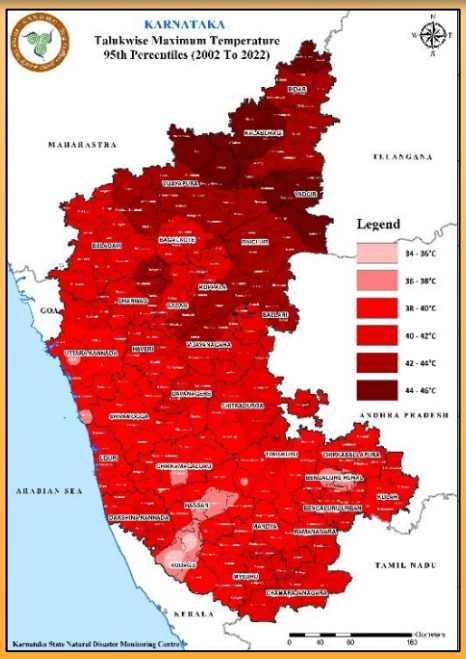
Karnataka State Disaster Management Authority

Revenue Department (Disaster Management)

Government of Karnataka



KARNATAKA STATE HEAT WAVE ACTION PLAN 2023-24

GOVT. OF KARNATAKA

Karnataka State Heat Wave Action Plan - 2023-24

Revenue Department
(Disaster Management)
Government of Karnataka

MESSAGE

The annual mean global temperature will likely be at least 1° Celsius above pre-industrial levels (1850-1900) in the coming five years (2020-2024). The change in the climate is influencing globally and resulting in increasing weather aberration instances. Heatwave is among the one which is increasing in terms of frequency and severity. Heat waves worldwide have become more extreme and frequent due to human-influenced climate change and global warming. Further, the frequency and duration of heat waves have increased.

Heatwaves can lead to dangerous consequences, including heat stress and heat stroke and can cause loss of human and animal lives. Thus, it is necessary for the concerned authorities to take appropriate Preparedness and mitigation measures to minimize the impact of the Heatwave on the population in vulnerable areas.

Karnataka state has always taken innovative and proactive steps towards Disaster preparedness and mitigation measures. Continuing that tradition, the Karnataka State Disaster Management Authority (KSDMA) has prepared Karnataka Heatwave Action Plan 2023 as per the NDMA guidelines 2019 for the State. The action plan intends to minimize the probable hardship faced by the community due to Heatwave conditions in the State during the upcoming summer season.

I congratulate Dr. Manoj Rajan, Commissioner of KSDMA, for proactively developing this comprehensive Heatwave Action Plan for the State. I urge all the concerned Departments and Agencies to use this action plan to take necessary measures and implement the Heatwave mitigation measures suggested therein. Also, I recommend the departments conduct community outreach programs to create awareness amongst the public about the dangers of the Heatwave and remedial measures to be taken at the community level.

Sri R Ashoka
Hon'ble Revenue Minister
Government of Karnataka

FOREWORD

Global climate change is inevitable. Climate Change reasons increase the mean average surface temperature over a region. We are already witnessing extreme weather events. Heat waves are projected to increase in number, intensity and duration over most land areas in the 21st century. It is a period of abnormally high temperatures, more than the normal maximum temperature. In the past few years, India country as a whole experiencing the impact of heatwave conditions in terms of an increase in the number of heat wave days and an increase in the number of States.

Over the past two decades, Karnataka to has witnessed an increasing trend in temperature during March-June, particularly in the North Interior and Coastal Karnataka districts. A heat wave is a combination of temperature and relative humidity; the threshold for each individual varies. Hence, there is a need for mass awareness of effective health interventions for the prevention of heat-related illnesses and mortality. It is now widely recognized that many heat-related risks are manageable through timely warnings about an impending event and adopting a heatwave action plan.

In this context, the Karnataka State Disaster Management Authority (KSDMA) has developed Heat Wave Action Plan 2023 for Karnataka. The action plan aims to provide a framework for implementing heat response activities in a coordinated manner and facilitate the stakeholders by providing insight into various aspects related to heat risk reduction and coordination among various departments, individuals and communities for mitigating the impacts of the heat wave. Mass public awareness through electronic and print media has been accepted as the key to tackling heat waves.

The efforts of Commissioner KSDMA and his team in bringing out the Heat Wave Action Plan 2023 are appreciated. I am confident that the Action Plan will go a long way in mitigating compounded risks from rising heat.

V. Rashmi Mahesh, IAS
Relief Commissioner cum Principal Secretary
to Govt, Revenue Department (Disaster
Management)

PREFACE

The Year 2022 was the **sixth** warmest year since global records began in 1880 at 0.89°C; despite La Niña conditions keeping the global temperature low for the second consecutive year, 2022 is still 6th warmest year on record. This value is 0.13°C less than the record set in 2016, and it is only 0.02°C higher than the last year's (2021) value, which now ranks seventh highest. The 10 warmest years in the 143-year record have all occurred since 2010, with the last nine years (2014–2022) ranking as the nine warmest years on record.

Over the past several years, there has been an increasing trend of heatwave conditions in India, impacting many States, Districts, Cities and Towns. The World Meteorological Organisation (WMO) issued a statement on global climate in 2018 asserting that global temperature would continue to increase due to climate change and global warming. The Intergovernmental Panel on Climate Change (IPCC) fifth assessment report pointed out that, the number of warm days and nights had increased globally between 1951 and 2010.

Sendai Framework for Disaster Risk Reduction 2015-2030 has reiterated the need for a more integrated approach to adaptation, sustainable development, environmental management and DRR, and on the need to improve data on disaster losses by building on, expanding, and strengthening existing national disaster loss databases and risk analysis. Heat Vulnerability is linked to characteristics of individuals, buildings and urban structures.

This Year's Heat Wave Action Plan 2023 has been prepared by the inclusion of experiences in previous years. I am sure that District administration and field-level functionaries will find the Heat Wave Action Plan 2023 beneficial and hope that the nodal officers of the departments as well as the District administration, will take early and required steps at the appropriate time in dealing with heat wave during the next heat wave season from April to June to minimize the adverse impacts.

I acknowledge my thanks to Sri. Gavaskar, Sri. Aadarsh and the other team members for their contributions in preparing the Heat Wave Action Plan-2023.

Dr. Manoj Rajan, IFS
Commissioner,
Karnataka State Disaster Management Authority,
Government of Karnataka

Contents

CHAPTER 1: INTRODUCTION

Air temperatures on Earth have been rising since the Industrial Revolution. While natural variability plays some part, the preponderance of evidence indicates that human activities particularly emissions of heat-trapping greenhouse gases are primarily responsible for making our planet warmer. According to the temperature analysis led by a scientist at NASA's Goddard Institute for Space Studies (GISS), the average global temperature on Earth has increased by at least 1.1 °C since 1980. Most of the warming has occurred since 1975, at a rate of roughly 0.15 °C to 0.20 °C per decade.

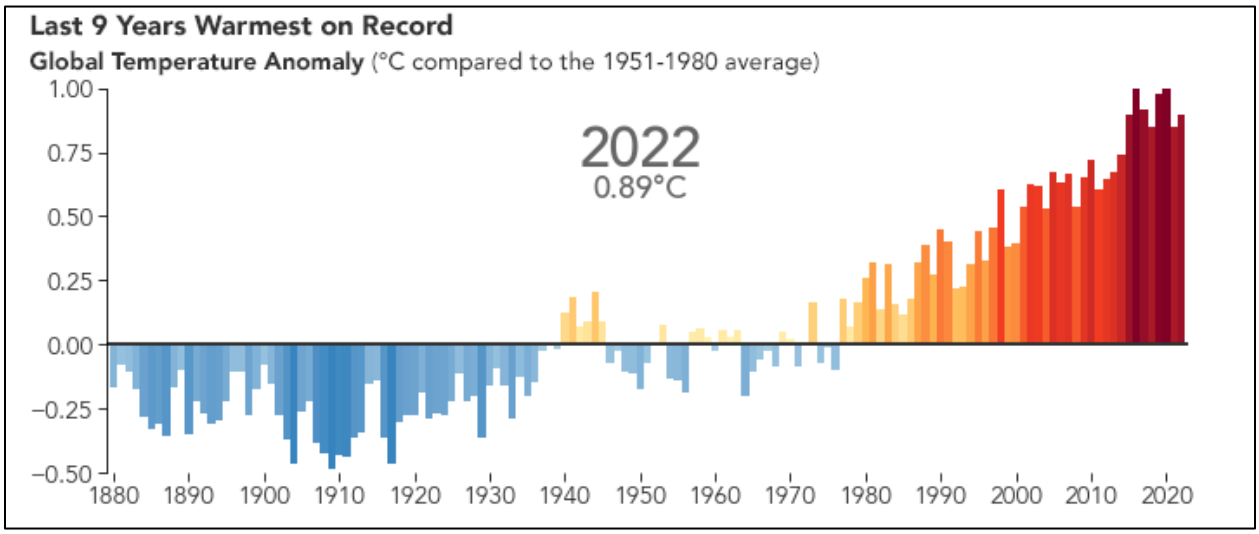


Fig 1: Annual Global Land and Ocean Temperature Anomalies Graph. ***(Source: NASA)***

The Year 2022 was the **sixth** warmest year since global records began in 1880 at 0.89°C; despite La Niña conditions keeping the global temperature low for the second consecutive year, 2022 is still 6th warmest year on record. This value is 0.13°C less than the record set in 2016 and it is only 0.02°C higher than the Year 2021 value, which now ranks seventh highest. The 10 warmest years in the 143-year record have all occurred since 2010, with the last nine years (2014–2022) ranking as the nine warmest years on record. As per IMD, after 146 years, India has recorded the warmest February, with the

maximum temperature rising to 29.54 degrees Celsius across the country, which is the highest since 1877. (Source IMD press conference dated 1st March 2023).

Asia had its second-warmest year on record at +1.80 °C. This value is 0.26 °C less than the record year set in 2020. The Year 2022 marked the 35th consecutive year with temperatures above average. Asia's 10 warmest years have occurred since 2007. Asia's trend from 1910–2022 was +0.17 °C per decade.

The annual mean global temperature will likely be at least 1° Celsius above pre-industrial levels (1850-1900) in the coming five years (2020-2024). The change in the climate is influencing globally and resulting in increasing weather aberration instances, and Heatwave is among the one which is increasing in frequency and severity. Heat waves worldwide have become more extreme and frequent due to human-influenced climate change and global warming. Further, the frequency and duration of heat waves have increased. Since 2014, India has experienced 12 of its 15 warmest recorded years.

Heat Wave is also called a –**SILENT DISASTER** as it develops slowly and kills & injures humans and animals. The adverse impacts of Heat waves can be significantly reduced by educating people on the dos and don'ts of Heat waves and developing a culture of reporting health issues to medical facilities in time, ensuring timely diagnosis and treatment.

Global climate change is inevitable. Climate Change reasons increase the mean average surface temperature over a region. We are already witnessing extreme weather events. Heat waves are projected to increase in number, intensity and duration over most land areas in the 21st century. It is a period of abnormally high temperatures, more than the normal maximum temperature, during the pre-monsoon (March to May) summer season. Heat waves typically occur between March and May and, in some rare cases, extend till June.

According to the India Meteorological Department (IMD), Climate research and

Services (CRS), Climate of India during 2022 stated that The annual mean land surface air temperature averaged over **India** during 2022 was (+) 0.51 °C above the long-term average (1981-2010 period). The Year 2022 was the **fifth warmest Year for India** on record since nationwide records commenced in 1901. However, this is lower than the highest warming observed over India in 2016 (anomaly of +0.71°C) and higher than the previous year, 2021 (anomaly of +0.44°C). The five warmest years on record, in descending order, were 2016 (+0.71°C), 2009(+0.55°C), 2017 (+0.541°C), 2010 (+0.539°C) and 2022 (+0.51°C). It may be mentioned that 11 out of the 15 warmest years were during the recent fifteen years (2008- 2022). The past decade (2012-2021/ 2013-2022) was also the warmest decade on record, with the decadal averaged annual mean temperature anomaly (Actual-LPA) of 0.37°C /0.41°C. The Country averaged annual mean temperature during 1901-2022 showed a significant increasing trend of 0.64°C /100 years (Fig 2), while a significant increasing trend was observed in maximum temperature (1.0°C /100 years) and a relatively lower increasing trend (0.28°C /100 years) in minimum temperature.

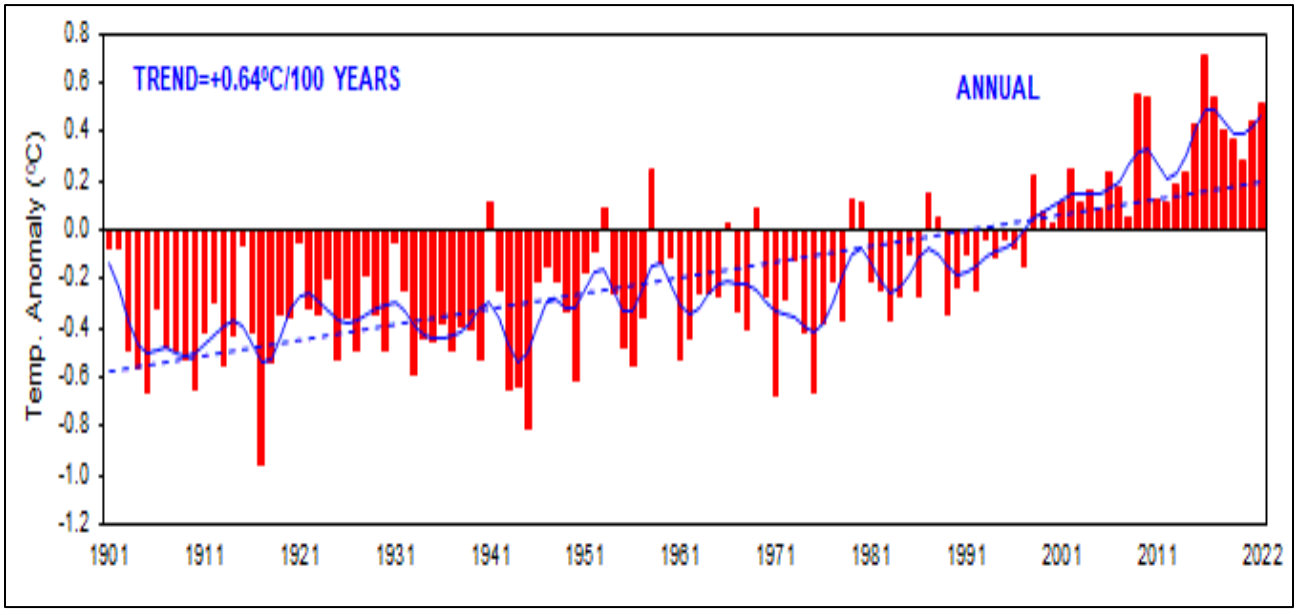


Fig 2: Annual mean land surface & air temperature anomalies averaged over India for the period 1901- 2022

The anomalies were computed concerning the base period of 1981-2010. The dotted line indicates the linear trend in the time series. The solid blue curve represents the sub-decadal time scale variation smoothed with a binomial filter. ***(Source: IMD)***

The Country averaged 2022 monthly mean temperatures and was above normal for the ten months except for January and February (anomaly 0.09 °C, -0.16 °C respectively), where it was normal. The All India mean temperature during the month of March with an anomaly of +1.61 °C and April with an anomaly of +1.36 °C were second highest since 1901 and December with an anomaly of +1.00 °C was the highest in 1901. The maximum temperature was the highest, and the minimum temperature was the third highest for March since 1901. The maximum temperature was the third highest, and the minimum temperature was the second highest for April since 1901. The maximum and minimum temperatures were the second highest for December since 1901.

One of the Country's hottest and longest heat waves began recording weather reports. The highest temperatures occurred in Churu, Rajasthan, reaching up to 50.8 °C, a near-record high in India, missing the record of 51.0 °C was set in 2016 by a fraction of a degree. In 2019, 32 days were classified as parts of the heat wave, making it the second longest recorded.

The heat wave coincides with extreme droughts and water shortages across the Country. High temperatures and lack of preparation exacerbated the water crisis. Higher daily peak temperatures of longer duration and more intense Heat waves are increasing globally due to climate change. As stated in the State Level Climatic Monologue prepared by IMD, as indicated in (Fig 3), State averaged summer mean maximum temperatures have increased over Andaman and Nicobar, Andhra Pradesh, Goa, Himachal Pradesh, **Karnataka**, Kerala, Lakshadweep, Maharashtra, Mizoram, Rajasthan, Sikkim & Tamil Nadu.

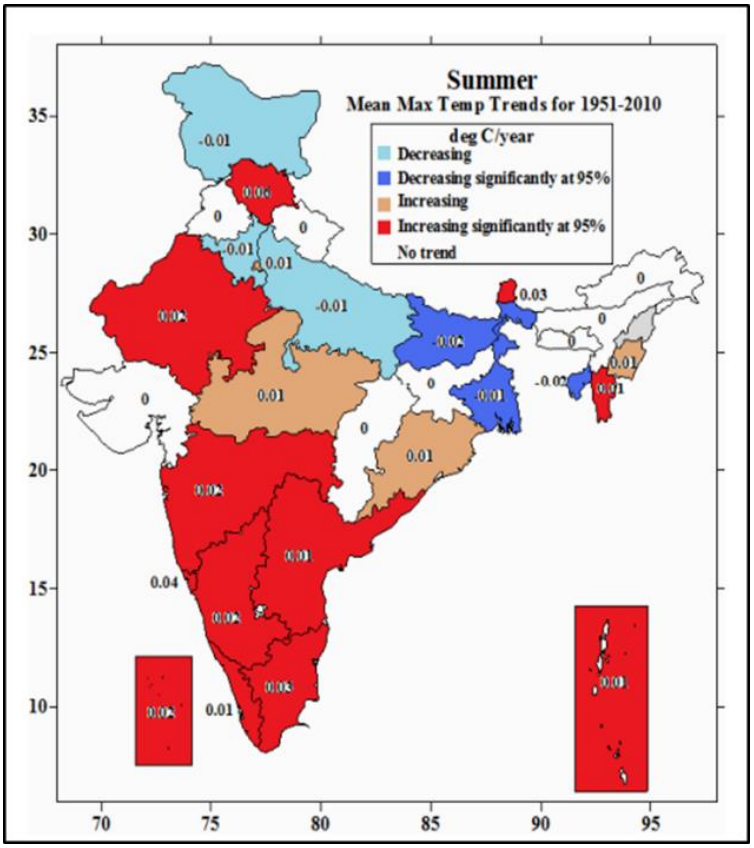


Fig 3: Mean Maximum Temperature trends for 1951-2010 for the Country

Karnataka has been subjected to various Natural Disasters Especially, Hydro-Meteorological disasters, every year. Devastating weather phenomena like successive Droughts, Floods, Fires, Landslides, hailstorms, Lightning, Heat waves, and strong surface winds have been causing loss of life and property in the State. The State is highly vulnerable to Heatwaves; out of 31 districts in the State, 15 are vulnerable to heatwaves on a different scale. Climatological data indicates that North Interior Karnataka (NIK) districts are prone to high-temperature days. Whereas other regions of the State, like South Interior Karnataka (SIK), Coastal and Malnad regions, are less prone to high temperatures when compared to North Interior Karnataka due to maritime air over these regions. Still, on some occasions, high temperatures may also develop over these regions in situ under favourable conditions. Considering the extent of vulnerable communities to high temperatures and heat wave conditions, the Government of Karnataka has prepared

an action plan for Heat Waves based on guidelines framed by NDMA. The State Government notified that Heat Wave is a state-specific natural disaster and proactively conducts weather watch meetings under the chairmanship of the Additional Chief Secretary and Development Commissioner of GoK, involving several line departments. It has led to better-coordinated actions to deal with natural disasters like heat waves.

Karnataka State Natural Disaster Monitoring Centre (KSNDMC) is a unique monitoring centre for collecting observational weather data at every 15 minutes intervals with its densely located weather monitoring network across the State to take timely decisions by the Government. The extensive ground weather observational network established by KSNDMC plays a significant role in providing the observational meteorological data and issuing timely weather-related warnings like heat-related bulletins and also forecast for the next 3 days at Grampanchayath level and the next 5 days district level warnings from IMD through different dissemination modes like Varunamitra help desk to the general public, mainly farmers community and also disseminates through WhatsApp groups, Social media, email & messages to the concern officials at District, Taluk, Hobli (sub-block) & Grampanchayath level.

Based on the last 20 years (2002-22) max temperature data, estimated by KSNDMC, the threshold values with the 95^{th} percentile (a number that is greater than 95% of the numbers in the given set) at the taluk level. When it reaches the threshold / critical temperature value in °C, more focus is given to the taluks to minimize the heat-related distresses.

CHAPTER 2: HEAT WAVE VULNERABILITY

2.1 Definition of Heat wave

A heatwave is a condition of atmospheric temperature that leads to physiological stress, which sometimes may cause death. The World Meteorological Organization defines a Heatwave as five or more consecutive days when the daily maximum temperature exceeds the average maximum temperature by five degrees Celsius. Different countries define Heat waves differently in the context of their local conditions. In India, Heat wave conditions are considered if the maximum temperature reaches at least 40 °C or more for plains, 37 °C or more for coastal areas and at least 30 °C or more for hilly regions.

The following criteria are used to declare a Heatwave condition prevailing:

a) Based on Departure from Normal

- **Heat Wave:** Departure from normal is 4.5 °C to 6.4 °C
- **Severe Heat Wave:** Departure from normal is >6.4 °C

b) Based on Actual Maximum Temperature (for plains only)

- **Heat Wave:** When actual maximum temperature≥45 °C
- **Severe Heat Wave:** When actual maximum temperature≥47 °C

c) Criteria for describing Heat Waves for coastal stations

- When maximum temperature departure is 4.5°C or more from normal

Warm Night: It should be considered only when max. Temp. ≥ 40°C. It is defined based on departures of minimum temperatures and is as follows:

- **Warm Night:** Departure from normal is 4.5°C to 6.4°C
- **Very Warm Night:** Departure from normal is >6.4°C or more

2.2 Vulnerability Assessment

Identifying the vulnerable population helps in designing appropriate strategies and interventions at the community level. The physical vulnerability could be due to age, pregnancy, chronic disease, type of housing, occupation etc. Each city or town should assess using available resources and robust scientific methods. One of the methods could be a case-control study in a community or a workplace to identify the most vulnerable population and the risk factors of being vulnerable. The first phase would be a household survey gathering information on socio-demographic data, medical conditions, medication use, adaptive practices during summer, community strategies, and challenges. A qualitative technique should be used to explore the opportunities, challenges and innovations during summer. The list of the possible vulnerable population can be but is not limited to pregnant lactating women, elder (>= 60 yrs), children (<5 yrs), persons with disabilities (physical or mental), persons with chronic diseases, persons suffering from immune-compromised diseases, and or persons with debilitating conditions patients taking certain medications (anti-cholinergic).

The districts of North Interior Karnataka are prone to high temperatures for a longer duration of a year (Fig 4). Coastal and South Interior Karnataka are less prone to heat waves when compared to NIK due to the occurrence of maritime air over these regions. Still, on some occasions, Heat waves may also develop over these regions in situ under favourable conditions.

Last six years (2017-2022) district wise recorded maximum temperature in deg C provided in the **Table: 1**

District-wise and year-wise recorded Maximum temperature details with location & date for the last six years (2017-2022) are provided in **Annexure: VII.**

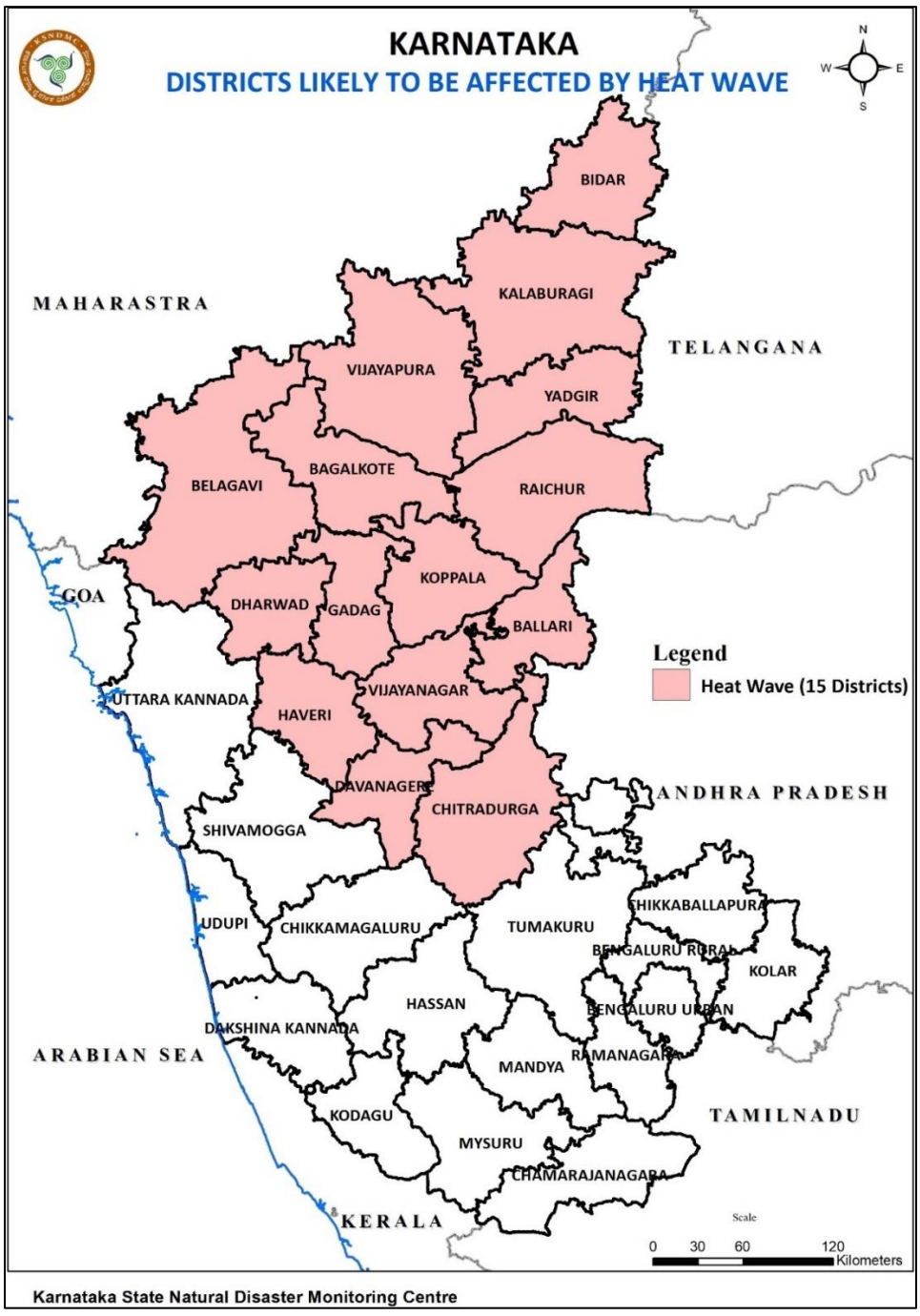


Fig 4: Heatwave-prone districts of Karnataka

Based on the last 20 years (2002-2022) temperature data, KSNDMC estimated the Taluk-wise maximum temperature threshold values with the 95th percentile as per the IMD recommendations (Fig 5). According to the threshold obtained using the above method, more focus is given to the particular taluks to minimize the heat-related impacts whenever it reaches the threshold / critical in °C.

