



Heat & Cold Wave Monitoring, Early Warning & Impact-Based Forecasting (IBF) System in India

Operational Criteria, Multi-Tier Forecasting Cascades, Dissemination Networks & Regional Heat Action Frameworks

1. IMD Heatwave Criteria, Monitoring Thresholds & Warm Night Definitions

Temperature Thresholds:

- **Plains Stations:** Maximum temperature must reach at least 40.0°C to be considered for heatwave status.
- **Hilly Regions:** Maximum temperature must reach at least 30.0°C.
- **Coastal Stations:** Departure from normal is $\geq 4.5^{\circ}\text{C}$ with actual max temp $\geq 37.0^{\circ}\text{C}$.
- **Heat Wave Classification:** Normal departure of $+4.5^{\circ}\text{C}$ to $+6.4^{\circ}\text{C}$ OR actual max temp $\geq 45.0^{\circ}\text{C}$.
- **Severe Heat Wave:** Normal departure $> +6.4^{\circ}\text{C}$ OR actual max temp $\geq 47.0^{\circ}\text{C}$.
- **Spatial Requirement:** Criteria met in at least 2 stations within a Met Sub-division for ≥ 2 consecutive days.
- **Warm Night Criteria:** Max temp $\geq 40.0^{\circ}\text{C}$ and Min temp departure $+4.5^{\circ}\text{C}$ to $+6.4^{\circ}\text{C}$ (Very Warm Night $> +6.4^{\circ}\text{C}$).

IMD Heatwave Operational Criteria Thresholds

PLAINS REGION	HILLY REGION	COASTAL STATIONS
Base Requirement: Max Temp $\geq 40.0^{\circ}\text{C}$ Heat Wave: Departure $+4.5^{\circ}\text{C}$ to $+6.4^{\circ}\text{C}$ OR Actual Max $\geq 45.0^{\circ}\text{C}$ Severe Heat Wave: Departure $> +6.4^{\circ}\text{C}$ OR Actual Max $\geq 47.0^{\circ}\text{C}$	Base Requirement: Max Temp $\geq 30.0^{\circ}\text{C}$ Heat Wave: Departure $+4.5^{\circ}\text{C}$ to $+6.4^{\circ}\text{C}$ Severe Heat Wave: Departure $> +6.4^{\circ}\text{C}$	Base Requirement: Max Temp $\geq 37.0^{\circ}\text{C}$ Heat Wave: Departure $\geq +4.5^{\circ}\text{C}$ from Normal Spatial Condition: ≥ 2 stations in subdivision for ≥ 2 consecutive days

2. IMD Coldwave Criteria, Monitoring Thresholds & Fog Conditions

Core Coldwave Operational Thresholds:

- **Plains Stations Base:** Minimum temperature must be $\leq 10.0^{\circ}\text{C}$ to qualify for coldwave evaluation.
- **Hilly Regions Base:** Minimum temperature must be $\leq 0.0^{\circ}\text{C}$.
- **Cold Wave Status:** Min temp departure -4.5°C to -6.4°C OR actual min temp $\leq 4.0^{\circ}\text{C}$.
- **Severe Cold Wave:** Min temp departure $> -6.4^{\circ}\text{C}$ OR actual min temp $\leq 2.0^{\circ}\text{C}$.
- **Coastal Stations:** Departure from normal is $\leq -4.5^{\circ}\text{C}$ with actual min temp $\leq 15.0^{\circ}\text{C}$.
- **Cold Day / Severe Cold Day:** Min temp $\leq 10.0^{\circ}\text{C}$ and Max temp departure -4.5°C to -6.4°C (Severe $< -6.4^{\circ}\text{C}$), addressing severe winter fog inversions.

IMD Coldwave & Cold Day Operational Criteria

COLD WAVE (Plains Min $\leq 10^{\circ}\text{C}$)

Departure: -4.5°C to -6.4°C OR Actual Min Temp $\leq 4.0^{\circ}\text{C}$
Hills Min $\leq 0^{\circ}\text{C}$ | Coastal Departure $\leq -4.5^{\circ}\text{C}$

SEVERE COLD WAVE

Departure $> -6.4^{\circ}\text{C}$ OR Actual Min Temp $\leq 2.0^{\circ}\text{C}$
High risk of hypothermia & frost damage

COLD DAY (Plains Min $\leq 10^{\circ}\text{C}$)

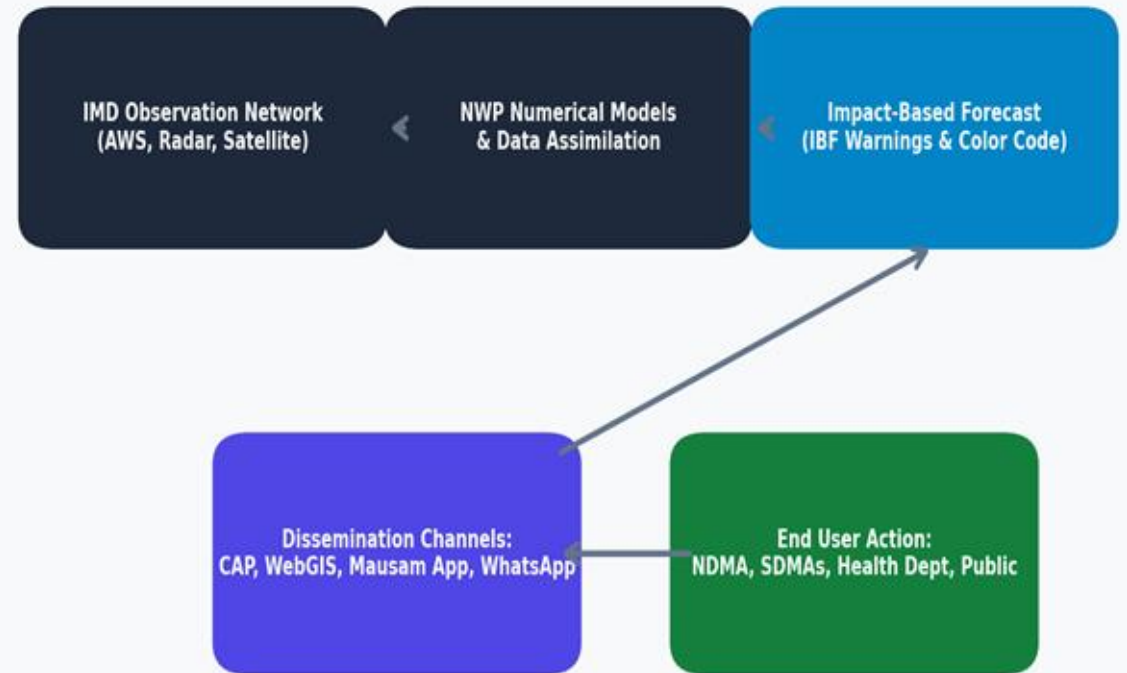
Max Temp Departure: -4.5°C to -6.4°C (Severe $< -6.4^{\circ}\text{C}$)
Associated with dense persistent winter fog layer

3. Early Warning Dissemination Networks & Stakeholder Integration

Multi-Channel Dissemination & End-Users:

- **Common Alert Protocol (CAP):** Geo-targeted SMS/Mobile App alerts sent directly to citizens in affected districts in regional languages.
- **WebGIS & Mobile Platforms:** Real-time warning visualization via Mausam App, MEGHDOOT (agriculture), and DAMINI (lightning).
- **Institutional Disaster Agencies:** Direct API integration with NDMA, SDMAs, and SEOCs for emergency control room operations.
- **Health Ministries & Hospitals:** Triggers surge capacity protocols, medical supply pre-positioning, and cooling shelter activation.
- **Agriculture & Outdoor Labor:** Gramin Krishi Mausam Sewa (GKMS) advisories + enforced work-rest cycles for construction and port workers.

IMD Early Warning Dissemination Network Architecture



4. Impact-Based Forecast (IBF) Methods & Color-Coded Warning System

The Paradigm Shift to Impact-Based Forecasting:

- **From 'Weather' to 'Impact':** Shift from 'What weather will be' (e.g. 45°C) to 'What weather will do' (health risks, productivity loss, grid pressure).
- **Risk Matrix Integration:** Combines Meteorological Hazard + Exposure Overlay + Socio-Economic Vulnerability Index.
- **Green (No Action):** Normal conditions. Standard public awareness.
- **Yellow Alert (Be Updated):** Heatwave in isolated pockets persisting 2 days. Moderate health concern for vulnerable groups (infants, elderly).
- **Orange Alert (Be Prepared):** Severe heatwave persisting 2 days or heatwave 4+ days. High risk of heat illness; water supply & labor protocols activated.
- **Red Alert (Take Action):** Extreme severe heatwave >2 days or heatwave >6 days. Extreme health danger; emergency heat action plans fully executed.

IMD Impact-Based Forecast (IBF) Color Code Matrix

GREEN: No Action Required

Normal weather conditions. No special protective measures required for general public.

YELLOW ALERT: Be Updated

Heat/Cold wave in isolated pockets persisting 2 days. Moderate health impact for vulnerable populations.

ORANGE ALERT: Be Prepared

Severe heat/cold wave persisting 2 days OR heatwave 4+ days. High health impact; work-rest schedules required.

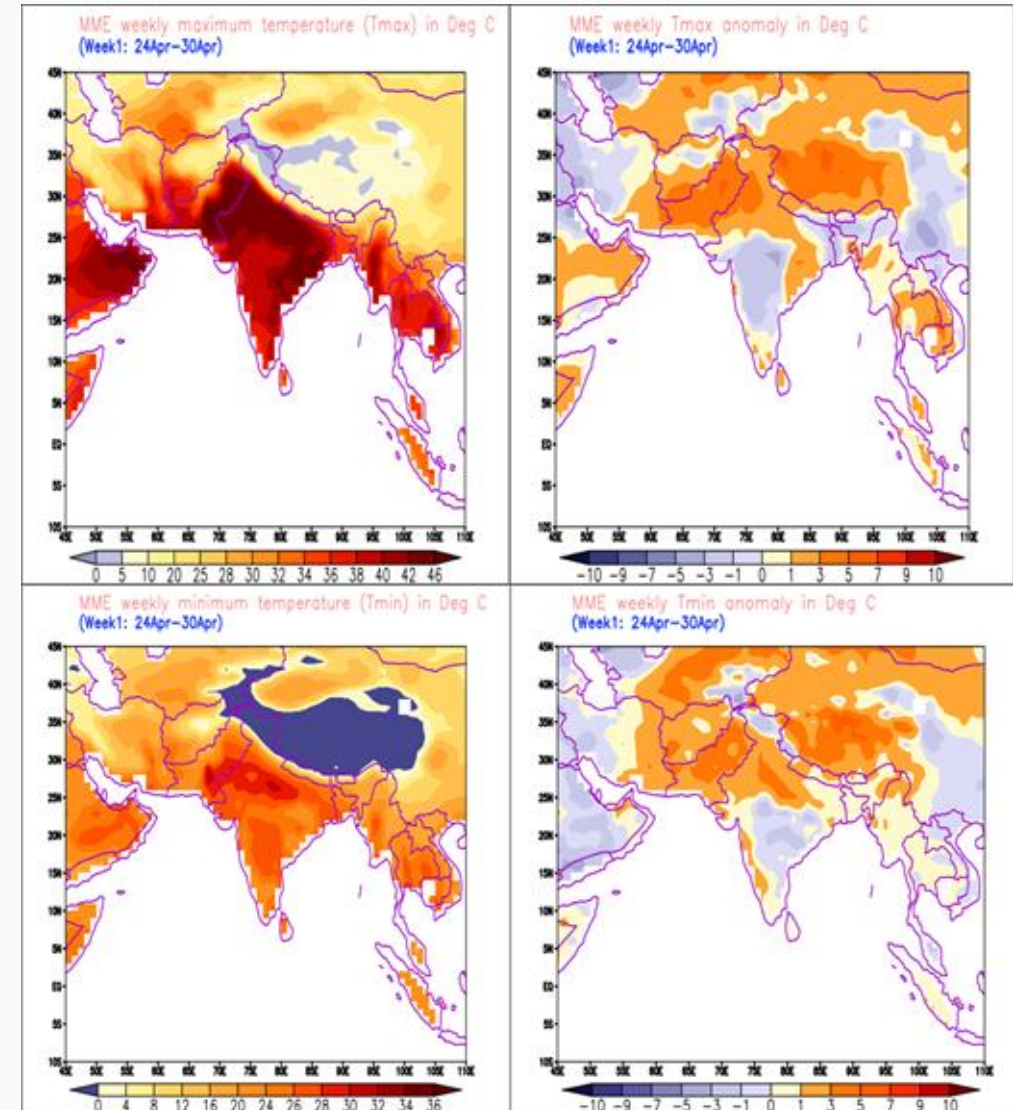
RED ALERT: Take Action

Extreme severe heatwave >2 days or heatwave >6 days. Very high danger of heatstroke/hypothermia for all ages.

5. Regional Climate Frameworks & Urban Heat Action Plans (SASCOF Examples)

Key Insights & Models:

- **SASCOF Regional Outlooks:** South Asian Climate Outlook Forum multi-country consensus forecasts for seasonal heat-health monitoring across South Asia.
- **Percentile Thresholding:** Integration of 90th, 95th, and 98th percentile climatological temperature thresholds alongside Relative Humidity (RH) and Heat Index.
- **Subdivision 7-Day Maps:** Daily color-coded sub-divisional risk maps communicated directly to state emergency operation centers.
- **Ahmedabad Heat Action Plan (HAP):** Pioneering urban heat resilience model establishing municipal cooling centers, roof painting, and public awareness.
- **Urban Microclimate Systems:** Integration with specialized city systems like i-FLOWS (Mumbai) & C-FLOWS (Chennai) for hyper-local heat risk mitigation.



Transition from Weather Prediction to Impact-Based Protection Saves Lives

TRADITIONAL FORECASTING

- **Primary Focus:** Predicts physical event parameters like air temperature and wind speed.
- **Standard Output:** 'Temperature will reach 45°C tomorrow in Region X.'
- **Key Metrics:** Climatological magnitude, duration, and statistical thresholds.
- **Major Limitation:** Provides the same generic alert regardless of local humidity, population vulnerability, or urban infrastructure density.

IMPACT-BASED FORECASTING

- **Primary Focus:** Predicts human, health, and socio-economic consequences.
- **Core Formula:** $\text{Risk} = \text{Hazard} \times \text{Vulnerability} \times \text{Exposure}$.
- **Actionable Output:** 'Outdoor construction productivity will drop 40%; hospital admissions expected to spike 15%.'
- **Contextual Advantage:** Differentiates 42°C in a humid, dense coastal city (Extreme Risk) vs 45°C in dry desert (Moderate Risk).

Four Forecasting Timescales Drive Multi-Tiered Stakeholder Interventions

SEASONAL & MONTHLY	EXTENDED RANGE	MEDIUM RANGE	SHORT RANGE
Lead Time: 1 - 3 Months Season Start & Monthly Action Goal: PREPARATION & DRILLS Pre-season exercises, refresher training, mock drills, and background risk assessment across state/national agencies.	Lead Time: 1 - 4 Weeks Issued Every Thursday Action Goal: ON-GROUND PLANNING Activation of Heat Action Plans (HAPs) based on 2-week probabilistic outlooks for heatwave & warm night spells.	Lead Time: 4 - 7 Days Issued Twice Daily Action Goal: ANTICIPATORY ACTIONS Pre-positioning resources, setting up district cooling centers, and adjusting work schedules for high-risk zones.	Lead Time: 1 - 3 Days Issued Twice Daily Action Goal: IMMEDIATE RESPONSE Execution of mandatory district-level SOPs, hospital staff surge capacity, and emergency community advisories.

