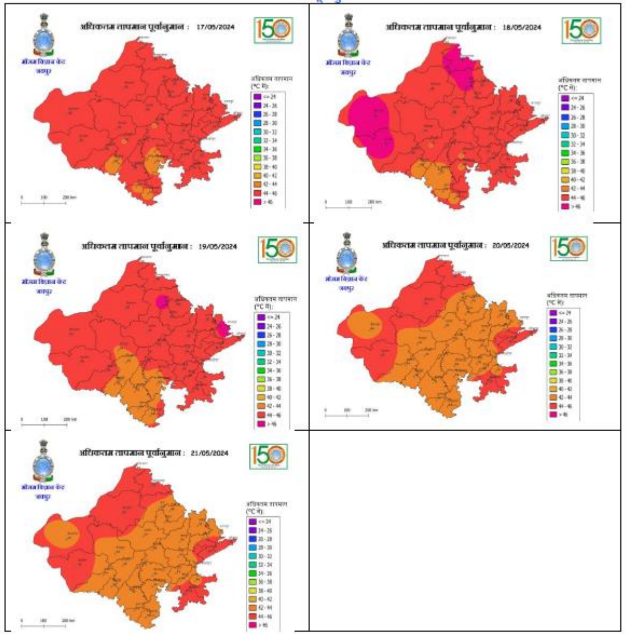
अधिकतम तापमान पूर्वानुमान मानचित्र



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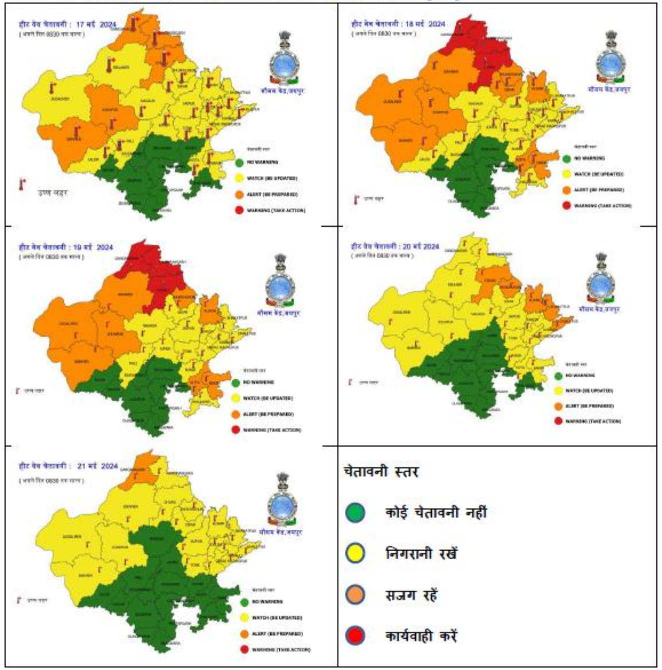
मौसम विज्ञान केंद्र जयपुर

3. जिलेवार हीटवेव चेतावनी / District wise Heat wave warning map:



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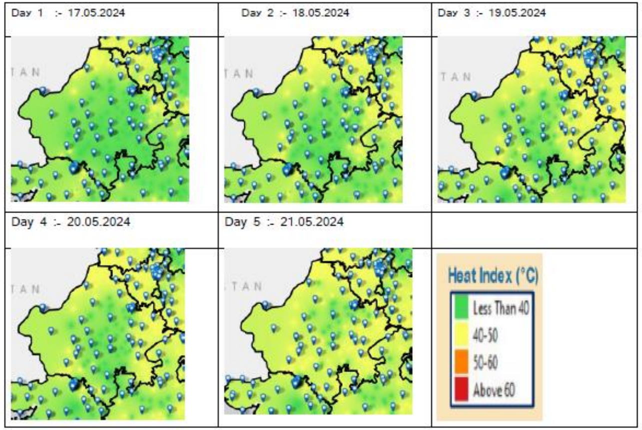
Heat Index (External Forecast) at 1430 IST based On 17-05-2024

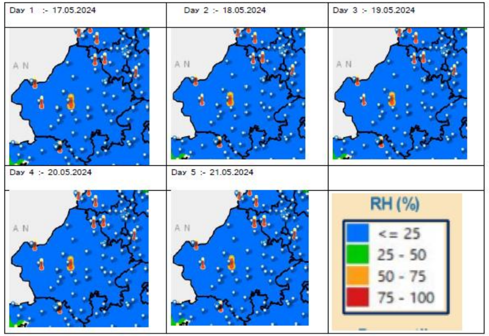


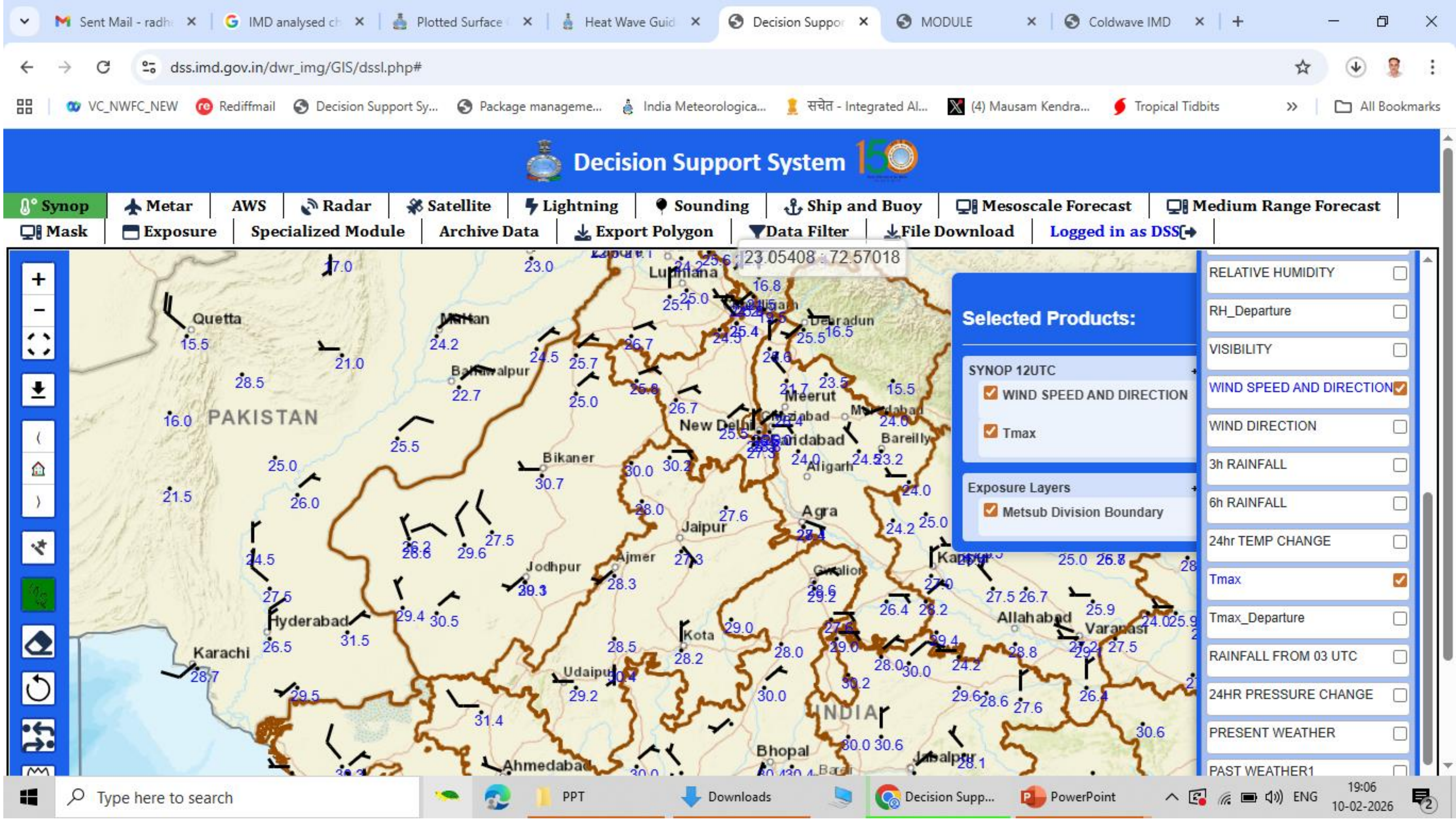
अपेक्षित प्रभाव	• बुजुर्ग बच्चे तथा बीमार व्यक्ति गर्मी के शिकार हो सकते हैं। • उन लोगों में गर्मी की बीमारी के लक्षणों की संभावना बढ़ जाती है जो या तो लंबे समय तक धूप में रहते हैं या भारी काम करते हैं। • तीव्र उष्ण लहर के जिलों में फसलों व सब्जियों पर उष्मागत तनाव (Heat Stress) होने की काफी संभावना है। • उष्ण लहर का असर पालतू पशु पक्षियों व वन्य जीवो पर भी हो सकता है।
कार्यवाही के सुझाव	• गर्मी के जोखिम से बचें यथासंभव छायादार स्थान में रहे। • निर्जलीकरण से बचें पर्याप्त मात्रा में पानी पियें। • ओ आर एस, घर का बना पेय जैसे लस्सी, नींबू पानी आदि का प्रयोग खुद को हाइड्रेट रखने के लिए कर सकते हैं। • किसानों को सलाह दी जाती है कि पशुओं को उष्मागत तनाव से बचने के लिए समुचित उपाय करें तथा फसलों में नियमित रूप से सुबह अथवा शाम के समय अपने खेतों में सिंचाई करें। • पशु पक्षियों व अन्य जीवो को उष्ण लहर से बचाव की आवश्यक कदम उठाने चाहिए।