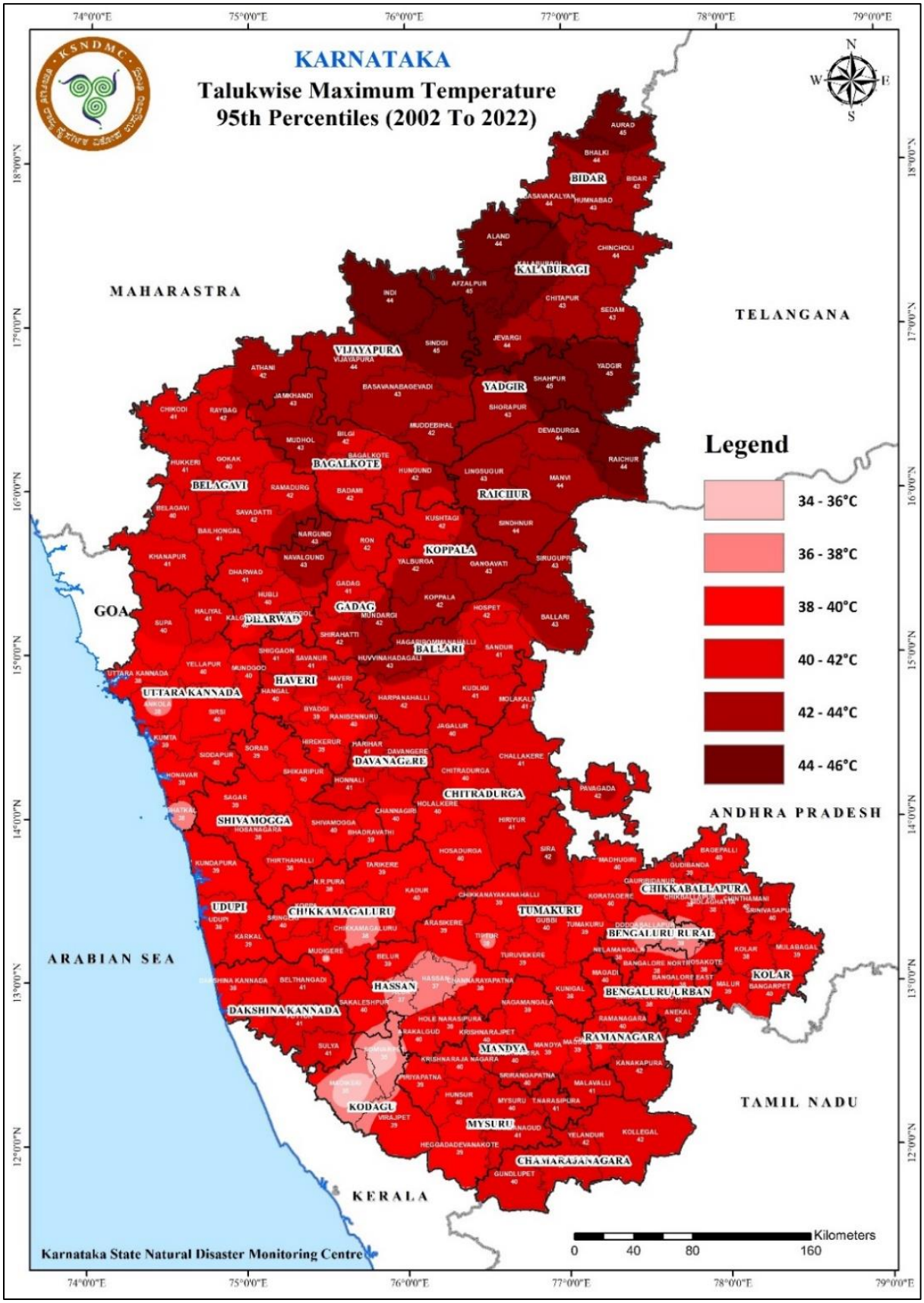


Fig 5: Taluk wise maximum temperature 95th percentile map of Karnataka

95th percentile:

Percentiles are used as an indicator of likely occurrence of particular event. Percentiles are related to deciles and are expressed as a number out of 100 (similar to a percentage). The percentile refers to the ranking of a particular value relative to all of the values for that location. For example, if there are 100 years maximum temperatures for a location, **95th percentile** (is a number/value that is greater than 95% of the numbers in a given set) **represents the only 5% of the years, Maximum Temperature values are crossed out of 100 years.**

Maximum Temperature thresholds are fixed based on Percentiles method for monitoring Heat Wave condition in the Karnataka State. For the last 20 years of Maximum Temperatures data form 2002 to 2022 has been considered and calculated Maximum Temperature thresholds for March, April and May months and presented in the Fig 6.1 to Fig. 6.3.

Month wise spatial observations are given below:

March: Percentile values of maximum temperature thresholds are ranging from 34° C to 44°C over the state. The maximum temperature thresholds varying from 38°C to 42°C spreading across majority part of the area in state. Thresholds are ranging 42°C to 44°C over the parts of Raichur and Yadgir districts. Whereas, the maximum temperature thresholds are varying between 34°C to 38°C over the parts South Interior and Coastal Karnataka regions.

April: Percentile values of maximum temperature thresholds are ranging from 34°C to 46°C over the state for April month. The maximum temperature thresholds are very high for North-Eastern districts of North Interior Karnataka region with ranging from 42°C to 44°C. Remaining parts of the state is varying between 38°C to 42°C.

May: Percentile values of maximum temperature thresholds are ranging from 34°C to 46°C over the state for May month. The maximum temperature thresholds are very high

for North-Eastern districts of North Interior Karnataka region with ranging from 42°C to 46°C. Parts of North and South Interior Karnataka regions are varying between 38°C to 42°C. Whereas, the maximum temperature thresholds are varying between 36°C to 38°C in the parts of Malnad and Coastal regions.

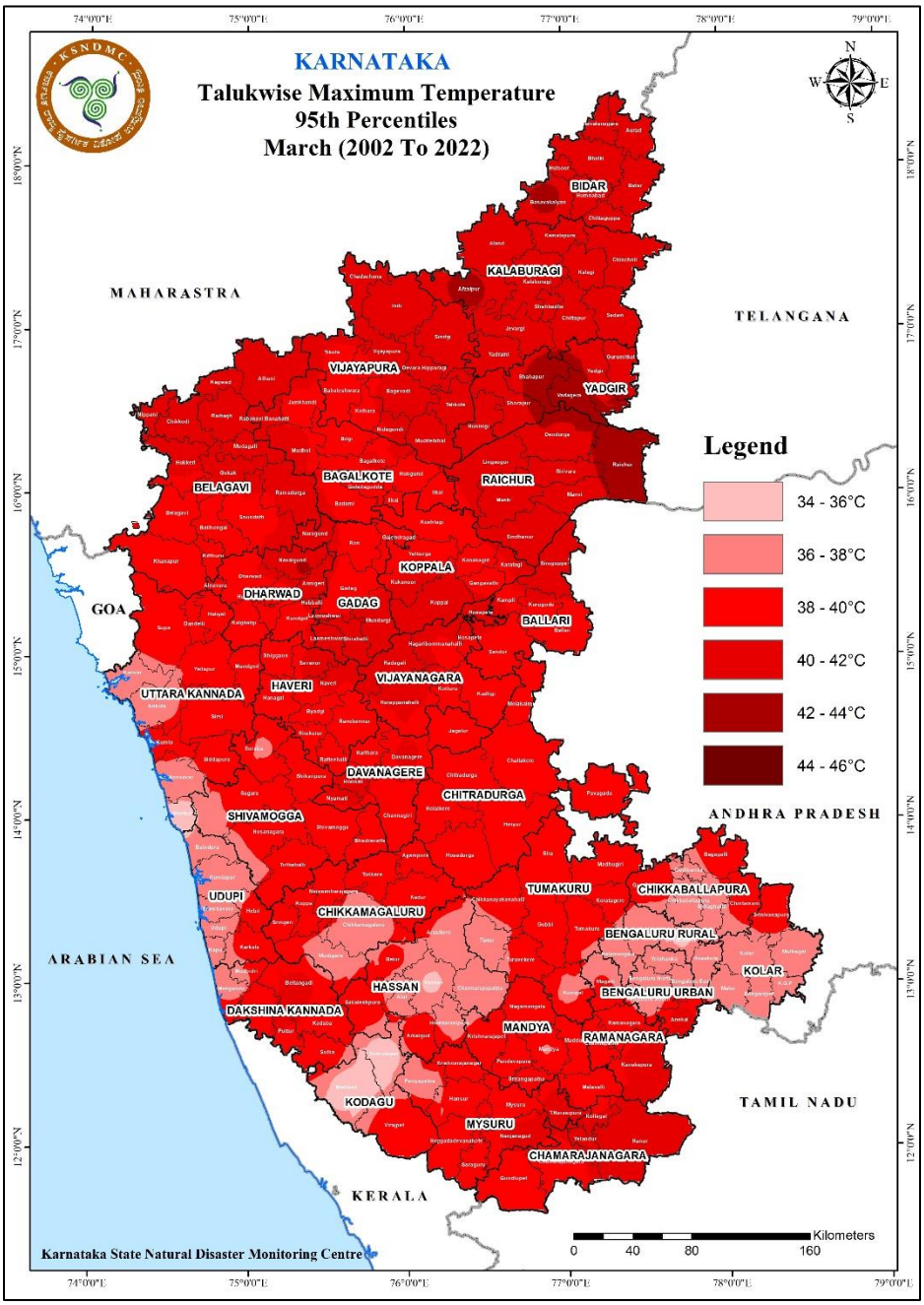


Fig.6.1 Taluk level 95th percentile maximum temperature map for March Month

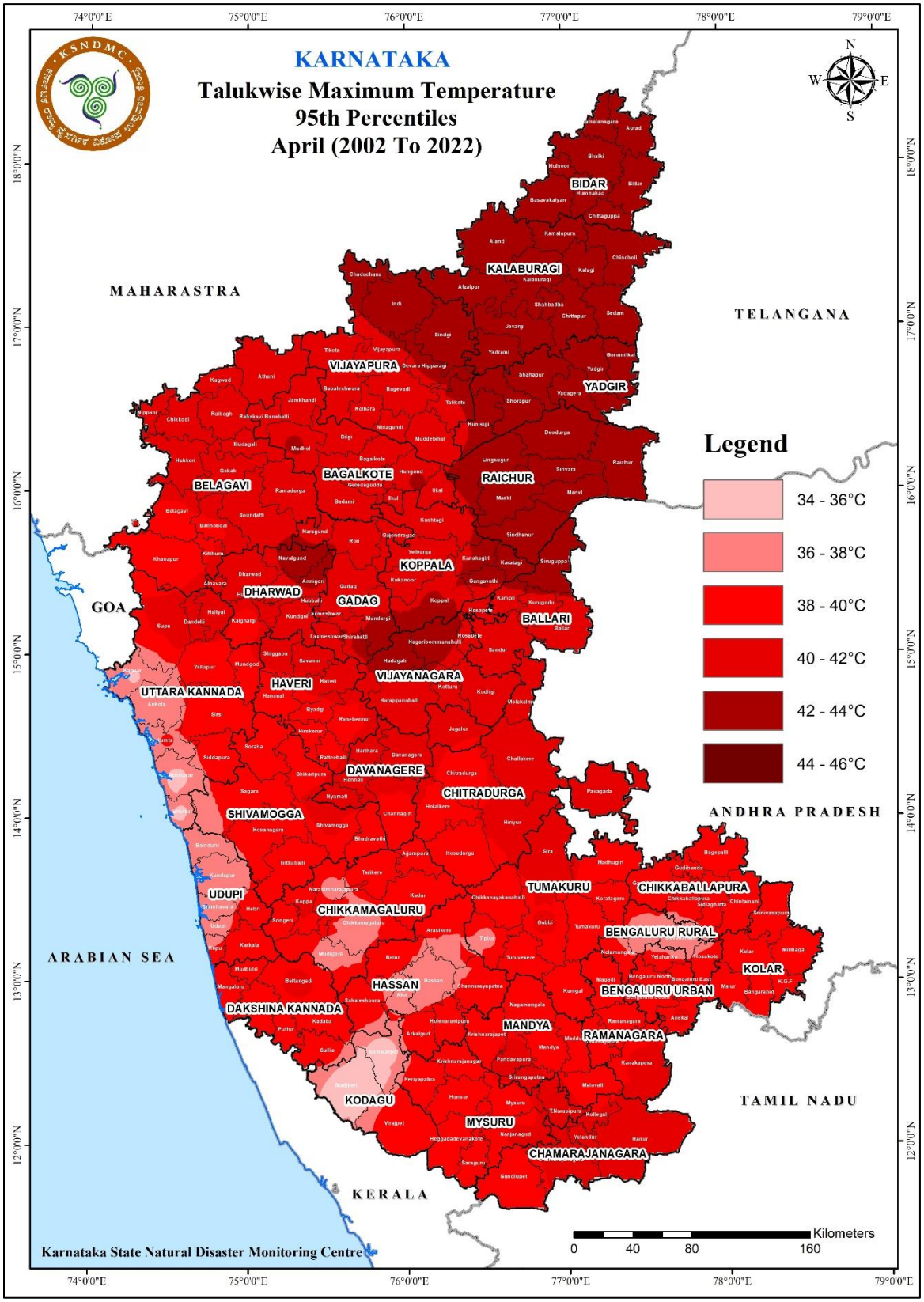


Fig. 6.2 Taluk level 95th percentile maximum temperature map for April Month

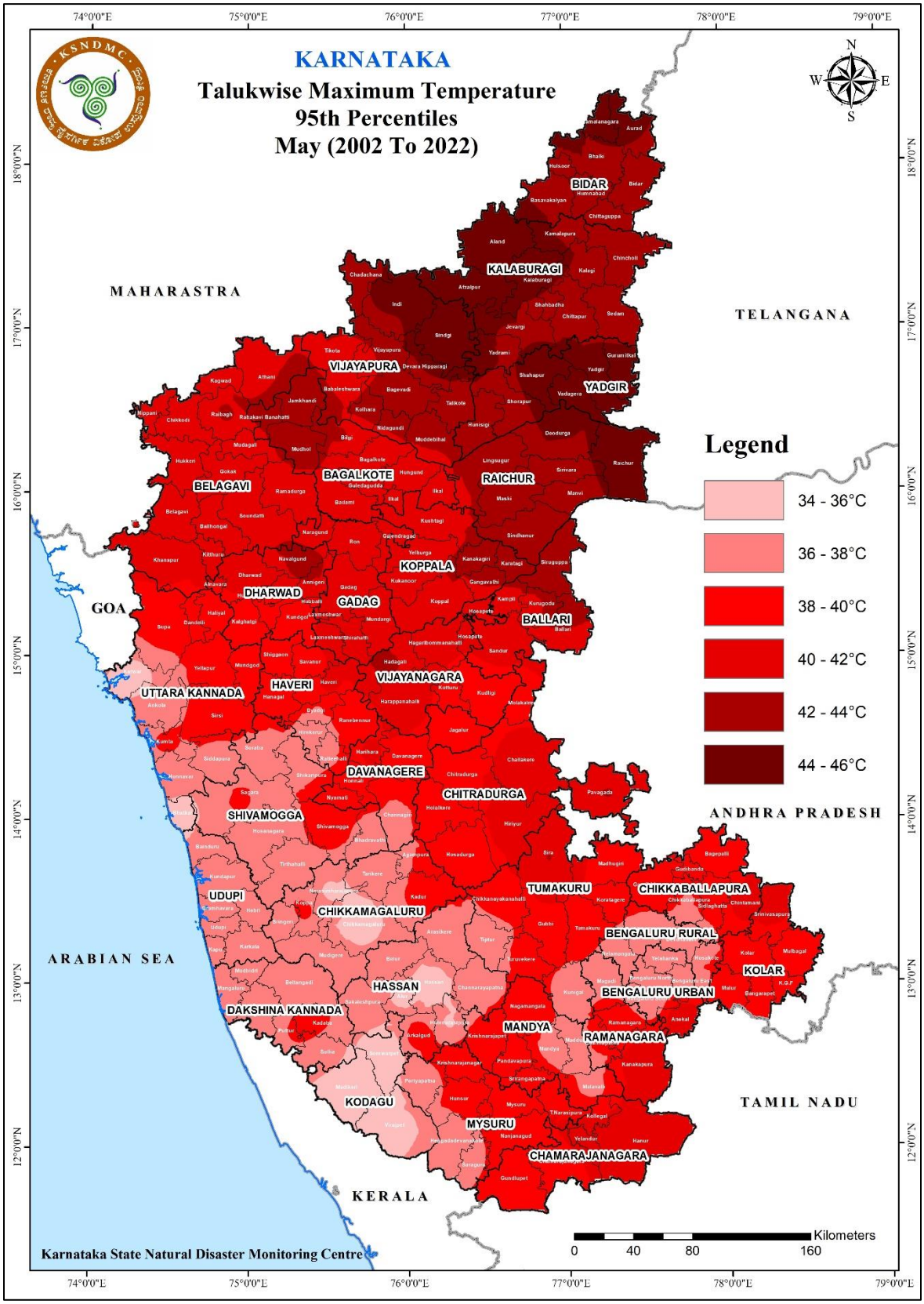


Fig. 6.3 Taluk level 95th percentile maximum temperature map for May Month

District-wise maximum temperatures recorded during last six years (2017 – 2022)

Sl.No.	District	2017	2018	2019	2020	2021	2022
1	Bagalkote	45.3	42.9	44.5	42.6	40.2	43
2	Ballari	45.3	44.7	44.7	42.8	40.7	44.1
3	Belagavi	43.3	41.6	43.7	42	41.3	41.9
4	Bengaluru Rural	39.1	38.3	38.7	38.7	38.6	39.3
5	Bengaluru Urban	39.6	38.1	39.9	38.9	38.9	39.7
6	Bidar	44.1	44.4	45.2	45.8	42.2	45.6
7	Chamarajanagara	40.9	39.6	41.7	40.4	40.1	38.1
8	Chikkaballapura	40	40.4	41.5	40.6	40.7	39.1
9	Chikkamagaluru	39.8	39.5	40.9	40.9	39.6	39.9
10	Chitradurga	42.9	42.5	42.7	41.9	40.2	40.9
11	Dakshina Kannada	39.8	40.9	42.8	42	40.7	39
12	Davanagere	42.5	43.1	43	41.5	40.7	40.8
13	Dharwad	42.1	41.8	43.9	41.9	43.2	43.4
14	Gadag	42.8	41.4	42.9	42.5	41.5	43.4
15	Hassan	39.9	39.6	40.8	40.1	38.9	39.2
16	Haveri	42.9	40.9	42.7	40.5	42.2	41.7
17	Kalaburagi	45.1	45.3	46.6	46	42.5	44.4
18	Kodagu	39.4	38.2	39.8	40.7	39.3	36.9
19	Kolar	40.6	40.3	40.8	41.5	39.9	40
20	Koppala	41.8	43	44.8	43.5	41.9	42.4
21	Mandya	41.6	39.8	40.5	39.7	39.9	39.6
22	Mysuru	40.9	39.2	40.9	40.2	39.8	39.6
23	Raichur	43.6	43.7	44.9	45.2	42.6	44.8
24	Ramanagara	42.8	41.8	42.6	41.5	39.6	39.7
25	Shivamogga	40.9	40.1	42.1	41	40.6	39.7
26	Tumakuru	42.7	41.5	42.1	41.3	40.7	41.4
27	Udupi	39.1	39.5	40.1	40.2	38.9	38
28	Uttara Kannada	42.3	41.9	44	40.1	41.4	40.2
29	Vijayapura	44	43.8	45.2	45.3	42.7	44.9
30	Yadgir	45.3	45	45.8	45.1	43.7	44

Table 1: Year-wise and District wise maximum temperature recorded over the State during 2017-2022

North interior districts of Karnataka state are prone to heatwave-like conditions. Past 6 years (Fig 6), district-wise maximum temperature observations indicate that extreme north districts adjacent to Telangana and Maharashtra States experienced high temperatures during the peak summer season. However, it was observed that, during the years 2020, 2021 and 2022; the observed max temperatures were comparatively less than the 2019 max temperatures recorded over the State.

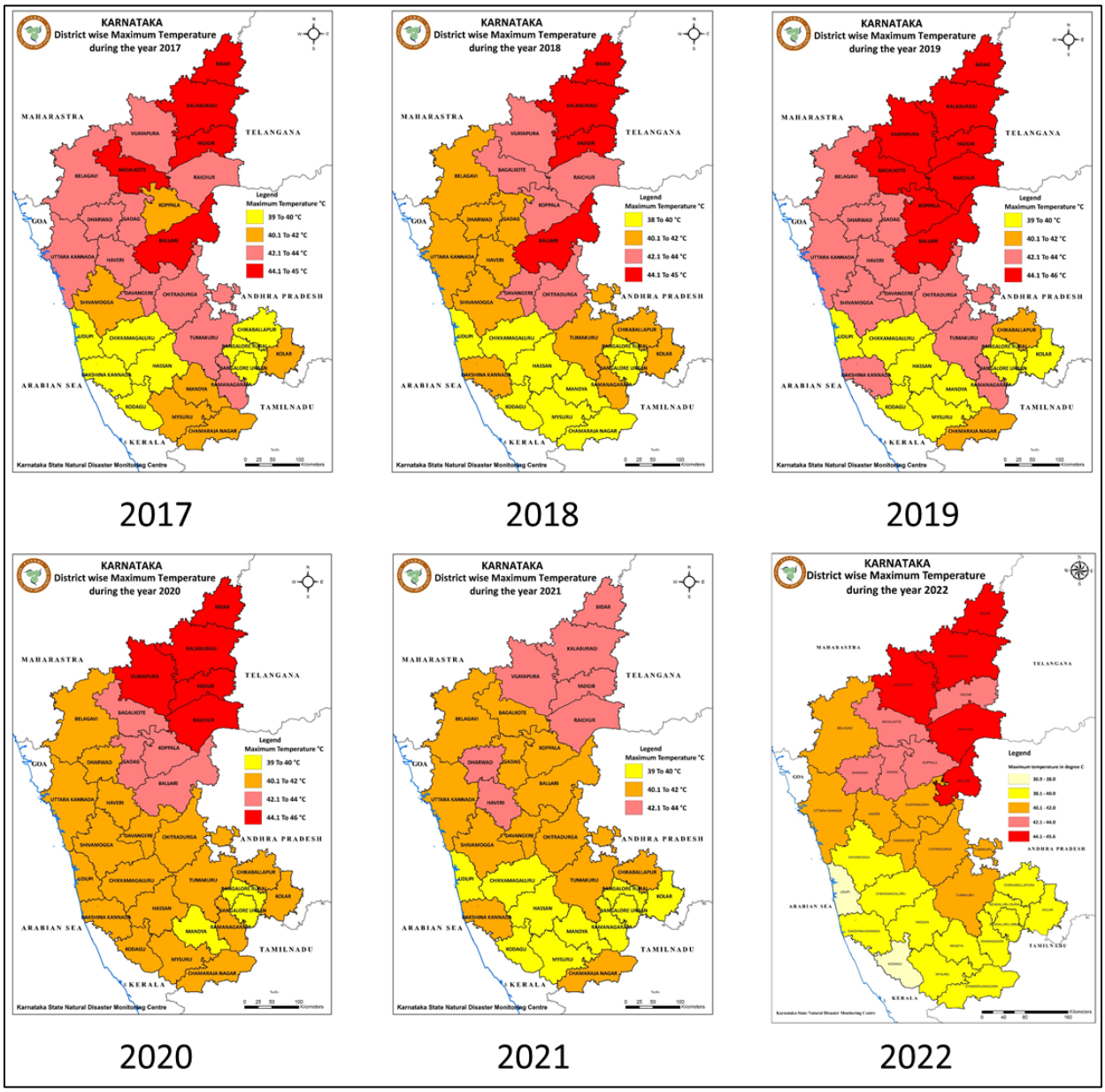


Fig 7: Last six years (2017-2022) district-wise maximum temperature recorded maps

2.3 Declaring Heat Wave for the State

To declare a Heatwave, the above criteria should be met for at least two stations in a Meteorological sub-division for at least two consecutive days. A Heatwave will be declared on the second day.

The annual All-India daily maximum and minimum temperatures heat wave in India typically occurs between March and June (Fig 7). The annual Cycle of Minimum and maximum temperature in India is as follows:

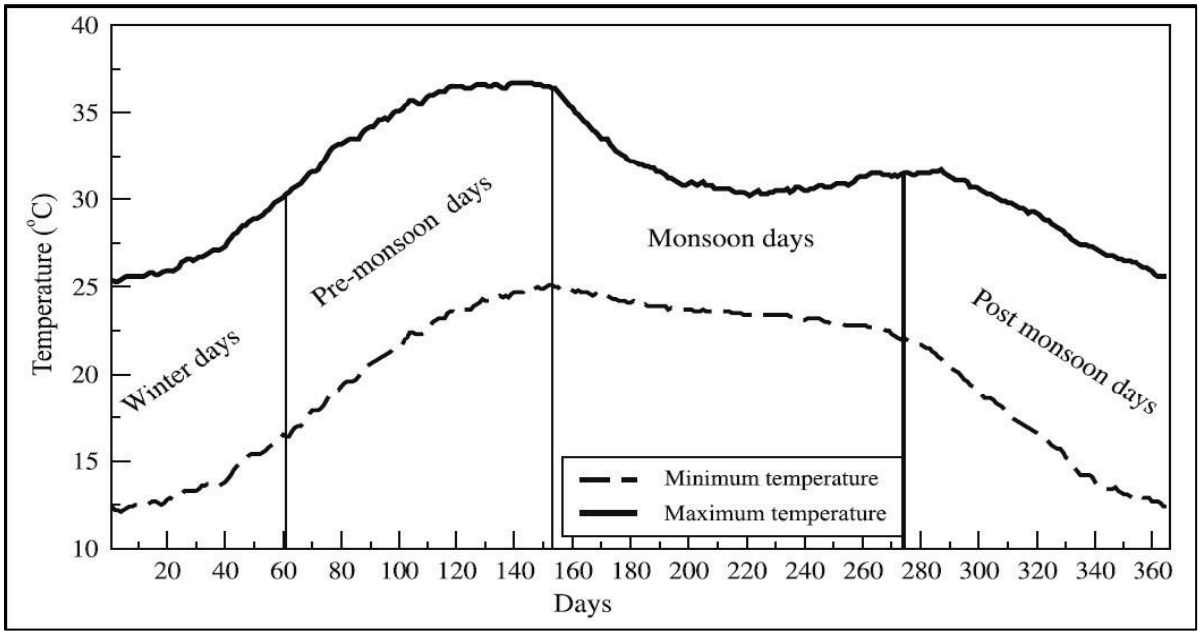


Fig 8: Maximum Temperature typical pattern in India

Karnataka reported less mortality due to Heat waves during the same period. Still, the North Interior of Karnataka remains vulnerable to Heat waves as many of these are bordering districts of Telangana and Andhra Pradesh (Rayalaseema). As recorded through the KSNDMC weather monitoring network, most parts of the North Interior Karnataka (NIK) have recorded hot weather conditions.