Four-Tier Colour-Coded Alert System Triggers Contextual SOP Actions

Alert Level	Meteorological Criteria	Expected Impact	Suggested SOP Actions	Stakeholder Role
GREEN (Normal Day)	Temperatures near normal.	Comfortable conditions. No health impact expected.	No cautionary action required. Routine monitoring.	IMD routine reporting.
YELLOW (Heat Alert / Watch)	Heatwave in isolated pockets persisting for 2 days.	Moderate health concern for vulnerable groups (infants, elderly).	Avoid heat exposure. Wear light cotton clothes, cover head, hydrate.	SDMA/NDMA bulletins; local water distribution.
ORANGE (Severe Alert / Be Prepared)	Severe heatwave for 2 days OR heatwave for 4+ days.	High likelihood of heat illness in outdoor workers & vulnerable people.	Avoid peak sun; drink ORS, lassi; activate work-rest protocols.	Pre-position ambulances, adjust field hours.
RED (Extreme Warning / Action)	Severe heatwave > 2 days OR total HW days > 6 days.	Very high likelihood of heat stroke in ALL age groups.	Extreme care for all. Cooling shelters active; emergency surge.	EOC active; hospital medical staff surge.

Multi-Parameter Data Fusion Synthesizes Physical & Vulnerability Layers

METEOROLOGICAL LAYER

Temperature & Percentiles

- Absolute Maximum & Minimum Temperatures (up to 7 days).
- Historical 90th, 95th, and 98th Percentile departures.
- Co-existence of Heat Waves and Warm Night conditions.

HEAT INDEX & WBGT

Humidity & Micro-Climate

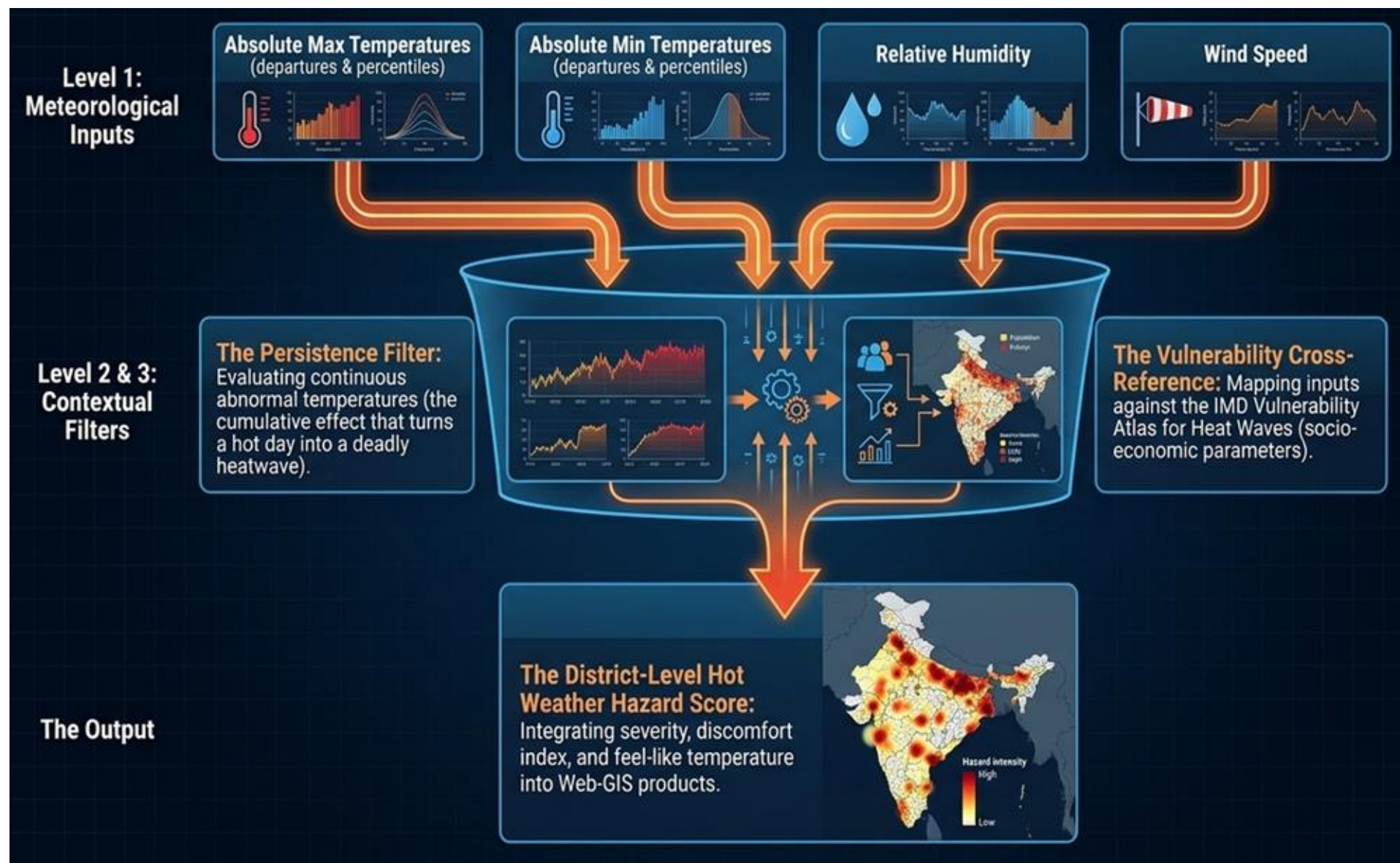
- Relative Humidity forecast integration for 'Feel-like' Heat Index.
- Wet Bulb Globe Temperature (WBGT) monitoring for coastal/marine heat.
- Urban Heat Island (UHI) mapping via MODIS/Landsat thermal satellite data.

GIS VULNERABILITY ATLAS

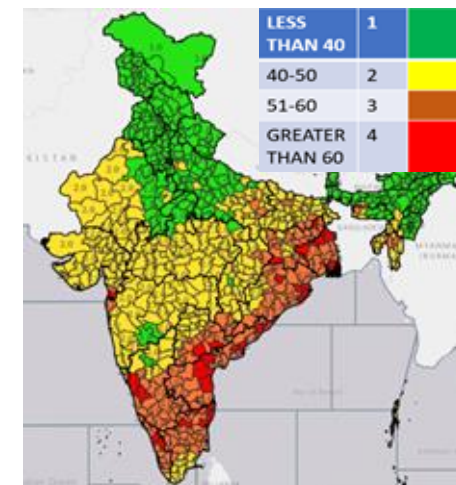
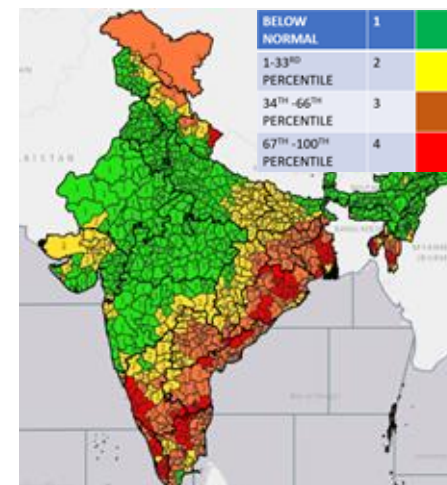
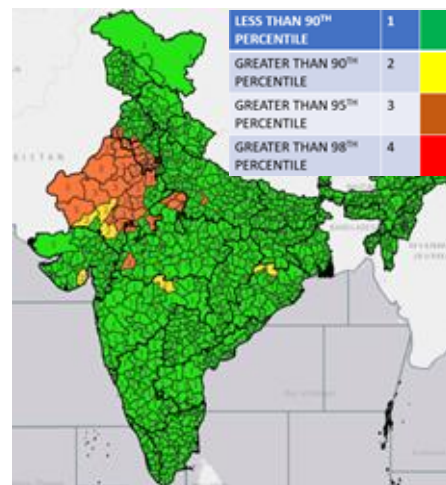
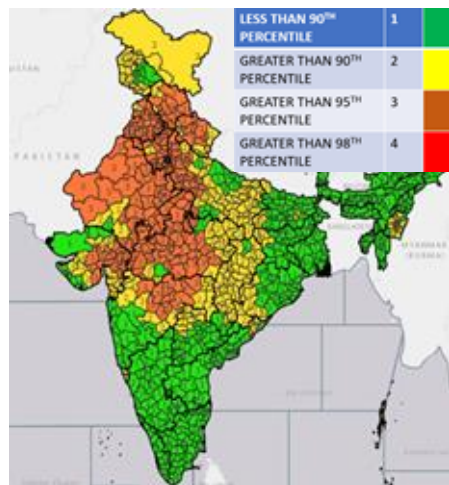
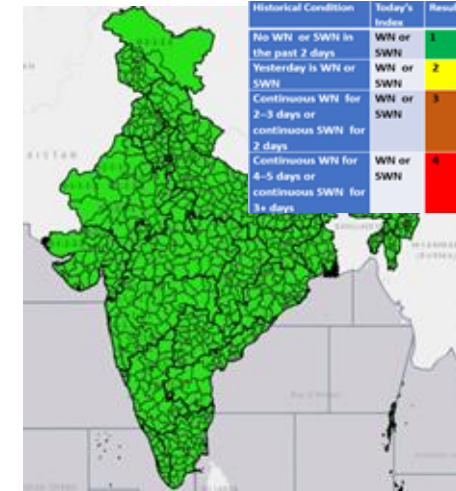
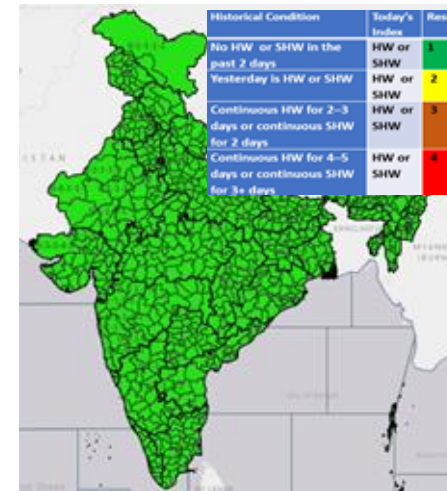
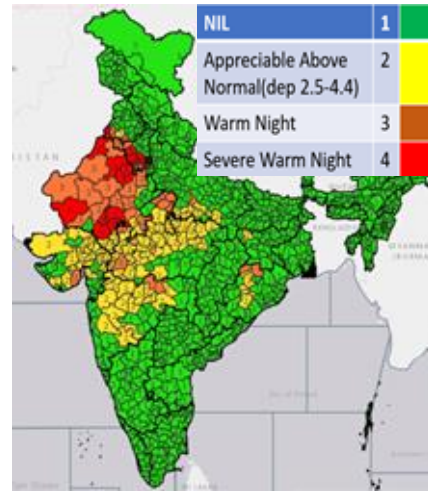
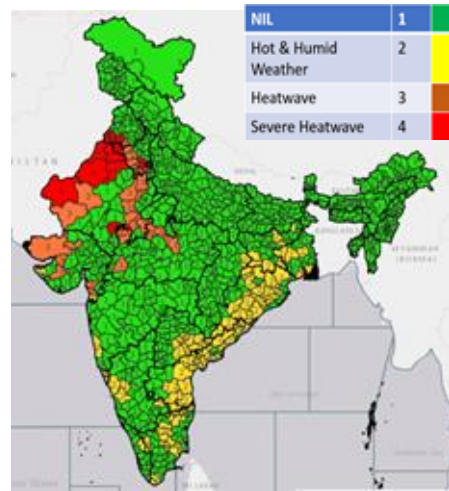
Socio-Economic & Infrastructure

- Population density & vulnerable demographic mapping (elderly, infants).
- Overlay with Indian Railway network, national highways, and power grids.
- Automated risk scoring for schools, SEZs, power plants, and hospitals.

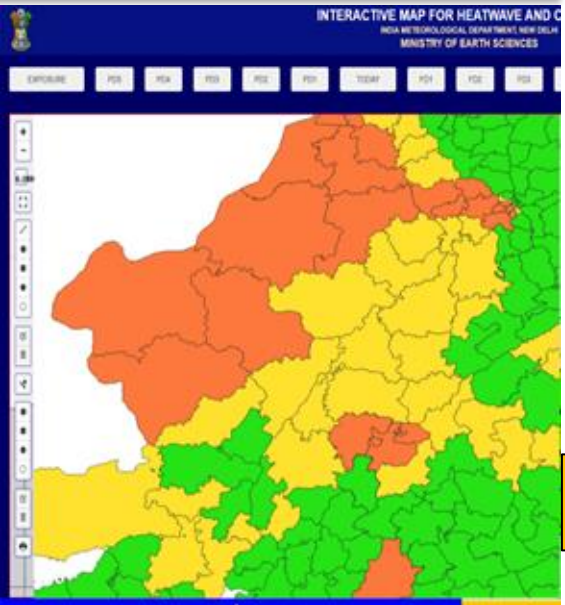
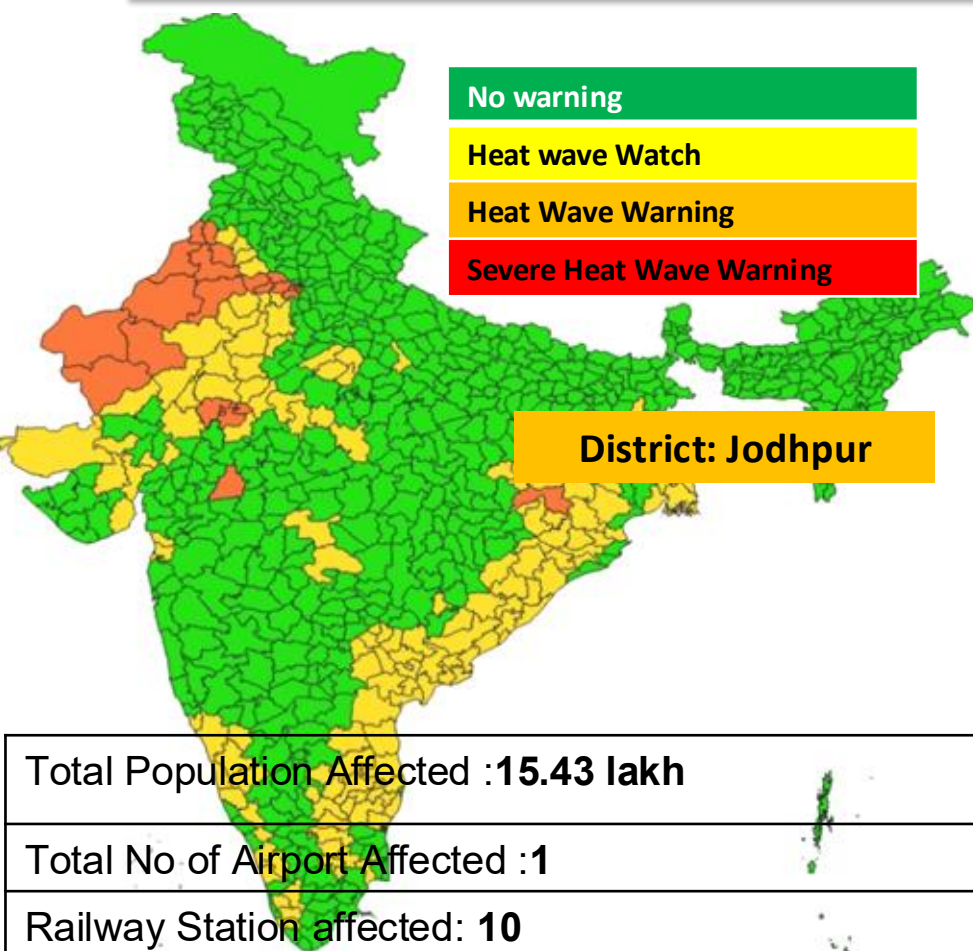
Calculating Hot Weather Hazard:



An example of district-wise Heat wave warning products Prepared Daily



Composite Index Based Heat Wave Watch and Warning



District: JODHPUR: ORANGE Warning (Be prepared)

IMPACTS

- **Human Health:** Increases risk of heatstroke, dehydration, and cardiovascular issues; vulnerable populations suffer most.
- **Agriculture:** Reduces crop yields, causes drought stress, disrupts planting/harvesting cycles.
- **Livestock:** Causes heat stress, reduced productivity, higher mortality.
- **Transport:** Damages roads/railways, causes delays and accidents, affects worker safety.
- **Economy:** Disrupts labor productivity, increases health and infrastructure costs.
- **Water Resources:** Increases evaporation, reduces freshwater availability, worsens droughts.