Government of India
Ministry of Earth Sciences
India Meteorological Department
Meteorological Centre Jaipur

भारत सरकार
पृथ्वी विज्ञान मंत्रालय
भारत मौसम विज्ञान विभाग
मौसम विज्ञान केंद्र जयपुर

Relative Humidity at 1430 IST based On 17-05-2024





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Exposure
Specialized Module
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WIND SPEED AND DIRECTION
Tmax
Exposure Layers
Metsub Division Boundary
RELATIVE HUMIDITY
RH_Departure
VISIBILITY
WIND SPEED AND DIRECTION
WIND DIRECTION
3h RAINFALL
6h RAINFALL
24hr TEMP CHANGE
Tmax
Tmax_Departure
RAINFALL FROM 03 UTC
24HR PRESSURE CHANGE
PRESENT WEATHER
PAST WEATHER1
Quetta
PAKISTAN
Multan
Bahawalpur
Bikaner
Jodhpur
Ajmer
Jaipur
Hyderabad
Karachi
Udaipur
Kota
Ahmedabad
Ludhiana
Dehradun
Meerut
New Delhi
Ghaziabad
Faridabad
Moradabad
Bareilly
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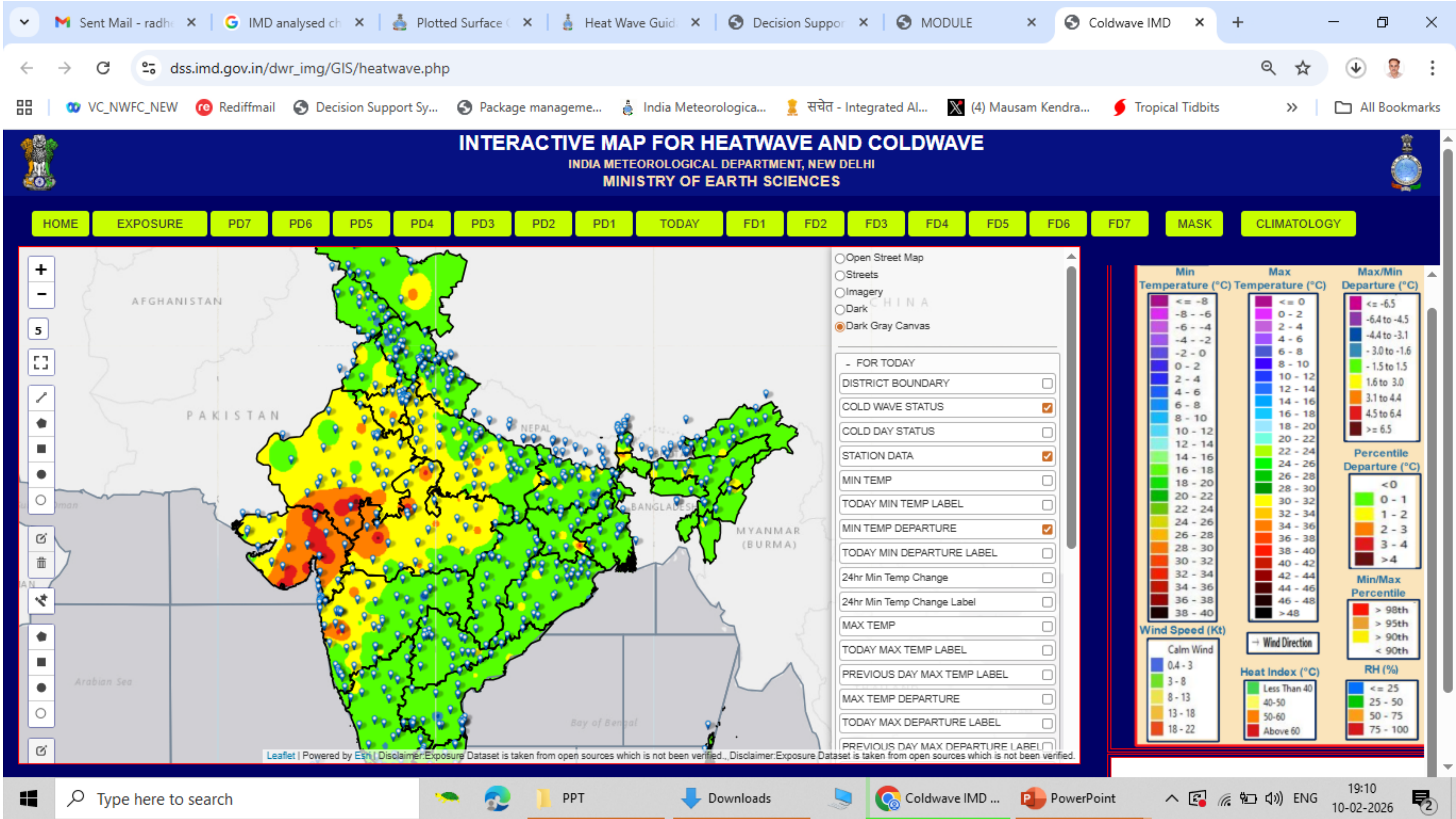
DECISION SUPPORT SYSTEM FOR WEATHER FORECASTING