Based on the experiences, KSNDMC identified the districts likely to be affected by heatwave conditions over the State, and the map is given.

Typically, NIK (as shown in the Fig: 4) remains dry from March to June. Several districts

of this region have recorded temperatures above normal by 3°C to 5°C. In general, many districts increase maximum temperatures observed above normal by 2-4°C from March to June.

During the summer, the high temperatures of the past 5 years in neighbouring States of Andhra Pradesh and Telangana (then undivided Andhra Pradesh) unprecedentedly high day and night-time temperatures resulted in 2776 deaths (Source: THE HINDU newspaper dated on 19th Dec, 2022).

2.4 Temperature / Humidity Index

The level of heat discomfort is determined by a combination of meteorological (temp, RH, Wind, direct sunshine), social/ cultural (clothing, occupation, accommodation) and physiological (health, fitness, age, level of acclimatization) factors. There will be no harm to the human body if the environmental temperature remains at 37 °C. Whenever the environmental temperature increases above 37°C, the human body starts gaining heat from the atmosphere. If humidity is high, a person can suffer heat stress disorders even with the temperature at 37°C or 38°C as high humidity does not permit the loss of heat from the human body through perspiration. Heat Index values are used in some countries to calculate the effect of humidity. The Heat Index measures how hot it feels when relative humidity is factored in with the actual air temperature. The Heat Index chart used by the National Weather Service of the USA below shows that if the air temperature is 34 °C and the relative humidity is 75 per cent, the heat index – how hot it feels – is 49 °C. The same effect is reached at just 31 °C when the relative humidity is 100 per cent.

The chart provided in **Table 2** is developed for the prevailing heatwave conditions and the acclimatization of people in colder countries; however, it does not directly apply to India. The US National Weather Service states that the Heat Index calculation using this chart may produce meaningless results for temperatures and relative humidity

outside of the range depicted in the chart. As temperature and humidity outside the range of this chart are not uncommon in many parts of India, they cannot be directly used. The notion of looking at temperature and humidity in combination is good; however, to develop a usable matrix in the Indian context, more research needs to be done.

However, the temperature is not the sole criterion for Heat waves; relative humidity and other meteorological factors determine Heatwave conditions. Threshold values of temperature and relative humidity are to be determined for each district of Karnataka to take a specific action plan, especially the humid region comprising coastal districts of the State - Uttara Kannada, Udupi & Dakshina Kannada are more prone to heat index-related threats.

HEAT WAVE INDEX CHART

Relative Humidity (%)	Temperature (˚C)																
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	55	57	
50	27	28	30	31	33	35	36	38	41	43	46	49	52	55	58		
55	28	29	30	32	34	36	38	40	43	46	48	52	54	58			
60	28	29	31	33	35	37	40	42	45	48	51	55	59				
65	28	30	32	34	36	39	41	44	48	51	55	59					
70	29	31	33	35	38	40	43	47	50	54	58						
75	29	31	34	36	39	42	46	49	53	58							
80	30	32	35	38	41	44	48	52	57								
85	30	33	36	39	43	47	51	55									
90	31	34	37	41	45	49	54										
95	31	35	38	42	47	51	57										
100	32	36	40	44	49	56											

Caution | Extreme Caution | Danger | Extreme Danger

Source: Calculated °F to °C from NOAA's National Weather Service

Table 2: Temperature and Relative Humidity Heat Wave Index

CHAPTER 3: WEATHER MONITORING & EARLY WARNING MECHANISM

Karnataka State Natural Disaster Monitoring Centre (KSNDMC) has taken up pioneering and path-breaking initiatives towards monitoring natural disasters and risk reduction. KSNDMC has established a network of GPRS-enabled and solar-powered Telemetric Weather Stations at all the 850 Hoblis (sub- Tehsil: 250 sq. km each) and 176 Micro-Watersheds in the State **(Fig: 6)**. The weather data comprising temperature (^{0}C), Relative Humidity (%), Wind Speed (m/s), Wind Direction (Degrees), Rainfall amount (mm) and intensity (mm/hr) data has been collected at every 15 minutes through these weather monitoring stations.

The density of the weather monitoring stations network is the highest and first in the Country. Also, the temporal resolution of the data collected (96 data points a day/station) through this network of stations is a need of the hour for the researchers to develop simulations and related advisories. The monitoring network can capture the highly uneven distribution of rainfall and weather parameters in terms of space and time; in turn, it helps the decision-makers make a timely decision at the micro level.

The Centre has established a state-of-the-art facility to collect data at a very high spatial and temporal resolution, data analysis, information and advisory generation and dissemination to the Stakeholders in a near-real-time. Necessary computer/web applications have been developed to collect, store, analyze and transmit reliable, accurate and seamless data with the least manual intervention. As a result, the time interval between data collection and decision-making is almost near-real-time. Based on the near real-time data collected, the Centre identifies and maps the vulnerable hazard areas, prepares reports with advisories and disseminates them to stakeholders.

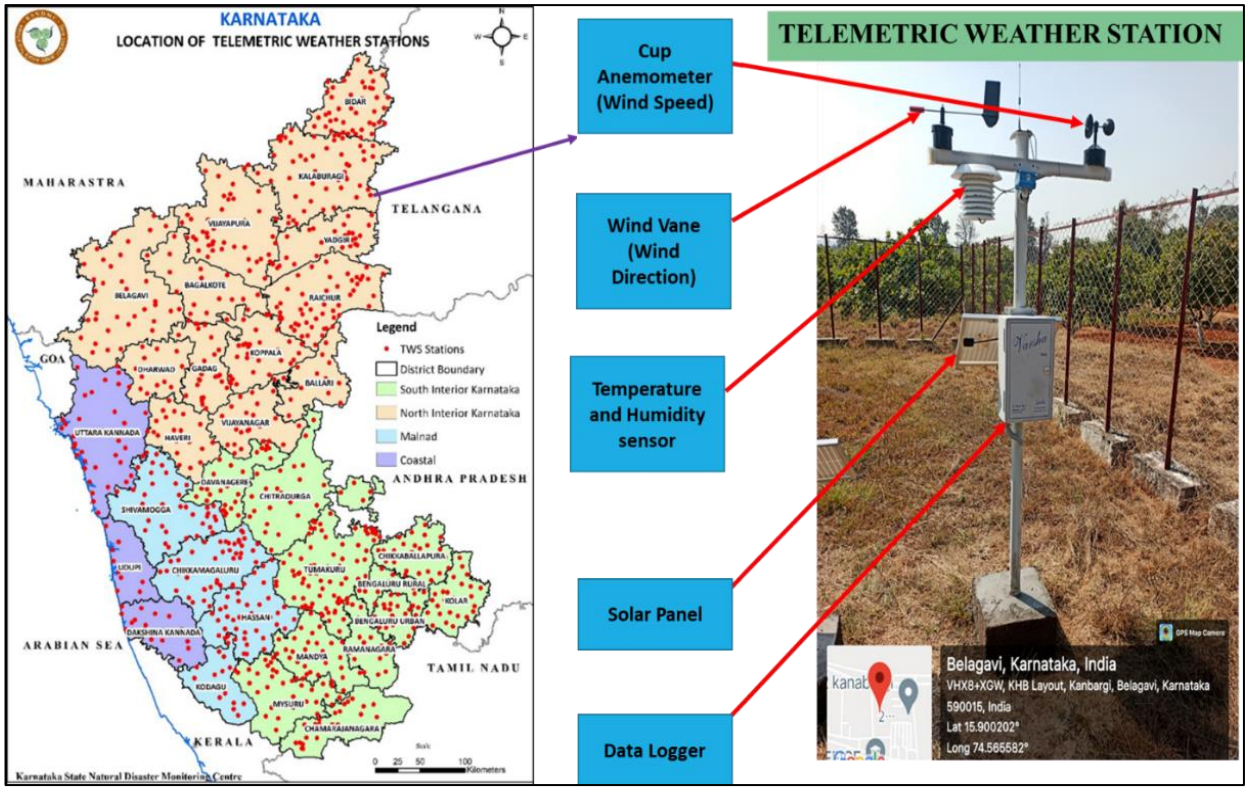


Fig 9: Telemetric Weather Stations network across the State

High Spatial and Temporal resolution data thus collected from the ground on various parameters are being converted into information. Subsequently, in conjunction with the weather forecast, the meteorological information is used to generate customized weather Advisories and disseminated to the users. Providing early warnings about possible extreme weather condition, Weather forecast at high spatial and temporal resolution helps the end-users to plan and implement appropriate measures to minimise the adverse impact of extreme weather condition.

KSNDMC issues Temperature bulletins during peak summer days each time maximum temperatures distributions are high in the State and maps are also generated based on the recorded through the Telemetric weather Stations (TWS) network installed at every Hobli level (Sub-block). This network provides every 15 minutes interval temperature data with an approximate 25 sq. km grid distributed all across State. The experimental temperature forecast for the next three days at gram panchayat level by Space Application Centre (SAC) – ISRO and IMD 5 days district level temperature forecasts issues through social media.

Maximum Temperature distribution (Fig: 10) for past 24 hours (from 0830 hrs IST of 20th April to 0830 hrs IST of 21st April 2022 over the State.

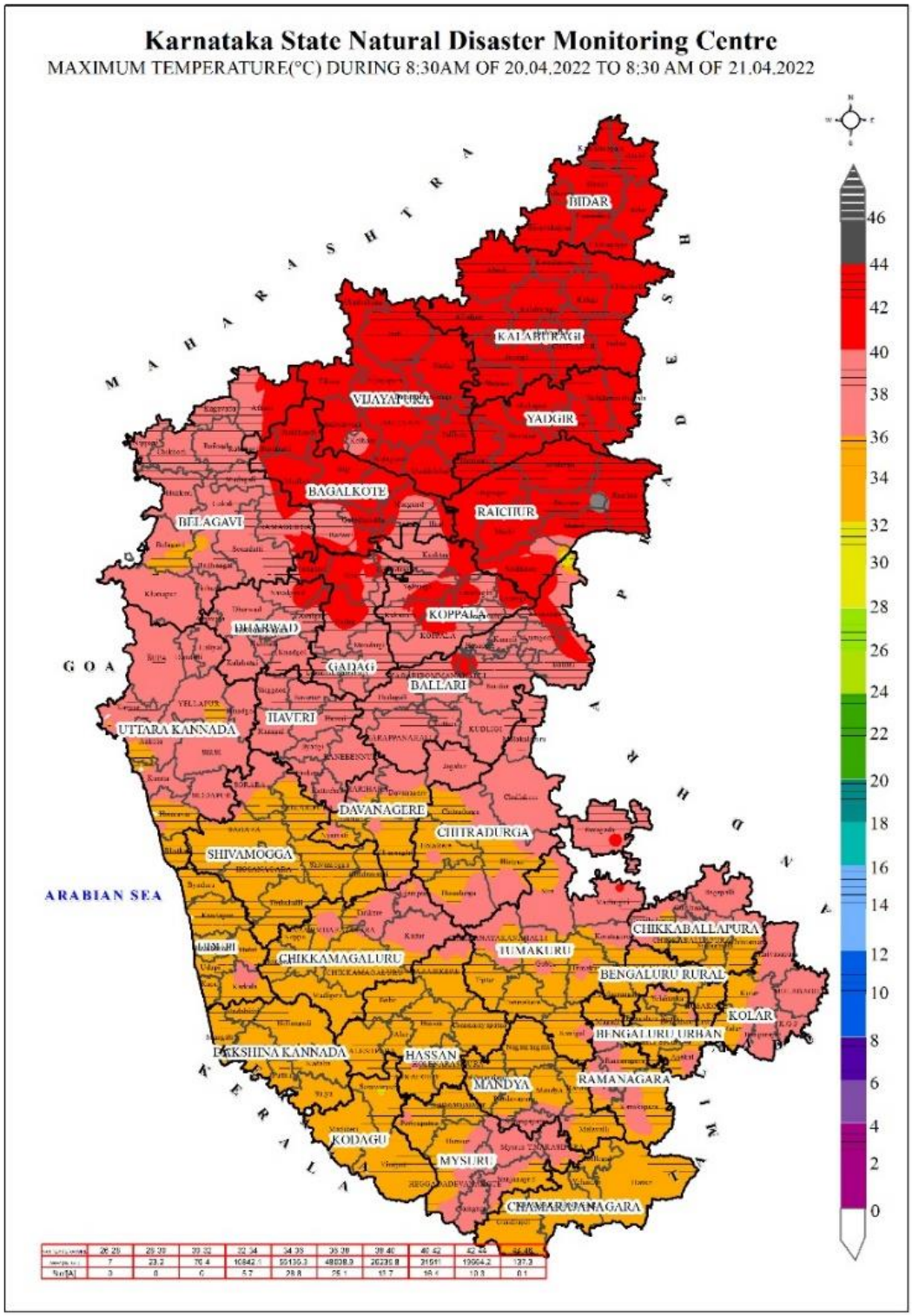


Fig 10: Spatial distribution of observed maximum temperature map as on 21st April, 2022

3.1 Early Warnings & Information Dissemination:

Information Dissemination plays an essential role in disaster risk reduction. KSNDMC has employed various Dissemination systems to send Disaster-related information through Alerts, Advisories and Early Warnings to all Government Executives & Communities in Real-time.

KSNDMC has developed a unique integrated public alert and warning system called Disaster Early Warning System (DEWS) to disseminate early warnings to the potentially vulnerable panchayats effectively. DEWS will provide rapid, reliable and effective communication to the public in case of major emergencies such as natural disasters like Floods, Heavy releases from upper catchment reservoirs/ Dams, Hailstorms, Earthquakes, Heavy rains, Lightning & Thunderstorms and Heat waves. This DEWS equipped potentially identified vulnerable panchayats with integrated announcement systems. This system has features like text-to-speech, recording service, automated message service, scheduled broadcast of messages & group broadcasting. These pre-defined features will be issued during pre & post-disaster events whenever crossing the limits of defined threshold values.

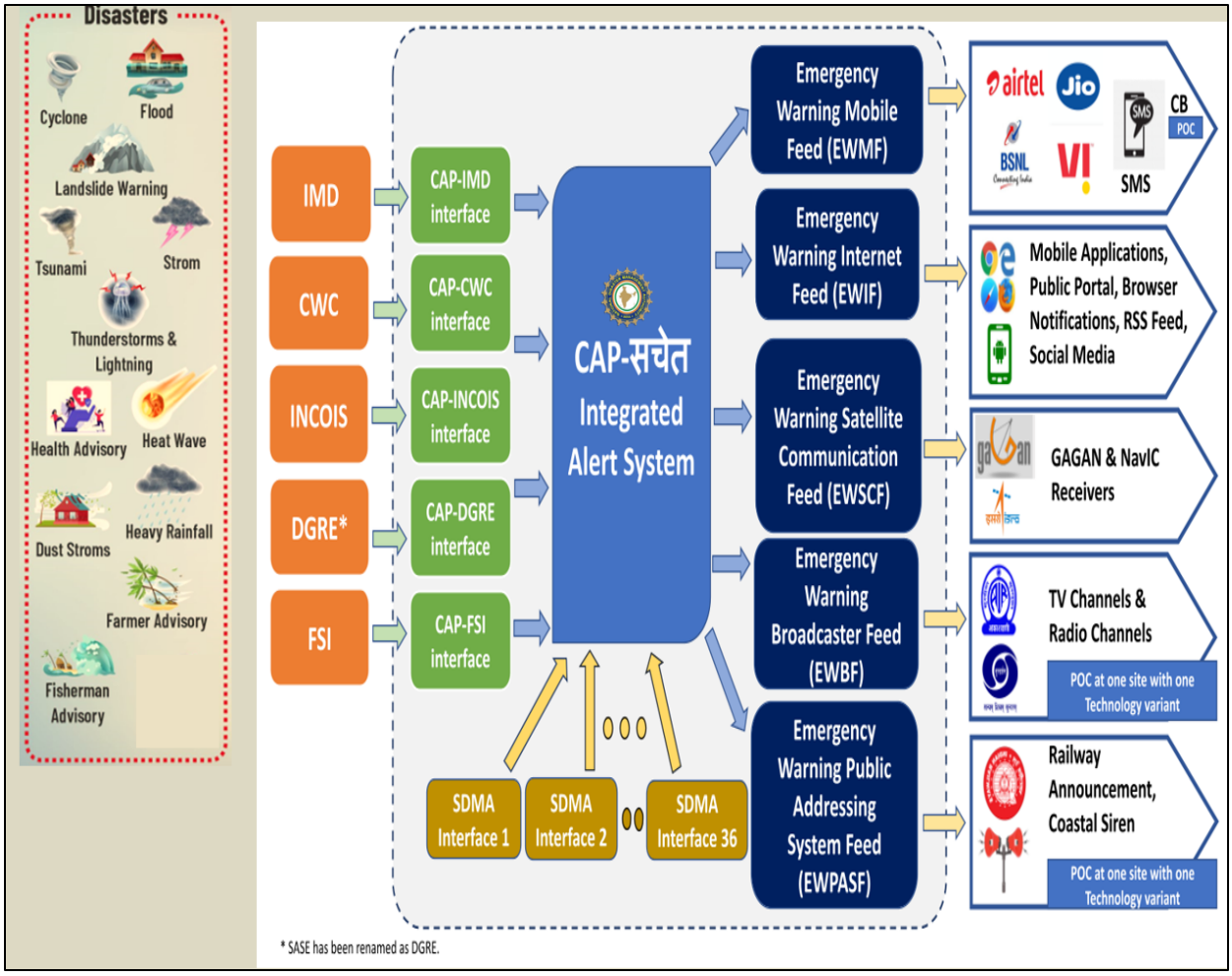
The warning messages will be broadcasted to outdoor receivers with the Public address system automatically using the DEWS system at that particular Gram Panchayath office before any disaster occurs, with the help of the existing highly dense weather observational network and forecast mechanism in the State. A dedicated team of operators and technical officers monitors regularly. It follows the specified criteria for each disaster and issues alerts/ early warnings accordingly to the likely affected community/area in advance to effectively minimize the loss of life and property in the State.

The warnings and weather advisories will also be disseminated to the public in regional language through 24 x 7 Interactive Help Desk “VARUNA MITRA” operational at KSNDMC. The database, customized to every Grampanchayath, of about 28 lakh farmers

/ general public available at KSNDMC will also be used for disseminating the disaster related information along with weather advisories.

CAP Platform:

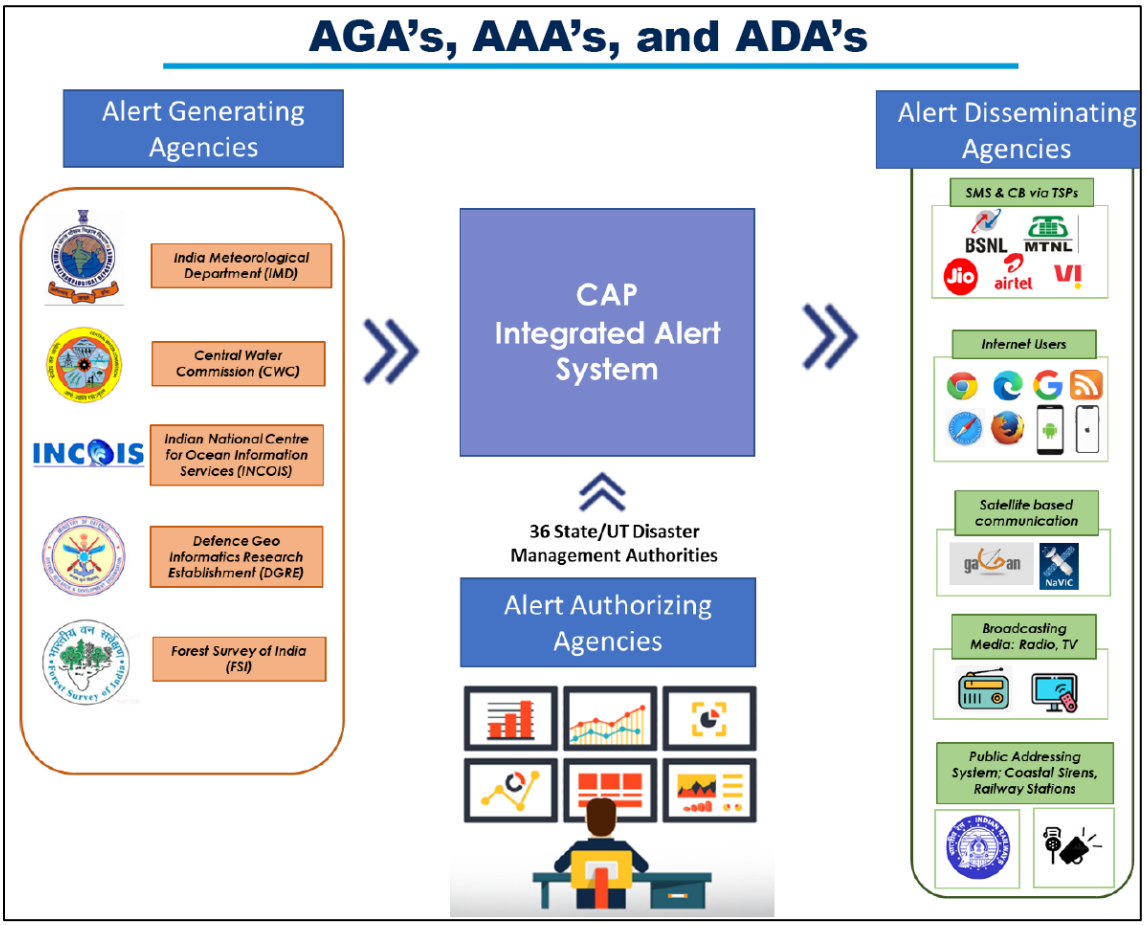
National Disaster Management Authority (NDMA), under Ministry of Home Affairs (MHA) has implemented Common Alerting Protocol (CAP) Integrated Alert System for geo targeted dissemination of disaster alerts through various media. Centre for Development of Telematics (C-DOT) is the technical executor of this Project. Under this project, the Cell Broadcast (CB) technology also explored and geo-targeted alerts can be delivered to citizens in a short span of time and in case of severe heat wave conditions CB can be used for dissemination of alerts clarified by NDMA.



Implementation of CAP platform

The platform will facilitate to Alert Authorizing Agencies (AAA's) , the Alert Generating Agencies (AGA's) and the Alert Dissemination Agencies (ADA's) to give flexible geo-targeted alert dissemination in English or in vernacular language over one or multiple media to the targeted public, based upon Alert Category (i.e., severity type, vulnerable areas and lead time). CAP based Integrated Alert System has developed Standard Operating Procedures (SOP's) to AGA's and general guidelines to all project implementing agencies & AAA's by NDMA and C-DOT.

CAP platform enables near – real time dissemination of early warnings through multiple means of technology including SMS, Cell Broadcast, Radio, TV, Siren, Social Media, Web Portals and Mobile Applications using geo-intelligence. This one-stop solution is a concrete step towards realizing Hon'ble Prime Minister's 10 point Agenda for Disaster Risk Reduction.



Flow chart of CAP Integrated Alert System to AGA's, AAA's & ADA's

Fig 11: Different modes of dissemination of Information

Links for Information Education and Communication (IEC) Materials

1. YouTube playlist (English)

   https://youtube.com/playlist?list=PLOuQBh7LWB0jkqsur5Ce2xLjZwXXl7mTr
2. YouTube playlist (Hindi)

   https://youtube.com/playlist?list=PLOuQBh7LWB0jlLuA3YvSuCoX16bmYveuP
3. **https://ndma.gov.in/index.php/Resources/sign_videos/Early-warning-Heatwave**
4. **https://ndma.gov.in/Resources/sign_videos/heat-wave-preparedness**
5. **https://ndma.gov.in/Resources/awareness/heatwave**
6. https://ndma.gov.in/Natural-Hazards/Heat-Wave/Dos-Donts

3.2 Forecast and Issuance of Heat Alert or Heat warning

India Meteorological Department (IMD), Ministry of Earth Sciences, is the nodal agency for providing current and forecast weather information, including warnings for all weather-related hazards for optimum operation of weather-sensitive activities. It warns against severe weather phenomena like tropical cyclones, squally winds, heavy rainfall/snow, thunder-squall, hailstorm, dust storms, Heat waves, warm nights, fog, cold waves, cold nights, ground frost, etc. It also provides real-time data and weather prediction of maximum temperature, Heatwave warnings, extreme temperature, and heat alerts for vulnerable cities/rural areas.

A new system of exclusively heat-related warnings has been introduced with effect from 03 April 2017 by IMD. These warnings, valid for the next four days, are issued around 1600 hours IST daily and are provided to all concerned authorities (Departments of health, disaster management, Indian Red Cross and Indian Medical Association, NDMA etc.) for taking suitable action at their end. A bulletin in extended range with the outlook for the next two weeks (for all hazards, including Heat waves) is issued every Thursday (available at http://imd.gov.in/pages/extended.php).

In addition to the above, Climate Forecast System based forecasts maps of daily maximum temperatures and their departures from normal for the next 21 days(issued every Thursday) are also available on the IMD website;
(http://nwp.imd.gov.in/cfs_all.php?param=tmax & http://nwp.imd.gov.in/cfs_all.php?param=tmaxa respectively).