ACTION

- **Human Health:** Improve heat warning systems, expand access to cooling centers, promote hydration and public awareness.
- **Energy:** Boost energy efficiency, diversify energy mix, upgrade grids for heat resilience.
- **Livestock:** Provide shade, ventilation, ample water; modify feeding times.
- **Transport:** Upgrade infrastructure for heat resilience, adjust work hours, enhance maintenance.
- **Economy:** Invest in heat-resilient jobs and technology, support heat-impacted sectors.
- **Water Resources:** Improve water conservation, build reservoirs, enhance drought planning.

Total Population Affected :15.43 lakh	Total No of SEZ affected: 1
Total No of Airport Affected :1	Total No of Power Station affected:6
Railway Station affected: 10	Total No of Power Plants affected:4
Railway affected :North Western Railway	Major Towns affected:9
Hospitals affected: 35	

Sector-Specific Guidance Protects Vulnerable Workers & Infrastructure

INFORMAL WORKERS & LABOR PROTECTION

- **Grassroots Communication:** Pilots with street vendor, hawker, and domestic worker associations delivering simple-language audio messages & bulletins.
- **Work-Rest Protocols:** Pre-positioning WBGT monitors at outdoor construction sites 24-48 hours before heat peak.
- **Ahmedabad Case Study:** Heatwave days cause 1.19 hours of worktime loss and require 1.65 hours of additional rest time for outdoor worker safety.
- **High-Risk Sectors:** Agriculture (60% work hours lost by 2030) and Construction (19% work hours lost).

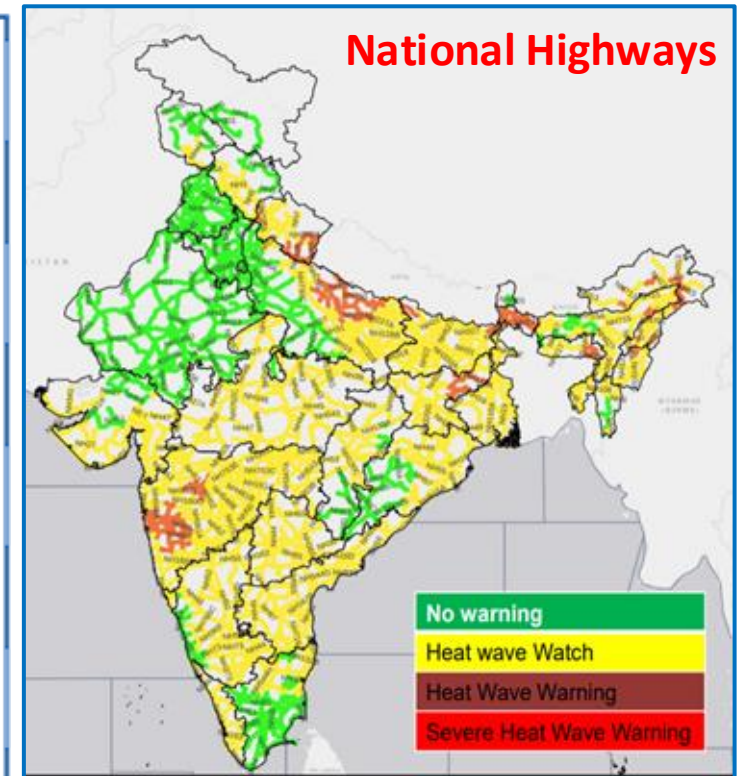
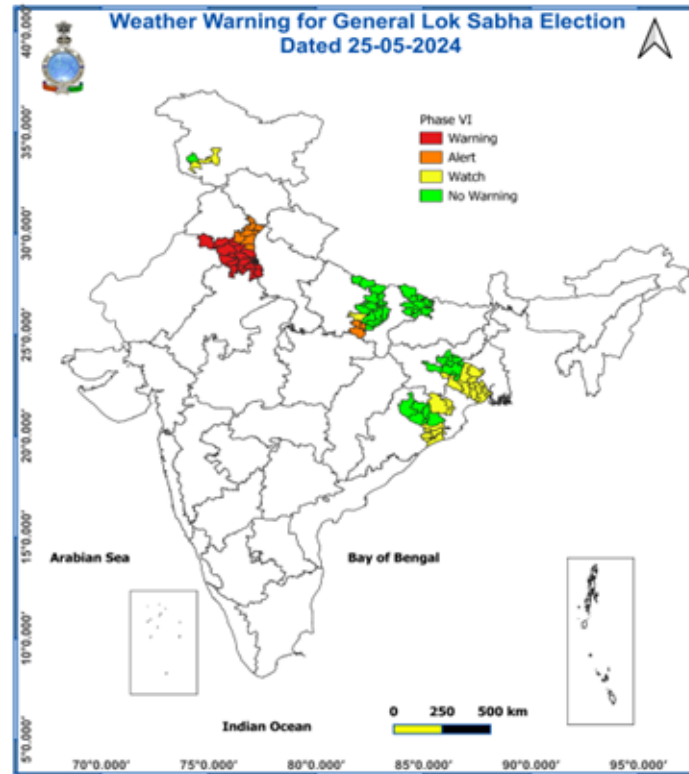
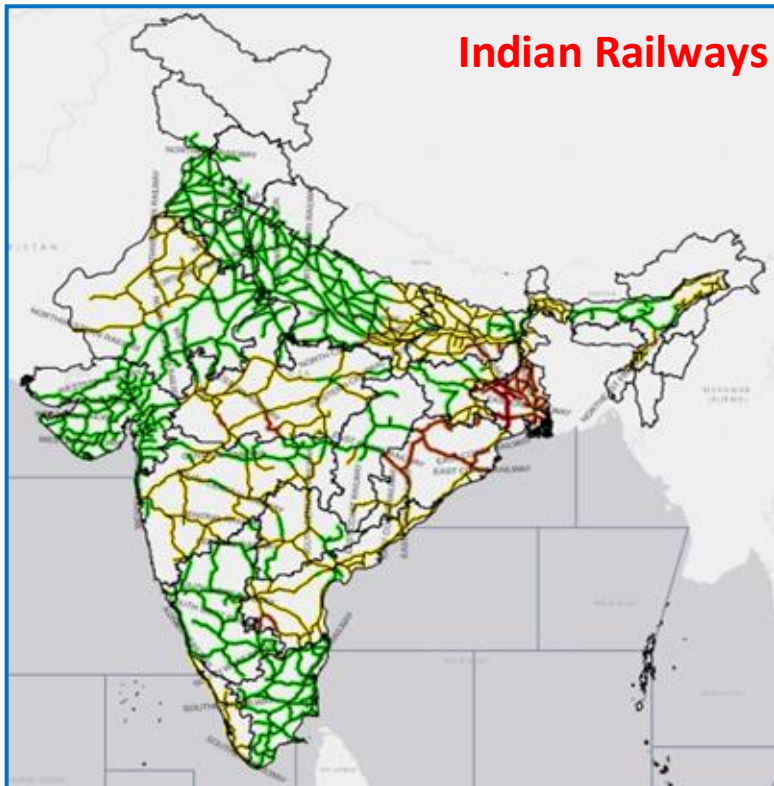
CRITICAL INFRASTRUCTURE & MULTI-AGENCY SOPS

- **Power Grid Protection:** Predicting peak AC load demand 48-72 hours ahead to prevent transformer explosions and rolling blackouts.
- **Sectoral Weather Bulletins:** Dedicated heatwave warning maps overlaid with Indian Railway network, highway corridors, and General Election voting phases.
- **Multi-Agency Coordination:** Pre-established roles linking Municipalities (cooling centers), IMD (alerts), Health (hospital capacity), and Emergency Services (ambulances).
- **Public Health Synergy:** Correlating temperature forecasts with historical ambulance call volumes to pre-position resources.

Success Story of IMD in IBF for Heatwaves



Sectorial IBF warnings by IMD



Multi-Channel Dissemination Delivers Hyper-Local Early Warnings Nationally

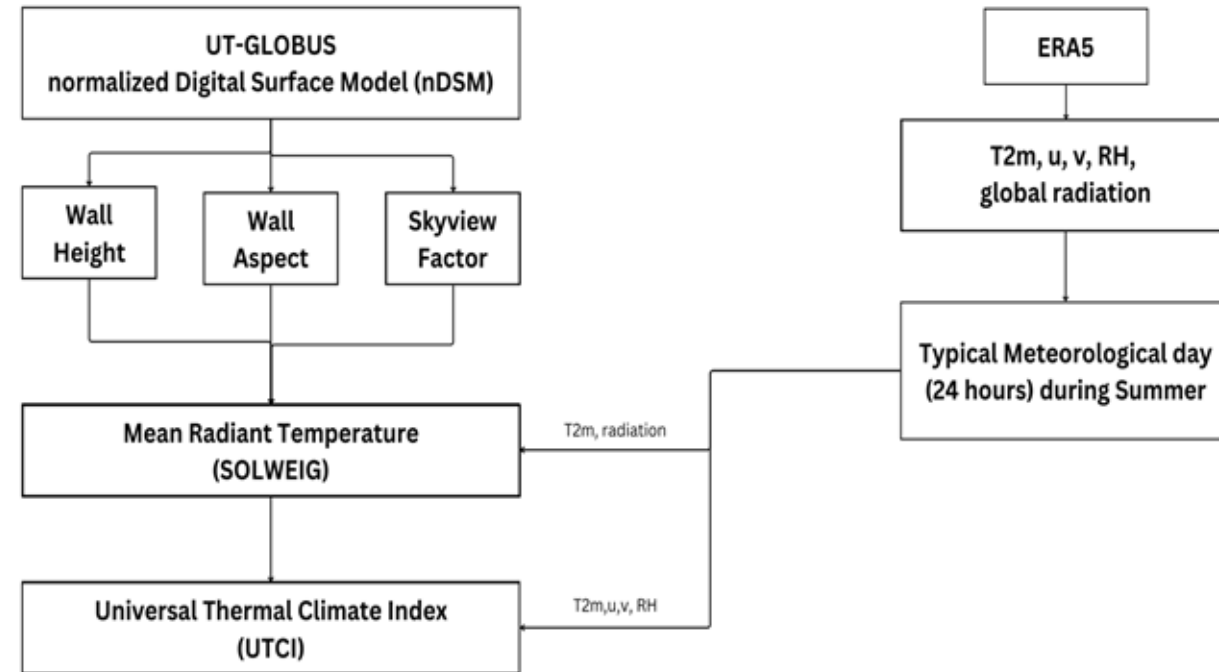
DIGITAL PLATFORMS	MASS MEDIA	OFFICIAL DIRECT
Mausam App, SACHET Portal (NDMA), UMANG, Web-GIS Portal, and Open APIs for automated system integration.	CAP-enabled location SMS, TV news broadcasts, radio alerts, and real-time social media infographics.	Direct E-mails, State Emergency Operation Centres (SEOC), Agromet Advisories, and District Collector portals.

KEY ACHIEVEMENTS & STRATEGIC OUTLOOK

- ✓ **150 Years of Service to the Nation: Transitioning India from reactive disaster response to world-class proactive climate resilience.**
- ✓ **Hyper-Local Web-GIS Platform: District-wise and station-wise heatwave warning products accessible to stakeholders in real-time.**
- ✓ **Health-Climate Integration: First-of-its-kind weekly disease vector transmission window outlooks (Malaria/Dengue) linked with temperature ERFs.**
- ✓ **Inclusive Protection: Extending tailored warning services directly to informal workers, outdoor laborers, railways, and power utilities.**

Universal Thermal Climate Index (Experimental)

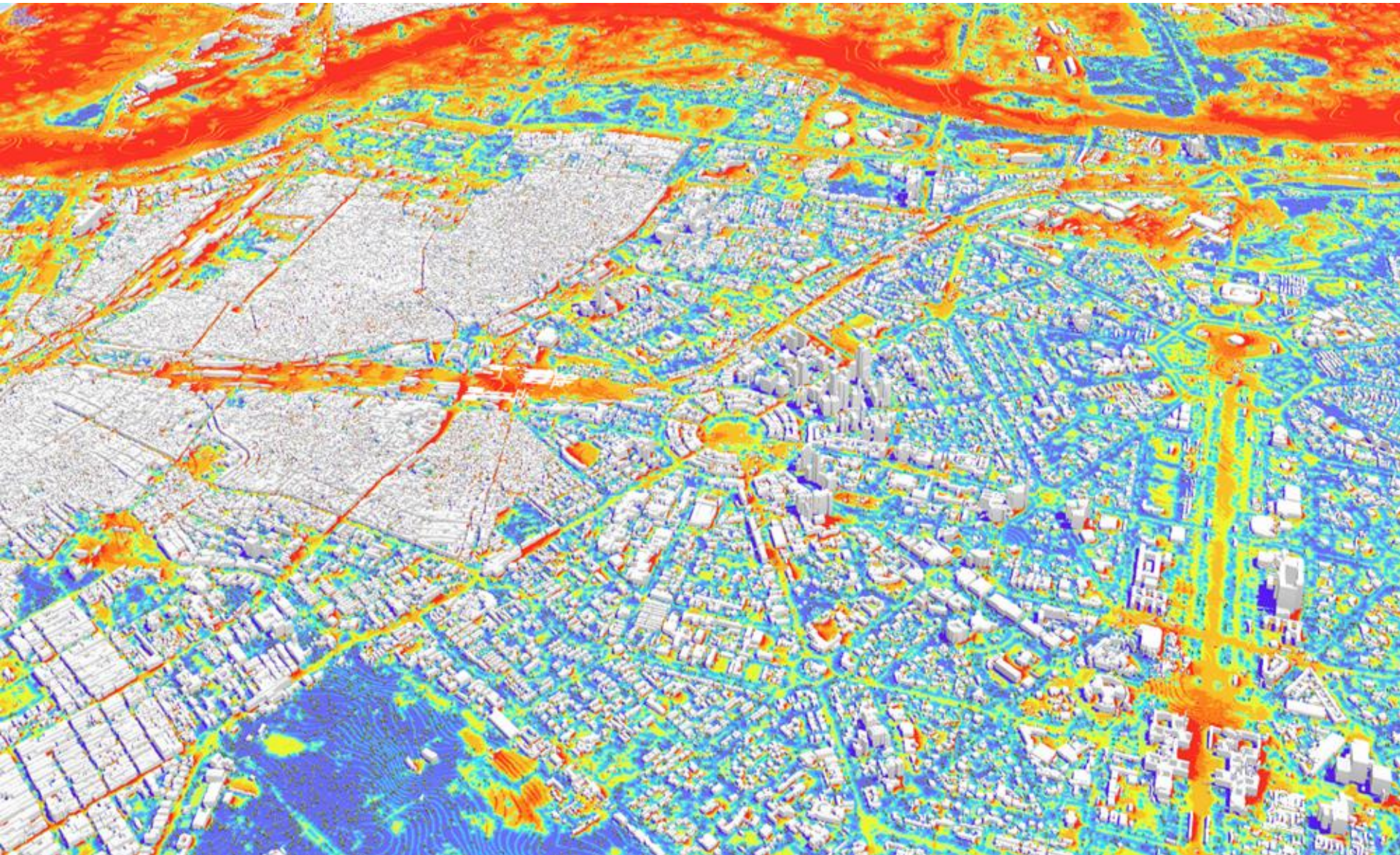
- The universal thermal climate index (UTCI) is a human biometeorology parameter that is used to assess the linkages between the outdoor environment and human well-being.
- Thermal comfort indices describe how the human body experiences atmospheric conditions, specifically air temperature, humidity, wind, and radiation.
- There are four variables required to calculate the UTCI: 2m air temperature, 2m dew point temperature (or relative humidity), wind speed at 10m above ground level, and mean radiant temperature (MRT)



Data Sources:

- The universal thermal climate index (UTCI) is computed using data from the ECMWF ERA5 reanalysis.