THUNDERSTORM MODULE	HEAVY RAINFALL MODULE	HEATWAVE/COLDWAVE MODULE	CYCLONE MODULE
MODEL-DISPLAY MODULE	DYNAMIC METEOGRAM	DRMS MODULE	MARINE(SEA AREA) MODULE
MARINE(COASTAL) MODULE	MARINE(2 Deg SEA AREA) MODULE	MARINE(FLEET AREA) MODULE	MARINE(GMDSS) MODULE
FISHERMAN WARNING	LOPAR IDENTIFICATION	SWFP	T Number Module
TOURISM MODULE	SYNOPTIC ANALYSIS	ERF	WIS2BOX
AIR QUALITY	EFI	OBSERVATION PLOTS	ARCHIVAL_TEST_MODULE
DYNAMIC MME MODULE	INFERENCE	IMD FOG WARNING	ROUTE FORECAST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India Meteorologica...
सचेत - Integrated Al...
(4) Mausam Kendra...
Tropical Tidbits
All Bookmarks
INTERACTIVE MAP FOR HEATWAVE AND COLDWAVE
INDIA METEOROLOGICAL DEPARTMENT, NEW DELHI
MINISTRY OF EARTH SCIENCES
HOME
EXPOSURE
PD7
PD6
PD5
PD4
PD3
PD2
PD1
TODAY
FD1
FD2
FD3
FD4
FD5
FD6
FD7
MASK
CLIMATOLOGY
AFGHANISTAN
PAKISTAN
NEPAL
CHINA
BANGLADESH
MYANMAR (BURMA)
Arabian Sea
Bay of Bengal
Open Street Map
Streets
Imagery
Dark
Dark Gray Canvas
- FOR TODAY
DISTRICT BOUNDARY
COLD WAVE STATUS
COLD DAY STATUS
STATION DATA
MIN TEMP
TODAY MIN TEMP LABEL
MIN TEMP DEPARTURE
TODAY MIN DEPARTURE LABEL
24hr Min Temp Change
24hr Min Temp Change Label
MAX TEMP
TODAY MAX TEMP LABEL
PREVIOUS DAY MAX TEMP LABEL
MAX TEMP DEPARTURE
TODAY MAX DEPARTURE LABEL
PREVIOUS DAY MAX DEPARTURE LABEL
Leaflet | Powered by Esri | Disclaimer:Exposure Dataset is taken from open sources which is not been verified., Disclaimer:Exposure Dataset is taken from open sources which is not been verified.
Min Temperature (°C)
<= -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
16 - 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
Max Temperature (°C)
<= 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
16 - 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
40 - 42
42 - 44
44 - 46
46 - 48
>48
Max/Min Departure (°C)
<= -6.5
-6.4 to -4.5
-4.4 to -3.1
- 3.0 to -1.6
- 1.5 to 1.5
1.6 to 3.0
3.1 to 4.4
4.5 to 6.4
>= 6.5
Percentile Departure (°C)
< 0
0 - 1
1 - 2
2 - 3
3 - 4
> 4
Min/Max Percentile
> 98th
> 95th
> 90th
< 90th
Wind Speed (Kt)
Calm Wind
0.4 - 3
3 - 8
8 - 13
13 - 18
18 - 22
Wind Direction
Heat Index (°C)
Less Than 40
40-50
50-60
Above 60
RH (%)
<= 25
25 - 50
50 - 75
75 - 100
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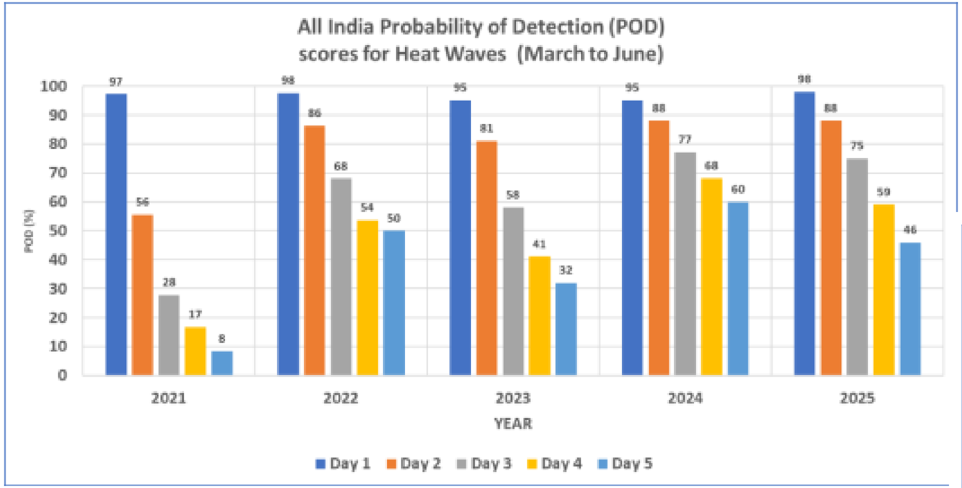
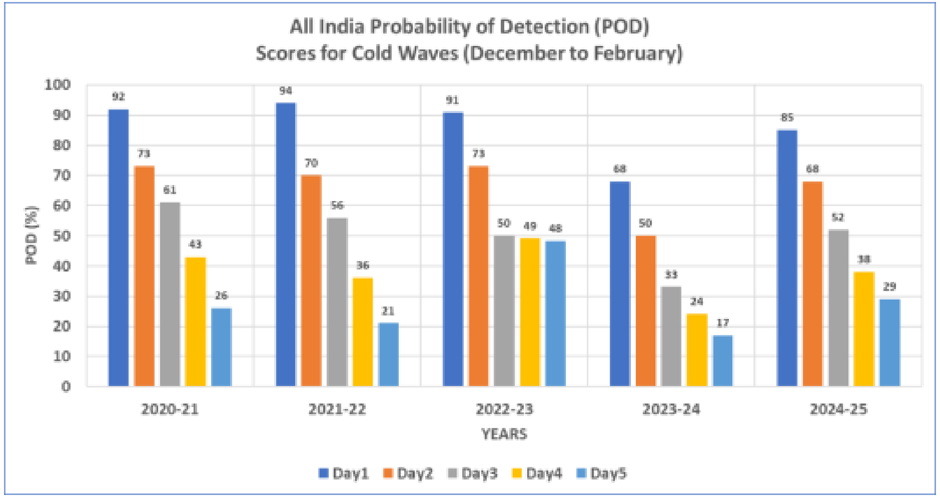
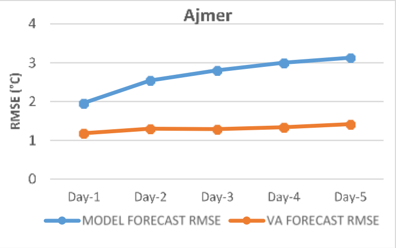
PROBABILITY OF DETECTION OF HEAT WAVE AT SUBDIVISION LEVEL

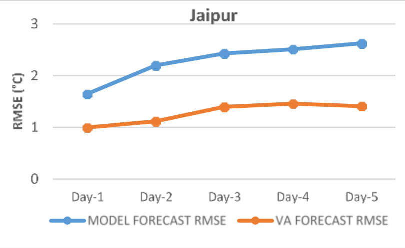


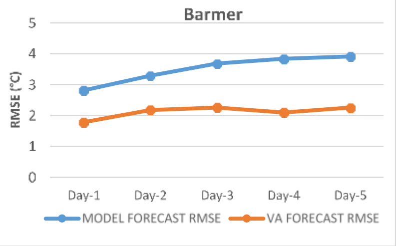
PROBABILITY OF DETECTION COLD WAVE

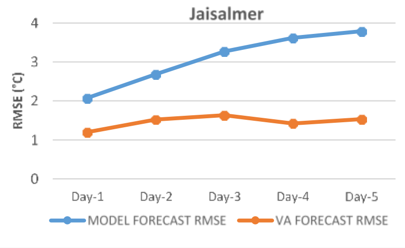


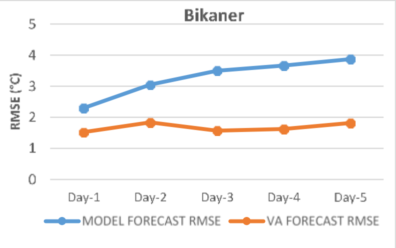
Maximum Temperature forecast Verification for SUMMER -2024