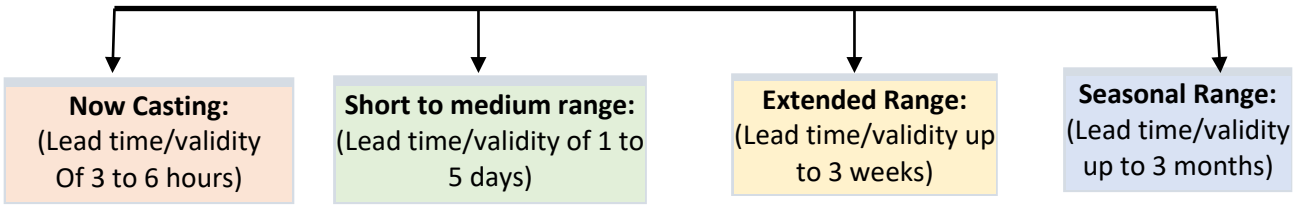
In 2016, IMD introduced a system of issuing seasonal temperature outlooks for the next three months; for 2023, the seasonal outlook for the temperatures valid for March to May 2023 was issued on 01 March 2023. These seasonal outlooks are issued as a press release on the IMD website and through electronics and print media. These are also provided to

all concerned Chief Secretaries, Disaster Managers, and the health sector through the India Medical Association (IMA).

3.3 Temperature Forecast: Specific Range, Time duration and area

IMD issues forecasts and warnings for all weather-related hazards in the short to medium range (valid for the next five days) every day as a part of its multi-hazard early warning system. These warnings updated four times a day, are available at http://www.imd.gov.in/pages/allindiawxfcbulletin.php

The operational system of weather forecasts and warnings is summarised in the chart below:



According to IMD seasonal Outlook for maximum and minimum temperatures during March to May (MAM), 2023 issued on 01st March, 2023 Indicates for Karnataka State; the seasonal max & min temperatures are likely to be normal to below normal probabilities over North & South Interior Karnataka districts; Whereas, Coastal Karnataka districts are likely to have normal to above normal probabilities.

Heat Wave outlook for March to May season 2023 issued based on Multi Model Ensemble Forecasting System by IMD indicates; Majority of the North Interior Karnataka Districts are likely to have 20-30 % probability of Heat Wave during March-May; Whereas, probability of occurrence of the heat wave in the rest of the State is less likely.

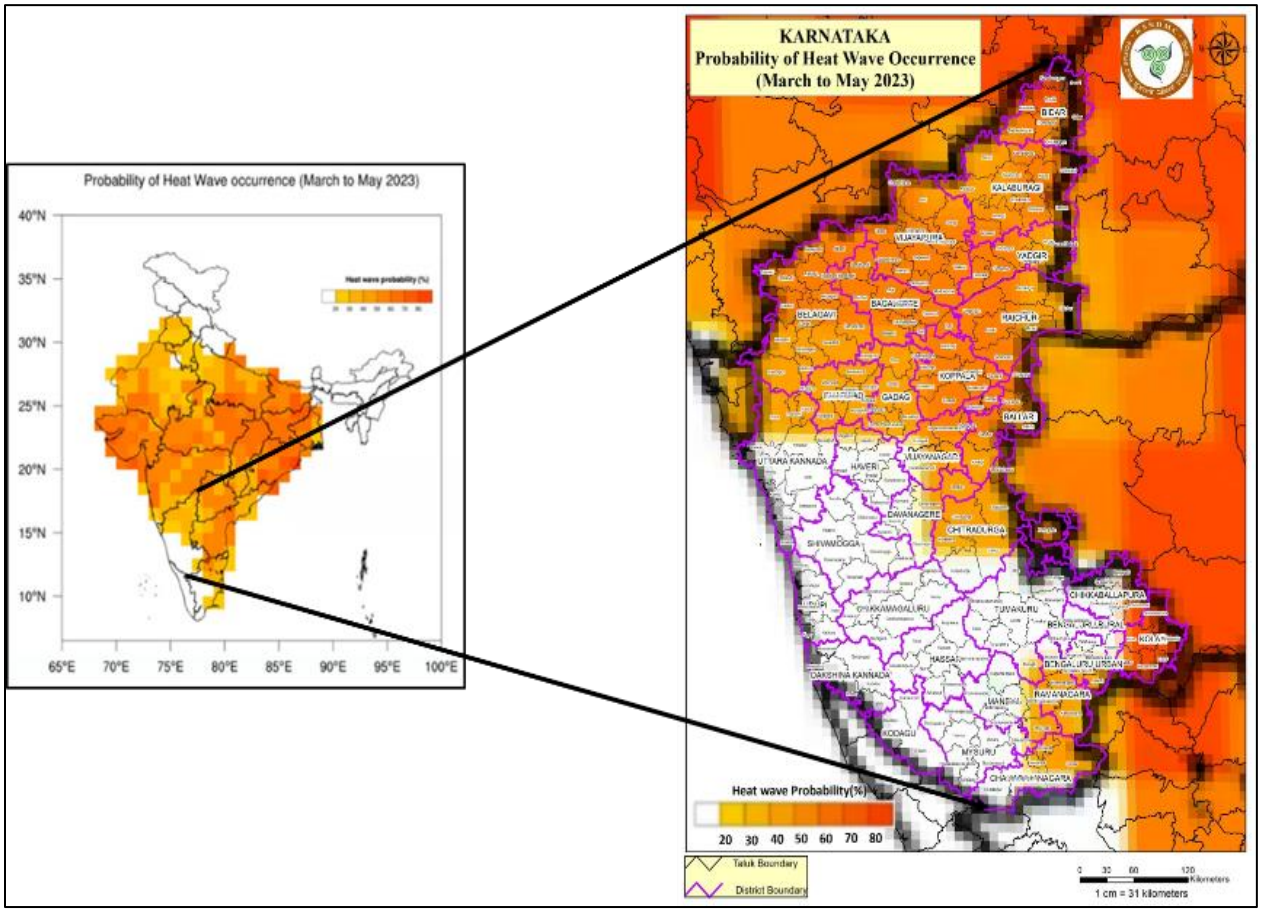


Fig 12: Probability of Heat Wave Occurrence during March to May – 2023. ***(Source: IMD)***

The experimental based temperature forecast for the next three days with 12 hrs interval at gram panchayat level generated by Space Application Centre (SAC) – ISRO in collaboration with KSNDMC is available on daily basis and the dynamic spatial maps will be prepared through automated applications developed at KSNDMC and maps are available in KSNDMC daily reports and website for public usage and also to all the concerned line departments as shown in the below Fig. 13.

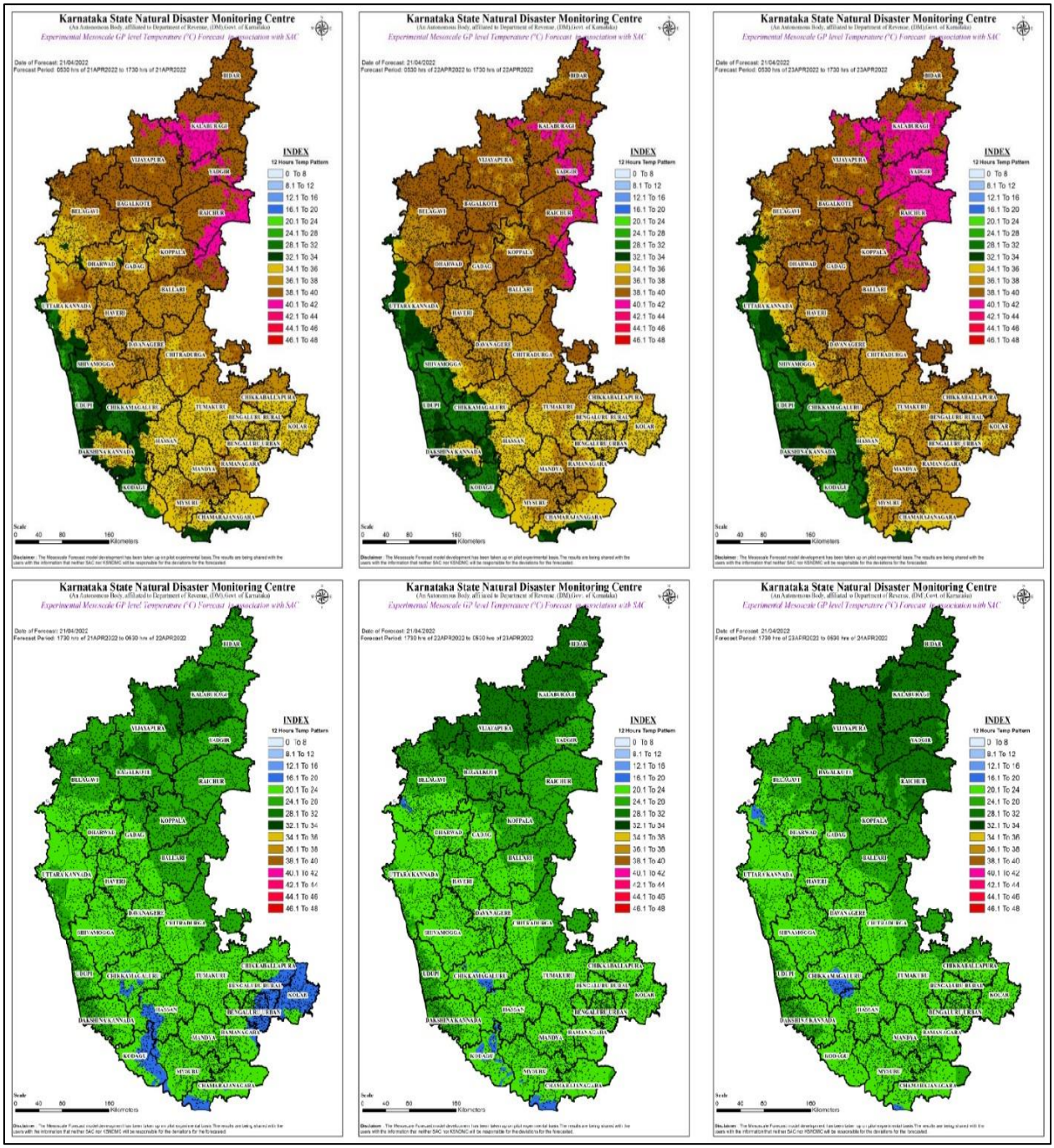


Fig 13: Temperature forecast map at Gram panchayat level for next three days with 12 hours interval as on 21st April, 2022

CHAPTER 4: HEAT WAVE ACTION PLAN AND ITS APPROACH

4.1 Rational for Heat wave Action Plan

Many States are affected during the Heat wave season, such as Andhra Pradesh, Telangana, Odisha, Gujarat, Rajasthan, Madhya Pradesh Chhattisgarh, Uttar Pradesh, Maharashtra, **Karnataka**, Tamil Nadu, Bihar, Jharkhand, West Bengal, Haryana, Punjab and Delhi. The actual numbers of deaths resulting from Heat waves are higher than the reported numbers. Mostly the deaths in rural areas due to Heat wave are often not reported. The booming service sector with a large number of vegetable vendors, auto repair mechanics, cab drivers, construction workers, roadside kiosk operators etc., is particularly vulnerable to the Heat wave conditions. Though the richer sections of India can cope with higher temperatures by investing in air conditioners and coolers, the poorer population remains vulnerable to the higher temperatures. These Heat wave related deaths can be prevented with an evidence-based plan, effective implementation and frequent updating in line with recent scientific development.

Hence, a State-level strategy and plan to combat Heat wave should be developed. Comprehensive heat preparedness and response require government authorities, non-governmental organisations, and civil society involvement.

4.2 The objective of Heat Wave Action Plan

The Heat Wave Action plan aims to provide a framework for developing plans for implementation, inter-agency coordination and impact evaluation of Heat wave response activities in cities town that reduce the negative impact of extreme heat. The plan's primary objective is to alert those at high risk of heat-related illness in places where extreme heat conditions exist or are imminent and take appropriate precautions. The plan also calls for preparedness measures to protect livestock/animals as extreme heat causes significant stress to them as well. The Heat wave action plan intends to mobilise departments and communities to help protect communities, neighbours, friends, relatives, and themselves against avoidable health problems during spells of very hot weather. The plan also intends to help early warning agencies

and the media be proactive on steps taken to negate Heat wave impacts. The administrative/preventive actions that need to be taken by multiple agencies ministries/departments are enumerated in the Roles and responsibilities **Table: 12**. All districts/cities/towns can learn from their others' experiences and develop a plan to deal with Heat waves effectively.

4.3 Action Plans

Recurring /regular activities

a) Putting up display boards for colour coded Heat wave alerts and Do's and Don'ts in public places such as parks, hospitals, etc.
b) Multiple medium of communication (in Kannada) like TV, Radio and Newspaper for awareness.
c) Identify and reduce awareness gap by disseminating information using pamphlets, hoardings, LED displays on advertisement boards.
d) Change in timings of schools, colleges, offices, markets, etc.

Short-Term:

a) Installing temporary kiosks for shelter, and distribution of water, medicines, etc.
b) Developing mobile applications for spreading awareness on heat-related issues and locating shelters, drinking water kiosks, etc.
c) Issuing advisories for tourists.
d) Setting up special cool shelters for "Wage Employment programmes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGA).
e) Providing shade and drinking water for on-duty traffic personnel.

Medium Term:

a) LED Display boards installed at District Headquarters displaying the real-time weather data pertaining to Rainfall, Temperature, Humidity and Wind Speed should be incorporated into precautionary measures for Disaster Management.

b) Involving Forest department to collate local coping and adaptation strategies indigenous technologies such as vernacular building materials and construction of green building. Energy Conservation Building Code (ECBC) etc. related to Heat wave risk mitigation.
c) New heat wave criteria must be evolved based on gridded data with maximum and minimum temperature to develop a scientific model to determine all-cause mortality.
d) Zonal/regional HAP for megacities like Bengaluru, Mysuru & Mangaluru etc., should be developed for its effective implementation.
e) Identify "heat hot-spots" in State through appropriate tracking and modelling of meteorological data. Promote the timely development and implementation of local Heat Action Plans with strategic inter-agency coordination and a response targeting the most vulnerable groups.

Long Term:

a) Focused capacity building- Heat wave mitigation management should be added in school curriculum to sensitise school children and local people. Training programmes in local level/ community level for awareness among people.
b) Integrate climate variability mitigation and adaptation efforts in HAP.
c) Yearly improvisation of Heat wave plan through response and feedback data collection.
d) Operational forecast of maximum temperature over State in short, medium and extended range timescale is very useful in giving Heat Wave outlook.
e) Up-gradation of forecast system & associated equipments to provide Heat wave alerts minimum of 2 to 3 weeks prior to the event.
f) Health-harming air pollution apportionment studies, emission inventories and health impact assessments of ambient and household air pollution through District wise Clean Air Action Plans and use these findings to inform policies targeted at reducing the main sources of pollution via an inter-ministerial approach.
g) Evaluation of cascading effects of Heat waves over flood, drought and hydrological models.

h) Involvement of academia along with collaboration and more participation from higher educational institutes may be developed. The centres for excellence and dedicated research centres may have a pivotal role to play.

4.4 Key strategies:

Severe and extended heat waves can cause disruption to general, social and economic services. Government agencies will have a critical role to play in preparing and responding to heat waves at the local level, working closely with health and other related departments on a long-term strategic plan.

a) Ensure preparedness and convergence between departments and other stakeholders.
b) Establish Early Warning System and communication systems
c) Developing inter-agency response plan and coordination in field
d) Preparedness at the local level for health eventualities
e) Health care system capacity building
f) Public awareness and community outreach
g) Collaboration with private, non-government and civil society
h) Assessing the impact - feedback for reviewing and updating the plan

4.5 Identification of Colour Signals for Heat Alert

IMD Currently follows a single system of issuing warnings for the entire Country through a colour-coded system as given below. This system advises on the severity of an expected heat hazard. However, threshold assessments carried out in different parts of the Country tell us that different cut-off points determine the warning signals appropriate for a specific state/region. Therefore, the States, districts and cities should carry out their respective threshold assessments for mortality and provide the information to IMD so that it can provide specific warning alerts to those States.

Red Alert (Severe Condition)	Extreme Heat Alert for the Day	Normal Maximum Temperature increase 6º C to more
Orange Alert (Moderate Condition)	Heat Alert Day	Normal Maximum Temperature increase 4º C - 5º C
Yellow Alert (Heat-wave Warning)	Hot Day	Nearby Normal Maximum Temperature
Green (Normal)	Normal Day	Below Normal Maximum Temperature

Table 3: Alert Criteria for Heat Wave

4.6 Colour Code Signals for Heat Alert and Suggested Actions

Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No action)	Normal Day	Maximum temperatures are near normal	Comfortable temperature. No cautionary action required	**Normal activity**
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists for 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**

Colour Code	Alert	Warning	Impact	Suggested Actions
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i)Severe heat wave conditions persist for 2 days. (ii) though 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	**(a) Avoid heat exposure- keep cool. Avoid dehydration.** **(b) Wear lightweight, light-coloured, loose, cotton clothes.** **(c) Cover your head.** **(d) Drink water frequently, even if not thirsty.** **(e) Use ORS, homemade drinks like lassi, torani (rice water), lemon water/juice, buttermilk, etc., to keep yourself hydrated.** **(f) Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.** **(g) Take bath in cold water frequently.** **<u>In case of SUNSTROKE:</u> The main thing is to bring down the body temperature. Lay the person in a cool, place, under a shade. Wipe her/him with a wet cloth/wash the body frequently. Pour normal temperature water on the head. Consult a Doctor immediately.**
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.	**Along with suggested action for Orange Alert, Extreme care needed for vulnerable**

Table 4: Colour code signs for Heat Wave and suggested Actions

CHAPTER 5: HEAT WAVE PREPARDNESS & MITIGATION MEASURES

5.1 Prevention of Heat-Related Illness:

Heat waves characterised by long duration and high intensity have the highest impact on morbidity and mortality. An increase in humidity may exacerbate the impact of extreme summer heat on human health**.** There is growing evidence that the effect of Heat wave on mortality is greater on days with high levels of ozone and fine particulate matter. Global climate change is projected to further increase Heat waves' frequency, intensity, and duration and attributable death (WHO). Heat-related illness is avoidable. It can be best prevented if the vulnerable populations/communities are made aware of prevention tips, basic Do's and Don'ts through effective use of various media.

Preventive and mitigation measures to be taken during Heat wave as follows:

a) Rescheduling schools and office timings in vulnerable districts (North Karnataka) to avoid peak heat periods during summer.
b) Flexi work time for workers under MGNREGA to avoid peak heat.
c) Productivity discount (reduced target/workload but paid full wages) during summer to prevent fatigue and exertion.
d) Mass awareness on hydration and drinking water in strategic locations to be made available. ORS will be adequately stocked.
e) Building Public Awareness about Heat waves, dos and don'ts and management through innovative (Information Education Communication) IEC activities focusing mainly on vulnerable communities. Community Outreach program at ward level and Panchayat level.
f) Do not leave kids unsupervised in parked cars. Vehicles can rapidly heat up to dangerous level.
g) Give them plenty of fluids to drink and check on child for concentrated (dark – coloured) urine, which can indicate dehydration.
h) Listen to radio; watch TV; read newspaper for local weather news.

5.2 Hospital Preparedness Measures for Managing Heat-related Illness:

Paramedics and front line workers to be trained at Hospitals in all Districts/ BBMP should ensure that the following measures are in place:

a) A detailed action plan to tackle heat-related illness well in advance of hotter months.
b) Operational framework- preparing specific health adaption plan, development of guidelines and response plan in the line of State Action Plan.
c) Need for updating heat health action plan, and issuing advisories for hospital preparedness, surveillance and weekly monitoring, including capacity building.
d) Promoting strategic media coverage of climate and health linkages at the State level in Kannada language to increase support for climate mitigation and adaptation responses.
e) Long-term measures such as adopting cool roofs, improving green/forest coverage and analysing health impacts in urban planning.
f) Paramedics and front line workers to be trained according to the Standard Operating procedures to tackle all levels of heat-related illness. Capacity-building measures for doctors, nurses and other staff should be undertaken.
g) Cases with suspected heatstroke should be rapidly assessed using standard Treatment Protocols.
h) Identify surge capacities and mark the beds dedicated to treat heatstroke victims and enhance emergency department preparedness to handle more patients.
i) Identify RRT (Rapid Response Teams) to respond to any emergency call outside the hospitals.
j) Ensure adequate arrangements of Staff, Beds, IV fluids, ORS, essential medicines and equipment to cater to management of volume depletion and electrolyte imbalance.
k) May try to establish outreach clinics at various locations easily accessible to the vulnerable population to reduce the number of cases affected. Health Centres must undertake awareness campaigns for neighbourhood communities using different means of information dissemination.

l) Primary health centres must refer the patients to the higher facility only after ensuring adequate stabilisation and basic definitive care (cooling and hydration).

m) Hospitals must ensure proper networking with nearby facilities and medical centres to share the patient load which exceeds their surge capacities.

n) All cases of heat-related illness (suspected or confirmed) should be reported to IDSP (Integrated Disease Surveillance Programme) unit of the district.

5.3 Acclimatisation:

Those who come from a cooler climate to a hotter climate, especially during the Heat wave season, are at risk. They should be advised not to move out in the open for a period of one week. This helps the body get acclimatised to heat. They should also be advised to drink plenty of water. Acclimatisation is achieved by gradual exposure to the hot environment during a Heat wave season.

5.4 Identification for Heat Wave related illness and recordings of causalities:

It is important to undertake an objective identification of Heat wave illnesses and systematically record casualties resulting from Heat wave. Districts may form committees at the district level with members not below the rank of Assistant Civil Surgeon. Tahsildar, and Inspector of Police to enquire into the deaths due to heat strokes/ Heat waves for correct reporting. In order to do so, the following four factors need to be taken into account.

- Recorded maximum temperature during the particular time period and place.
- Recording incidents, Panchanama or others witness, evidence or verbal -autopsy.
- Post-mortem/medical check-up report with causes.
- Local authority or Local body enquiry/verification report.
- Cases of heat exhaustion and heatstroke should be reported.

5.5 Health Care Facilities wise Reporting in Integrated Health Information Platform (IHIP) developed by NCDC

Reporting of heat wave related illness and causalities are the key to drawn causal relationship between heat wave and health impacts. The verifiable data on heat wave illness will enable future

research on approaches to deal with Heat wave. National Center for Disease Control has developed Integrated Health Information Platform (IHIP https://ihip.nhp.gov.in/idsp/#!/login) for reporting on health related illness, logins for which is available with Health Department. All Health Facilities to be on boarded to IHIP platform for reporting. DHO will ensure compliance to the same and shall provide weekly consolidated report for the district.

5.6 Need for data and analysis

As Heat wave is a notified as a State-specific disaster in Karnataka. In order to prepare for and take those necessary mitigate actions against Heat wave, we need data on age group, sex and occupation of those who die of Heat wave. We also need to collect data on whether the deaths occurred indoors or outdoors. Similarly, data on the economic status of the people who died needs to be collected. A format for collecting this data is provided at **Annexure V & VI**, which the SDMAs and DDMAs will use.

Data from various domains are very much needed to have a sound evidence-based policy. Its proper stratification valid and reliable data is needed for mortality and morbidity-the health outcomes directly and indirectly related to heat. Most recent work exploring the effects of ambient temperature on human health has not considered the direct heat-related health events such as heat strokes, heat exhaustion, and fatigue. However, counter-intuitive it might seem, these direct health outcomes are often not preferred by the research community. This is because their definitions are not always standardised, and the application of these definitions often may not be clinically feasible. Moreover, these direct heat outcomes are often biased by other factors in the affected area, thus compromising their validity. Instead, the research community has frequently examined the effects of heat on general health indicators that include all-cause mortality, disease-specific mortality and morbidity - cardiovascular and respiratory events being prominent among them, visits to emergency departments of health facilities, demand for ambulance services and others - which might be causally associated to soaring

temperatures. Hence, the availability of such data from vital registration system of local and district bodies, various tiers of health facilities and health departments are essential to carry out meaningful analysis of heat-related health events.

Reliable meteorological data, which constitute the exposure variables, are also necessary for robust evidence generation in the field- this includes data regarding various dimensions of ambient atmospheric temperature, relative humidity, rainfall and wind flow. Standardised atmospheric pollution data are often used to control their variations in these health prediction models, which can refine the dependency estimates of health outcomes on atmospheric heat.

Mortality data must be acquired from the registrar of Birth/Deaths at different levels. The determination of threshold values and characterising the temperature-mortality relationship and vulnerability assessment. It will help in preparation of heat action plan. All these data are needed in a time-series format - collected at the same time intervals, at the same locations and for a considerable period of time, so that studies can identify even the smaller but critical effects of heat on the affected population can be based on statistical data. Along with strengthening the vital registration systems, a proper data sharing strategy among all stakeholders should be developed. Each death should be registered at the respective municipality and/or block and the concerned medical officers should provide a medical certificate for the same. The format given at the end of this chapter has been adopted from the Department of Health and Family Welfare, Government of Odisha, can be used for collecting data on Heat wave related deaths.

5.7 Prevention, Preparedness and Mitigation Measures:

Built Environment

According to experts, urban areas have a significant role intending to climate change. They point out that construction of roads, buildings, and other structures replace the naturally vegetated landscape within urban areas, leading to changes within the

microclimate. As a result, various urban and pre-urban or rural landscapes observe different temperatures, which leads to the development of Urban Heat Island (UHI) phenomenon. The impact of Heat wave and UHI altogether affects human health, energy consumption and the environment. Local warming from the UHI intensifies the discomfort of urban residents and increases their vulnerability to heat stress. Urban areas experience different UHI intensities due to different physical and built characteristic properties. Building material, building height and density, population density, and percentage of green cover are a few of the factors that affect the magnitude of UHIs between different cities.

Examining the local cause of the disproportionate increase in temperature assists in identifying vulnerable hot spots for developing various mitigation measures. Each city should assess its built environment and identify major factors contributing/controlling the UHI magnitude. The assessment could be carried out and evaluated from local or regional research groups or institutions. Based on the assessment results, critical urban areas should be mapped and assigned priority of action accordingly. In long term measures, these factors should be incorporated in urban planning and design policies or proposals to minimise the heat stress risk.