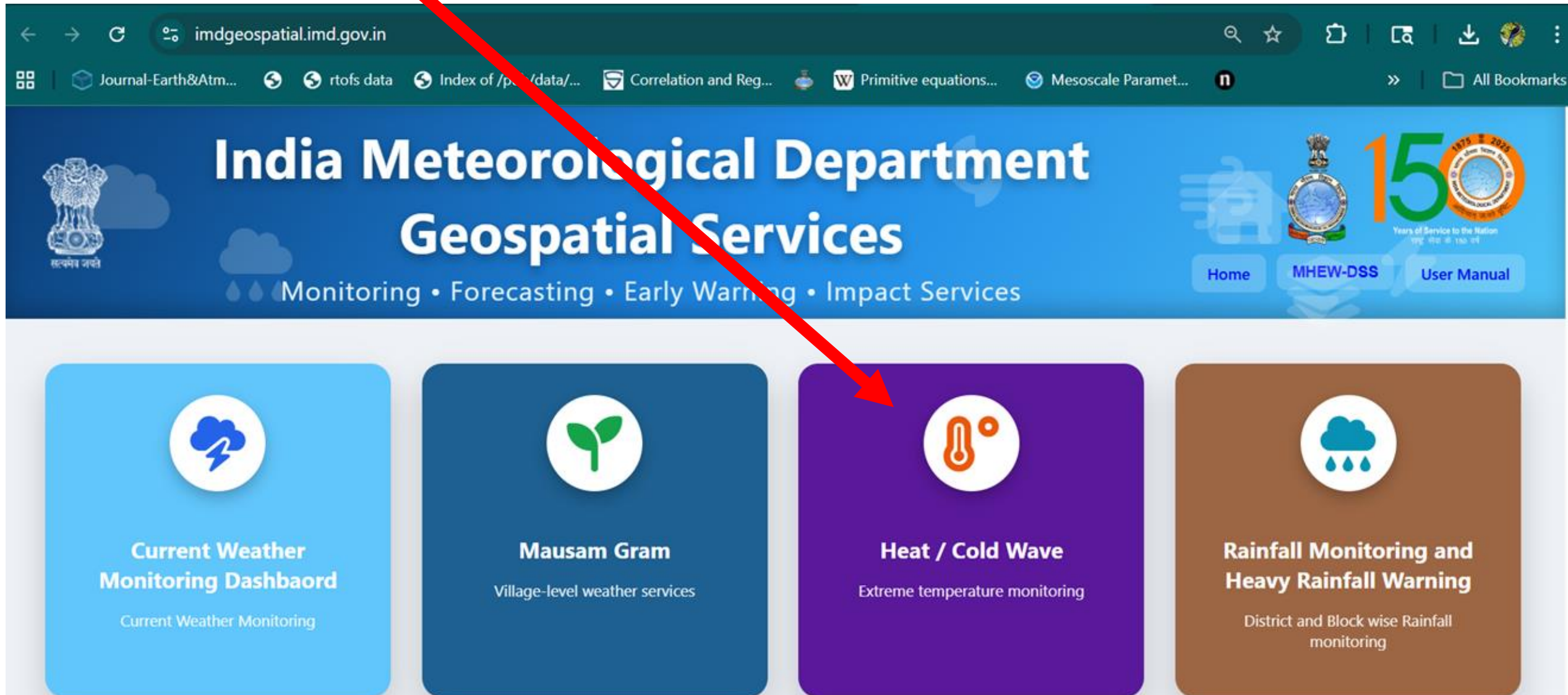
Universal Thermal Climate Index (Initial Results)



UTCI (°C) range	Stress Category
above +46	extreme heat stress
+38 to +46	very strong heat stress
+32 to +38	strong heat stress
+26 to +32	moderate heat stress
+9 to +26	no thermal stress
+9 to 0	slight cold stress
0 to -13	moderate cold stress
-13 to -27	strong cold stress
-27 to -40	very strong cold stress
below -40	extreme cold stress

<https://arcg.is/1DDuuX3>

<https://imdgeospatial.imd.gov.in/>



The screenshot shows the homepage of the India Meteorological Department Geospatial Services portal. The browser address bar displays the URL imdgeospatial.imd.gov.in. The page features a blue header with the department's name and a 150th anniversary logo. Below the header, there are four service tiles: 'Current Weather Monitoring Dashbaord', 'Mausam Gram', 'Heat / Cold Wave', and 'Rainfall Monitoring and Heavy Rainfall Warning'. A red arrow points from the URL to the 'Heat / Cold Wave' tile.

India Meteorological Department Geospatial Services

Monitoring • Forecasting • Early Warning • Impact Services

Home MHEW-DSS User Manual



Current Weather Monitoring Dashbaord

Current Weather Monitoring



Mausam Gram

Village-level weather services



Heat / Cold Wave

Extreme temperature monitoring



Rainfall Monitoring and Heavy Rainfall Warning

District and Block wise Rainfall monitoring

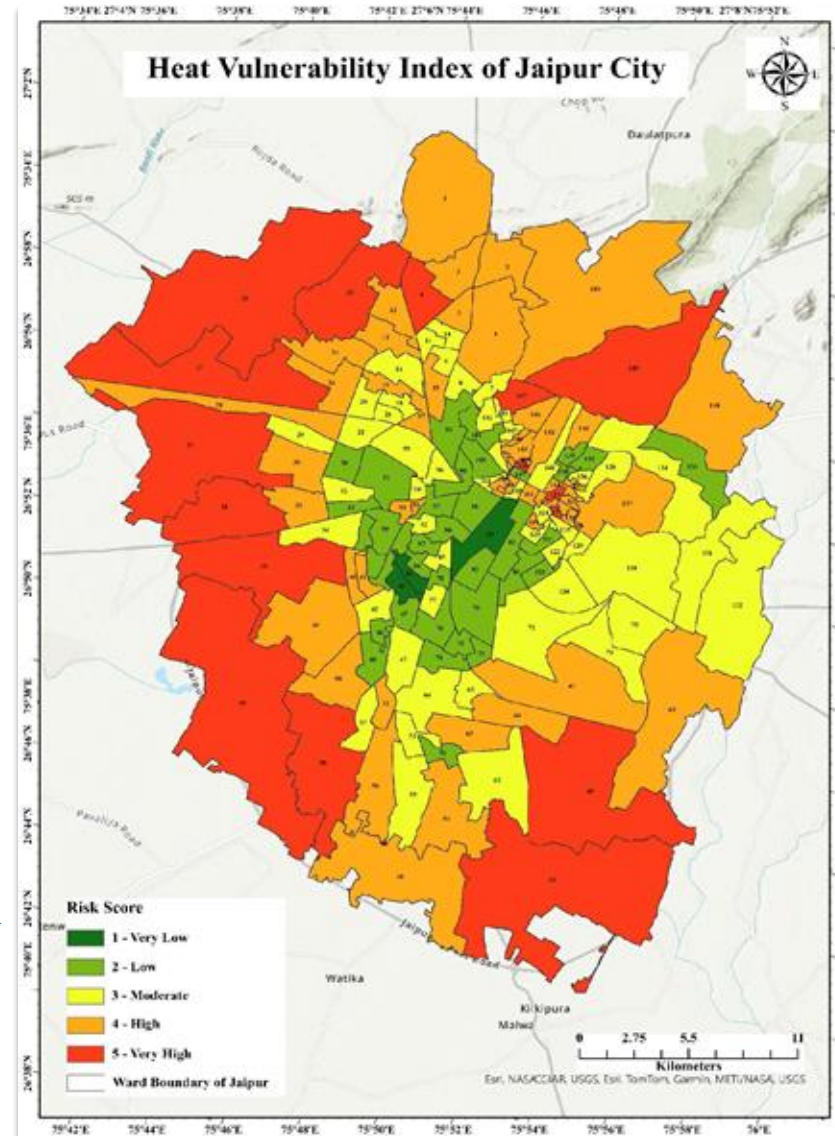
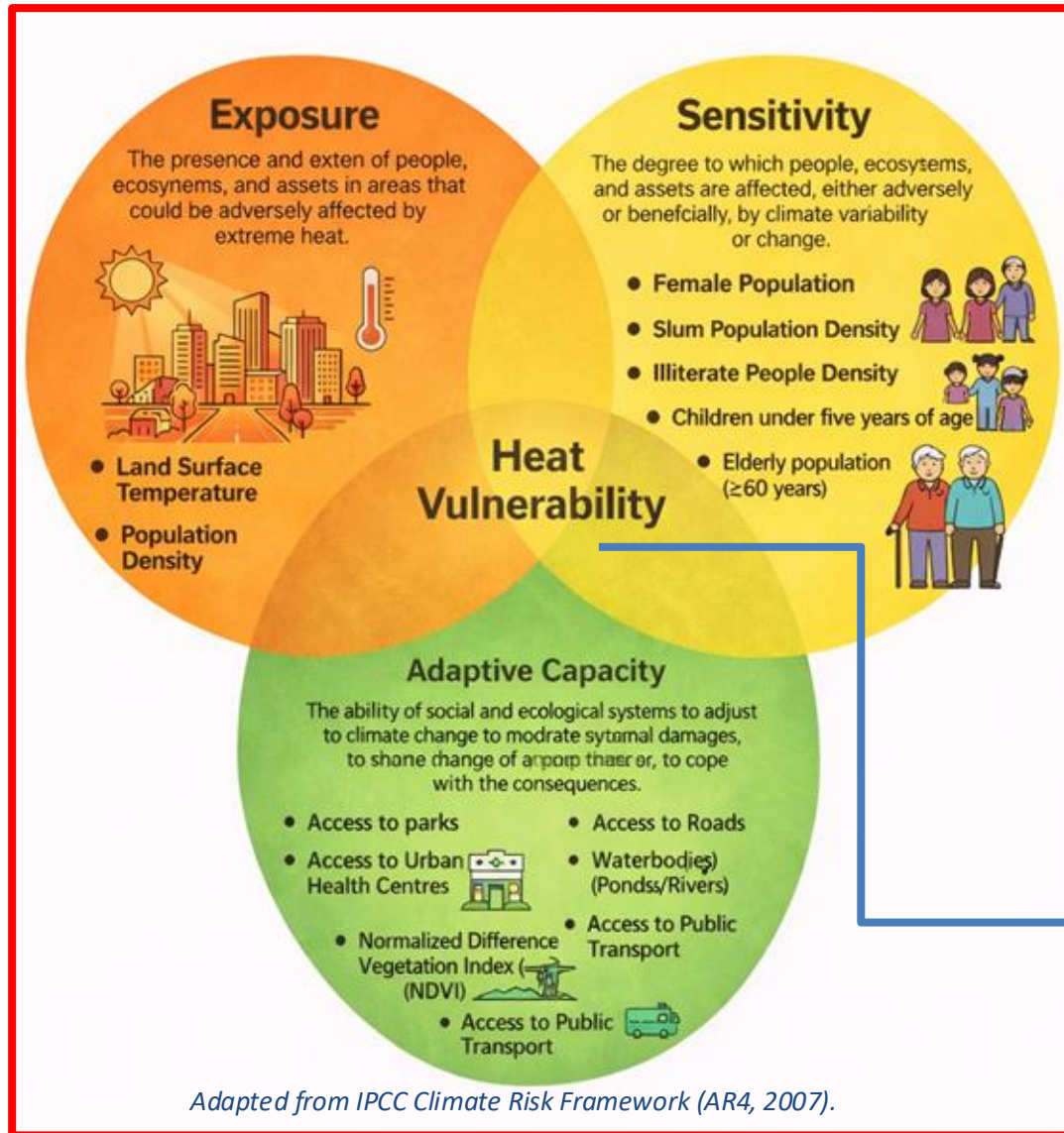
HEATWAVE IMPACT-BASED FORECASTING

Jaipur Heat Action Plan : Launched in March, 2026



VULNERABILITY: Framework + Who Is Most at Risk? | Jaipur HAP 2026

A three-component framework used in Jaipur HAP - pinpointing where risk is highest, who suffers most, and what protects them



Women & Girls

Higher sensitivity; less access to cooling & healthcare

Elderly (60+)