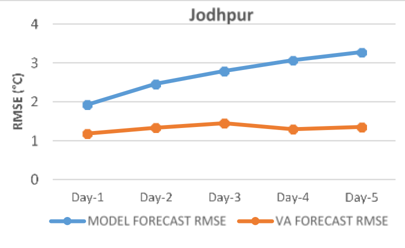


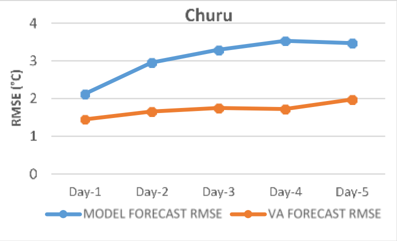


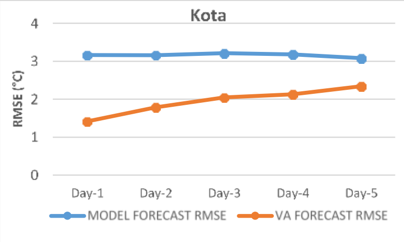


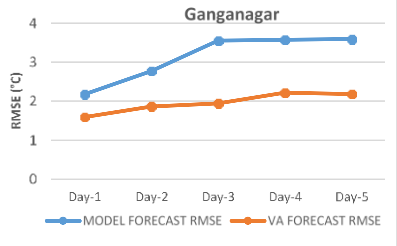


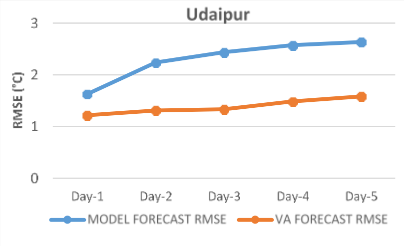






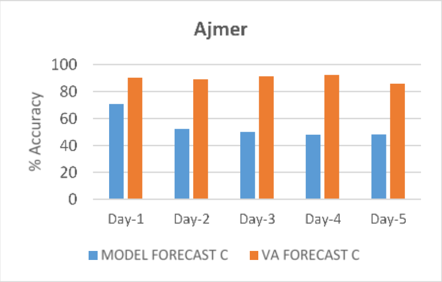


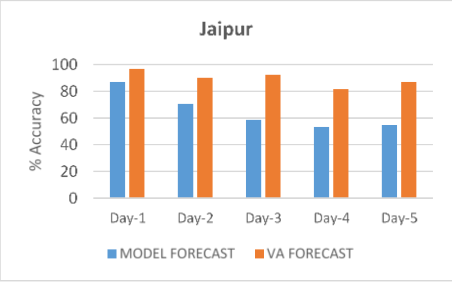


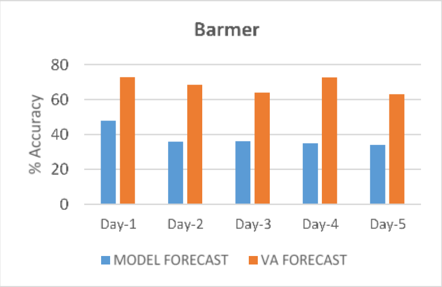


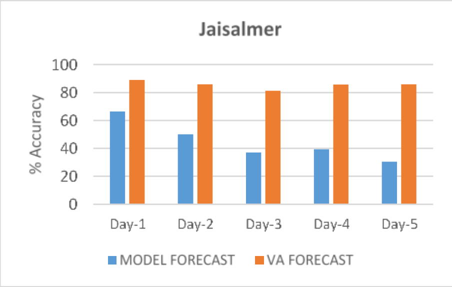
- **The RMSE (Root Mean Square Error) for maximum temperature is lower for the value-added forecasts than for the GFS model at all times, indicating better precision of operational temperature forecast.**

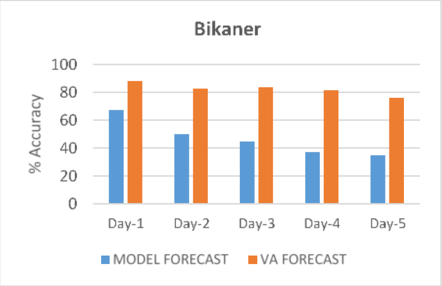
Tmax FC verification :
Model FC Vs Value added Forecast for SUMMER 2024

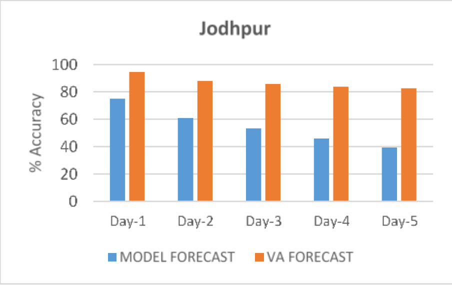


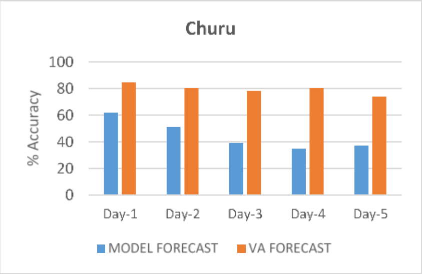


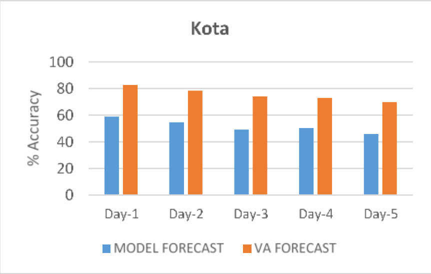


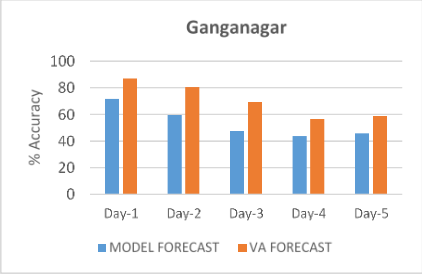


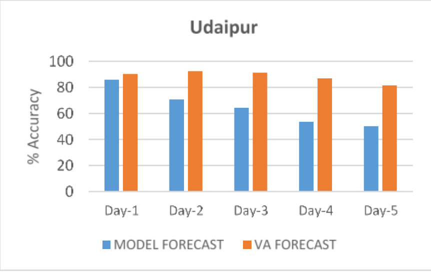










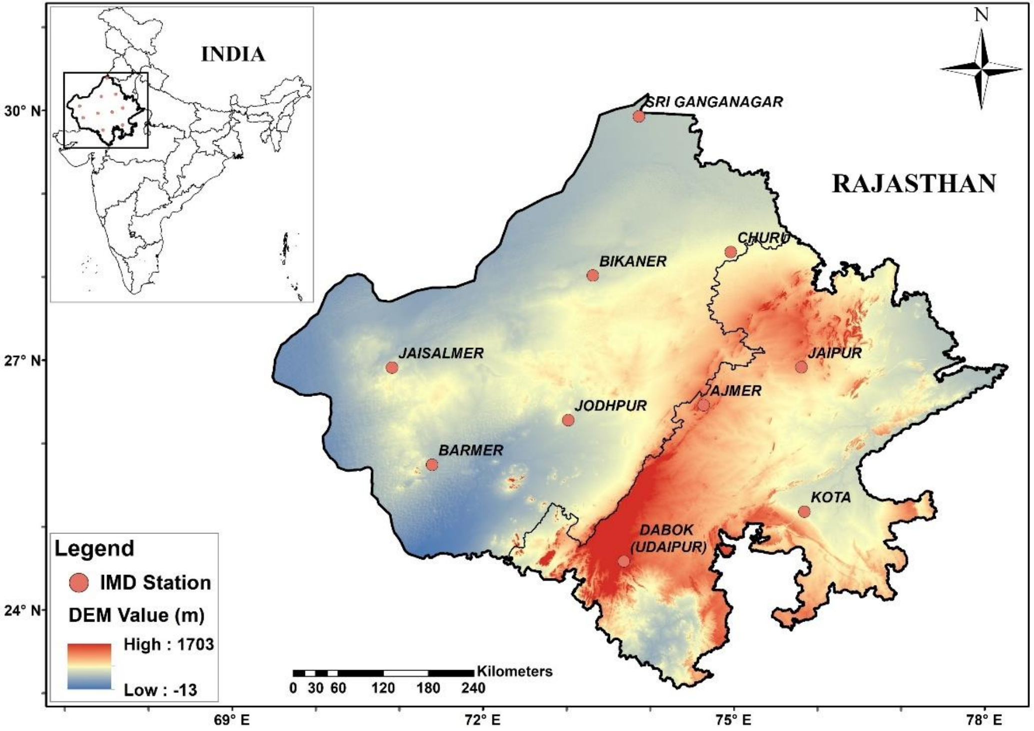


- **Value-added forecasts consistently outperform the direct model forecasts (GFS) in qualitative efficiency and accuracy for all forecast days.**