City-level medium/long term measures

a) Identification and evaluation of factors leading to disproportionate increase in temperature within the city.
b) Generating a Heat wave risk and vulnerability map for developing a strategic mitigation action plan.
c) Mapping hot-spots within the city and integrating them in vulnerability assessment.
d) Measures to reduce the temperature in these hot spots by developing vertical gardens, small parks with a water fountain etc., must be developed.
e) Coordination with different research and educational institution for built environment assessment.

f) Allocate part of research and development in the financial budget approvals for Heat wave action planning.
g) Curbing future UHI manifestation by incorporating findings from the built environment assessment into urban planning and design policies or bylaws.
h) Integrating heat action plan with the development plan. Development plans should be should focus on reducing heat stress and water stress in the city.
i) Adhering to building codes in the city.

- **Cool roofs to Provide Affordable Thermal Comfort:** Urban residents living in slums have fewer options to adapt to rising temperatures. This increases their vulnerability to heat and results in greater adverse impacts of extreme heat on these communities; in their issue brief "Rising Temperatures, Deadly Threat", the NRDC and IIPH Gandhinagar identified several specific factors that increase the vulnerability of slum residents to extreme heat:

- **Higher exposure to Extreme Heat:** Slum residents are more likely to be exposed to heat since they work primarily outside or in unventilated conditions. They live in homes constructed of heat-trapping materials with tin or tarpaulin roofs their communities lack trees and shade.

- **Greater susceptibility to Health Effects of Extreme Heat:** Lack of access to clean water, poor sanitation, overcrowding, malnutrition, and a high prevalence of undiagnosed/untreated chronic medical conditions due to poor access to healthcare heighten slum community members' susceptibility to extreme heat's effects on health.

- **Fewer Adaptation Options Available:** Slum residents lack control over their home and work environments, with limited access to (and inability to afford) reliable electricity and cooling methods like fans, air coolers and air conditions, insufficient access to cooling spaces, and a dearth of health information on which to act. All these factors reduce slum residents' opportunities to adapt to increasing temperatures.

5.8 Cool Roofs in the Indian Context

Leading studies have shown that cool roofs work to guard against increasingly warmer temperatures in Indian cities. Cool roofs need limited maintenance, and a cool protective coating can be reapplied every 4-5 years and increase the longevity of the roof beneath it. This, combined with the nearly 20% savings on the building's air conditioning costs, makes cool roofing very cost-effective over the long run. In a country where less than 10% of households have air conditioning, access to affordable cooling can be a matter of survival for millions of people and not just comfort. Light-colored roofs have been used as traditional heat management techniques in India. Slum communities are one of the groups most susceptible to extreme heat because of the lack of access to cooling and that slum housing is often made of heat-trapping materials such as thin sheets, cement sheet (asbestos), plastic and tarpaulin without sufficient ventilation. As living standards rise, the demand for cooling and air conditioning will rise dramatically, threatening to strain the Country's electric grid, worsen air pollution, increase fuel imports, and magnify the impacts of global warming. Reduced air conditioning use is critical to saving energy consumer costs, reducing emissions and reducing hydrofluorocarbons. Thus, an affordable solution is cool roofs.

A cool roof is a white reflective roof that stays cool in the sun by minimising heat absorption and reflecting thermal radiation to help dissipate the solar heat gain. Research has shown that city-wide installations of highly reflective roofs and pavements, along with planting shade trees will, on average, reduce a city’s ambient air temperature by 2 to 4 degrees Celsius in summer months and also large scale, cool roofs can reduce the urban heat island effect in a city. [1,2] Cool roofs include coatings and treatments such as lime-based whitewash, white tarp, white china mosaic tiles and acrylic resin coating and provide an affordable solution for providing thermal comfort.

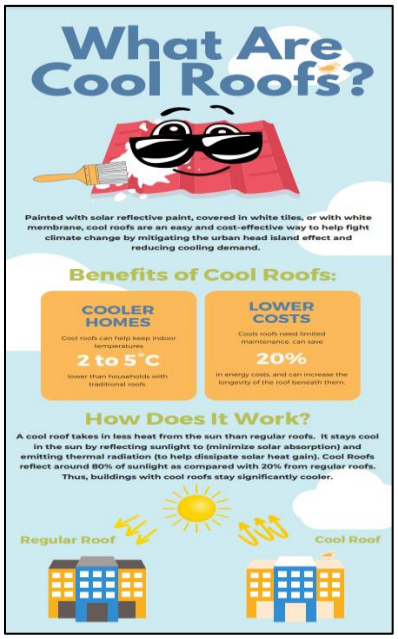
Livestock preparedness during hot weather: Extreme heat causes significant stress to livestock. There is a need to plan well for reducing the impacts of high temperatures on livestock. Keeping an eye on the weather forecasts and developing a mitigation plan for high to extreme temperatures can be effective in ensuring that the livestock has sufficient shade and water on hot days.

Prevention, preparedness and mitigation measures for various stakeholders are enumerated in the Roles and Responsibilities Managing Heat Wave in the following **Table: 12**.

[1]*Natural Resource Defence Council, "Looking Up: How Green Roofs and Cool Roofs Can Reduce Energy Use, Address Climate Change, and Protect Water Resources in Southern California", June 2012, http://www.nrdc.org/sites/default/files/GreenRoofsReport.pdf (last accessed on 05 April, 2017)*

[2]*"Vishal Garg, Cool Roofs Toolkit, "Cool Roof Activities in India", http://www.coolrooftoolkit.org/wp-content/uploads/2012/04/Vishal-Presentation.pdf (last accessed on 05 April, 2017)*

"Heatwave Action: House Owners' Guide to Alternate Roof Cooling Solutions, April 2022" https://ndma.gov.in/sites/default/files/PDF/Guidelines/Cool-Roof-Handbook.pdf



Benefits of Cool Roofs

CHAPTER 6: ROLES AND RESPONSIBILITIES OF MANAGING HEAT WAVE

6.1 STATE LEVEL

Karnataka State Disaster Management Authority (KSDMA) and State line departments

- KSDMA in coordination with KSNDMC shall update Heatwave Action Plan as per the NDMA guidelines 2019.
- The authority must circulate Heatwave Action Plan to all Collectors & HoDs of concerned line departments with instructions for its implementation and appoint a Nodal Officer at State, District and Taluk levels for communicating early warning and coordinating the implementation of Heatwave Action Plan.
- The authority instruct departments/ agencies to prepare and submit their action plans to state government.
- KSDMA reviews and monitor the heat wave situation through video conferencing with concerned line departments/districts/ Taluks. Widely publicise Do's & Don'ts.
- KSDMA in association with I & PR department, Panchayati Raj along with KSNDMC shall publish IEC print material (print material, video, radio jingles etc) in regional language. Warnings may be disseminated by using SMS, WhatsApp, Facebook, Twitter etc.
- The state Health and Family Welfare departments must ensure stock of ORS packets at health centres, anganwadis, schools and other important locations.
- Education department must re-schedule school timings to avoid hot weather impact. Schools may start early and close before noon or as per the local climatic conditions.
- Panchayati Raj institutions must setup large- scale drinking water stations (kiosks) at public places.
- The Panchayati Raj Department shall set up special shelters for MGNREGA/construction workers and rescheduling their working hours.

- The revenue department shall undertake local thresholds assessment with the partnership of expert institutions
- The KSDMA allocates funds from SDRF for the plan implementation including preparedness, capacity building mitigation activities (long term and short term).
- The revenue (DM) department provides a common web based platform (Whats App or other comfortable social network) for inter- department/ agency coordination an knowledge management.
- KSDMA instruct departments to take preparedness measures based on the warning issued by IMD and KSNDMC. KSDMA has to ensure proper reporting of heatwave related impacts including deaths by each departments as per the formats issued by NDMA and SDMA shall compile the same and send to NDMA.
- SDMA organizes state level awareness programme on heatwave impact mitigation and preparedness to all the concerned department heads during the first week of March.
- To undertake an awareness campaign to inform and educate the public on Heat wave Do's & Don'ts.
- Undertake necessary steps to prevent heat-related deaths.
- Hold regular Press conferences on the risks and dangers of heat-related illnesses, activate "cooling centres" such as temples, public buildings, malls, etc. and urge NGOs, community groups and individuals to open drinking water/buttermilk kiosks at public places during Heat Wave conditions.
- Urge power companies to prioritise maintaining power supply to critical facilities (such as hospitals and UHCs).

6.2 KEY POINTS FROM HON'BLE PRIME MINISTERS REVIEW OF HOT WEATHER PREPAREDNESS DURING MARCH – 2023

- Separate awareness material should be prepared for different stakeholders including citizens; medical professionals; municipal & panchayat authorities; disaster response teams like firefighters etc. **(Action – Deputy Commissioner's Office)**
- To incorporate some multimedia lecture sessions in schools to sensitise children on dealing with extreme heat conditions. Protocols and dos and don'ts for hot weather should be prepared in accessible formats, and various other modes of publicity like jingles, films, pamphlets etc. should also be prepared and issued. **(Action – Education Department)**
- IMD to issue daily weather forecasts in a manner which can be easily interpreted and disseminated. It was also discussed that TV news channels, FM radio etc. could spend a few minutes daily to explain the daily weather forecast in a manner which would allow citizens to take necessary precautions. **(Action – KSNDMC)**
- Detailed fire audits of all hospitals and that mock fire drills be done in all hospitals by Fire Departments. **(Action – Fire Department)**
- Coordinated effort to deal with forest fires. Systemic changes should be made to support efforts to prevent and tackle forest fires. **(Action – Forest Department)**
- Availability of fodder and of water in reservoirs should be tracked. **(Action – Animal Husbandry Department)**
- Food Corporation of India was asked to prepare to ensure optimal storage of grains in extreme weather conditions. **(Similar action by Cooperation Department)**

6.3 DISTRICT LEVEL

District Disaster Management Authorities- District line departments

- District Disaster Management Authorities (DDMA) organizes review meetings with district line departments before heat season starts and revise heatwave action plans at the district level.

- District Commissioners hold regular Press conferences on the risks and dangers of heat related illness, activated “cooling centres” at important locations – Religions places, Community and Public buildings, Malls and bus stands.

- District administrations also support NGO’s, Community Groups and Individuals to open “Free Water Shelter” at public congregation places for providing drinking water and butter milk during Heat Wave conditions.

- Undertake awareness campaign to inform and educate the public on Heat wave Do's & Don'ts.

- DDMAs must ensure all line departments are following guidelines under the heatwave action plan.

- Provisions should be made to ensure physical distancing along with the availability of soap, water and sanitising stations.

- Undertake necessary steps to prevent heat-related deaths with the support of district line departments.

- Hold regular Press conferences on the risks and dangers of heat-related illnesses, activate "cooling centres" such as temples, public buildings, malls, etc. and urge NGOs, community groups and individuals to open drinking water / butter milk kiosks at public places during Heat Wave conditions.

- Ensure that all concerned line departments/agencies are well connected with the early warning facilities from KSNDMC and IMD.

- DDMAs has to ensure heatwave impact reports from all the concerned line departments as per the formats issued by NDMA.

- Organize district level awareness programme on heatwave impact mitigation and preparedness to all the concerned department heads during the first week of March.

6.4 DEPARTMENT LEVEL

1) Department of Health and Family Welfare

National Center for Disease Control (NCDC) has formulated National Action Plan on Heat Related Illnesses in 2021 and has been circulated to State Departments. The plan outlines challenges posed by heat wave, heat-related illness and their management from Primary to Tertiary level; SOPs for surveillance of heat wave stroke cases and deaths; preparedness plan before and during summer season; special emphasis on Heat Related Illness in elderly, infants and children, pregnant women, outdoor and manual workers and other vulnerable sections.

- Department should increase resiliency to extreme heat at Health Facilities level by arranging uninterrupted electricity supply, install solar panels, adopt measures to reduce indoor heat through measures of cool/green roof, window shading etc.
- Capacity building training to Medical Officers, Health Staff and sensitization of grassroots level workers on heat illness with focus on early recognition and management through training manual developed by the NCDC.

- As per the heat wave management advisory issued on 28th February 2023 by the Ministry of Health and Family Welfare, Government of India, following action needs to be taken.
- Compliance of National Action Plan on Heat Related Illness for effective preparedness of health facilities to address heat impact & management of cases.
- Review Health Facility preparedness in terms of essential medicines, intravenous fluids, ice packs, ORS, drinking water as well as dissemination of necessary IEC materials based on the Do's and Don'ts on Extreme Heat/Heat issued by the Ministry.
- Undertake orientation/training and issue alerts to village level functionaries.
- Adopt Heat focused examination procedures at local hospitals.
- Develop a monitoring mechanism for implementation of Heat wave health hospital preparedness plan.
- Deploy additional staff to take care of persons affected due to sunstroke, activate Emergency services and keep an adequate stock of ORS and Intravenous (IV) fluids in all hospitals / PHCs / UHCs.
- Follow a standard protocol for investigating and arriving at the cause of death.
- Adopt a uniform process for registration of casualties/ deaths due to Heat wave.

National Action Plan for Heat Wave Illness 2021, NDMA Guidelines on Hospital Safety

1. National Action Plan for Heat Wave Illness 2021 (https://ncdc.gov.in/WriteReadData/linkimages/NationActionplanonHeatRelatedIllnesses.pdf)
2. NDMA Guidelines on Hospital Safety (https://nidm.gov.in/PDF/pubs/NDMA/18.pdf)
3. Translation of pictorial Dos and Don'ts to Kannada (in coordination with Health Department)

Prevention of Fire in Health Care Facilities

Compliance to Health Ministry advisory dated 2nd March 2023 on prevention of threats of Hospital Fires in Government and Private Health Facilities, which sets out the following:

- Compliance to National Building Code of India and National Disaster Management Authority guidelines on Hospital Safety.
- Undertake regular Fire Safety Audits and inspection on various structural and non-structural elements of fire safety.
- Fire Safety and regular fire drills to be undertaken as part of hospital disaster management, with clearly spelt out responsibilities of different hospital functionaries and other stakeholder agencies.
- Hospital staff to be trained and reoriented in prevention and management of fires, including operating fire equipment, patient evacuation to minimize the risk of loss of lives and property.
- Provisioning for adequate availability of functional fire detection and alarm system, automatic sprinkler systems, fire extinguishers, wet risers, hose reel, ample water storage and supply, etc.

Reporting and IEC Activities

- Online daily surveillance on heat related illnesses and deaths through Integrated Health Information Platform (IHIP) developed by NCDC.
- IEC and Community Level Awareness guidelines about the precautions to be taken to safeguard against heat wave issued.
- Social media campaign on heat and its impact on health as an ongoing activities.

2) Department of Agriculture and Horticulture

- Constant monitoring of crop condition and lookout for heat stress on crops.
- Contingency plan to mitigate heat stress on crops. Weekly monitor at State level.
- Satellite image based monitoring using NDVI and satellite imaginary provided Mahalanobis National Crop Forecast Centre, Ministry of Agriculture and Farmers Welfare.
- Based on IMD's and KSNDMC weather projections, Agriculture Department in consultation with UASs to issue regular advisories to farmers.

3) Department of Forest, Environment and Ecology

- Formulation of Action plan and preparedness for Forest Fire Management.
- Creation of fire lines and water harvesting structures, control burning and engagement of fire watchers in high fire prone districts.
- Forest Survey of India, Dehradun generates forest fire alert twice a day on a real time basis using Satellite data, which is being disseminated to concerned stakeholders. Forest fire vulnerability map has been prepared with forest-fire danger rating and forest fire forecast system. For Karnataka, 167 large forest fire alerts had been issued during the month of February and 597 alerts have been issued during March till date. The alert to be disseminated at near real time to all concerned stakeholders to take suitable action.
- State forest department to undertake response measures to control forest fire through forest staff, fire watchers and local communities.
- As directed by Ministry of Forest, Environment and Climate Change, funds under Centrally Sponsored Scheme, CAMPA and Wild Life Management Scheme to be utilized for forest fire management.

- Support of Airforce/Navy/Coast Guard for Bambi Bucket operation in case of major fires. Coordination with Fire Department and NDRF to assist in tackling major fires.
- 24/7 Control room with Toll-Free number is set up in the Ministry.
- A new scheme "National Programme on Forest Fire Management" is being prepared with funding support from NDMA with an outlay of around 1200 Crore. The programme will support forest fire preparedness, response and mitigation in 100 most fire prone districts in the country. Forest Department to identity districts prone to Forest Fire and Submit proposal to Ministry of Forest, Environment and Climate Change.

4) Department of Water Resource

- Track reservoir levels.
- Water available should be prioritized for drinking water purpose.
- Jal Jeevan mission in heat wave prone districts to be accelerated to ensure piped drinking water.
- Ensure equipment in pumping stations are functioning

5) Department of RDPR

- Ensure adequate and clean drinking water supply in rural areas.
- Monitor functioning of RO plants and other water supply equipment.
- Repair of damaged platforms of hand pumps, repair of damaged pipe lines. Repair of damaged pumping machines.

6) Urban Development Department

- Ensure adequate and clean drinking water supply in Urban areas.
- Monitor functioning of RO plants and other water supply equipment.

- Repair of damaged platforms of hand pumps, repair of damaged pipe lines. Repair of damaged pumping machines.

7) Minor Irrigation Department

- Repair of damaged canal structures.
- Repair of embankments of minor irrigation projects.
- Repair of weak areas such as piping in tanks.

8) Department of Animal Husbandry

- Ensure adequate fodder and water availability for cattle.
- Proactive Surveillance for identifying heat stress in animals.
- Issue of advisory of timely advisory to farmers based on IMD heat wave forecast.

9) Energy Department

- To take proactive measures to meet rising electricity demand and ensure there's no load shedding during summer. Peak demand to be gauged and gaps in power supply should be addressed.
- Ensure National and Regional Integration of Power supply grid to ensure immediate restoration of power. Monitor function of Load Dispatch Centers
- Ensure uninterrupted power supplies to critical infrastructures such as Health Care Facilities, water pumping stations etc.

10) Revenue department (Disaster Management)

- Review and revise heatwave action plan
- Circulate state plan with all the concerned line departments and agencies
- Ensure that all departments are ready with their action plan.

- Instruct all concerned line departments to send daily and monthly impact report as per the format attached in the Annexure- V.
- Monitor capacity building activities and awareness programmes both for the officials and vulnerable community.
- Document heatwave impact data and best practices in heatwave preparedness and mitigation.
- Share consolidated heatwave impact data and best practices to NDMA

11) KSNDMC, Revenue Department (DM), GoK and IMD, GoI

- Ensure timely and accurate temperature forecasts and communicate district wise maximum temperature details on daily basis.
- Giving Heatwave alerts/warnings promptly through Mobile application, Social Media pages, SMS, E-Mail, DEWS and KSNDMC website.
- c) Posting bulletins on the website whenever temperature crosses 40^0c in plain areas and 37 ^{0}C in coastal areas and make sure that the information has reached the health department officials, district administration and end users.

12) Information and Public Relations (I & PR) Department

- District officers has to be instructed to identify high risk areas for giving more attention
- Develop IEC material (posters, pamphlets, leaflets, wall paintings etc.) in local languages and widely publicise them for creating awareness.
- Create public awareness on heat-related illnesses and preventive tips (Do's & Don'ts) through electronic media (TV, FM Radio), print media (News Papers) and Social Media (Facebook, Twitter and WhatsApp).

13) Municipal corporations

- Identify a vulnerable place in the city, town, and slum areas, which are hotspots for Heat wave, and ensure drinking water facilities.
- As per direction of ACS & Development, During the travelling time inside the bus also, drinking water facility made available in the heat prone districts
- Open parks/open areas during daytime for providing spaces with shade.
- Regular sprinkling of water on roads.
- Construct shelters and sheds at public places and provide public parks during the Heat wave season.
- Promote cool roofs initiative -paint the roof white, create green roofs and walls, and plant trees in the neighbourhood to keep them cool.
- Appropriate planning while constructing new buildings (e.g., in architecture, width/height ratio, street development, orientation and site) in urban areas.
- Ensure capacity building of structural engineers, civil engineers and architects for construction of green buildings and maintenance and fire safety of structures.
- Ensure construction of green buildings which adhere to the environment and building codes.

14) Labour & Employment department

- Organise awareness camps and publish health advisories on Heat-related illnesses for industrial and other labour. Direct employers to reschedule working hours for outdoor workers to avoid peak hours (12 Noon to 3 PM).
- Coordinate with the health department and ensure regular health check-ups of workers.
- Ensure the availability of drinking water and undertake other necessary measures for construction workers.
- Regulate / Reduce piece rate for daily wages worker.

15) Animal Husbandry Department

- Preparation, implementation and review of Heat wave action plan to safeguard the cattle.
- Activate field staff and Gaupalaks/ Shepherds at village level to create awareness among those with Livestock on Animal Management during Heat wave conditions.
- Create shelters for livestock and animal husbandry and maintain it.
- Pre-positioning of adequate veterinary medicines and supplies.
- Provide and maintain cattle troughs with safe drinking water.

16) Information Technology (IT) department

- Preparation of dashboard/interface for monitoring Heat wave conditions in the district/state.
- Bulk SMS alerts to be sent through this dashboard/ portal.
- Develop a mobile application for spreading heat-related issues, alerts and information about shelters and drinking water.

17) Education Department

- Reschedule school timings (restrict school timings between 11 AM and 3 PM, start mid-day schools) and vacations as per the Heat wave situation.
- Ensure cool places for all educational institutions, and availability of drinking water facilities.
- Ensure that students avoid outdoor physical activities during the summer. Don't allow open-air classes.

18) PR&RD department

- Implementation of instruction for mainstreaming heat health precautionary measures, including rescheduling of working hours and reduce piece rate, in all schemes and programmes.
- Restrict the working hours between 11 AM to 3 PM under MGNREGA.
- Ensure shed for resting and drinking water facilities for workers at all workplaces.

19) Electricity and power supply department

- Ensure repair & maintenance work on time for uninterrupted power supply.
- Reschedule load shedding of power to avoid peak heat hour.

20) Transport Department

- Ensure shelter/shades at Bus terminals/stops.
- Ensure drinking water facilities at major bus stops.
- Ensure facilities for First Aid at major bus stands / terminals. Consider changing bus timings to avoid peak heat hours, in consultation with the district administration.
- Ensure shade and cool jacket for on-duty traffic police as they are more exposed to Heat wave.

21) Divisional Railways Manager

- Repair/maintenance of mechanical/ electrical system on priority basis including fan and cooling system.
- Ensure drinking water facilities in trains and at railway stations.

22) Forest Department

- Ensure proper afforestation (greenery) at public places.
- Continuous watch in the forest area to avoid and prevent forest fires.

- Provide safe drinking water and shade in forest areas.
- Maintain water bodies/ponds in the forest area for wild animals & birds.

23) Tourism & Endowment Department

- Ensure proper registration of tourists who are visiting the State.
- Publicise advisories for tourists on Heat wave conditions in the State.
- Build temporary shaded areas and ensure availability of safe drinking water for pilgrims at religious places.

24) Department Of Education

Preparedness at Schools: (Heat management planning)

- Create infrastructure that reduces exposure to heat e.g. room ventilation, access to additional fans, shade provision (plant trees or build structures), and source alternative venues for outdoor activities.
- Consider the provision of at least one priority area of the school with artificial cooling.
- Build staff and student awareness about the prevention, monitoring and identification of heat stress symptoms.
- Consider suitable uniform options that incorporate UV protection and cooling fabrics.

Managing schools during excessive heat or heatwave conditions

- Modify or suspend normal school activities during excessive heat.
- Postpone any outdoor or sporting activities where appropriate
- Increase access to the coolest areas of the school grounds or facilities for lessons or other activities.
- Ensure students with additional support needs are appropriately supervised, including the monitoring of their hydration.
- Ensure school lunch boxes are stored in cool areas.

- Facilitate and encourage students to drink plenty of water and to stay out of the sun.
- Department of Health recommends that during hot weather, water (room temperature or slightly cool rather than very cold) is the best fluid to drink.
- Every school must have first aid kits with sufficient quantities of ORS packets and other essential items.
- Undertake normal first aid procedures in the event of a student or staff member becoming heat stressed.
- Schools must prepare separate action plan for hot weather preparedness.
- Communicate the action plan details to teachers, supporting staff, transport agencies, children and parents
- While preparing guidelines in the action plan, ensure that the following areas are to be covered - Class rooms, labs, play grounds, cafeteria, school buses
- Ensure physical distancing and personal hygiene measures at the special shelter facilities, drinking water facilities

Playing and exercising safely in hot weather

Factors to consider when cancelling or postponing a sporting event include, but are not limited to:

- The temperature - both ambient and relative humidity (local weather conditions can be checked on the TSDPS and IMD website)
- The duration and intensity of the event (for example, an endurance or distance event has more potential for problems than a stop-start team event)
- Rest and drink breaks
- Time of day
- Local environment
- Acclimatisation of the participants
- Fitness levels of participants
- Age and gender of participants.