Reduced thermoregulation; chronic conditions

Chronic Patients

Diabetes, hypertension medication + heat risk

Children Under 5

Cannot self-regulate; PHCs in high-risk NW wards

Informal Workers

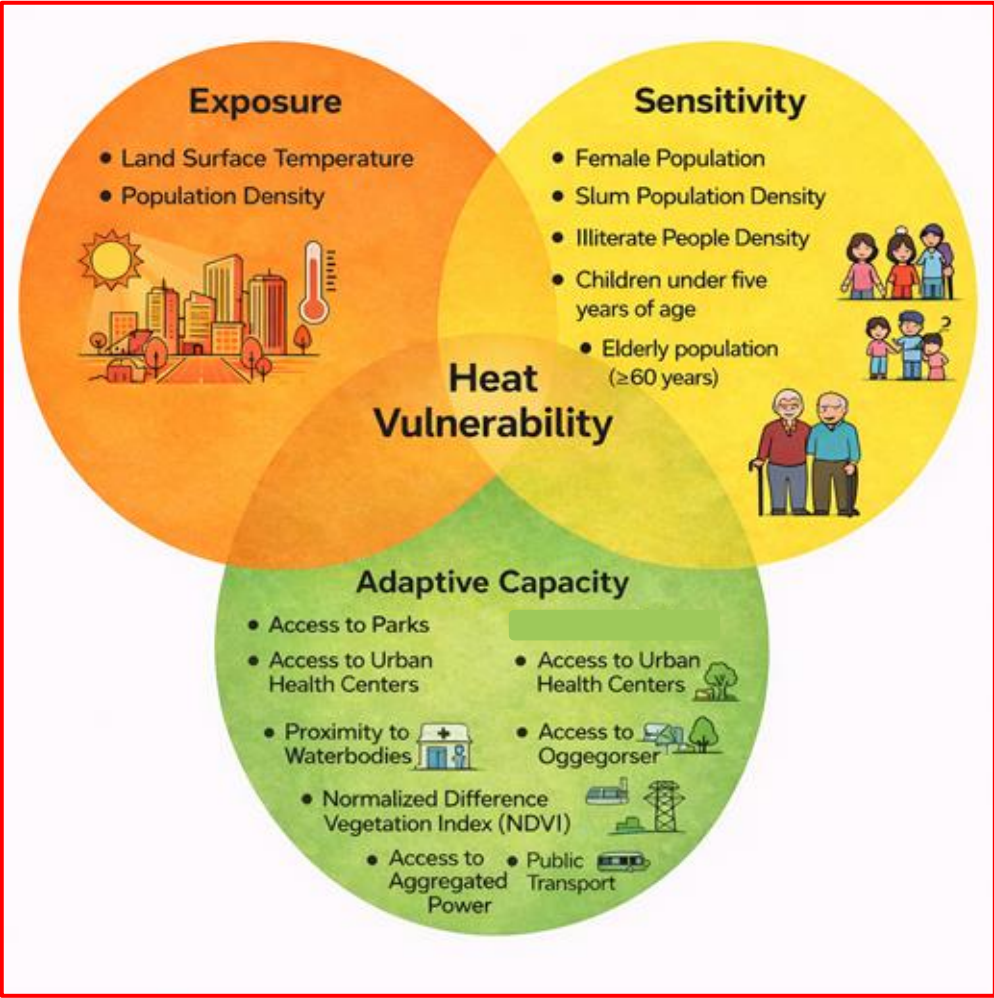
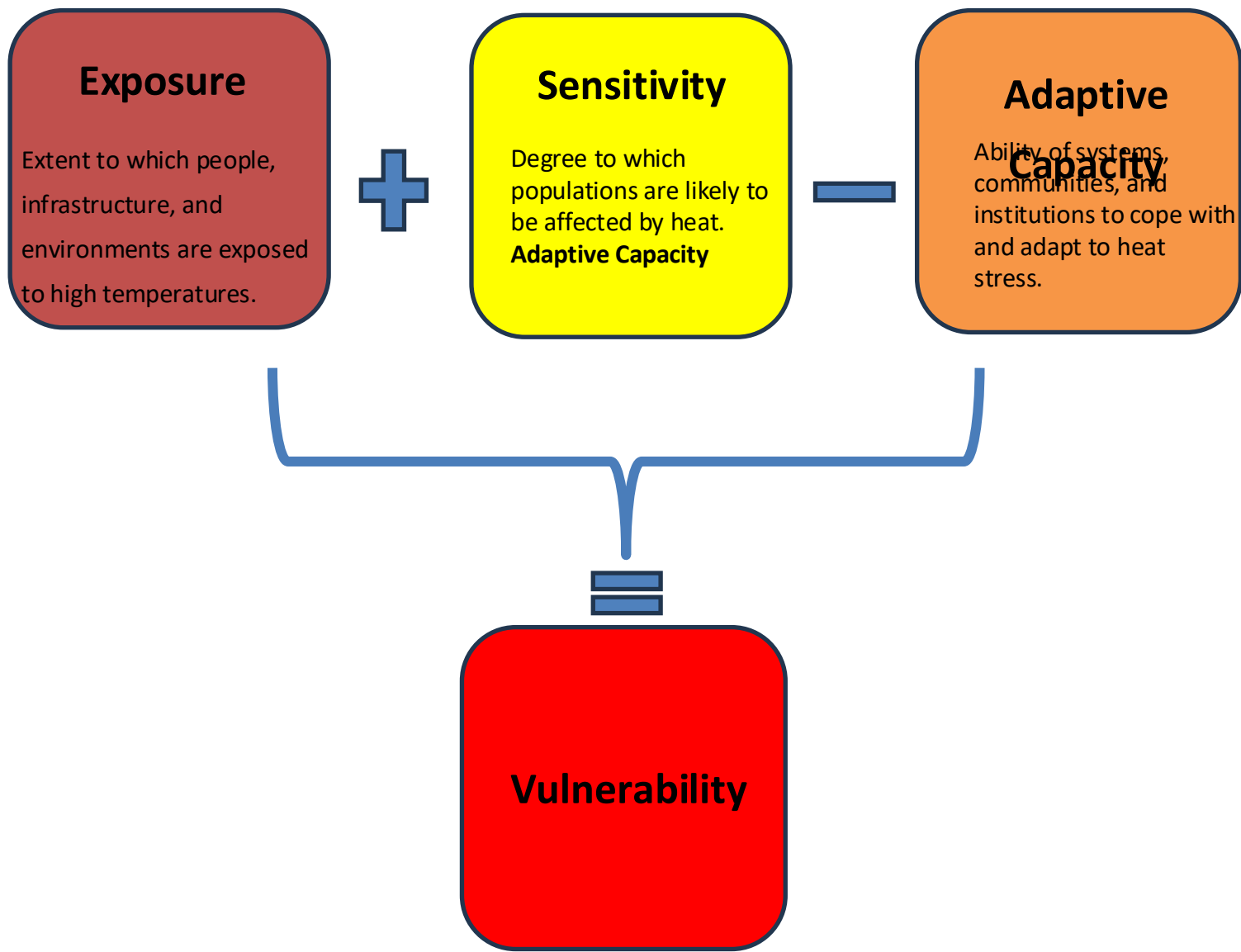
Construction, rickshaw prolonged outdoor exposure

Slum Residents

Metal/asbestos roofs trapped heat, no escape

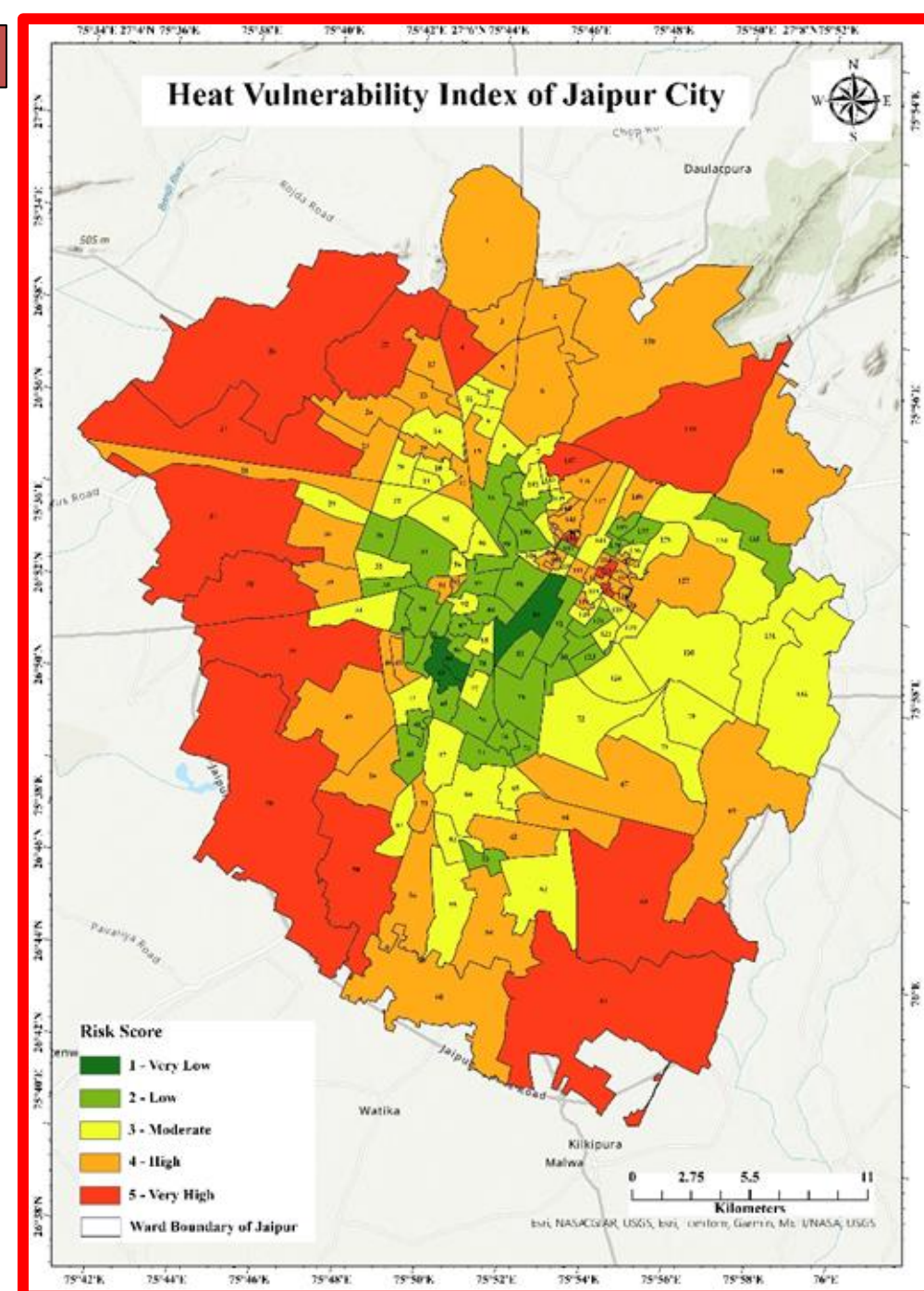
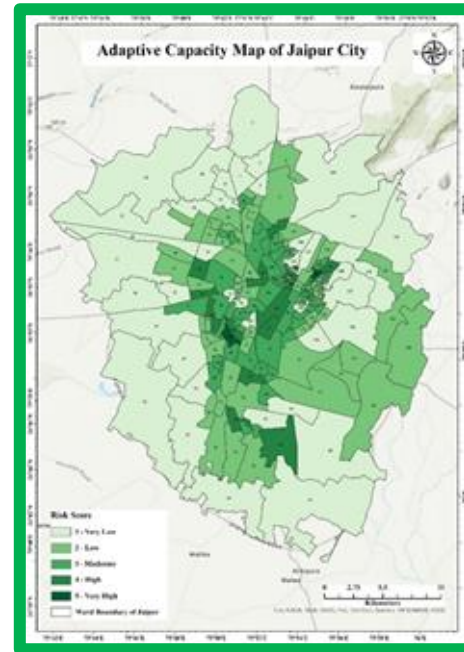
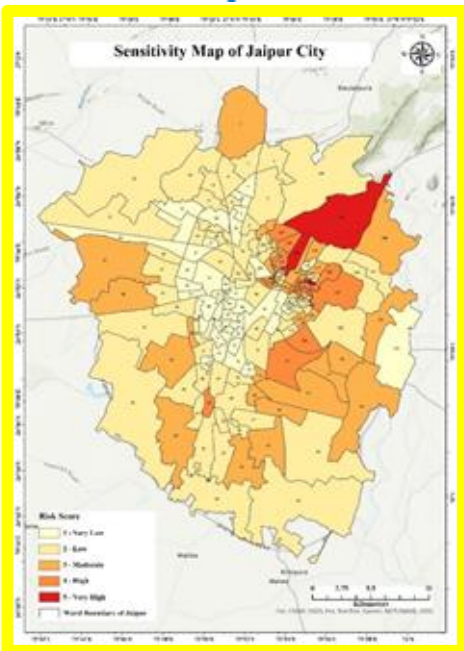
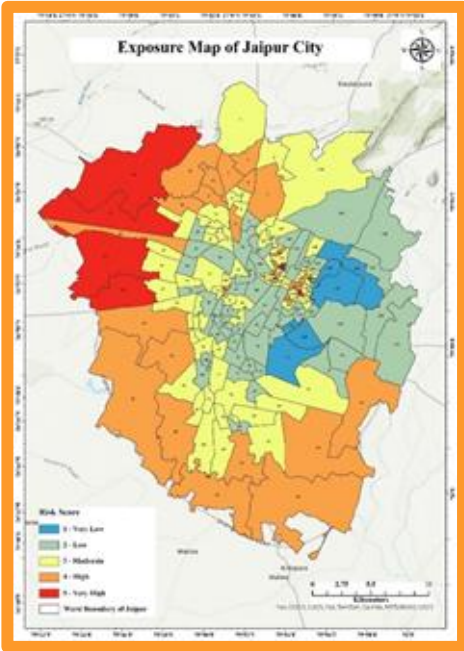
HEAT VULNERABILITY ASSESSMENT

This framework is based on the vulnerability concept defined by: **IPCC AR4 (2007)** $Vulnerability = Exposure + Sensitivity - Adaptive Capacity$



• Heatwave risk is the product of three latent factors: Exposure, Sensitivity and Adaptive Capacity.

DERIVATION OF HEAT VULNERABILITY INDEX OF JAIPUR



Adapted from IPCC Climate Risk Framework (AR4, 2007).