DECESION SUPPORT SYSTEM (DSS)

HEATWAVE SERVICES FOR RAJASTHAN : A NW STATE OF INDIA

A BRIEF ABOUT RAJASTHAN, INDIA

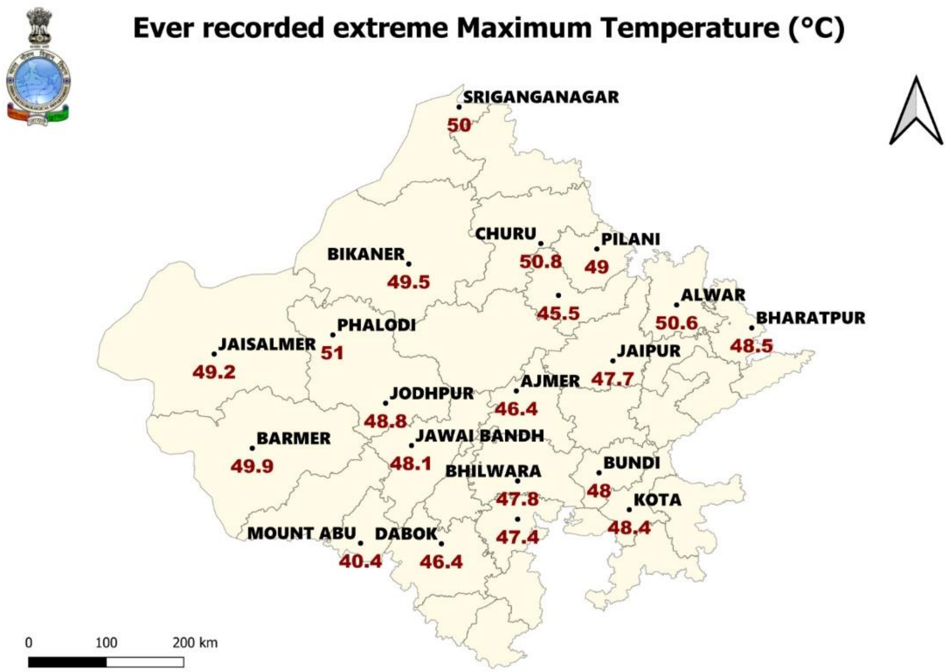


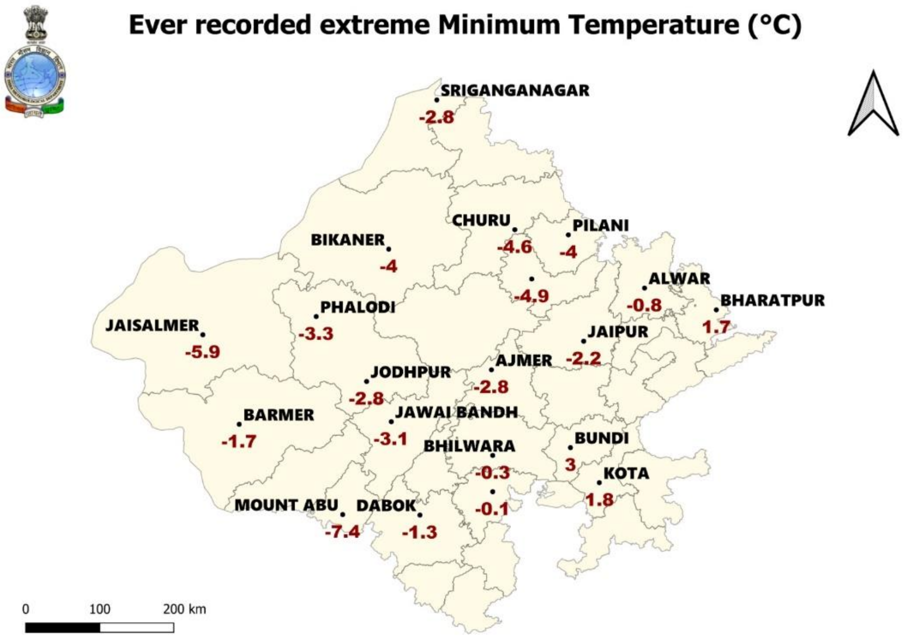
- **Rajasthan is the northwestern state of India and well known for its extreme high temperatures in summer due to its geography and physiography.**
- **The period of March to June are considered as summer season in Rajasthan.**
- **The desert region of west Rajasthan experiences extreme temperatures with average 9-11 heatwave days in the entire season.**
- **The hot and dry South westerly strong winds prevail over the region many a times in summer season is locally called "Loo".**

SEASON & CHIEF WEATHER SYSTEMS IN RAJASTHAN, INDIA

Season	Adverse weather	Weather system
Winter Season (Jan-Feb)	Cold wave, Cold day, fog, ground frost, hailstorm	Western Disturbance
Pre monsoon or Summer season (March-May)	Thunderstorm, Dust storm, Hailstorm, Heat wave, Warm night	Western Disturbance, Tropical Cyclone (Occasionally)
SW Monsoon (June-Sept)	Heavy Rainfall, thunderstorm & lightning	Low pressure systems of BoB & Arabian sea, MTC
Post Monsoon (Oct-Dec)	Fog, Cold wave	Western Disturbance