HEAT WAVE - DO'S AND DON'TS

Sl. No.	Do's	Don'ts
1	Try to stay in cool places	Expose to direct sun light or hot. breeze
2	Use umbrella during hot days	Move under hot sun without umbrella
3	Wear thin loose cotton garments, preferably white Colour	Use of black and synthetic, thick. clothes during summer season
4	Wear a hat of cotton or a turban	Move under the hot sun without a hat or turban
5	Try to void outdoor physical activity. from 11a.m to 04 p.m.	Attend to strenuous physical. activity under the hot sun
6	Take ample water along with salted. buttermilk and glucose water	
7	Take measures to reduce the room temperature like warning, using window. shades, fanning and cross ventilation	Allow direct hot air into the living. rooms
8	Shift the person with heatstroke. symptoms a cool dwelling	Delay in shifting the person suffering from heat stroke to a cool place
9	Person suffering from heat stroke should. have minimum clothing	Person suffering from heatstroke. to have thick clothing
10	The person suffering with Heat wave stroke has to be sponged with cold water, indirect application of ice packs.	The person suffering from heat. stroke to be sponged with hot water and to be exposed to hot air
11	The person suffering with heatstroke. should be kept in between ice blocks	
12	If the persons affected with Heat wave stroke and are not showing any improvement, he/she should be shifted to	Delay in shifting the person affected with heat stroke whenever there in no improvement in his condition
13	Providing adequate water/ ORS/ Buttermilk once coming from outside during summer	After coming from outside immediately, drinking Tea/Coffee/ Honey

Table 5: Preparedness at Community level- Do's and Don'ts

Knowledge of effective prevention and first-aid treatment, besides an awareness of potential side-effects of prescription drugs during hot weather, is crucial for physicians and pharmacists to best mitigate the effects of heat illness. The details of case definitions are mentioned in **Annexure-II.**

Heat Disorder	Symptoms	First Aid
Heat rash	Skin redness and pain, possible swelling, blisters, fever, headaches.	Take a shower using soap to remove oils that may block pores, preventing the body from cooling naturally. If blisters occur, apply dry, sterile dressings and seek medical attention.
Heat Cramps	Painful spasms usually in leg and abdominal muscles or extremes, Heavy sweating.	Move to a cool or shaded place. Apply firm pressure on cramping muscles or gently massage to relieve spasms. Give sips of water; if nausea occurs, discontinue.
Heat Exhaustion	Heavy sweating, weakness, skin cold, pale, headache and clammy extremities. Weak pulse. Normal temperature possible. Fainting, vomiting.	Get victim to lie down in a cool place. Loosen clothing. Apply cool, wet cloth. Fan or move victim to air-conditioned place. Give sips of water slowly and if nausea occurs, discontinue. If vomiting occurs, seek immediate medical attention, call 108 and 102 for an ambulance.
Heat Stroke (Sun Stroke)	High body temperature. Hot, dry skin. Rapid, strong pulse. Possible unconsciousness or altered mental status. The victim will likely not sweat.	Heatstroke is a severe medical emergency. Call 108 and 102 for an ambulance for emergency medical services or take the victim to a hospital immediately. Delay can be fatal Move victim to a cooler environment. Try spraying cold water on the body and fan the wet body. If possible, sponging or cool bath sponging to reduce body temperature. Use extreme caution. Remove clothing. Use fans and/or air conditioners. **DO NOT GIVE FLUIDS ORALLY if the person is not conscious.**

Table 6: Symptoms and First Aid for various Heat Disorders

Must for All Do's

a) Stay at home and listen to the radio; watch TV; read Newspaper for updates/advisories on the local weather.

b) Drink sufficient water as often as possible, even if not thirsty. Persons with epilepsy or heart, kidney or liver disease who are on fluid-restricted diets; or have a problem with fluid retention should consult a doctor before increasing liquid intake.

c) Use ORS (Oral Rehydration Solution), homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc., to keep yourself hydrated.

d) Wear lightweight, light-coloured, loose, cotton clothes.

e) Avoid going out. If it is necessary to go outside, cover your head (cloth/hat or umbrella) and face. Avoid touching any surface as far as possible.

f) Maintain physical distancing at least 1 meter from other persons.

g) Wash hands frequently and properly with soap and water. When soap and water is not available, use hand sanitiser.

h) Keep separate towels for each member of the house. Wash these towels regularly.

Other Precautions

a) Stay indoors as much as possible.

b) Keep your home cool -use curtains, shutters or sunshades, and open windows at night. Try to remain on the lower floors.

c) Use fans damp clothing and take a bath in cold water frequently to cope up with excess heat.

d) If you feel sick – high fever/throbbing headache/dizziness/nausea or disorientation/continuous coughing/shortness of breath, see a doctor immediately.

e) Keep animals in the shade and give them plenty of water to drink.

Don'ts

a) Do not go out during the lockdown. If you have to go out for essential work as permitted, try to schedule it during cooler hours of the day. Avoid going out during peak heat hours -especially between 12.00 noon and 3.00 p.m.
b) Do not go out barefoot or without a face and head cover.
c) Avoid cooking during peak hours. Open doors and windows to ventilate the cooking area adequately.
d) Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrate the body.
e) Avoid high-protein, spicy and oily food. Do not eat stale food.
f) Don't touch your eyes, nose and mouth without washing your hands.
g) Avoid close contact with people who are sick.
h) Do not go out if you are sick; Stay at home.

Employers and Workers

Do's

a) Provide clean and cool drinking water at the workplace.
b) Caution workers to avoid direct sunlight. If they have to work in the open (agricultural labourers, MNREGA workers, etc.), ensure that they cover their heads and face at all times.
c) Schedule strenuous jobs to cooler times of the day.
d) Increase the frequency and length of rest breaks for outdoor activities.
e) Give special attention to pregnant workers or workers with a medical condition.
f) Make all the workers wear face covers, maintain a physical distance of 1-1.5 m from others and practise hand hygiene. Provide soap and water for frequent hand washing. Caution them to not touch their faces without washing their hands.
g) Make provision for lunch/dinner space in a manner such that there is a 1-1.5 m distance between two persons.

h) Sanitation workers should cover their heads, wear mask and gloves. Don't touch the mask after wearing it. They should wash their hands thoroughly and frequently.
i) Once you go home after work, take a bath and wash your used clothes thoroughly.
j) Always follow Social Distancing.
k) If someone is sick, he/she must be reported to the duty supervisor.

Don'ts

a) Don't spit, smoke or chew tobacco at workplace.
b) Don't shake hands or hug others.
c) Don't touch your face – especially eyes, nose and mouth.
d) Avoid close contact with people who are sick.
e) Don't go to work if you are sick; Stay at home.

Police / Traffic Police Personnel

a) Wear cool jacket while on duty during the day.
b) Stop people/vehicles at a distance from you. Do not touch the documents you are checking. Also avoid touching any surface, as far as possible.
c) As far as possible, wash your hand regularly and thoroughly. If soap and water are not readily available, use hand sanitiser. DO NOT touch your face with unwashed hands.
d) Wear face mask at all times. Change them periodically and dispose of the used mask safely.
e) Drink sufficient water, as often as possible, even if not thirsty.
f) Use protective gear – shade, sunglasses, and sunscreen.
g) As far as possible, relatively young personnel should be put on traffic duty during the day.

h) When you go home after work, take a bath and wash your used clothes thoroughly.

Senior Citizens

Do's

a) Stay indoors as much as possible. Don't go to crowded places like parks, markets and religious places.

b) Keep your home cool, use curtains and fans or cooler.

c) Maintain hygiene by regularly washing hands, especially before having meals.

d) Call a doctor immediately if you feel sick and experience any of the following:

e) High body temperature, with or without body ache

f) Throbbing headache, dizziness, nausea or disorientation

g) Coughing and/or shortness of breath

h) Unusually poor appetite

If you are looking after a senior citizen:

i) Help her/him in regularly washing hands and Ensure timely meals and water intake.

j) Use a face cover to cover your nose and mouth while attending on him/her.

k) Wash your hands thoroughly before touching him/her.

l) In case you are suffering from fever/ cough / breathing difficulty, don't go near her/him. Try to make someone else attend to him/her during that time.

ANNEXURE -I

Case Definitions: Range of Heat Illness - Typical Presentations-symptoms, signs & prognosis

Clinical Entity	Age Range	Setting	Cardinal Symptoms	Cardinal/ Important Signs	Pertinent Negative findings	Prognosis
Heat rash/ prickly heat/ Miliaria	All, but frequently children	Hot environment; +/- insulating clothing or swaddling (wrap in tight clothes)	Itchy rash with small red bumps at pores in the skin. Seen in setting of heat exposure; bumps can sometimes be filled with clear or white fluid	Diffused red colour skin or vesicular rash, itching of the skin without visible eruption	Not focally distributed like a contact dermatitis	Full recovery with elimination of exposure and supportive care
Heat cramps	All	Hot environment, typically with exertion, +/- insulating clothing	Painful spasms of large and frequently used muscle groups	Uncomfortable appearance, may have difficulty fully extending affected limbs/ joints	No contaminated wounds/ tetanus exposure; no seizure activity	Full recovery with elimination of exposure and supportive care
Heat exhaustion	All	Hot environment; +/- exertion; +/- insulating clothing or swaddling (wrap in a tight clothes)	Feeling overheated, light-headedness, exhausted and weak, unsteady, feeling of vomiting, sweaty and thirsty, inability to continue activities	Sweaty/ diasporaetic; flushed skin; hot skin; normal core temperature; +/- dazed, +/- generalized weakness, slight disorientation	No coincidental signs and symptoms of infection; no focal weakness; no difficulty in swallowing food or speech; no overdose history	Full recovery with elimination of exposure and supportive care; progression to heat syncope/ stroke if continued exposure
Heat syncope	Typically, adults	Hot environment; +/- exertion;	Feeling hot and weak; light-headedness followed by a	Brief, generalized loss of consciousness in hot setting, short period	No seizure activity, no loss of bowel or bladder	Full recovery with elimination of exposure and

Clinical Entity	Age Range	Setting	Cardinal Symptoms	Cardinal/ Important Signs	Pertinent Negative findings	Prognosis
		+/- insulating clothing or swaddling (wrap in a tight clothes)	brief loss of consciousness	of disorientation, if any	continence, no focal weakness, no difficulties in food swallowing or speech	supportive care; progression to heat stroke if continued exposure
Heat Stroke	All	Hot environment; +/- exertion; +/- insulating clothing or swaddling (wrap in a tight clothes)	Sever overheating; profound weakness; disorientation, not fully alert, convulsion, or other altered mental status	Flushed, dry skin (not always), core temp less than 40 degree Celsius or 104degree Fahrenheit; altered mental status with disorientation, incoherent behaviour, coma, convulsion; tachycardia; tachycardia; hypotension	No coincidental signs and symptoms of infection; no focal weakness; no difficulties in swallowing food or speech, no overdose history	25-50% mortality even with aggressive care; significant morbidity even if survives

ANNEXURE – II

Heat illness Treatment Protocol

Recognizing that treatment protocols may vary slightly according to the setting. (EMS, health centre, clinic, hospital emergency department, etc.), the following should apply generally to any setting and to all patients with heart related illnesses:

1. Initial patient assessment primary survey (airway, breathing, circulation, disability, exposure), vital signs including temperature.

2. Consider heat illness in differential diagnosis if:

a. Presented with suggestive symptoms and signs.

b. Patient has one or more of the following risks factors:

i. Extremes of age (infants, elderly)

ii. Debilitation/physical deconditioning, overweight or obese

iii. Lack of acclimatization to environmental heat (early in summer season)

iv. Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory disease.

v. Taking one or more of the following:

a) Sympathomimetic drugs, b) Anticholinergic drugs, c) Barbiturates, d) Diuretics, e) Alcohol & f) Beta blockers

3. Remove from environmental heat exposure and stop physical activity.

4. Initiate passive cooling procedures.

a. Cool wet towels or ice packs to axillae, groin and around neck; if patient is stable,

may take a cool shower, but evaluate risk of such activity against gain and availability of other cooling measures.

b. Spray cool water or blot cool water onto the skin.

c. Use fan to blow cool air onto moist skin.

5. If temperature lower than 40^{o} C, repeat assessment every 5 minutes; if improving attempt to orally hydrate (clear liquids, ORS can be used but not necessary; cool liquids better than cold). If temperature is 40^{o} C or above, initiate IV rehydration and immediately transport to emergency department for stabilization.

Annexure-III

IEC MATERIALS

Do's

Don'ts

HEATWAVE : MUST FOR ALL

Listen to Radio; watch TV; read Newspaper for local weather news

HEATWAVE : DO's AND DON'Ts

Drink sufficient water - even if not thirsty

HEATWAVE : DO's AND DON'Ts

Use ORS (Oral Rehydration Solution), homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated

HEATWAVE - DOs AND DONTs

Wear lightweight, light-coloured, loose, cotton clothes

HEATWAVE - DOs AND DONTs

Stay indoors as much as possible

HEATWAVE - DOs AND DONTs

Use fans, damp clothing and take bath in cold water frequently

HEATWAVE - DOs AND DONTs

Avoid cooking during peak hours

Open doors and windows to ventilate cooking area adequately

HEATWAVE - DOs AND DONTs

If you feel dizzy or ill, see a doctor immediately or ask somebody to take you to the doctor immediately

HEATWAVE - DOs AND DONTs

Keep animals in shade and give them plenty of water to drink

HEATWAVE - DOs AND DONTs

Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.

HEATWAVE - DOs AND DONTs

Avoid strenuous activities when outside in the afternoon

HEATWAVE - DOs AND DONTs

Do not go out barefoot

HEATWAVE : DO's AND DON'TS

Listen to radio; watch TV; read newspaper for local weather news

HEATWAVE : DO's AND DON'TS

Drink sufficient water - even if not thirsty

HEATWAVE : DO's AND DON'TS

Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body

HEATWAVE : DO's AND DON'TS

Cover your head: Use a cloth, hat or umbrella

HEATWAVE : DO's AND DON'TS

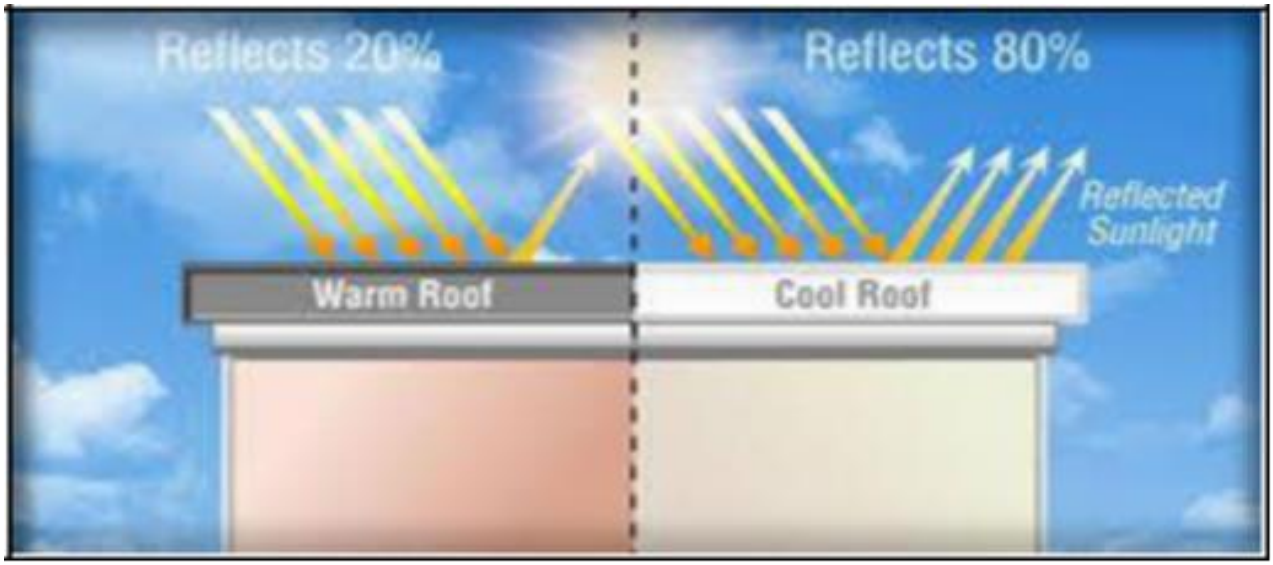
Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.

HEATWAVE : DO's AND DON'TS

Avoid strenuous activities when outside in the afternoon

HEATWAVE : DO's AND DON'TS

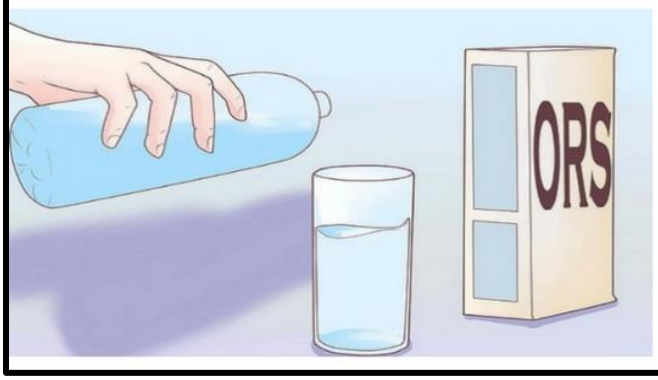
Caution workers to avoid direct sunlight



HEATWAVE : DO's AND DON'TS

Do not leave children or pets in parked vehicles - as they may get affected by Heat Wave

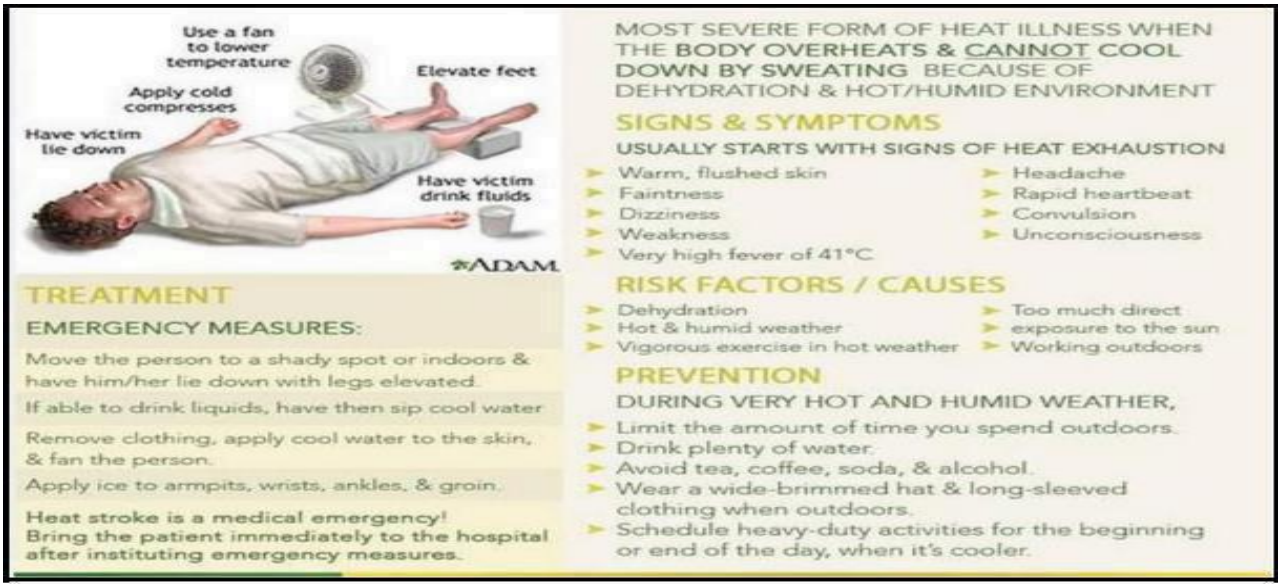
HEATWAVE : DO's AND DON'TS



Use ORS (Oral Rehydration Solution), homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated

HEATWAVE : DO's AND DON'TS

Wear lightweight, light-coloured, loose, cotton clothes



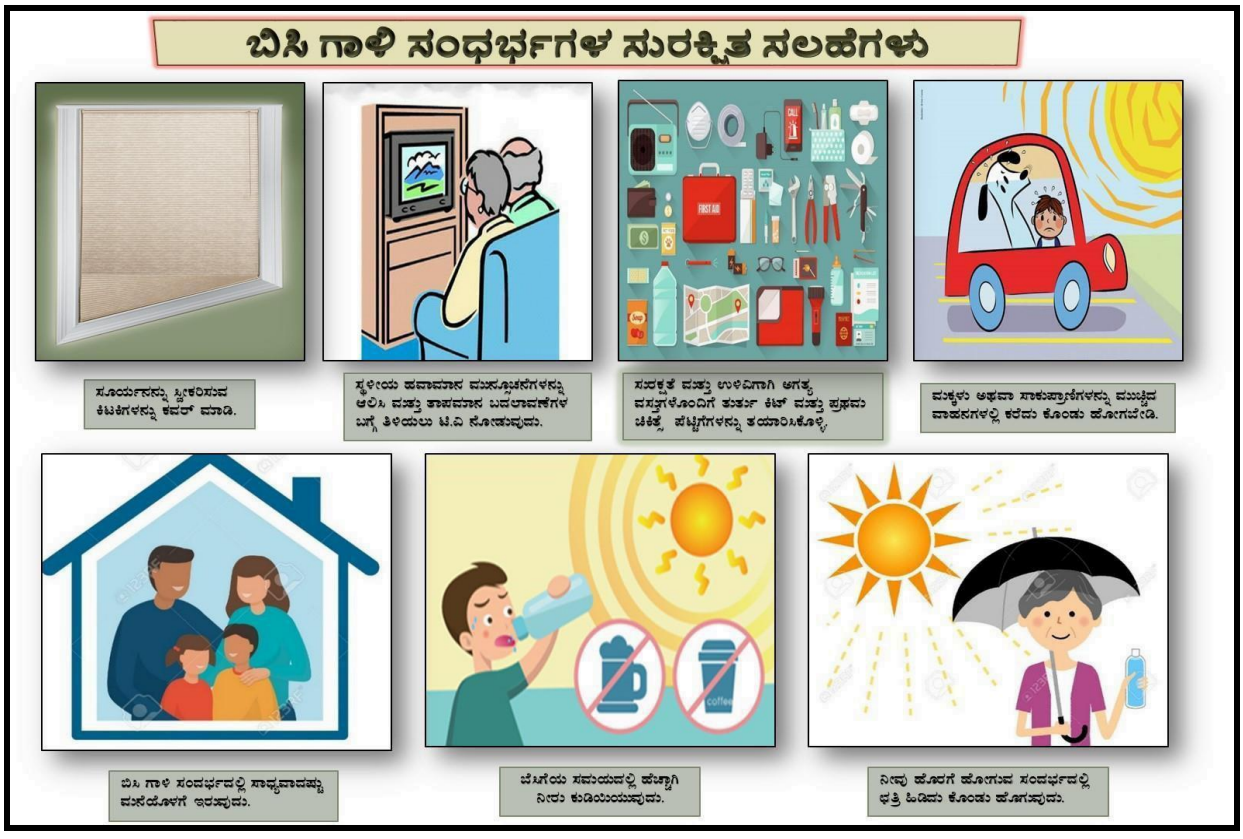
HEATWAVE : DO's AND DON'TS

Avoid cooking during peak hours.Open doors and windows to ventilate cooking area adequately

HEATWAVE : DO's AND DON'TS

Keep your home cool, use curtains, shutters or sunshade and open windows at night.Try to remain on lower floors

Keep animals in shade and give plenty of water to drink.




HEAT WAVE
CAN BE FATAL!
TAKE THE FOLLOWING PRECAUTIONS
• Listen to Radio; watch TV; read Newspaper for local weather news.
• Drink sufficient water - even if not thirsty.
• Use ORS (Oral Rehydration Solution), homemade drinks like lassi, torani (rice water) lemon water, buttermilk, etc. to keep yourself hydrated.
• Wear lightweight, light-coloured, loose, cotton clothes.
• Cover your head: Use a cloth, hat or umbrella.
• Keep animals in shade and give them plenty of water to drink.
• Do not leave children or pets in parked vehicles - as they may get affected by Heat Wave.
HEAT WAVE
100
90
80


AVOID
STRENUOUS
ACTIVITIES
WHEN OUTSIDE
IN THE AFTERNOON
TAKE THE FOLLOWING PRECAUTIONS
ORS
ORS
• Listen to Radio; watch TV; read Newspaper for local weather news.
• Drink sufficient water - even if not thirsty.
• Use ORS (Oral Rehydration Solution), homemade drinks like lassi, torani (rice water) lemon water, buttermilk, etc. to keep yourself hydrated.
• Wear lightweight, light-coloured, loose, cotton clothes.
• Cover your head: Use a cloth, hat or umbrella.
• Keep animals in shade and give them plenty of water to drink.
• Do not leave children or pets in parked vehicles - as they may get affected by Heat Wave.
HEAT WAVE
100
90
80


CARE
FOR THE OLD & FRAIL
IN THE RISING HEAT
TAKE THE FOLLOWING PRECAUTIONS
ORS
ORS
Check on them twice a day during extreme heat, especially if he/she lives alone.
Make sure they have access to a phone.
If they seem to be suffering from heat stress, cool them down.
Use cool baths, showers, or place wet towels on their neck and underarms.
Call a doctor or an ambulance after taking steps to cool them down.
Encourage them to keep a bottle of water with them at all times.
HEAT WAVE
100
90
80
70
60


PROTECT
YOUR INFANTS
FROM THE
HEAT WAVE
TAKE THE FOLLOWING PRECAUTIONS
ORS
ORS
Do not leave kids unsupervised in parked cars. Vehicles can rapidly heat up to dangerous temperatures.
Give them plenty of fluids to drink. Learn how to identify heat-related illnesses in infants.
Check on the child for concentrated (dark-coloured) urine, which can indicate dehydration.
HEAT WAVE
100
90
80
70
60


PROTECT
YOUR CHILDREN
FROM THE
HEATWAVE
PRECAUTIONS FOR CHILDREN
Children Should:
Always carry a bottle of water. Drink lemon water/ buttermilk/ coconut water/ fresh fruit juice regularly.
Wear light coloured, lightwight, loose cotton clothes.
Cover their heads when out in the sun with a cap and an umbrella.
Avoid junk food during summer, Go for fresh fruits, salads and home-cooked meals.
Stay out of direct sunlight, especially during peak hours from 12 noon to 4 p.m. Play outdoor games in the evenings.
Take the child to a doctor if he/she complains of dizziness, nausea, constant headache, chest pain and breathing problems.
ORS
ORS
HEAT WAVE
100
90
80
70


PROTECT
YOUR ANIMALS
FROM HEAT WAVE
PRECAUTIONS FOR PETS DURING HEAT WAVE
If possible, bring your pets inside when it is very hot.
If they can't be left inside, make sure there are some sheltered shady spots in the garden where your pet can rest. Check there will be shade at all times of day, as that will change depending on the position of the sun.
Don't leave pets in closed garden sheds or garages, as these can heat up very quickly on a hot day.
Make sure your pets have plenty of clean, fresh water to drink and that it is not placed in the sun. Putting ice blocks in your pet's water during the day will help keep it cool.
Consider having two drinking bowls in case one runs out of water or gets knocked over.
Don't leave your pet's food outside in the heat. If your pet does not eat its food when first given, bring it inside and put in the fridge until later.
If you have a dog, avoid walking it in the heat. Take it for a walk in the early morning or evening when it is cooler.
Don't let your dog walk on hot surfaces (pavements, bitumen roads, hot sand), as their paws are sensitive and can get burnt.
Never leave pets alone in a car in any circumstance, even if the windows are partly open.
HEAT WAVE
100
90
80
70


Prevention kit for extreme heat
Water bottle
an Umbrella or Cap
Hand fan
Handkerchief
ORS
Glucose/Electrolyte/Oral Rehydration
See Raju, our panchayat is a risk informed panchayat.
For safety and protection against extreme heat, these things should be handy.