VULNERABILITY, HEAT RISK ZONE & HEALTH INFRASTRUCTURE

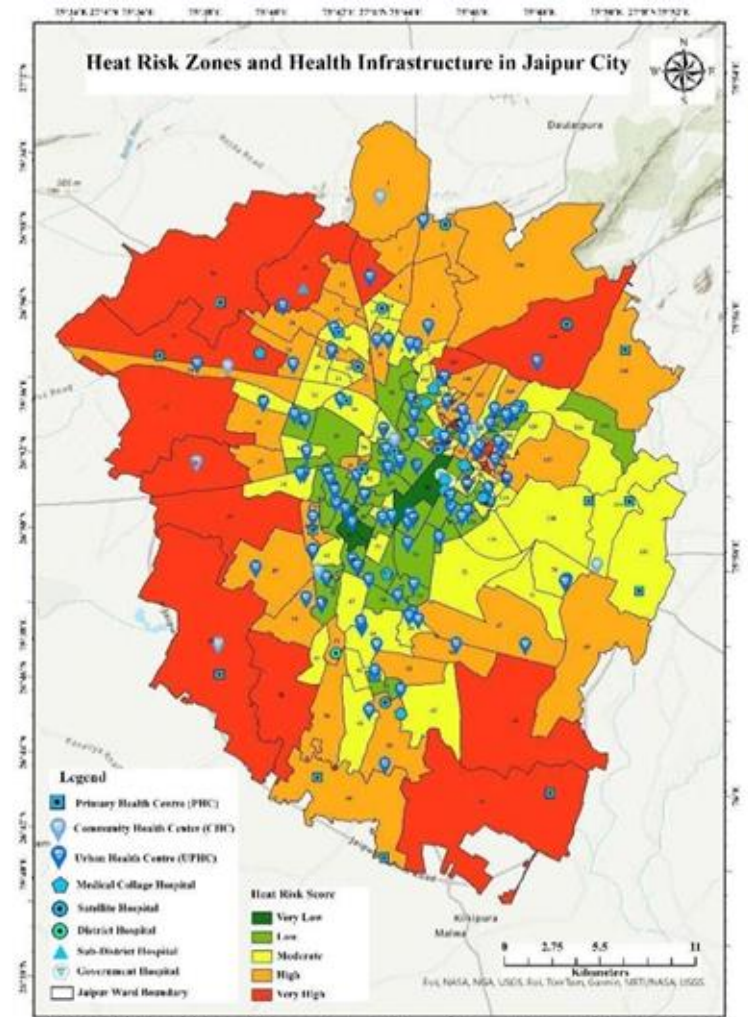
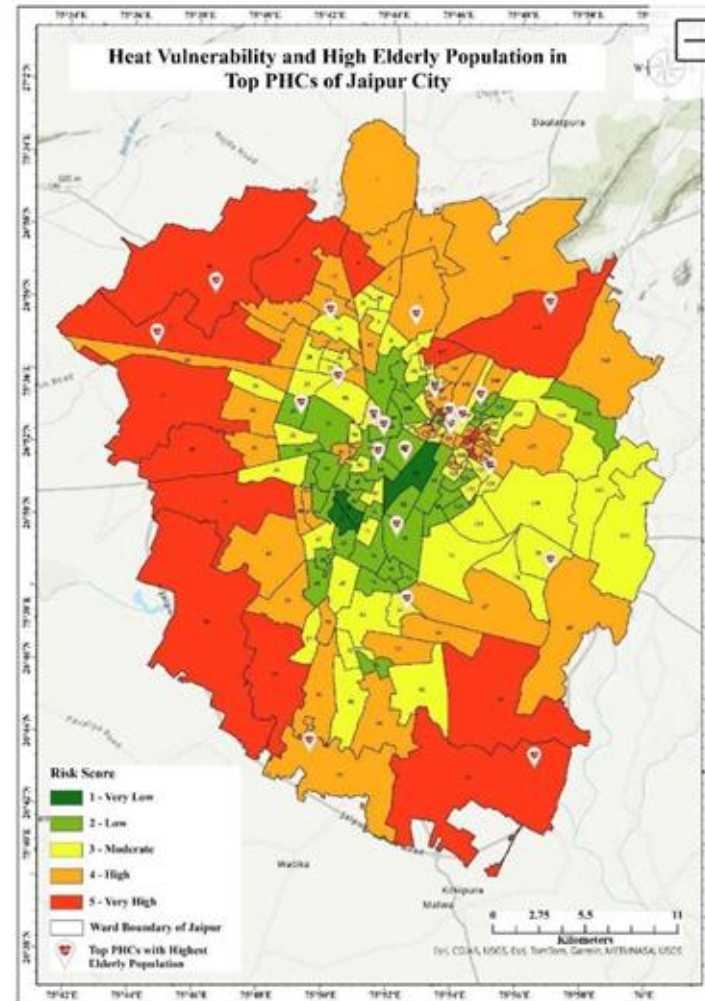
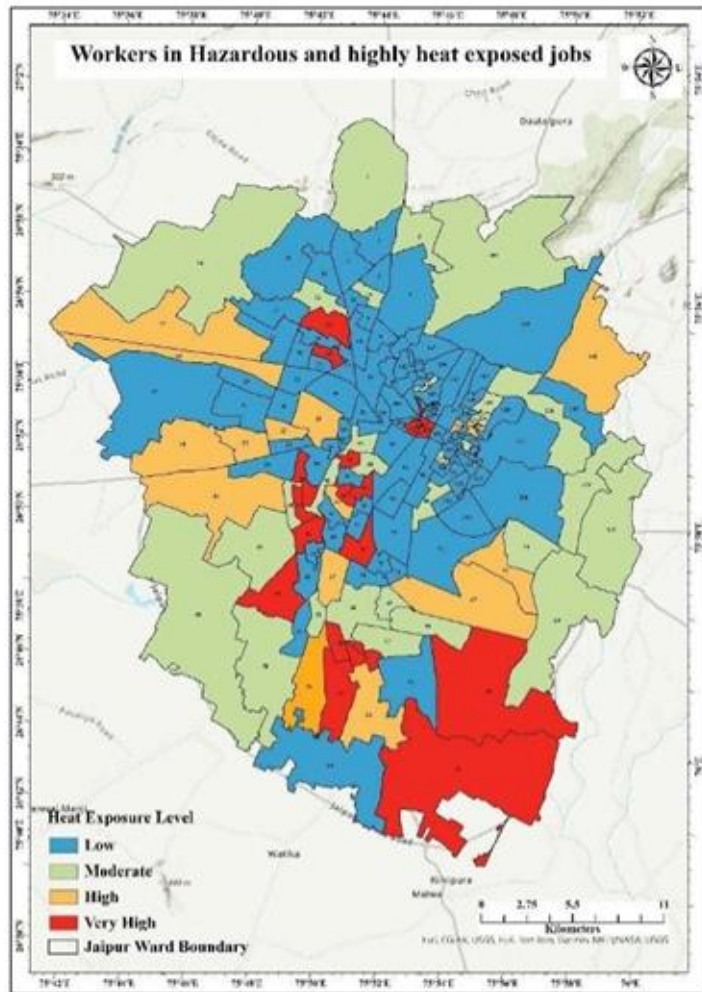
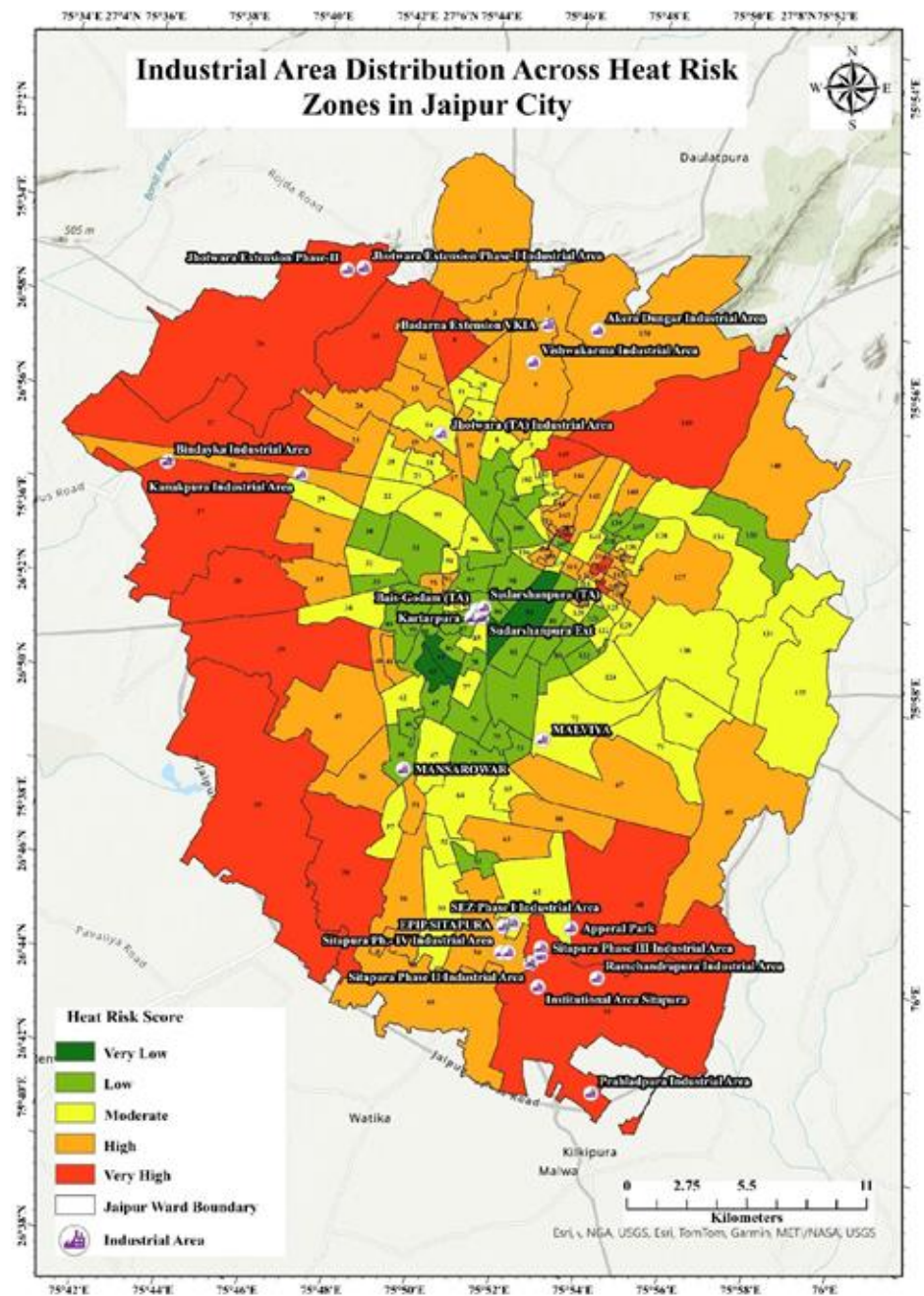


Figure 19 Ward-wise proportion on people working in highly heat-exposed jobs

Figure 17 High Elderly population overlaid on Heat Vulnerability Map

Figure 20 Access to Public Facilities in Jaipur

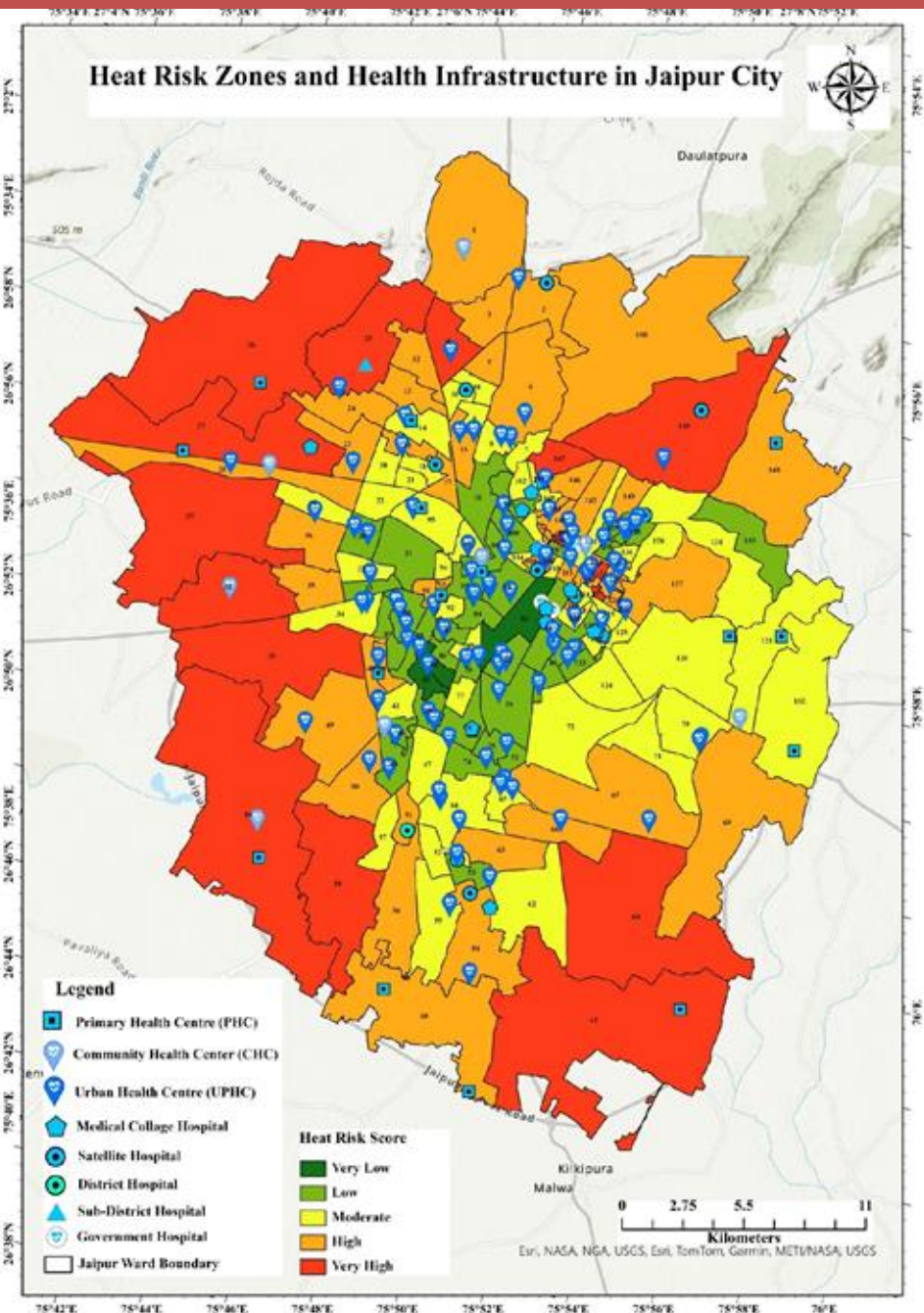
INDUSTRIAL EXPOSURE ACROSS HEAT RISK ZONES IN JAIPUR CITY



- This map presents the ward-level **Heat Risk Index** for Jaipur city, with industrial areas overlaid to assess exposure.
- The base layer shows categorized heat risk zones ranging from Low to Very High. Industrial clusters have been spatially mapped to understand their distribution across these risk categories.
- The accompanying table summarizes the Heat Vulnerability Index (HVI) risk score and identifies wards where industrial activities are located within each risk category. This helps in prioritizing industrial heat mitigation interventions in high-risk wards.

		Wards with Industrial Presence	
Very High	5	4, 25, 27, 37, 61	5
High	4	2, 6, 28, 54, 150	5
Moderate	3	72, 85	2
Low	2	48, 84, 87	3

ALIGNMENT OF HEALTH INFRASTRUCTURE WITH HEAT RISK ZONES – JAIPUR CITY



- This spatial analysis provides a decision-support framework to align health infrastructure planning with identified heat risk zones, ensuring equitable and climate-responsive urban health preparedness under the Jaipur Heat Action Plan.
- High-risk peripheral wards require focused healthcare strengthening during heatwave events.