EXTREME TEMPERATURES : EVER RECORDED





Phalodi	51.0 (Deg. Cel)	19.05.2016

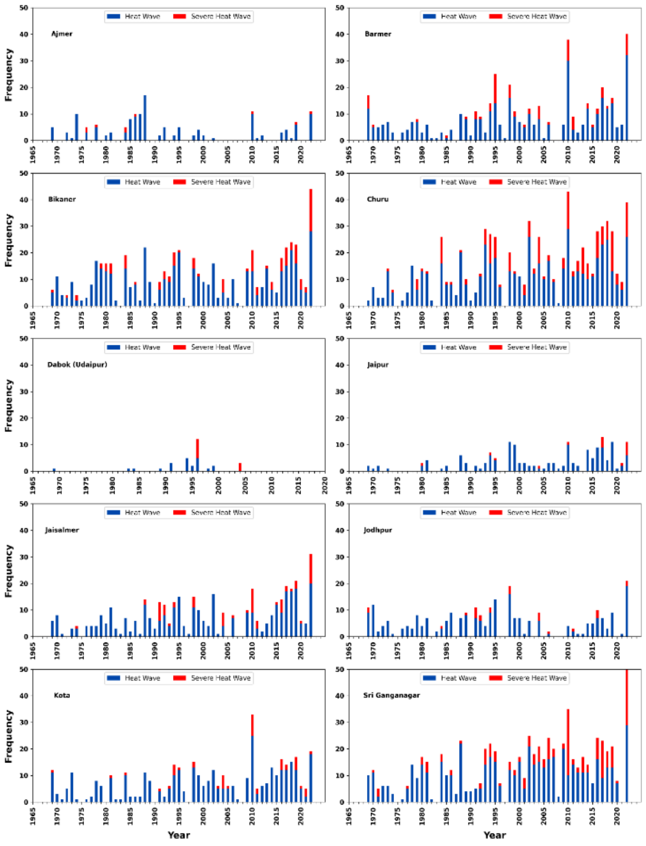
Jaisalmer	-5.9 (Deg. Cel)	12.01.1967

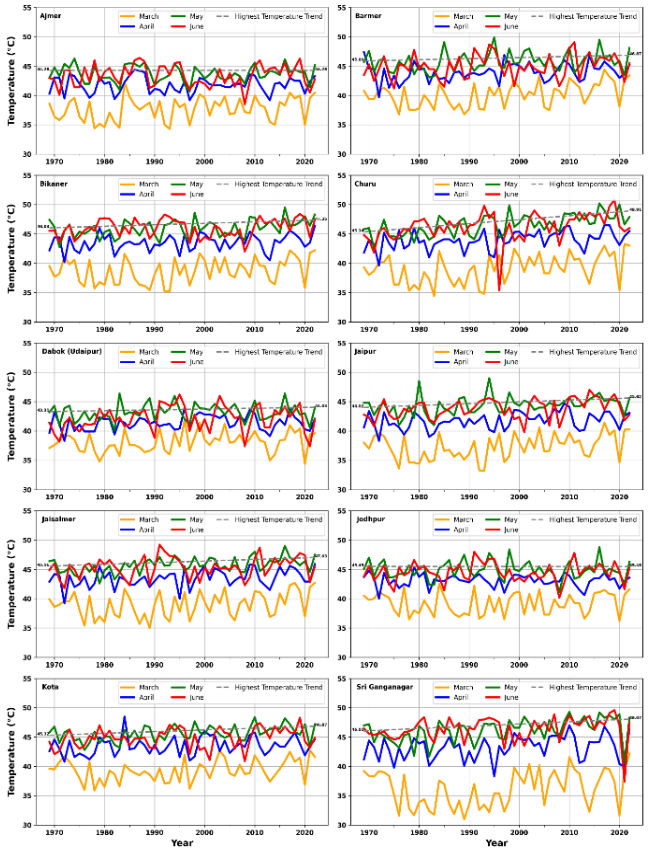
CLIMATOLOGY OF HEAT WAVE 1969-2022

Station	Mean Heat Wave Days				Coefficient of Variation			
	March	April	May	June	March	April	May	June
Ajmer	0.2 ± 0.6	0.7 ± 1.5	0.7 ± 1.9	1.3 ± 2.0	3.19	2.07	2.51	1.56
Dabok	0.5 ± 2.1	0.4 ± 1.2	0.4 ± 1.1	1.2 ± 1.7	3.94	3.15	2.86	1.47
Jaipur	0.2 ± 0.8	1.0 ± 2.0	1.1 ± 1.8	1.3 ± 1.8	3.29	2.07	1.66	1.38
Kota	0.8 ± 1.6	1.1 ± 2.2	4.4 ± 4.4	2.6 ± 3.1	2	1.93	1	1.21
Bikaner	1.1 ± 2.1	2.1 ± 3.2	5.1 ± 4.8	3.6 ± 3.6	2.01	1.51	0.94	1.01
Barmer	1.9 ± 3.1	1.7 ± 3.0	3.4 ± 3.8	2.0 ± 2.7	1.6	1.76	1.12	1.36
Churu	1.4 ± 2.4	2.2 ± 3.4	6.6 ± 5.5	5.1 ± 4.4	1.76	1.55	0.83	0.87
Sriganganagar	0.2 ± 1.0	3.0 ± 4.2	5.9 ± 4.9	5.3 ± 4.1	4.3	1.41	0.83	0.76
Jodhpur	1.1 ± 1.8	1.0 ± 1.6	1.8 ± 2.8	1.8 ± 2.4	1.65	1.65	1.56	1.37
Jaisalmer	1.1 ± 2.0	1.3 ± 2.5	3.6 ± 3.7	2.5 ± 2.8	1.8	1.88	1.01	1.11

- **Low mean HW frequency with high coefficient of variation is observed in March.**
- **The highest mean HW frequency 3-7 days is observed in May with small coefficient of variation.**

TEMPORAL VARIATION OF HEAT WAVE (1969-2022)



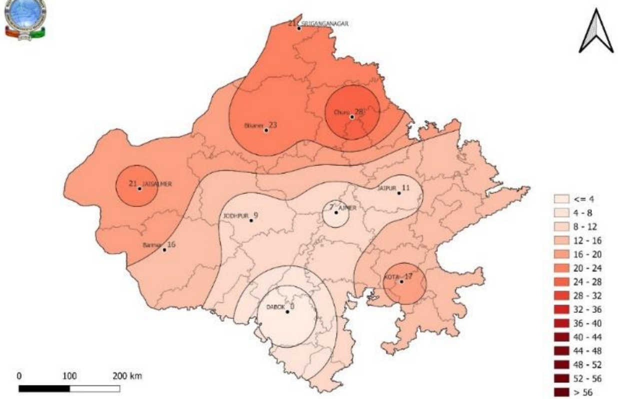


- Increase in frequency & intensity of heatwave is observed in the recent few decades.
- Frequency of severe heatwave is rapidly increasing, specially over the districts of desert region.
- The extreme Maximum Temperatures also shows an increasing trend over many stations.

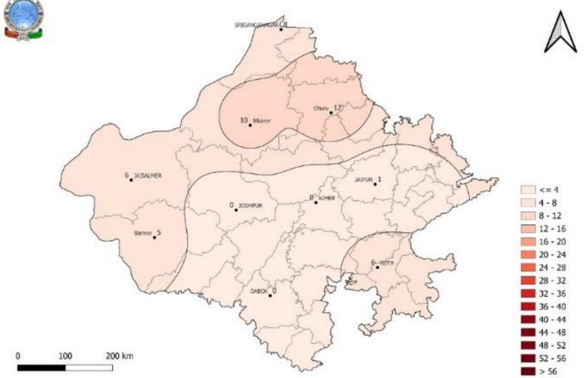
(Ref: Subhkaran Mahla, Radheshyam Sharma, 2025)

VARIABILITY OF FREQUENCY OF HEAT WAVE 2019-2024

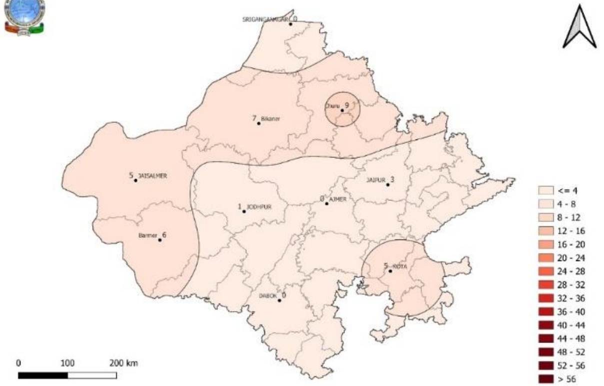
Observed Heat wave days in 2019 (March to June)



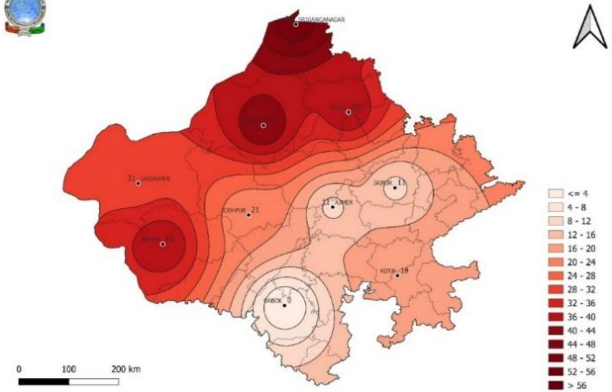
Observed Heat wave days in 2020 (March to June)



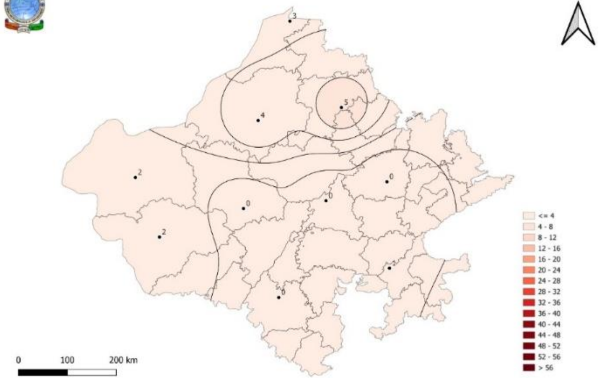
Observed Heat wave days in 2021 (March to June)