National Centre for Disease Control
Government of India

Ministry of Health & Family Welfare
Government of India

World Health Organization
India

Children love playing in the Sun heat should not spoil their fun

Symptoms of heat related illness


Fainting


Muscle cramps


Seizures


Irritability


Headache


Increased sweating


Weakness, dizziness


Acts or talk confused


Fast breathing and heartbeat


Nausea and vomiting


Difficulty in waking up or can't wake up


Body temperature rises to 105°F (40.5°C) or higher

Be careful when child is


Walking/cycling in Sun


School assembly


Playing barefoot in Sun

First aid measures


Bring the child indoors or into the shade immediately


Loosen their clothing while maintaining their dignity


Have the child lie down with slightly raised feet


Use fan to increase airflow


Sponge with tap water


If the child is alert and awake, provide frequen sips of cool, clear fluids


If the child vomits, turn them onto their side to prevent choking


If child is unconscious, don't give anything to drink/ eat

Prevention


Stay hyderated


Cover your self


Play in sun


Don't lock cars with kids inside

If your child has any of severe symptoms immediately visit nearest health care centre or call ambulance

People at risk

National Centre for Disease Control
Government of India

Ministry of Health & Family Welfare
Government of India

World Health Organization
India

Beat the Heat

Do's

Stay hydrated

Stay covered

Block direct sunlight

Remain indoor
during 12:00 PM – 04:00 PM

Don'ts

Avoid going out
12:00 PM - 4:00 PM

Avoid strenuous
activity in Sun

Don't leave kids and
pet unattended in vehicle

Avoid alcohol, tea, coffee,
high sugary drinks and fizzy drinks

Avoid cooking
2:00 PM - 4:00 PM

Don't walk barefoot

People at risk

National Centre for Disease Control
Government of India

Ministry of Health & Family Welfare
Government of India

World Health Organization
India

Battle the Heat, Let it not Defeat Workers

Provide medical help in case of emergency

Altered mental sensorium with disorientation

Hot, red and dry skin

Body temperature ≥ 40 °C or 104 °F

Throbbing headache

Nausea and vomiting

Muscle weakness or cramps

Anxiety, dizziness, fainting and light headedness

Rapid heart beat and Rapid, shallow breathing

First aid steps in case of heat illness

Rest in shaded area, offer water

Lie down with raised feet, sponge with tap water, offer water

Take the affected worker to Nearest hospital or call an ambulance

- If worker is unconscious, don't try to give anything to drink or eat
- If the worker is alert and awake, provide frequent sips of cool water or fluids like ORS solution
- Remove safety gear
- Loosen their clothing while maintain their dignity
- Slowly splash or sponge with tap water
- Increase the air flow by using a fan
- In case of vomiting, turn the worker onto their side to avoid choking

People at risk ▶

National Centre for Disease Control
Government of India

Ministry of Health & Family Welfare
Government of India

World Health Organization
India

Symptoms of heat related illnesses

Be alert, remember the symptoms And take precautions


Hot, red and dry skin


Body temperature ≥ 40 C or 104 F


Nausea and vomiting


Throbbing headache


Muscle weakness or cramps


Rapid shallow breathing and rapid heart beat


Anxiety, dizziness, fainting & light headedness

If you or others feel unwell


Hydrate yourself


Move to cooler place and take rest


Take cool shower

Visit doctor or call ambulance


Heat cramps lasts more than one hour


Unconscious


Body temperature ≥ (40°C or 104°F)


Symptoms get worse

People at risk

National Centre for Disease Control
Government of India

Ministry of Health & Family Welfare
Government of India

World Health Organization
India

Safeguard Workers from Heat

Provide safe working environment

Cool drinking water facility

Timely medical care

Frequent breaks in comfortable rest area

Cool and comfortable area for child care

Insulate and shield hot equipment

Assign additional workers or slow down work pace

Administrative measures

- Schedule mandatory breaks for those working under direct sun
- Schedule strenuous and outdoor work for cooler time of the day i.e morning or evening hours
- Ensure that baby care / crèche center has cool drinking water proper shade, cooling mechanisim and ORS solution
- Start a buddy system to monitor health of workers

People at risk

Table 7: Responsibility Matrix

Heat Wave			**Understanding Disaster Risk**
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
1	Observation Networks, Information Systems, Monitoring, Research, Forecasting, Early Warning and Zoning/ Mapping	KSNDMC in Collaboration with IMD-Bengaluru & Space Applications Centre (SAC) - ISRO	**Recurring/ Regular (RR)** • Support for organising training. • Dissemination • Maintaining preventive measures as per National and State Heatwave action plan. • Vulnerability Assessment and Establishing Heat-Health Threshold Temperatures. • Strengthening and maintaining monitoring and data logging systems for Temperature, Humidity, etc. required for threshold for heat wave alerts. • Establish and maintain Community-Based network for sharing alerts.
2	Hazard Risk Vulnerability and Capacity Assessment (HRVCA)	KSDMA, KSNDMC, RDPR- PRIs DMA-ULBs Universities & Technical Institutions	• Promote studies, Documentation and Research. • Provide Training & Technical support. • Studies on vulnerabilities and capacities Covering Social, Physical, Economic, Ecological, Gender, Social Inclusion and Equity Aspects. • Updating HRVCA. • Identification and listing of vulnerable Population / Communities / Settlements. • Identification of groups requiring special attention. • Develop guidelines. • Constitute/ strengthen the mechanisms for consultation with experts and stakeholders. • Conduct audit of Equipment and Human Resource Requirements.

Table 7: Responsibility Matrix

Heat Wave			**Understanding Disaster Risk**
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
3	Dissemination of warnings, data, and information	KSNDMC in Collaboration with IMD-Bengaluru KSDMA RDPR- PRIs, DMA-ULBs, KSNDMC-Disaster Early Warning System (DEWS)	• Support for organising training. • Extend technical support. • Create awareness preventive measures. • Extensive IEC campaigns to create awareness through media. • Specific messages for highly vulnerable groups such as Elderly, Young Children, Outdoor Workers and Slum residents.
4	Disaster Data Collection and Management	Department of planning, KSDMA, DDMA	**Recurring/ Regular (RR)** • Systematic Data Management of Data on Disaster Damage and Loss Assessments • Disaster Damage and Losses 2005-2015 baseline.

Table 8: INTER AGENCY COORDINATION

Heat Wave		Inter-Agency Coordination	
Sl. No.	Sub-Thematic Area for DRR	State Agencies and their Responsibilities	
		State	Responsibility
1	Overall disaster governance	KSDMA in Collaboration with concerned Departments, RDPR-PRIs, DMA-ULBs, and Health and Family Welfare	**Recurring/ Regular (RR)** • Creating/ strengthening the institutional framework including assigning nodal agency and nodal officials at different levels. • Preparing state/region-specific Heat Action Plan. • Team preparation and streamlining coordination mechanisms. • Technical inputs for implementation based on experience from different locations. • Collaboration with NGOs/CSOs. • Ensure the Local Administration (City/District) can understand and meaningfully use all the heat wave-related information from various agencies and health authorities – Central and State. • Team preparation and coordination – officials and agencies are well prepared for the Heat Wave Season. • Coordinate with IMD regarding Forecasts, Early Warning and Alert System Based on Drought Severity. • Appointing a State Nodal Agency and Officer. • Preparing/Adapting Heat Wave Action Plan. • Implementation as per specific conditions in the state. • Develop a clearly defined Interagency Emergency Response Plan with roles and information flows clearly marked out. • Ensuring coherence and mutual reinforcement of DRR, CCA and development. • Partnering local institutions with National Institutions / Experts. • Adapting HAPs developed in other Countries /Cities, Monitoring And • Evaluating Implementation and Impact on Mortality and Morbidity.

Heat Wave		Inter-Agency Coordination	
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
2	Preparation and Response	KSDMA in Collaboration with RDPR-PRIs, DMA-ULBs, HFW & Animal Husbandry and other concerned departments	• Directives/ Advisory on shelters, creating awareness, managing resources, organizing Medical Support, Strengthening Hospital Preparedness. • Organising and coordinating the immediate response. • Coordinate with Central agencies. • Implementing heat action plan. • Establishing First Aid/ Medical Aid facilities in key locations. • Identify vulnerable places and provide safe drinking water points at those places and worksites; also, provide ORS. • Develop a system to provide safe drinking water in public transports especially in the drought and heatwave prone districts. • Avoiding outdoor games/sports activities. • Livestock preparedness during hot weather - ensuring that the livestock has sufficient shade and water on hot days. • Heat treatment wings in hospitals. • Establishing medical assistance facilities at places of mass gathering. • Implement a system of heat alerts to trigger early morning shifts for schools and offices/ Rescheduling school and office timings during heat-wave season. • To construct cool shelters, bus stands, etc., that offer shelter from Heat Wave. • Promote creation of green roofs to mitigate the impact of Heatwaves.

Heat Wave		Inter-Agency Coordination	
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
3	Warnings, Information, Data	KSNDMC in Collaboration with IMD-Bengaluru. KSDMA and DDMA	• Issue Heat wave alerts, bulletins and weather forecasts on Short / Medium / Long range duration. • Periodical reviewing and updating heatwave action plans. • Public awareness and community outreach. • Coordinating the dissemination of warnings to all, down to the last mile –remote, Rural or Urban; Regular updates to people in areas at risk. • Follow the alerts/warning. • "Do's-and-Don'ts" during a heat wave should be available in local languages and disseminated through media. • Documentation. • Collecting Data from States. • Maintaining national-level database. • Collecting Data/Information necessary for Review/Update of the plan.

Table 9: STRUCTURAL MEASURES

Heat Wave		Structural Measures	
Sl. No.	Sub-Thematic Area for DRR	State Agencies and their Responsibilities	
		State	Responsibility
1	Heat wave shelters and other measures	RDPR- PRIs, DMA-ULBs, RGRHCL, KHB, Slum Development Board	• Directive to promote cool roofs and heat reducing integrated development. • Strengthening/mainstreaming the network medical assistance facilities. • Temperature forecasts and heat alerts will be sent as bulk messages on Mobile Phones, Local Electronic Media, Electronic Screens at Busy Traffic Intersections and Market Places. • Effective transportation. • ULBs to facilitate the public to take shelter in public parks and gardens during a heatwave condition.
2	Social Housing Schemes		• Guidelines and technical support for incorporation of protection from Heat Wave in multi-hazard resistant housing schemes. • Ensure incorporation of protection from Heat Wave in multi-hazard resistant features in the planning and execution of social housing schemes in Heat Wave prone areas.
3	Hazard resistant construction, strengthening, and retrofitting of all lifeline and critical infrastructure		• Collaboration with technical agencies and implementation. • Take up measures to provide or upgrade the existing buildings to heat resistant structures.

Heat Wave		Non-Structural Measures	
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
1	Techno-Legal regimes	KSDMA, RDPR- PRIs, DMA-ULBs, RGRHCL, KHB, Slum Development Board, Nirmithi Kendra's	• Implement Guidelines to prevent people from heat related hazards. • Improving the forest coverage and green Areas. • Promote use of building materials that provide protection from heat. • Promote designs to reduce heat island effects in urban areas. • Facilitate integrated development plans that can cope better with Heat Wave conditions.
2	Risk Transfer		**Recurring/ Regular (RR)** • Implementation of Risk Transfer Arrangements including multi-hazard insurance for life and property. • Policy Framework.

Table 10: INVESTING IN DRR

Heat Wave		Capacity Development	
Sl. No.	Sub-Thematic Area for DRR	State Agencies and their Responsibilities	
		State	Responsibility
1	Training	CDM - ATI. State Universities & Technical Institutions Health & Family Welfare (HFW)	**Recurring/ Regular (RR)** • Training and orientation programs for Central Govt. Staff, other direct Stakeholders. • Training support for youth through NCC, NYKS, Scouts and Guides and NSS, SDRF, CDEF, community, and volunteers. • Train key officials regarding pre, during and post Heat-Wave season activities. • Training for CDEF, Community, and Volunteers. • Training for deployment of Rapid Medical Response Teams. • Training on heat-wave specific Health Care for vulnerable groups.
2	Curriculum Development	CDM - ATI. State Universities & Tech. Institutions, Central & State Education Boards	• Inclusion of Heat Wave and similar issues in various curriculum.

Heat Wave		Capacity Development	
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
3	Awareness Generation	KSDMA, KSNDMC, ULBs, RDPR, Dept. of Health & Family welfare, CDM, ATI, State Universities & Tech. Institutions, Central & State Education Boards	• Support awareness campaigns/ IEC. • Support network of Civil Society Organizations for awareness generation about coping with Heat Wave. • Promoting awareness, alertness and preparedness. • Training programs for public, PRIs/ULBs. • Carry out Mass Media Campaigns in Heat-Wave prone areas. • Create awareness of coping with Heat Wave and HAP. • Generate and distribute awareness material to the public.
4	Mock Drills/ Exercises	Department of Health & Family welfare KSDMA, CDM – ATI, Health and Family Welfare Department	**Recurring/ Regular (RR)** • Promoting the planning and execution of emergency drills. • Identify and resolve communication gaps between participating departments, partners and the public. • Joint execution of emergency drills with local bodies to address Heat Wave Emergencies in relevant areas.
5	Vocational Training/ Skill development	KSDMA CDM – ATI, Department of Health & Family welfare, ULBs, Dept. of Housing, PWD, PRED Dept's of Education, WCD	**Recurring/ Regular (RR)** • Conduct training programmes. • Promoting skill development for –hazard resistant construction with emphasis on protection from heat in Heat-Wave prone areas for different types of housing and infrastructure. • Creating Tot teams for different trades relevant to Heat-Wave protection in the construction of different types of housing and infrastructure.

Heat Wave		Capacity Development	
Sl. No.	Sub-Thematic Area for DRR	State Agencies and their Responsibilities	
		State	Responsibility
			• Train the volunteers to assist the public in Heat Wave conditions.
6	Empowering women, marginalised communities, SC/ST, and persons with disabilities	Social Welfare and Backward Classes Department. Department of Disabilities & Senior Citizen Welfare etc.,	**Recurring/ Regular (RR)** • Guidance to addressing Heat Wave emergencies in relevant areas. • Promote gender sensitive and equitable approaches for awareness raising. • Incorporating gender sensitive and equitable approaches in Capacity Development for coping with Heat Wave emergencies.

Table 11: CLIMATE CHANGE RISK MANAGEMENT

Heat Wave		Climate Change Risk Management	
Sl. No.	Sub-Thematic Area for DRR	State Agencies and their Responsibilities	
		State	Responsibility
1	Research, Forecasting, Early Warning, Data Management, Zoning, Mapping	KSNDMC – DEWS in Collaboration with IMD-Bengaluru, Dept. of Forest and Ecology, KSDMA, Universities	**Recurring/ Regular (RR)** • Research on local threshold and Climate Change Adaptation. • Improving the dissemination information on of GACC and adaptation. • Develop GACC impact scenarios relevant for occurrence of Heat Wave. • Improving the forecasting of intensity, severity of extreme weather events. • Improving the assessment and monitoring of Intensity, Severity of Extreme Weather Events & Forecasting.

Heat Wave		Climate Change Risk Management	
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
			• Develop Database Management System relating to Heat Wave & Climate Change.
2	Hazard Risk Vulnerability and Capacity Assessment (HRVCA)	Revenue Department, in Collaboration with KSNDMC, IMD-Bengaluru, Forest and Ecology RDPR-PRIs DMA-ULBs, Universities	**Recurring/ Continuous (RR)** • Impact Assessment, Periodic review and evaluation. • Incorporate updated info on GACC in HRVCA while preparing or periodic revision of DM plans. • Creation of data bank and hazards risk & vulnerable mapping. • Assess Heat Wave risk and vulnerability due to GACC. • Update Heat-Wave vulnerability maps based on projected GACC impacts. • Assess the trends of Heat Wave risk under GACC scenarios. • Assess GACC risks of vulnerable and marginalised sections. • Provide technical support and guidance for comprehensive HRVCA considering GACC impacts.

Heat Wave		Climate Change Risk Management	
Sl. No.	**Sub-Thematic Area for DRR**	**State Agencies and their Responsibilities**	
		State	**Responsibility**
3	Climate Change Adaptation (CCA)	KSNDMC in Collaboration with IMD-Bengaluru DMA-ULBs, EMPRI UDD- UDAs, Municipal Corporations RDPR-PRIs All departments	• Sensitisation and awareness creation. • Support national CCA efforts. • Prepare Action Plans for CCA. • Coordination with Central Agencies. • Sponsor & promote state and local specific efforts for GACC Mitigation and Adaptation. • Understanding CCA needs. • Study GACC coping mechanisms. • Develop CCA mechanisms. • Develop local adaptation strategies and pilot projects. • Sponsor and promote state-specific efforts and local efforts. • Formulate strategy under GACC like Cool-Roof, Green Energy, Reducing Omission CO2. • Promote solar energy at roof top at every house or retrofitting. • Implement adaptation programs. • Promote appropriate combinations of Green and Blue infrastructure approach. • Promote adaptive measures in social protection programmes for the vulnerable groups. • Implementation of GACC adaptation programs • Integrate adaptive measures in social protection programmes for the vulnerable groups.

Table 12: ROLES AND RESPONSIBILITIES FOR MANAGING HEAT WAVE

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
Understanding Risk						
1	Formulation of policy. Plan and guideline	Preparation of heat Action Plan in coordination with all stakeholders	KSDMA/Revenue DM in consultation with concerned departments	Revision of National Guidelines for preparation of Action plan prevention and management of Heat wave	DDMA, consultation with concerned departments	Preparation/revision of heat Action plan based on SDMA revised Guidelines and local experience
Interagency Coordination						
2	Early Warning & Coordination	Disaster Early Warning System - KSNDMC	KSNDMC/KSDMA/Revenue Department	Strengthening of early Warning system-with accurate and timely alert systems. Issue Heat Wave alerts, Warnings and Coordination with DDMAs	KSNDMC/DDMA	Disseminate the information received from KSNDMC/IMD to the public at large and concerned Departments. Prepare sop for heat wave

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
		Response & Relief	DDMAs/ Health /ULBs/ RDPR/Education, Forest & Animal Husbandry Department	Take necessary measures, wherever applicable Flexible timing of schools, market and offices Provide occupational support and advisories	DDMAs, consultation with concerned departments	Coordination among all stakeholder with clearly defined roles and responsibilities Flexible timing of schools, MNREGA, market and offices Take necessary measures, wherever applicable Collaboration with non-government and civil society Provide occupational support and advisories special care for vulnerable groups- children disabled, women and old aged.
		Monitoring of medical preparedness	Health and Family Welfare Department and KSDMA	Develop a monitoring mechanism provision of funds for heat action mitigation plans. Surveillance of heat Wave impact Deployment of medical Teams	DDMAs, consultation with concerned departments	Develop monitoring mechanism for implementation of heat action plan Provision of funds for heat action mitigation plans. Deployment of rapid medical response teams
Investing in DRR-Non – structural measures						

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
3	Preparedness and Mitigation Measure	Preparedness Measure	KSDMA, Revenue Department (DM), Health and Family Welfare, RDRP and ULBs	Appointment of Nodal officer at each Ministry / Department Develop strategy for preparedness measures Issue necessary directions for preparedness	DDMAs, consultation with concerned departments	Appointment of Nodal officer at each level (state, districts, tehsil and block, department etc) Implementation of heat Action plan Issue necessary directions for preparedness
			Revenue Department (DM)	Issue directive to state police department for distributions of cool. Jacket for traffic police personnel	DDMAs, consultation with concerned departments	Ensure shade for on duty traffic police, as they are more exposed to heat wave and distribution of cool jacket for traffic police personnel
			KSDMA	Review preparedness & mitigation measures in heat prone states. Inter-ministerial coordination for preparedness activities	DDMAs, consultation with concerned departments	Heat Wave should be included in annual disaster event / calendar. Interstate collaboration for sharing experiences and data Reviewing preparedness & mitigation measures

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
		Short- and Medium-term mitigation measures	Health and Family Welfare Department	Issue directives for hospital preparedness & mitigation measures to states Formulation of schemes and program for heat-health safety Ensure monitoring Mechanism for heat health preparedness at state level	DDMAs, consultation with concerned departments	Prepare hospital preparedness plans preparedness of the heat health and social care system Ensuring 24*7 heat health facilities with adequate provision of basic medicine like ORS, Glucose etc. Dissemination of heat health plan by organizing awareness campaigns
			Forest Department	• Develop framework for tracking and modelling of heat hot spot based on IMD data. • Directives to maintain water bodies in the forest area for wild animals & birds. • Advisory for plantation in	DDMAs, consultation with concerned departments	• Identify "heat hot-spots" using framework for tracking and modelling based on IMD data. • Maintain water bodies in the forest area for wild animals & birds. • Afforestation and plantation • Prevention of a forest fire.

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
				fallow land available with different ministries		
			RDPR, Labour Department, and Education Department	Instruction on mainstreaming heat health precautionary measures, including re-scheduling of working hours and reduce piece rate, in all schemes and programmes,	DDMAs, consultation with concerned departments	• Implementation of instruction for mainstreaming heat health precautionary measures, including re-scheduling for working hours and reduce piece rate, in all schemes and programmes. • Ensure shed for resting and drinking water facilities for workers at all workplaces.
			Water Resource Department, RDPR and ULBs	Issue instruction for ensuring availability of drinking water facilities	DDMAs, consultation with concerned departments	• Ensure drinking water facilities. • Identify vulnerable place and ensure drinking water facilities. • Repair/maintenance of mechanical/ electrical fault of tube wells, ponds, Jorhat, at priority basis to ensure water storage. • Suitable arrangement for drinking water supply and promptly respond to water scarcity.

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
						• Ensure drinking water facilities at all common place and nearby habitation.
			Education Department	• Direction to states to re-scheduling of schools timing or closer of the schools as per heat wave situation, • Instruction for ensuring cool places in all educational institutions. • Encourage research on heat wave related issues through universities	DDMAs, consultation with concerned departments	• Rescheduling of school timing and vacation as per heat wave situation.

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
			Labour Department	• Directives to all states, construction companies, industries for precautionary measures to be taken during heat wave season. • Direction for rescheduling of working hours. • Necessary arrangement to regulate piece rate and requirement /urgency for undertaking physical work during summer	DDMAs, consultation with concerned departments	• Implement the direction for heat wave season • Re-scheduling of working hours for employees in different sectors. • Ensure drinking water facilities at workplaces. • Coordinate with Health department and ensure regular health check-up of the workers and provide emergency ice packs and heat illness prevention materials to construction workers.
			Agriculture Department and Animal Husbandry Department	• Advisory to sates for awareness generation about farmers/animal-health related issues arising from heat wave.	DDMAs, consultation with concerned departments	• Heat wave related advisory to farmers. Shelter for livestock and animal husbandry should be maintained. • Pre-positioning of adequate veterinary medicines and supplies. • Update contingency plan

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
				• Advisory to states to ensure availability of necessary veterinary medicine, equipment's.		regarding provision of drinking water for animals.
			ULBs and RDPR	• Issue advisory to all ULBs in heat wave vulnerable states for preparedness, mitigation & management of heat wave. • Give directives to construct shelters, sheds at public places, provide access to public parks during heat wave.	DDMAs, consultation with concerned departments	• Open park/open areas during daytime for providing spaces with shade • Sprinkling of water on roads • Construct shelters, sheds at public place, provide access to public parks during heat wave season. • Promote cool roofs initiative such as paint roof white, create green roofs and walls, and plan trees in neighbourhood to keep them cool.
			Transport Department	• Directive for protection of roads from melting and take precautionary measures	DDMAs, consultation with concerned departments	• To ensure 1) Shelter/Sheds at bus stops, 2) frequency of transportation, 3) drinking water facilities at bus stop. • Enable better emergency transport system for affected

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
						people to health care facilities with adequate equipment's
			Energy Department/ DISCOMS	• Advisory to all states as well as power generation, transmission, distribution and supply through DISCOM including repair & maintenance work for uninterrupted power supply. • Re-scheduling load shedding	DDMAs, consultation with concerned departments	• Ensure repair & maintenance work for uninterrupted power supply before and during the summer. • Re-scheduling load shedding
			All General Manager of Zone and Divisional Railways Manager / Metro Rail Corporations in states	• Repair/maintenance of mechanical/ electrical system on priority basis including fan and cooling system. • Ensure drinking water	DDMAs, consultation with concerned departments DDMAs, consultation with	• Repair/maintenance of mechanical/ electrical system on priority basis including fan and cooling system. • Ensure drinking water facilities in trains and railway stations

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
				facilities in trains and railway stations	concerned departments	
			KSDMA/KSNDMC/IT and BT/E-Governance/ Health Dept.	• R&D activities to promote utilization of S&T in the field of Heat wave risk reduction.	DDMAs, consultation with concerned departments	• To develop application/ App related to awareness generation, quick information sharing on the Heat Wave Risk Reduction. • R&D activities to promote utilization of S&T in the field of Heat wave risk reduction. • Promote research on heat wave related issues
Investing in DRR – Structural measures						
		Long term mitigation measures	PWD/ULB/RDPR	• Long term planning for heat resilient infrastructure, • Directives to states to promote cool roofs technology and use other similar heat reducing technology • Mixed land use planning may be adopted to	DDMAs, consultation with concerned departments	• Long term planning for heat resilience infrastructure, • Promote cool roofs technology and use other similar heat reducing technology • Ensure implementation of mixed uses planning adopted in heat wave affected cities • Heat appropriate planning of new buildings(consideration e.g. in architecture, width/height ratio, street development, orientation and site) in urban and rural areas. • Ensure capacity building of

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
				address heat wave affected cities • Heat appropriate planning of new buildings (consideration e.g. in architecture, width/height ratio, street development, orientation and site) in urban and rural areas. • Capacity building of structural engineers and architects for construction of green building, maintenance and fire safety of the structures.		structural engineers, civil engineers and architects for construction of green building, maintenance and fire safety of the structures. • Ensure to construction of green building, environment and building code related to heat wave risk mitigation.
			Urban Development	• Issue directives to states for to implements	DDMAs, consultation with	• Ensure implementation of latest National Building Code of India

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
			Department/ PWD/PDRP	National Building Code of India 2016 Part-IV "Fire & Life Safety" in their building byelaws	concerned departments	2016 Part – IV "Fire & Life Safety" in their building byelaws
			Urban Development Department/ PWD/RDPR	• Issue directives to states for construction of green building, Energy Conservation Building Code (ECBC) related to heat wave risk mitigation. Policy formulation to increase forest coverage and green area in view of increasing heat wave risks. Afforestation and mass plantation	DDMAs, consultation with concerned departments	• Ensure construction of green building, Energy Conservation Building Code (ECBC) related to heat wave risk mitigation • Increase forest coverage and green area • Afforestation and mass plantation • Coordinate with Transport Department and Road Construction Department for plantation of trees at roadside, barren land and other areas. Prevention of forest fire and control measures.

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
			Agriculture and Horticulture Department.	Advisory for short duration and heat resisting crops.	DDMAs, consultation with concerned departments	Promote short duration and heat resisting crops.
Capacity Development						
4	Capacity building and training	Capacity Building	KSDMA/DDMAs/ATI/Health and Family Welfare Department/ ULB/RDPR	Develop training module for different qualification at different level Preparation of Capacity Building plan and implementation Coordination with different ministries/ departments for capacity building activity. Conduct capacity building and t raining program as per domain and expertise of Ministry/ Department	DDMAs, consultation with concerned departments	Develop training module and conduct proper training program for different stakeholders Heat wave management should be added in school curriculum to sensitize school children and local people Conduct capacity building and training program as per domain and expertise of department.