		Wards with Health Centres	
Very High	5	4, 25, 26, 27, 61, 149, 37, 38, 39, 58, 59, , 68, 106, 113, 117, 147,	6
High	4	1, 2, 6, 15, 17, 23, 24, 28, 36, 41, 49, 51, 60, 63, 66, 67, 69, 93, 105, 108, 115, 119, 148, 150	24
Moderate	3	10, 18, 20, 95, 34, 42, 130, 131, 132, 134	10
Low	2	30, 33, 84 , 88, 90, 99, 107, 135, 138	9

 Inadequate health facilities

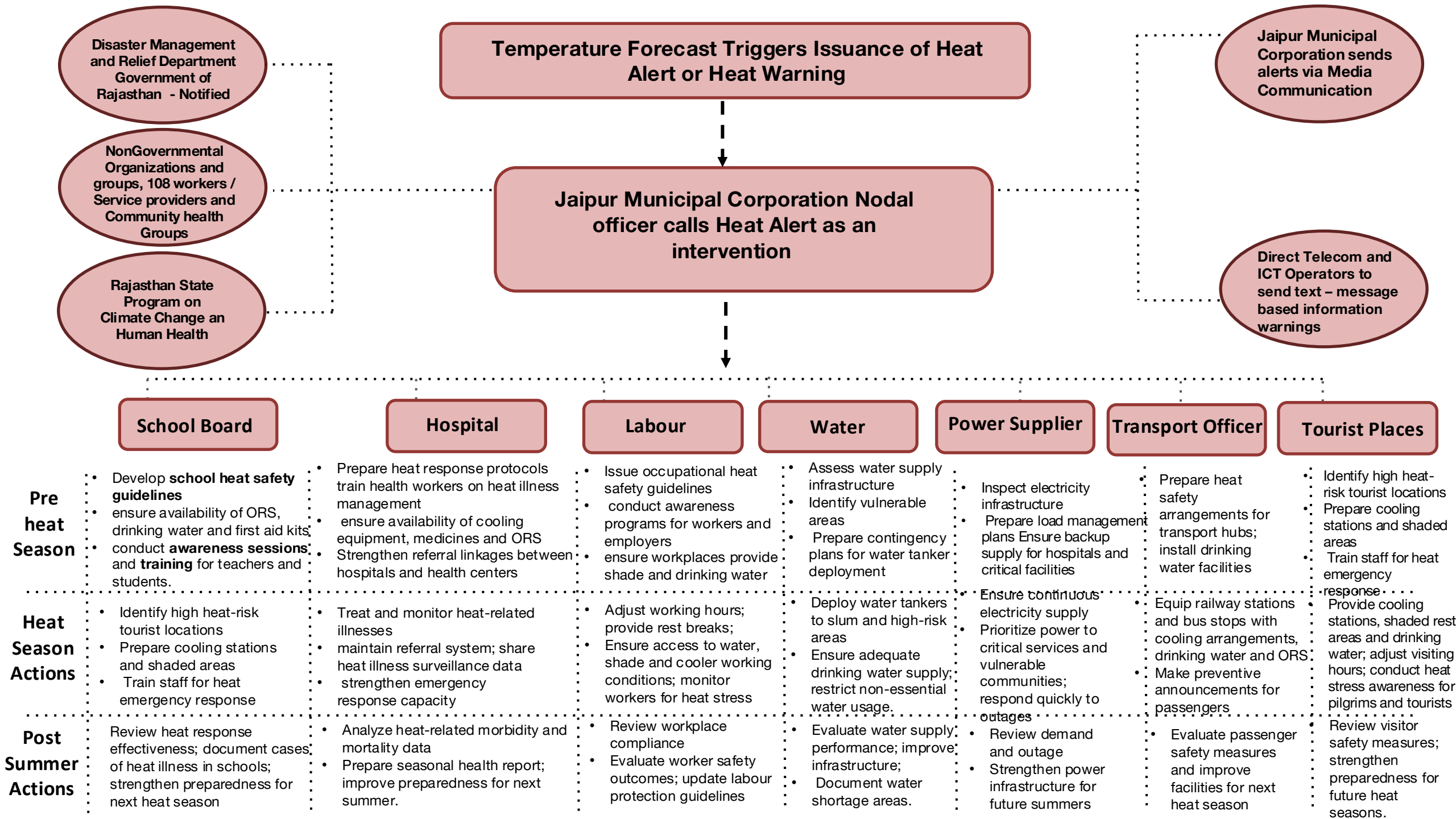
 Sufficient healthcare facility

IMPACT BASED ACTION FRAMEWORK

Table 3 Early Warning Systems Action Framework

Colour Code	Alert	Impact	Suggested Actions
Green	Normal Day	No cautionary action required	1. No additional precautions are necessary; routine daily activities can be carried out as usual. 2. Follow routine heat safety practices such as drinking water regularly and wearing light clothing in warm weather. 3. Health facilities maintain routine preparedness (availability of ORS, fluids, and trained staff). 4. Ongoing community awareness on heat illness prevention.
Yellow alert	Heat Alert (Maximum temperature > 40.68 °C) IMD Definition: max temp between 40-43 degrees or departure from normal is 4.5-6.4 degrees	Moderate Temperature. Heat is a moderate health concern for vulnerable people including pregnant women, elderly, children, people with NCDs, etc.	1. Avoid prolonged exposure to direct sunlight and extreme heat, especially during peak hours (12-3pm) 2. Wear loose-fitting, light-coloured cotton clothing to allow ventilation and reduce heat absorption. 3. Keep your head covered when outdoors to prevent direct sun exposure. 4. Use protective accessories such as a cloth, hat, or umbrella while stepping outside. 5. Drink water frequently and consume ORS or traditional cooling drinks (buttermilk, lassi, nimbu pani), and foods (onion, watermelon, musk melon) even if not thirsty.

Colour Code	Alert	Impact	Suggested Actions
			6. Health workers increase community awareness and monitor vulnerable individuals.
Orange alert	Severe heat alert for the day (Maximum temperature crosses 42.43 °C) IMD Definition: Max temp between 44-46 degrees or departure from normal is >=6.5 degrees	High Temperature. Increase likelihood of heat illness. High health concern for vulnerable people including pregnant women, elderly, children, people with NCDs, etc.	1. Avoid prolonged exposure to heat, especially during peak hours (12-3) 2. Drink adequate amounts of water throughout the day, even if not thirsty. 3. Consume ORS and cooling beverages (buttermilk, lassi, nimbu pani), and foods (onion, watermelon, musk melon) to maintain electrolyte balance. 4. Check on vulnerable individuals (elderly, infants, pregnant women, chronically ill). 5. Reduce strenuous outdoor work and seek rest under shade frequently. 6. Health facilities ensure availability of ORS, IV fluids, cooling spaces, and preparedness for heat illness cases.
Red Alert	Extreme Heat Alert for the day (Above 44.51 °C) IMD definition: Max temp over 47 degrees	Very high likelihood of developing heat illness and heat stroke for all ages	1. Stay in cool indoor environments whenever possible, especially during peak heat hours. 2. Avoid strenuous outdoor activities and reschedule work if possible. Take frequent rest breaks in shaded areas. 3. Drink water frequently and use ORS to prevent dehydration. 4. Move anyone with heat illness symptoms to a cool place and seek medical help immediately for heat-related illnesses (symptoms include: dizziness, headache, nausea, confusion). 5. Ensure regular monitoring of vulnerable populations including pregnant women, elderly, children, people with NCDs, etc. 6. Health systems activate heatstroke management areas, surveillance of heat illness cases, and emergency preparedness measures.



MITIGATION & ADAPTATION

MITIGATION — Reduce Heat at Source

Addressing the physical causes of heat — reducing temperature before it enters homes, shelters and public spaces.

Cool Roof & Mod Roof

Reflective coatings — 4–6°C indoor drop

Net Zero Cooling Station

Zero-energy community cooling hub

Green Net & Urban Greening

Shade + nature-based passive cooling

Cool Bus Stop

Cooled public waiting infrastructure

ADAPTATION — Live Safely with Heat

Helping communities prepare, respond and recover — through systems, training and behaviour change.

Early Warning System

IMD → WhatsApp → Community → Household

Heat Action Plans

Community co-created, activated on alert

Capacity Building

ASHA, Teachers, Police, Construction workers

Cool Auto & Cool Bus

Cooling mobility for outdoor commuters

Mitigation + Adaptation together = Heat Resilience. Both tracks are essential — neither works alone.

HEAT MAPPING : EXPERIMENT



MAHILA HOUSING TRUST

Towards Responsible Urban Development



HERA



Under Jaipur Heat Action Plan

Community-led Heat Mapping



Mapping Today for a Cooler Tomorrow



Identify
heat vulnerable
areas



Empower
communities
to act



Build
resilient &
liveable cities



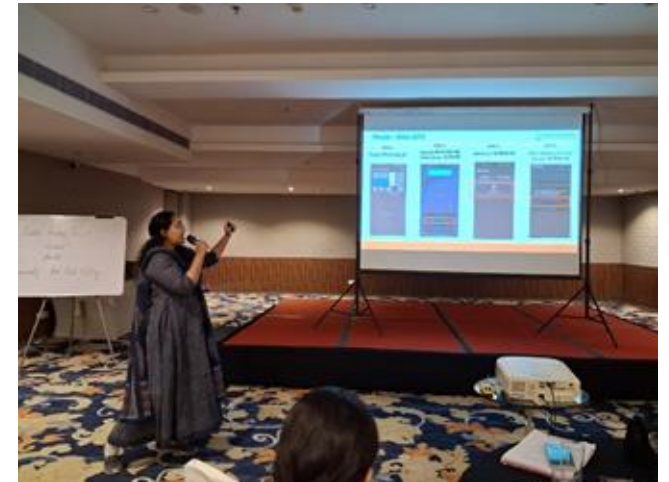
Jaipur



Together, we can
create cooler, healthier
and more sustainable Jaipur.



Photos



What is UTFVI?

- *How much hotter or cooler is this patch compared to the average of the whole city?*
- *Dimensionless index*

Why use UTFVI?

- Shows relative heat, not just absolute temperature - Instead of saying “this place is 35°C”, it says “this place is hotter than the city average by 20%”
- Easy to compare between cities - Because it is a ratio (dimensionless), you can compare Vadodara with Ahmedabad, without worrying about different temperature scales

Project Objective

Conduct India's first systematic nighttime mobile heat mapping campaign in Jaipur to generate high-resolution near-surface air temperature data for developing the NATHRA (Nighttime Air Temperature Heat Risk Assessment) framework and strengthening Heat Action Plans.

Why Night time heat mapping?

- Heat retained during the day is released at night
- Reveals Urban Heat Island (UHI) hotspots
- Identifies areas with poor night-time cooling
- Night-time heat poses serious health risks

Note: Women Climate Shock Insurance (WCSI)

Route Design and validation



Jaipur city area
484 km²

18 routes

Covering different
landscapes

IMD Visit – Outdoor Comparison

- MHT's Sensor
- Readings taken using phone via Bluetooth and Hobo Connect



- IMD's Sensor (Stevenson Screen with Mercury thermometer inside)
- Readings taken manually

Approximately 2 degree difference

Indoor Comparison with IMD

Conducted in a closed environment to eliminate conditions like wind and direct sun

IMD's Thermometer

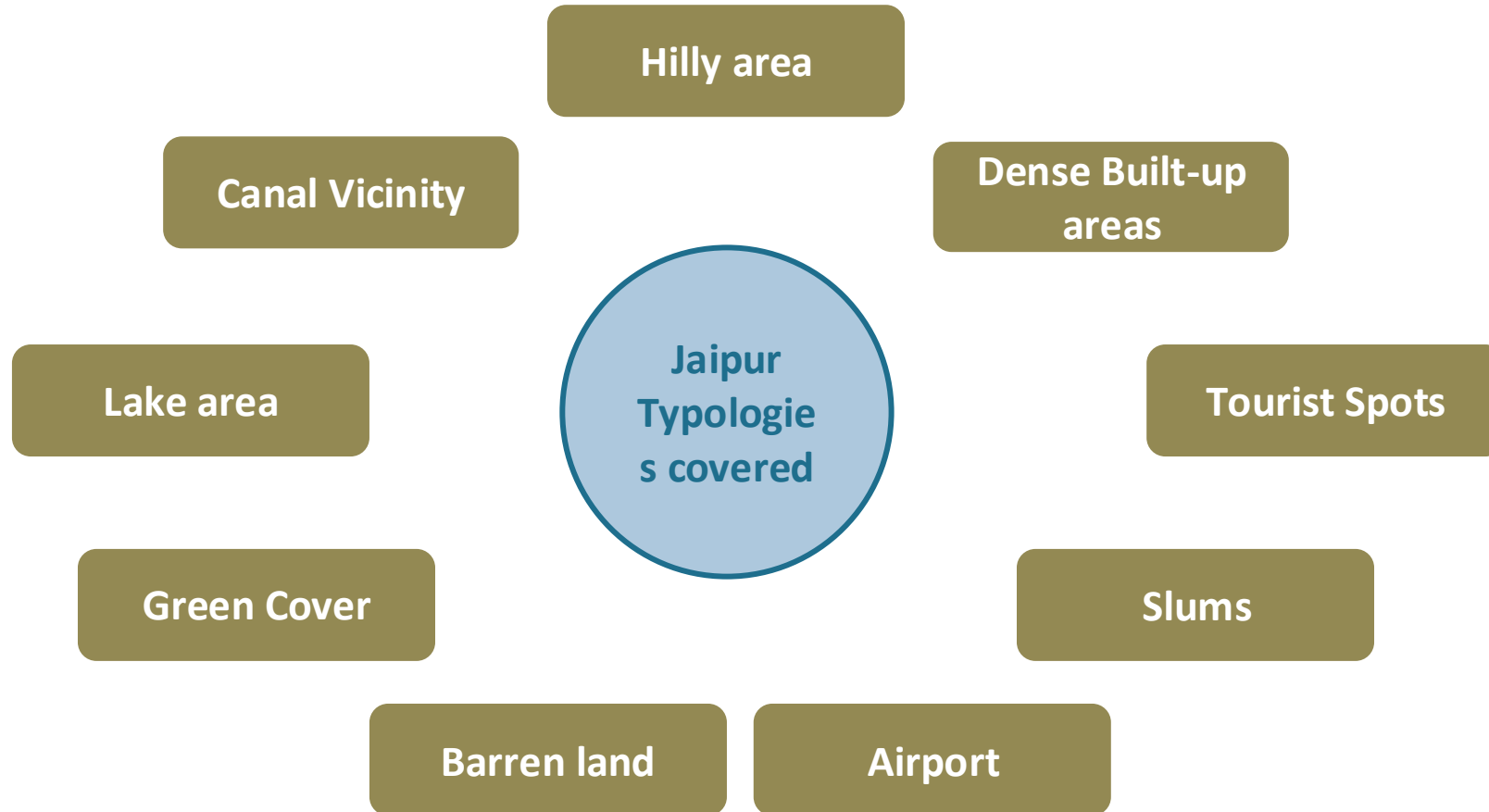


MHT's Sensor

Approximately 0.1 degree difference

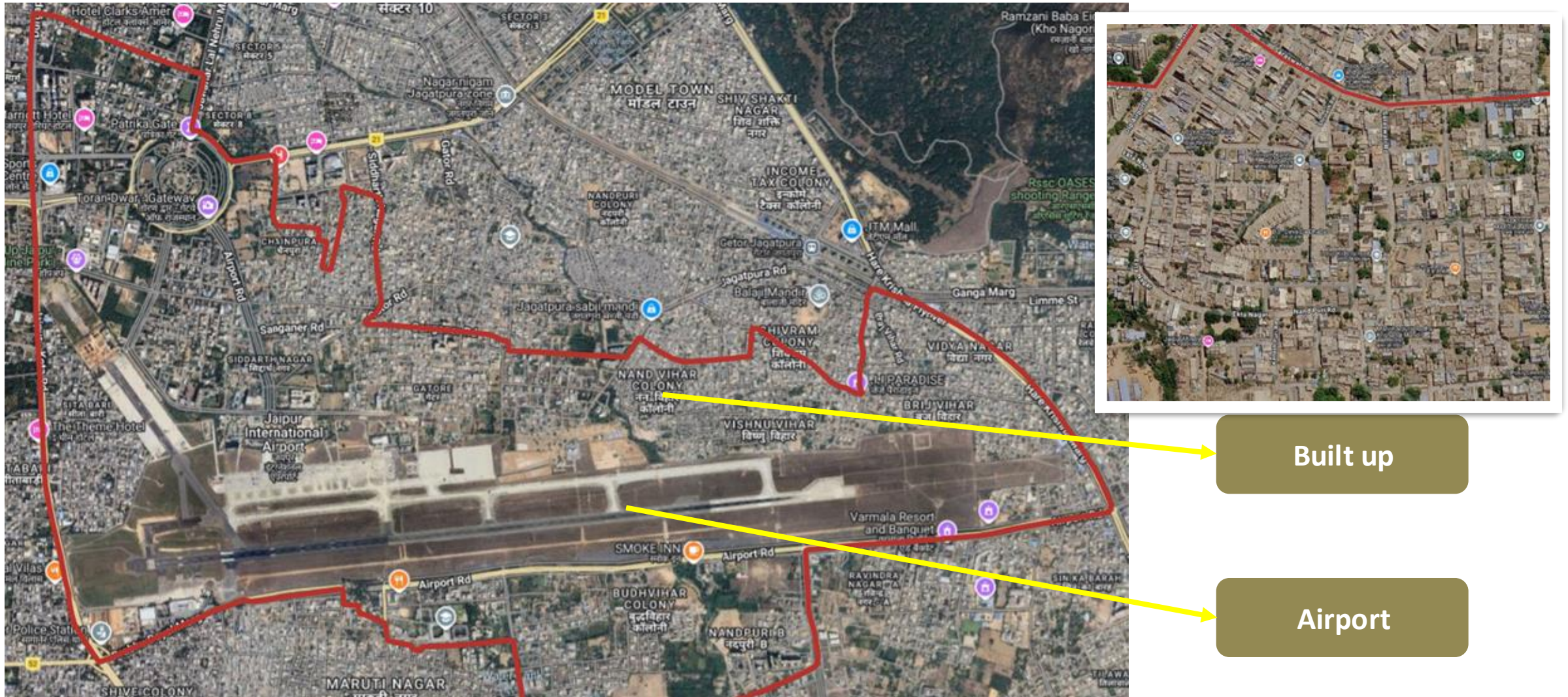
Typologies Covered in route

Typology is a way of classifying areas or zones into groups based on shared physical, functional, and contextual characteristics.