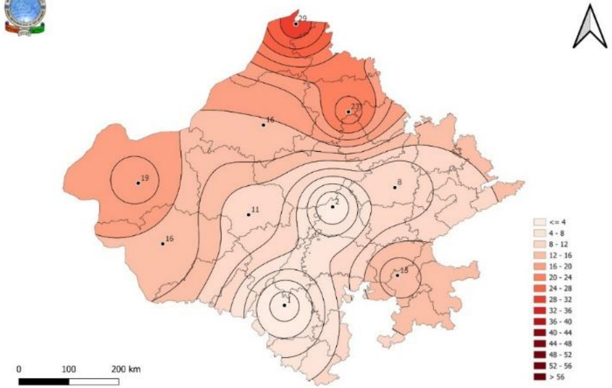
Observed Heat wave days in 2022 (March to June)

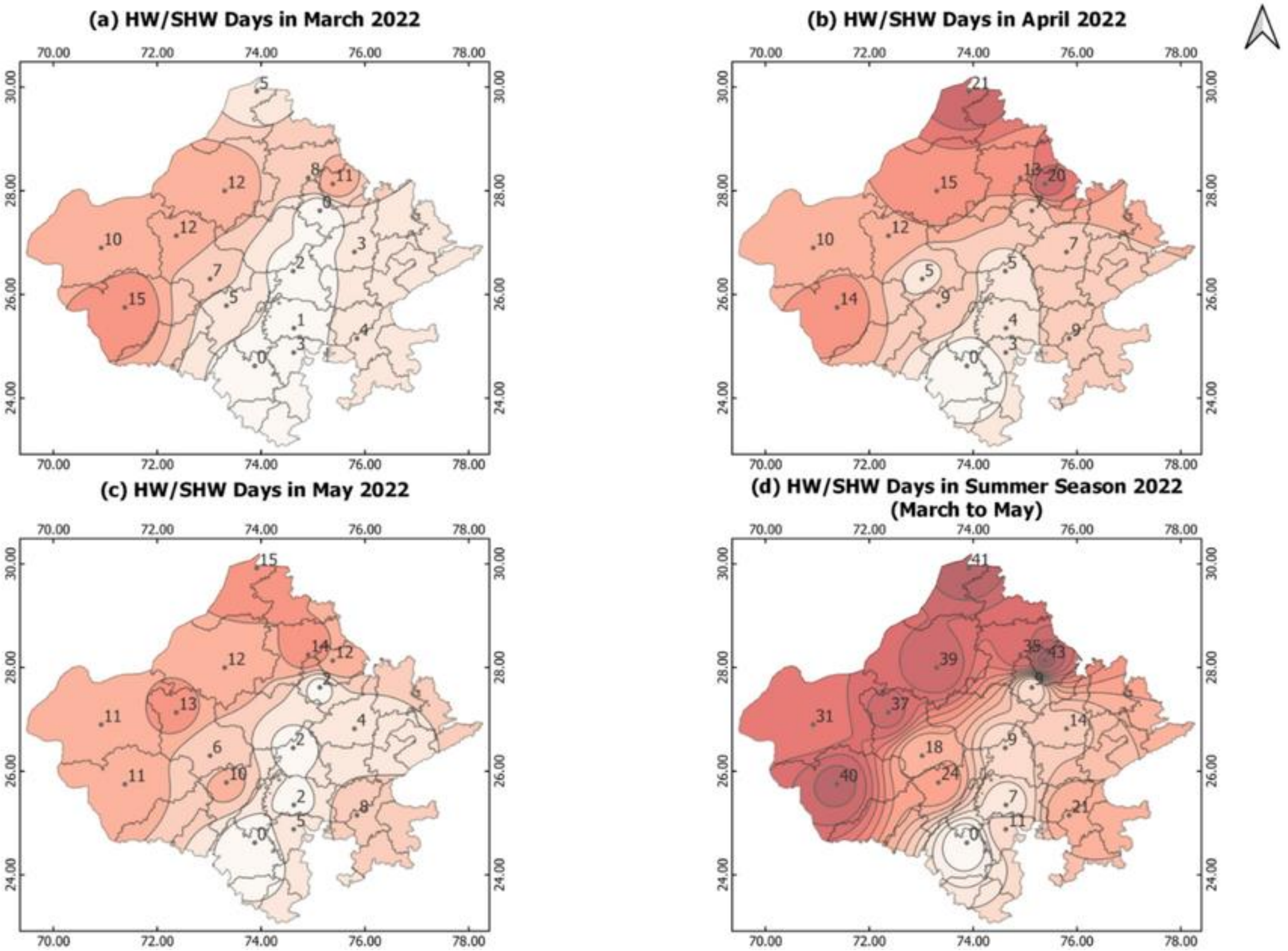


Observed Heat wave days in 2023 (March to June)



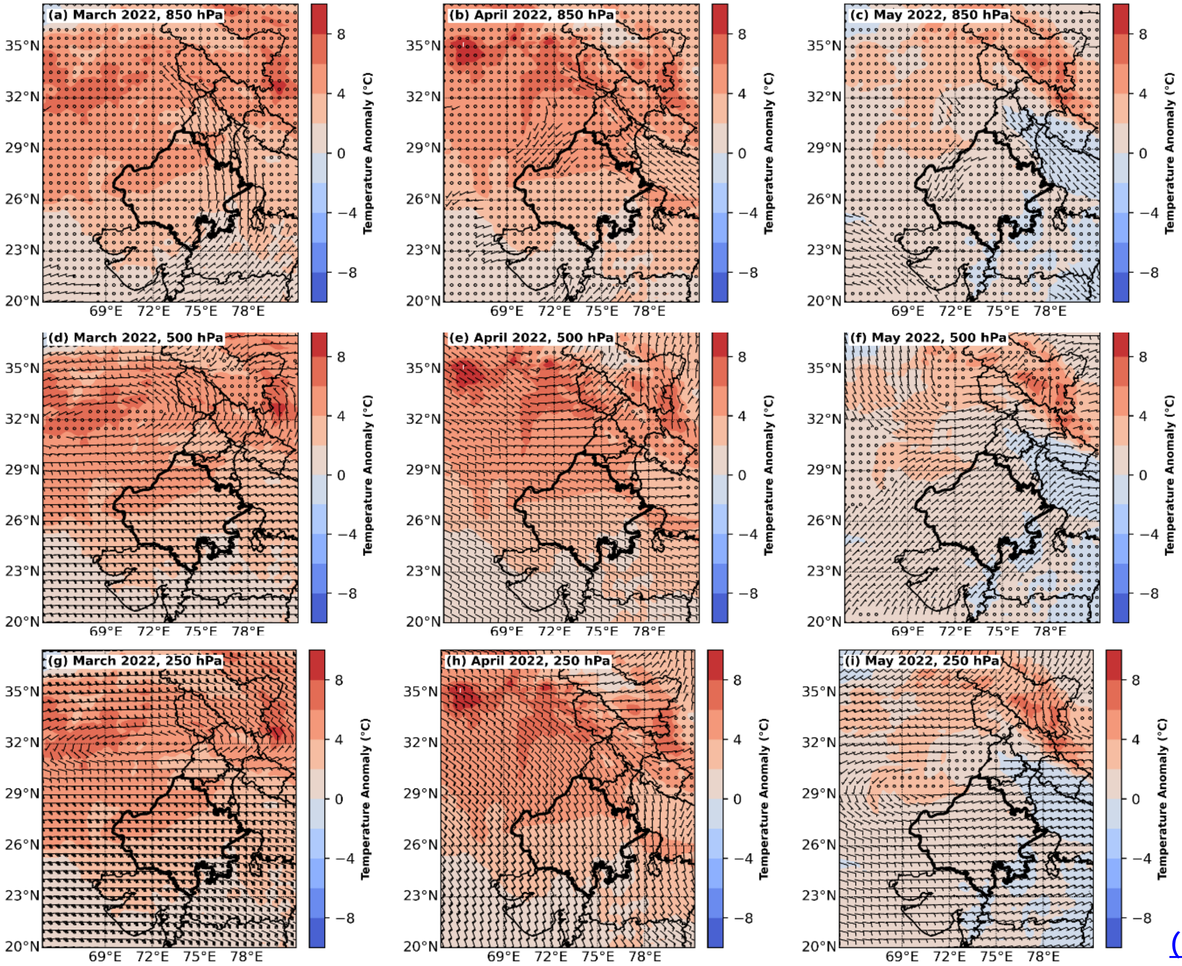
Observed Heat wave days in 2024 (March to June)