Tried covering 2 to 3 different typologies in a single route

Typologies Covered



Methodology Overview

Routes

Design 18 routes
representative of Jaipur city

Validate routes on ground

Edit and correct routes

Generate GPX and QR of
route

Meetings and stakeholder consultation

IMD Visit (Stakeholder
Consultation)

Permission from Jaipur
Nagar Nigam (JNN)

Permission from Traffic
Police

Preliminary Preparation

Old sensor Issues identified

Sensor Assembly

Training community

Mock Trial

Final Exercise

Final Heat Mapping Exercise

2 to 3 PM, 11 PM to 12 AM
and 5:30 to 6:30 AM

Methodology Overview

Routes



*Example: Route 1
Scan in BikeGPX*

Meetings and stakeholder consultation



IMD Visit

Preliminary Preparation



Sensor Assembly



Training

Final Exercise

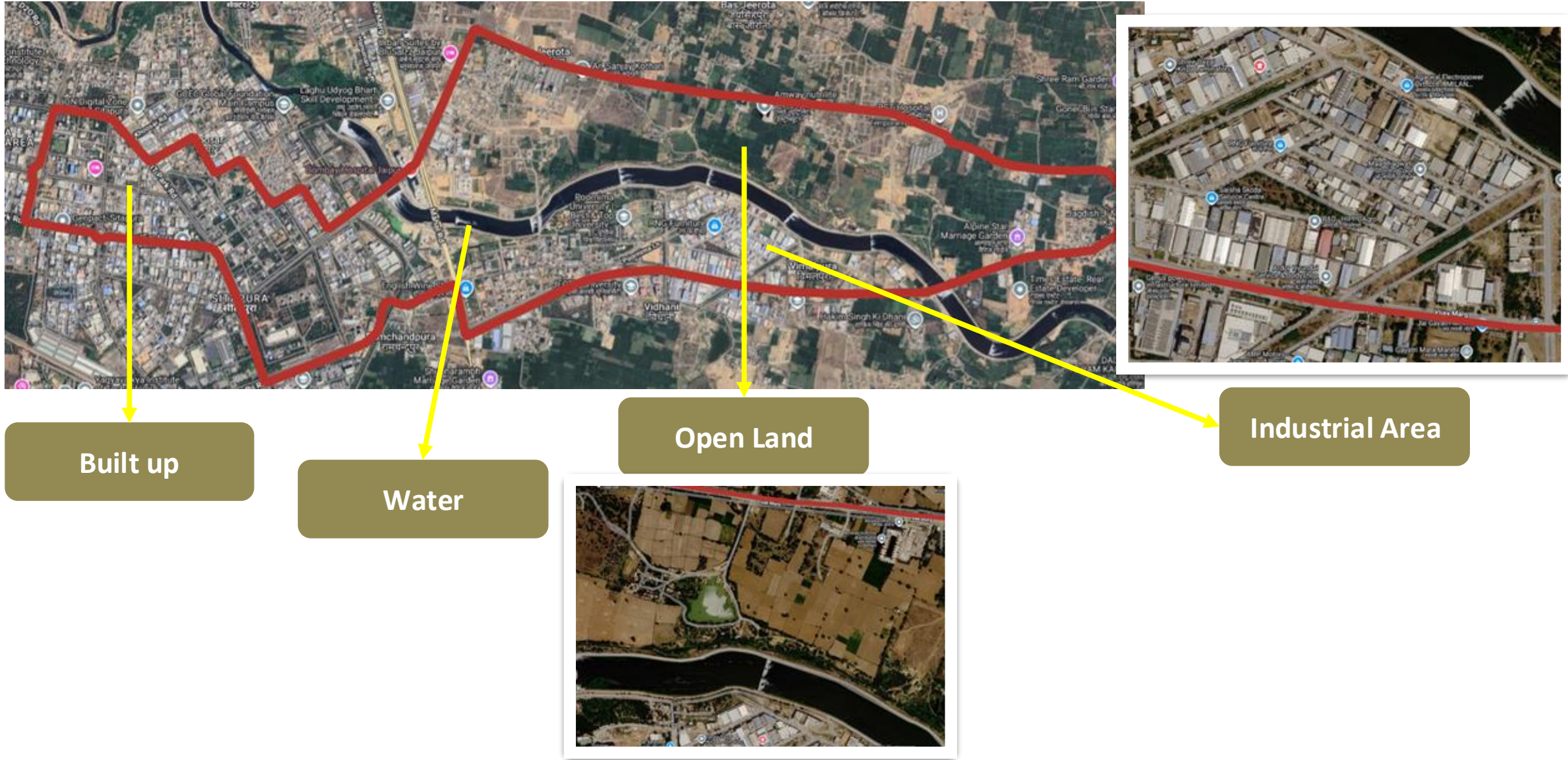


Heat Mapping

18 Routes at a Glance



Typologies Covered



Typologies Covered



Open Space

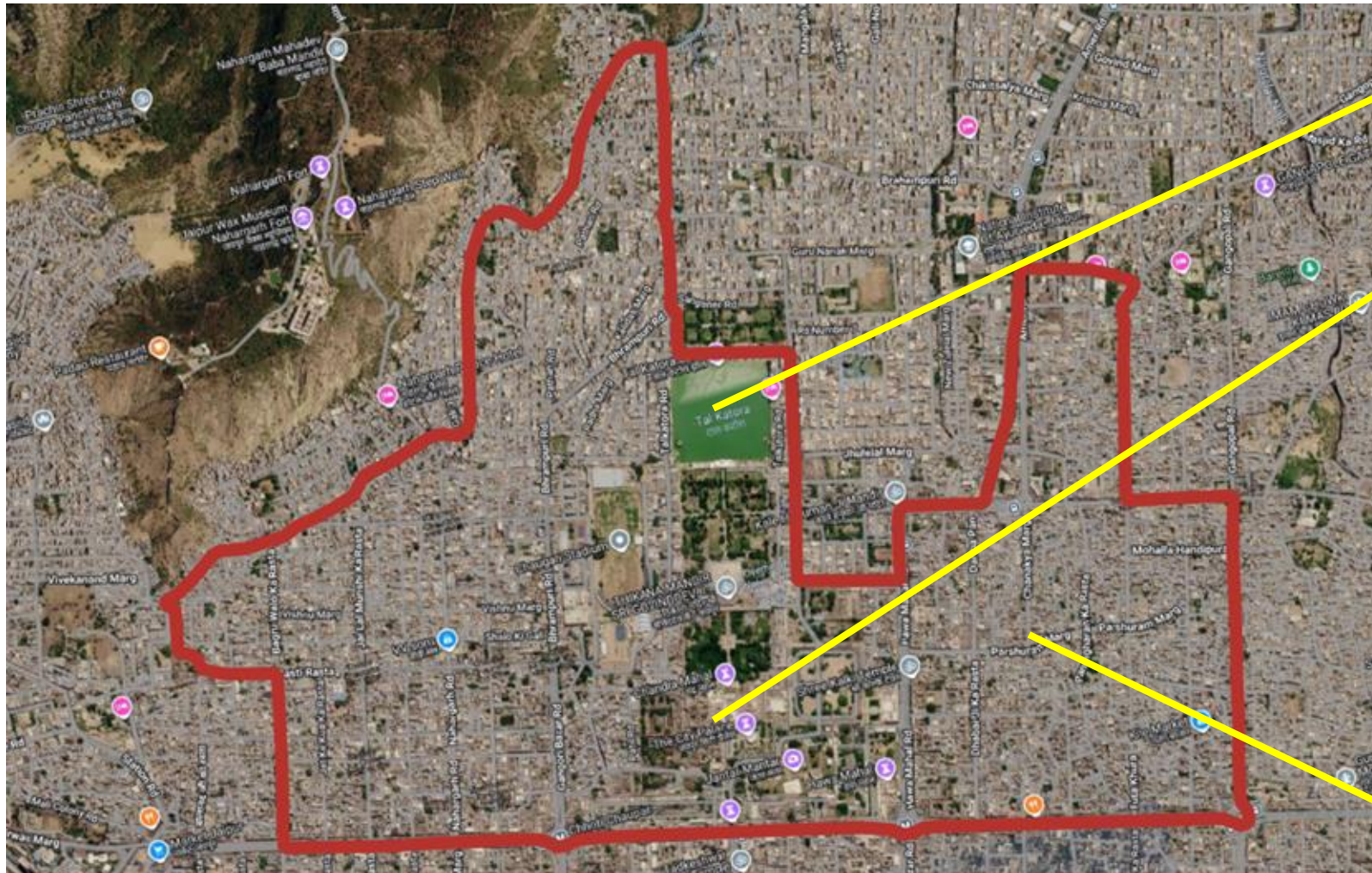
Hilly Area

Built Up

Industries

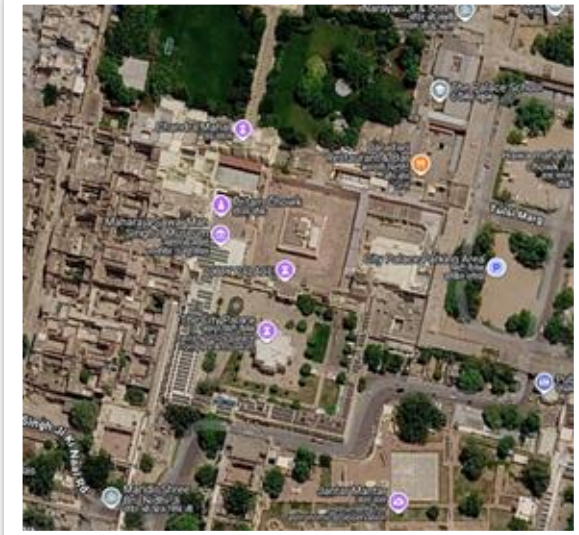


Typologies Covered



Lake

Tourist spot



Built up

Typologies Covered



Park

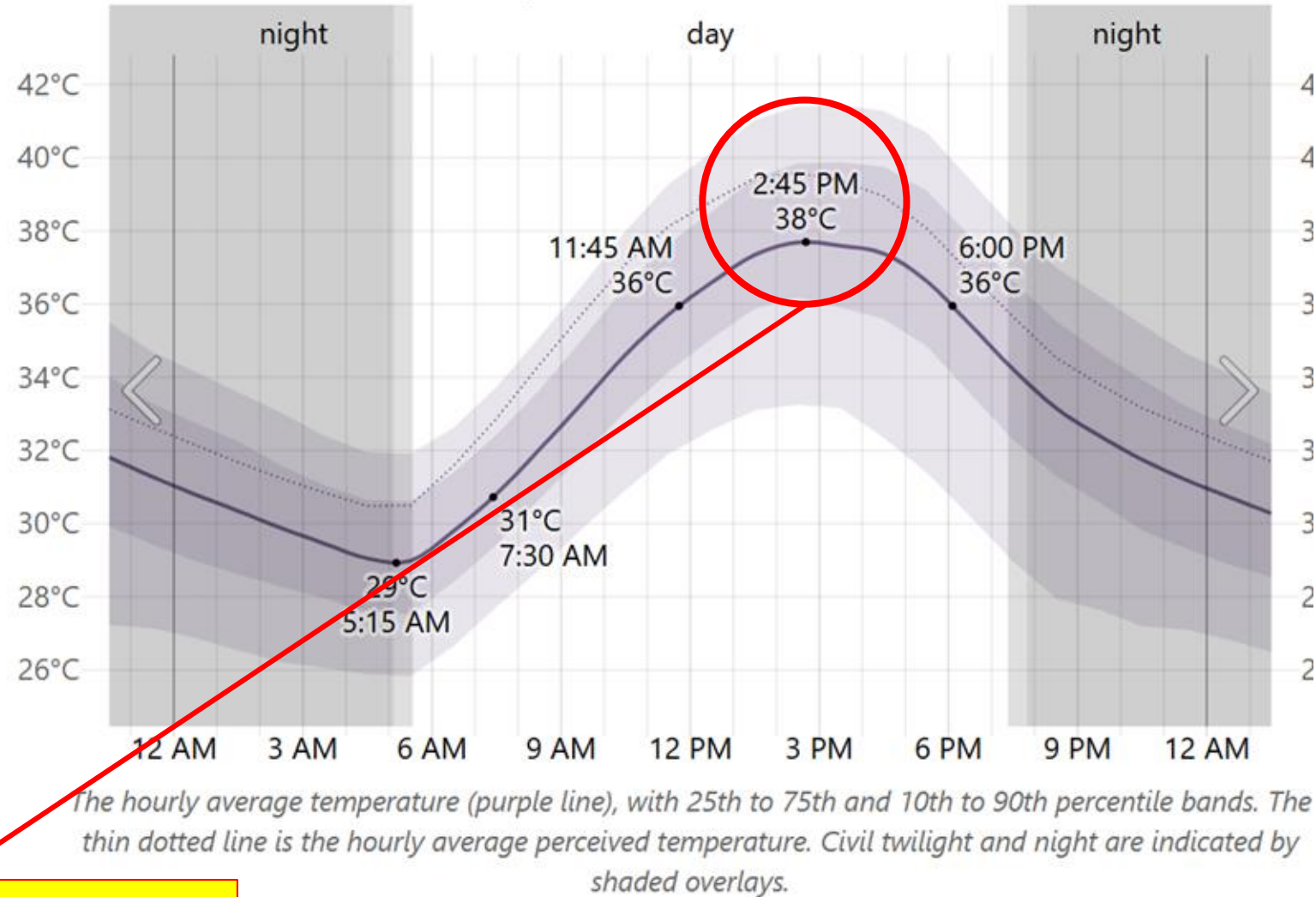


Basti and Open
land



Data Collection Timings

Timings	Why?
2 to 3 (Afternoon)	Peak Temperature of the day
11 to 12 (Night)	Thermal comfort
5:30 to 6:30 (Morning)	Peak difference between day and night time is recorded as per IMD



Peak temperature during 2 to 3



Thank you



भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