EXCEPTIONAL HOT SUMMER : 2022

WIND AND TEMPERATURE ANOMALY : 2022



- **An anti-cyclonic wind anomaly is formed over Rajasthan and adjoining areas in the lower tropospheric levels, strong A/C anomaly over central parts of the NW Indian subcontinent in the mid and upper tropospheric levels.**
- **As the anti-cyclonic anomaly moved slightly northwest ward in April in the mid and upper tropospheric levels, the heat zone with above normal temperatures 4 ℃ to 8 ℃ also shifted slightly towards the anti-cyclonic flow over northern parts of the northwest India and adjoining areas.**
- **Anticyclonic flow causes sinking air (subsidence), which suppresses clouds and enhances surface heating, leading to higher temperatures.**
- **Clear skies and dry conditions under high pressure also help temperatures climb.**

(Ref: Subhkaran Mahla, Radheshyam Sharma, 2025)

WEATHER BULLETINS BY MET CENTRE JAIPUR

1. **Extended Range Forecast**
   - **Validity** : **Next two weeks**
   - **Issued on** : **Every Thursday**

2. **Medium Range Forecast**
   - **Validity** : **Next Seven days**
   - **Issued on** : **Everyday at 1330 IST & 2030 IST**
   - **Warning** : **District wise warning (Impact based)**

3. **Short range forecast/Nowcast**
   - **Validity** : **Three hours**
   - **Issued on** : **Every three hour interval**
   - **Warning** : **District wise & city warning (Impact based)**

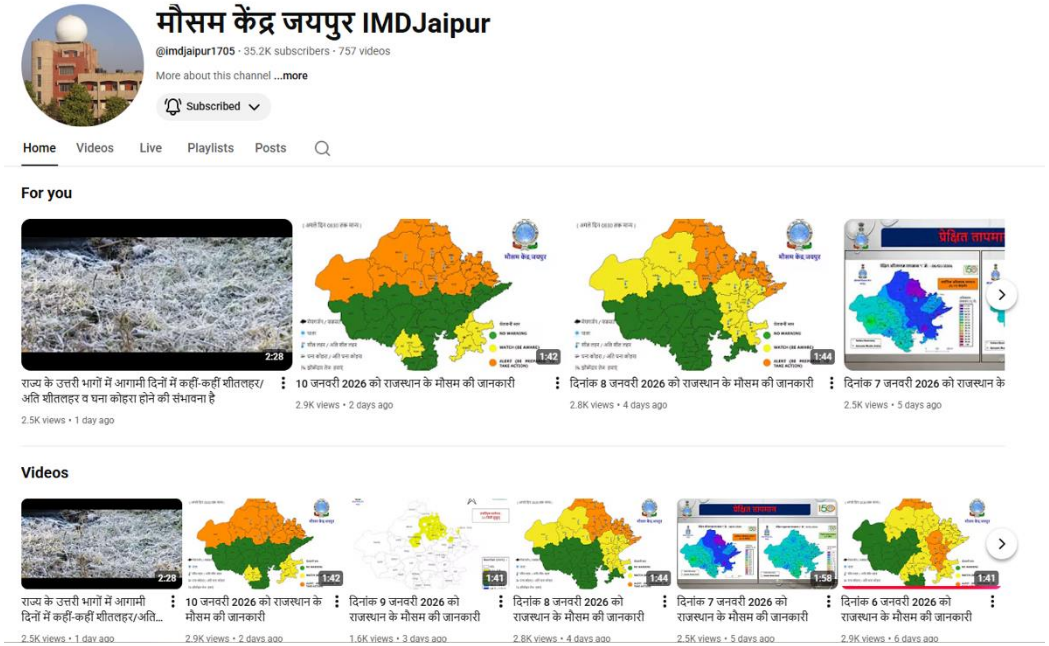
4. **Special Press Release**
   - **Issued on** : **In case of significant adverse weather system is expected over the region and updated till the end of significant system like : Cyclone, depression, Heat wave cold wave, severe thunderstorm etc.**

5. **Special Impact based Agro advisory : In case of significant adverse weather system**

DISSEMINATION OF WARNINGS

1. **Website** : **All bulletins & Warnings available**
2. **Press briefing** : **In case of expectation of severe weather**
3. **Social Media Platforms**
   - **WhatsApp** : **Dedicated WhatsApp groups for media & state administration**
   - **Youtube** : **Video briefing in regional language, Daily in Hindi (27K+)**
   - **Facebook** : **Regular update (15K+)**
   - **Tweeter or X** : **Chief weather observation & warning (58K+)**
   - **Website** : **Regular update**
4. **CAP SACHET** : **For all kinds of warnings dissemination**

SOCIAL MEDIA PLATFORMS



IMD follows a seamless unified forecasting strategy for Heat Waves. This section describes a heat wave case study based on this strategy utilized in 2024.

The **Seasonal outlook** for April to June 2024 was issued at the beginning of April 2024 as shown below: -

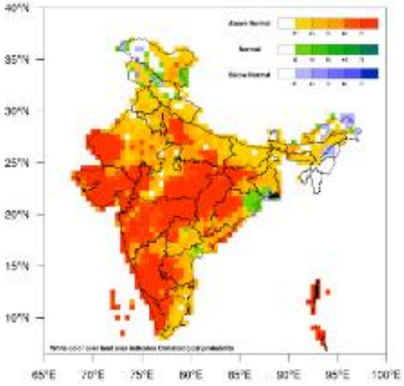


Fig 3.33 Forecast of Maximum Temperature during April to June season-2024

The seasonal outlook indicated that normal maximum Temperatures are likely over most parts of the country, especially with high probability over central India and western peninsular India. Normal to below normal maximum temperatures are likely over some parts of the western Himalayan region, Northeastern states, and north Odisha.

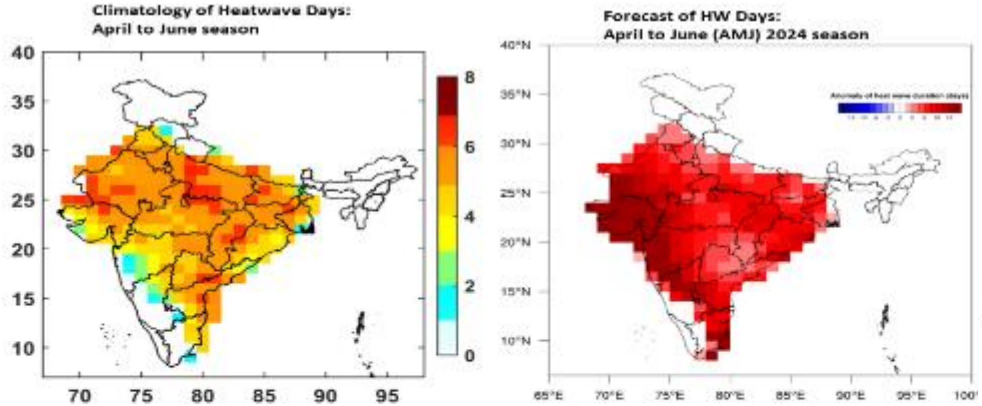


Fig 3.34 Forecast of Heat Wave days during April to June season-2024

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT


Thank you!