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
			PWD/ULB/RDPR	Capacity building of structural engineers, civil engineers and architects for construction of green building, maintenance and fire safety of the structures.	DDMAs, consultation with concerned departments	Capacity building of structural engineers, civil engineers and architects for construction of green building, maintenance and fire safety of the structures. Long term mitigation measures construction of green building, environment and building code related to heat wave risk mitigation.
5	Public Awareness and community outreach	Media campaign and IEC activity	Department of Information and Public Relations/KSDMA/DDMA/Health and Family Welfare	IEC Campaign to create awareness through print media, electronic media, social media etc. Issue advisories from time to time	DDMAs, consultation with concerned departments	IEC Campaign to create awareness through print media, electronic media, social medial etc. Display board with colour coding for heat wave alert. Display Do's and Don'ts in the Public areas, Hospitals, Park, etc. Develop of mobile application for faster spread of heat related issues, alertness, space for shelters and drinking water.

State / District Agencies & their Responsibilities						
SN	**Key Strategy**	**Task/Activities**	**State**	**Responsibility**	**District**	**Responsibility**
	Data collection and Documentation		KSDMA/Health and Family Welfare Department/ DDMAs/ULB/RDPR	Establish a Data monitoring cell and collecting Data from States and maintaining national-level data base. Standardized collection of granular data Development of a proper data sharing strategy among all stakeholders.	DDMAs, consultation with concerned departments	Establish a Data monitoring cell and collect data from district and maintain state level data base. A standardized collection of granular data Standard protocol for death investigation. Adopt uniform process for registration of casualties/ deaths due to heat wave based on the post-mortem report, death count, type of disease, time and duration.

The KSDMA, DDMAs and concerned department shall nominate senior officer as nodal officer for management of Heat Wave and reporting.

ANNEXURE- IV

FORMAT A: DEATH REPORTED DUE TO HEAT WAVE (STATES REPORT TO NDMA)

Name of the State: **Year:** **Reporting Periods:** **Date of Reporting:**

District: **Location:** **Occupation:** **Economic:**

		Urban		Rural		Total		Farmers	Labours	Hawkers	Others	Total	BPL	APL	Total
	Age Group	M	F	M	F	M	F								
District 1	0-6 years														
	7-18 years														
	19-35 years														
	36-60 years														
	61 > above														
	Sub Total														
District 2	0-6 years														
	7-18 years														
	19-35 years														
	36-60 years														
	61 > above														
	Sub Total														
Total State															

*If any other information related to heat wave, please enclose a separate page.

Name and designation of the reporting officer: Signature with Date

FORMAT B

DETAILS OF THE DEATH REPORTED DUE TO HEAT- WAVE (RECORD KEPT WITH STATE GOVERNMENT)

S. No.	Name and Address	Age	Sex (M/F)	Occupation	Place of death	Date and time of death	Max Temp recorded (Rectal and Oral)	Deaths reported during heat wave period or Not	List of chronic diseases present (Ask the family members)	Date and time of post mortem (If conducted)	Date and time of joint enquiry conducted with a revenue authority	Cause of death	Remarks	
													Related to post-mortem	Related to Joint enquiry
1														
2														
3														
4														

Name and designation of the reporting officer: Signature with Date

ANNEXURE- V

FORMAT A

DAILY REPORT OF HEAT STROKE CASES AND DEATHS (DISTRICT REPORT TO STATE GOVERNMENT)

S. No.	Village	PHC	Block/City	Name & Son/ Daughter/Wife of	Urban U Rural R	BPL Y/N	Age/Sex	Date of attack of Heat Stroke	Any Antecedent illness	Cause of death	Death confirmed by MOs and MROs
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
TOTAL											

FORMAT – B

(TO BE CUMULATED AT THE STATE LEVEL AND SENT TO CENTRAL GOVERNMENT)
DEATHS DUE TO HEAT RELATED ILLNESS - STATE

Sl.No.	Name of the district (Name of all districts)	New cases admitted due to Heat Related Illness since the last reporting	Cumulative no of cases admitted due to Heat Related Illness since 1st April.....	Deaths reported due to Heat Related Illness since the last reporting period	Cumulative no of deaths due to Heat Related Illness since 1st April....	Remarks (If any shortage of ORS/IV fluids/Treatment facilities etc...)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
TOTAL						

ANNEXURE VI

District wise and Year wise recorded Maximum temperature details with location & date for last five years (2017-2022):

District wise maximum temperature recorded during the year 2017					
Sl. No	District	Taluk	Location	Date	Temperature (^{0}C)
1	Bagalkote	Jamkhandi	Jamakhandi	20-04-17	45.3
2	Ballari	Siruguppa	Tekkalakote	24-05-17	45.3
3	Belagavi	Raibagh	Kudchi	19-04-17	43.3
4	Bengaluru Rural	Hosakote	Hosakote	19-04-17	39.1
5	Bengaluru Urban	Bengaluru North	Dasanapura_1	16-04-17	39.6
6	Bidar	Bidar	Bidar South	06-05-17	44.1
7	Chamarajanagara	Kollegal	Kollegala	08-05-17	40.9
8	Chikkaballapura	Gauribidanur	Gauribidanur	28-03-17	40.0
9	Chikkamagaluru	Kadur	Kadur	01-04-17	39.8
10	Chitradurga	Molakalmuru	Devasamudra	19-04-17	42.9
11	Dakshina Kannada	Bantwal	Bantwal	05-01-17	39.8
12	Davanagere	Davanagere	Davangere	14-04-17	42.5
13	Dharwad	Hubballi	Chabbi	19-04-17	42.1
14	Gadag	Ron	Hole Alur	16-04-17	42.8
15	Hassan	Channarayapatna	Channarayapatna	16-04-17	39.9
16	Haveri	Savanur	Savanur	28-04-17	42.9
17	Kalaburagi	Jevargi	Nelogi	24-05-17	45.1
18	Kodagu	Somwarpet	Kushalnagar	03-04-17	39.4
19	Kolar	Bangarapet	Kamsandra	19-04-17	40.6
20	Koppala	Koppala	Hitnal	05-03-17	41.8
21	Mandya	Malavalli	Halaguru	16-04-17	41.6
22	Mysuru	Hunsur	Hunsur	28-03-17	40.9
23	Raichur	Sindhanur	Turvihal	28-03-17	43.6
24	Ramanagara	Channapatna	Channapatna	30-04-17	42.8
25	Shivamogga	Tirthahalli	Mandagadde	28-03-17	40.9
26	Tumakuru	Pavagada	Nagalamadike	28-04-17	42.7
27	Udupi	Karkala	Ajekar	01-03-17	39.1
28	Uttara Kannada	Haliyal	Murkvad	09-04-17	42.3
29	Vijayapura	Sindgi	Sindhagi	17-04-17	44.0
30	Yadgir	Yadgir	Saidapur	25-05-17	45.3

District wise maximum temperature recorded during the year 2018					
Sl. No.	District	Taluk	Location	Date	Temperature (ºC)
1	Bagalkote	Jamkandi	Savalagi	03-05-18	42.9
2	Ballari	Ballari	Ballari	25-04-18	44.7
3	Belagavi	Raibagh	Kudchi	28-04-18	41.6
4	Bengaluru Rural	Devanahalli	Vijaypura	30-03-18	38.3
5	Bengaluru Urban	Bengaluru South	Kengeri_1	19-04-18	38.1
6	Bidar	Bhalki	Lakangaon	03-05-18	44.4
7	Chamarajanagara	Kollegal	Kollegala	16-04-18	39.6
8	Chikkaballapura	Gauribidanur	Hosur	29-04-18	40.4
9	Chikkamagaluru	Kadur	Kadur	19-04-18	39.5
10	Chitradurga	Challakere	Parasurampura	19-04-18	42.5
11	Dakshina Kannada	Bantwal	Vittal	03-03-18	40.9
12	Davanagere	Harihara	Harihara	03-04-18	43.1
13	Dharwad	Hubballi	Chabbi	24-04-18	41.8
14	Gadag	Mundargi	Dambal	20-04-18	41.4
15	Hassan	Channarayapatna	Hirisave	02-05-18	39.6
16	Haveri	Hanagal	Bommanhalli	25-04-18	40.9
17	Kalaburagi	Chittapur	Chittapur	30-04-18	45.3
18	Kodagu	Somwarpet	Sanivarsante	17-04-18	38.2
19	Kolar	Mulabagilu	Bairakur	27-04-18	40.3
20	Koppala	Gangavathi	Marali	23-04-18	43.0
21	Mandya	Srirangapatna	Belagola	24-03-18	39.8
22	Mysuru	T.Narasipura	Sosale	16-04-18	39.2
23	Raichur	Sindhanur	Sindhanur	22-04-18	43.7
24	Ramanagara	Ramanagara	Kutgallu	28-04-18	41.8
25	Shivamogga	Bhadravathi	Bhadravathi_1	10-04-18	40.1
26	Tumakuru	Madhugiri	Itakadibbanahalli	02-05-18	41.5
27	Udupi	Karkala	Ajekar	03-03-18	39.5
28	Uttara Kannada	Honnavar	Mavinakurvei	09-04-18	41.9
29	Vijayapura	Sindgi	Sindhagi	30-04-18	43.8
30	Yadgir	Yadgir	Hattikuni	02-05-18	45.0

District wise maximum temperature recorded during the year 2019					
Sl.No	District	Taluk	Location	Date	Temperature (^{0}C)
1	Bagalkote	Bagalkote	Rampura	26-04-19	44.5
2	Ballari	Sandur	Sandur	13-05-19	44.7
3	Belagavi	Athani	Kagwad	21-05-19	43.7
4	Bengaluru Rural	Doddaballapura	Sasalu	13-04-19	38.7
5	Bengaluru Urban	Anekal	Attibele	07-05-19	39.9
6	Bidar	Aurad	Santpur	24-05-19	45.2
7	Chamarajanagara	Kollegal	Kollegala	29-03-19	41.7
8	Chikkaballapura	Chintamani	Ambajidurga	24-05-19	41.5
9	Chikkamagaluru	Kadur	Chowlahiriyur	28-04-19	40.9
10	Chitradurga	Challakere	Nayakanahatti	13-04-19	42.7
11	Dakshina Kannada	Puttur	Puttur	30-05-19	42.8
12	Davanagere	Harihara	Malebennur	26-04-19	43.0
13	Dharwad	Navalgund	Navalgund	20-05-19	43.9
14	Gadag	Naragund	Naragund	21-05-19	42.9
15	Hassan	Arkalgud	Arkalgud	09-04-19	40.8
16	Haveri	Hanagal	Bommanhalli	20-05-19	42.7
17	Kalaburagi	Afzalpur	Atanur	15-04-19	46.6
18	Kodagu	Virajpet	Ammati	29-03-19	39.8
19	Kolar	Srinivasapura	Rayalpadu	27-04-19	40.8
20	Koppala	Gangavathi	Marali	19-05-19	44.8
21	Mandya	Maddur	Madduru_2	08-03-19	40.5
22	Mysuru	Hunsur	Hanagoadu	08-03-19	40.9
23	Raichur	Manvi	Mallat	01-06-19	44.9
24	Ramanagara	Ramanagara	Kutgallu	23-04-19	42.6
25	Shivamogga	Bhadravathi	Hole Honnuru (1)	28-04-19	42.1
26	Tumakuru	Sira	Sira	27-04-19	42.1
27	Udupi	Karkala	Ajekar	19-04-19	40.1
28	Uttara Kannada	Supa	Supa	19-05-19	44.0
29	Vijayapura	Sindgi	Almel	21-05-19	45.2
30	Yadgir	Yadgir	Yadgir	24-05-19	45.8

District wise maximum temperature recorded during the year 2020					
Sl. No.	District	Taluk	Location	Date	Temperature (^{0}C)
1	Bagalkote	Hungund	Amingarh	06-05-20	42.6
2	Ballari	Ballari	Rupanagudi	10-04-20	42.8
3	Belagavi	Raibagh	Raibagh	06-05-20	42.0
4	Bengaluru Rural	Hosakote	Anugondhalli	24-04-20	38.7
5	Bengaluru Urban	Bengaluru South	Kengeri	19-03-20	38.9
6	Bidar	Aurad	Kamalnagar	26-05-20	45.8
7	Chamarajanagara	Kollegal	Lokkanahalli	06-04-20	40.4
8	Chikkaballapura	Chintamani	Ambajidurga	24-05-20	40.6
9	Chikkamagaluru	Koppa	Hariharpur	01-04-20	40.9
10	Chitradurga	Hiriyur	Javanagondanahalli	03-04-20	41.9
11	Dakshina Kannada	Puttur	Uppinangadi	02-04-20	42.0
12	Davanagere	Channagiri	Basavapatna (2)	30-03-20	41.5
13	Dharwad	Hubballi	Chabbi	02-04-20	41.9
14	Gadag	Ron	Hole Alur	24-05-20	42.5
15	Hassan	Belur	Arehalli	29-03-20	40.1
16	Haveri	Savanur	Savanur	15-04-20	40.5
17	Kalaburagi	Afzalpur	Karajgi	26-05-20	46.0
18	Kodagu	Madikeri	Sampaje	01-04-20	40.7
19	Kolar	Srinivasapura	Srinivasapura	24-05-20	41.5
20	Koppala	Gangavathi	Karatgi	24-05-20	43.5
21	Mandya	Malavalli	Shivanasamudra	04-04-20	39.7
22	Mysuru	Hunsur	Gowdargyare	29-04-20	40.2
23	Raichur	Raichur	Chandrabanda	24-05-20	45.2
24	Ramanagara	Ramanagara	Kailancha	06-04-20	41.5
25	Shivamogga	Shivamogga	Haranahalli	02-04-20	41.0
26	Tumakuru	Pavagada	Pavagada	29-04-20	41.3
27	Udupi	Karkala	Ajekar	02-04-20	40.2
28	Uttara Kannada	Mundgod	Pala	29-03-20	40.1
29	Vijayapura	Sindgi	Almel	25-05-20	45.3
30	Yadgir	Shahapur	Doranahlli	25-05-20	45.1

District wise maximum temperature recorded during the year 2021					
Sl No	District	Taluk	Location	Date	Temperature (^{0}C)
1	Bagalkote	Bagalkote	Rampura	11-04-21	40.2
2	Ballari	Hagaribommanahalli	Hampa Sagara	01-04-21	40.7
3	Belagavi	Athani	Anantapur	30-03-21	41.3
4	Bengaluru Rural	Doddaballapura	Sasalu	03-04-21	38.6
5	Bengaluru Urban	Bengaluru East	Bidarahalli	02-04-21	38.9
6	Bidar	Bhalki	Nittur Buzurg	04-04-21	42.2
7	Chamarajanagara	Chamarajanagara	Chamarajanagara	03-04-21	40.1
8	Chikkaballapura	Chikkaballapura	Peresandra	04-04-21	40.7
9	Chikkamagaluru	Koppa	Hariharpur	27-03-21	39.6
10	Chitradurga	Hiriyur	Hiriyur	08-04-21	40.2
11	Dakshina Kannada	Beltangadi	Kokkada	27-03-21	40.7
12	Davanagere	Harihara	Harihara	06-04-21	40.7
13	Dharwad	Navalgund	Navalgund	01-04-21	43.2
14	Gadag	Ron	Hole Alur	01-04-21	41.5
15	Hassan	Arasikere	Kanakatte	10-04-21	38.9
16	Haveri	Hanagal	Bommanhalli	06-04-21	42.2
17	Kalaburagi	Sedam	Adki	30-03-21	42.5
18	Kodagu	Virajpet	Virajpet	27-03-21	39.3
19	Kolar	Kolar	Narasapura	02-04-21	39.9
20	Koppala	Gangavathi	Kanakgeri	05-04-21	41.9
21	Mandya	Malavalli	Shivanasamudra	08-04-21	39.9
22	Mysuru	T.Narasipura	T.Narasipura	01-04-21	39.8
23	Raichur	Raichur	Chandrabanda	30-03-21	42.6
24	Ramanagara	Channapatna	Mudugerehalli	03-04-21	39.6
25	Shivamogga	Soraba	Anavatti	06-04-21	40.6
26	Tumakuru	Pavagada	Pavagada	01-04-21	40.7
27	Udupi	Karkala	Ajekar	05-03-21	38.9
28	Uttara Kannada	Honnavar	Mavinakurvei	28-03-21	41.4
29	Vijayapura	Sindgi	Almel	08-04-21	42.7
30	Yadgir	Yadgir	Balichakra	05-04-21	43.7

District wise maximum temperature recorded during the year 2022					
Sl No	District	Taluk	Location	Date	Temperature (°C)
1	Bagalkote	Bagalkote	Rampura	09-05-22	43.0
2	Ballari	Hagaribommanahalli	Hampa Sagara	02-05-22	44.1
3	Belagavi	Athani	Anantapur	31-03-22	41.9
4	Bengaluru Rural	Doddaballapura	Sasalu	30-04-22	39.3
5	Bengaluru Urban	Bengaluru East	Bidarahalli	30-04-22	39.7
6	Bidar	Bhalki	Nittur Buzurg	01-05-22	45.6
7	Chamarajanagara	Chamarajanagara	Chamarajanagara	31-03-22	38.1
8	Chikkaballapura	Chikkaballapura	Peresandra	29-04-22	39.1
9	Chikkamagaluru	Koppa	Hariharpur	28-04-22	39.9
10	Chitradurga	Hiriyur	Hiriyur	28-04-22	40.9
11	Dakshina Kannada	Beltangadi	Kokkada	09-05-22	39.0
12	Davanagere	Harihara	Harihara	09-05-22	40.8
13	Dharwad	Navalgund	Navalgund	09-05-22	43.4
14	Gadag	Ron	Hole Alur	01-04-22	43.4
15	Hassan	Arasikere	Kanakatte	30-03-22	39.2
16	Haveri	Hanagal	Bommanhalli	18-03-22	41.7
17	Kalaburagi	Sedam	Adki	01-05-22	44.4
18	Kodagu	Virajpet	Virajpet	28-04-22	36.9
19	Kolar	Kolar	Narasapura	30-04-22	40.0
20	Koppala	Gangavathi	Kanakgeri	26-04-22	42.4
21	Mandya	Malavalli	Shivanasamudra	30-04-22	39.6
22	Mysuru	T.Narasipura	T.Narasipura	30-04-22	39.6
23	Raichur	Raichur	Chandrabanda	04-05-22	44.8
24	Ramanagara	Channapatna	Mudugerehalli	30-04-22	39.7
25	Shivamogga	Soraba	Anavatti	19-03-22	39.7
26	Tumakuru	Pavagada	Pavagada	29-04-22	41.4
27	Udupi	Karkala	Ajekar	03-05-22	38.0
28	Uttara Kannada	Honnavar	Mavinakurvei	23-04-22	40.2
29	Vijayapura	Sindgi	Almel	10-05-22	44.9
30	Yadgir	Yadgir	Balichakra	01-05-22	44.0
31	Vijayanagara	Hosapete	Mariyamanahalli	28-04-22	42.4

ANNEXURE VII

Abstract for number of the Districts, Talukas & Gram Panchayats having 95th percentile of maximum temperature of 43 deg C and above in the Karnataka State.

District Name	Taluk Name	No. of GPs
RAICHUR	Deodurga	34
	Manvi	43
	Raichur	37
	Sindhanur	42
KALABURAGI	Afzalpur	31
	Aland	51
	Chincholi	39
	Chittapur	50
	Kalaburagi	45
	Jevargi	46
	Sedam	29
BIDAR	Aurad	41
	Bhalki	42
	Bidar	37
	Basavakalyan	39
	Humnabad	37
VIJAYAPURA	Vijayapura	55
	Indi	55
	Sindgi	48
DHARWAD	Navalgund	27
YADGIR	Shahapur	44
	Shohapur	48
	Yadgir	46

Table 13: Abstract of No. of GPs having 95th percentile of Maximum Temperature of 43 deg °C and above.

966 Gramapanchayath form North Interior Karnataka region are experiencing the 95th percentile of maximum temperatures of 43 deg C and above in the State and details are provided below Table: 14.

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
RAICHUR	DEODURGA	Deodurga,Dondamali,Kotadoddi,Karegudda,Koppar,K.Irabagera,Jerabandi,Masarkal,Arakeri,Mustur,Alkod,Jagir,Jadaladinni,Kyadigera,Nagadadinni,B.Ganekal,Malledevaragudda,Bhumanagunda,Gabbur,Gugal,Maladkal,Hemnal,Hirebudur,Ramdurga,Shavantagera,Jalihalli,Galaga,Chinchodi, Palakanmaradi, Ganadhal,Hosura Siddapura,Karadi Gudda,Mundargi,Amarapur,Somanamaradi	34
	MANVI	Manvi,Chikkotankal,Madlapur,Sangapura,Chikkaparavi,Jutlapur,Pannurjagir,Halapur,Torandinny,Hiredinni,Malladagudda,Hirekatankal,Janekal,Potnal,Utakanoor,Bayagwat,Kallur,Kappagal,Harvi,Neeramanvi,Ganadinny,Kavital,Hira,Hirehanagi,Chincharaki,Kurdi,Gorkal,Sadapur,Sunkeshwara, Aroli,Mallat,Nakkundi,Bagalawad,Ballatagi,Navalkal,Pamankallur,Ameengada,Vatagal,Sirvar,Madgiri,Atnoor,Chagabhavi,K.Gudadinny	43

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	RAICHUR	Raichur,Bayidoddi,Manslapura,Mitti,Malkapura,Bijangera,Chandrabanda,Atkur,Yapaldinni,Shakawadi,Singanodi,Devarsugur,Chikkasugur,Kadlur,Sangamkunta,Yadlapur,Gilasuguru,Mamdapur,Matmari,Talamari,Idapanur,Bichali,Ganadhal,Marchatala,Nadigaddimalkapura,Heerapura,Kalmali,Jagarkal,JagirVenkatapura,Fathepur,Murhanpur,Marched,Yergara,Kamalapura,Jambaldinni,L.K.Doddi,Poorthipli,Udamagal	37
	SINDHANUR	Sindhanur,R.H.Camp,Hosalli.E.J,Badarli,Alabanur,Madasirwar,Balganur,Goudanbhavi,Gorebal,Chennalli,Gudadur,Kolabal,Udbala,Gunjihalli,Bappur,Tidigola,Virupapura,Hadganhal,Valaballary,Huda,Mukkunda,Roudakunda,Jalihal,Bassapura,Jawalgeri,Kunatagi,Bhoothaladinni,Devaragudi,Pagadadinni,Yelekudlagi,Salgundi,Dhadesugur,Somalapura,Turvihal,Gunda,Kalmangi,Umaluti,Hattigudda,Walkamdinni,Ragalaparvi,Ramatnal,Gonwar	42
KALABURAG	AFZALPUR	Afzalpur,Badadal,Anoor,Kallurd,Mallabad,Revoor,Ballurgi,Gour,Ghattarga,Tellur,Atanur,Banderwad,Bhairamadgi,D.Ghangapur,Bidnur,Gobbur,Gudur,Hasaragundgi,Kognur,Chowdapur,Madara,Karajgi,Algi,Mannur,Mashal,Udachan,Bankalaga,Nandaraga,Ramnagar,Sheshgiriwadi,Hosurwadi	31

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	ALAND	Aland,Padsawali,Hallisalagar,Kodalhangaraga,Munnalli,Hiroli,Jidga,Sarasamba,Sawleshwar,Hebali,Halatadakala,Tadakal,Chincholi(K),Khajuri,Alanga,Hodlur,Kinnisultan,Nirgudi,Rudrawadi,Tadol,Mataki,MadanaHipparga,Hadalagi,Nimbal,Dargasirur,Mogha,Narona,Kawatgi,Ambalga,Ladmugli,Salgera,Bhodhan,Sirchand,Chinchansur,Belamgi,Muddadaga,Keriambalaga,NimbargaTanda,Dhuttagaon,Kawalga,Yelsangi,Gola,Kadaganchi,Suntnoor,Busnur,Dhangapur,Madyal,Korhalli,Dannuru,Hittalsiroor,Cuk-Gulbarga	51
	CHINCHOLI	Chincholi,Nagaidlai,Shadipur,Anwar,Miryan,Polakpalli,Ainolli,Degalmadi,Konchavaram,Venkatapur,Kollur,Ainapur,Chimmanchod,Chengta,Hasargundagi,Salebeernalli,Chandankera,Gadilingadalli,Salagar,Basantapur,Kodli,Ratkal,Chimmaidlai,Halchera,Karakmukli,Mogha,Pastapur,Rummungud,Garampalli,Karakmukli,Sulepet,Gadikeshwar,Nidugunda,Hodebeerhalli,Karachkhed,Keroli,Siroli,Jattur,Garagapalli,Kupanoor	39

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	CHITTAPUR	Chittapur,Ravoor,Madbul,Satnoor,Diggaon,Mogala,Bhagodi,Dhongaon,Kardal,Gundgurti,Korwar,Dandothi,Hebbal,Pethsiroor,Ivani,Mugalanagaon,Ivani,Kalgi,Chincholli,Gotoor,Kodadur,Tengali,Arankal,Kandgol,Rajapur,Bedsur,Heroor,Arjamga,Tonasanahalli,Sangavi,Nalavara,Allur,Kollur,Allol i,Ladlapur,Sannati,Kamarwadi,Yagapur,Bhimanhalli,Rampurahalli,Halkatta,Shahabad,Bhankur,Honagunta,Kadabur,Ingalagi,Malgatti,Tonasanhalli,Wadi,Maratur	50
	KALABURAGI	Kalaburagi,Kusnur,Nandikur,NandurK.,Hagaraga,Aurad,Harsoor,Sannur,Kallahangarga,Kumsi,Srinivassaradgi,Bhupalteganur,Algood,Farhatabad,Kawalga,Ferozabad,Herur,Khanadal,Kiranagi,Basavapattana,Minajagi,Saradagib,Kamlapur,Dongeragaon,Kalmud,Maraguthi,Okali,Sonth,Kinnisadak,Kamalapur Tanda, Kalmandergi, Neelakod, Mahagaon Tanda,Bablad,Holkunda,Jeevangi,Kurikota,Nagoora,Pattan,Kadni,Saranasirasagi,TajSultanpur,Bhimanhalli,Melkunda,Savalgi	45
	JEVARGI	Jevargi,Harwal,Harnur,Kudi,Kolkur,Kellur,Sonn,Kallahangarag,Andola,Ganwar,Naribole,Biryal,Gudurs.A,Yalwar,Madari,Ijeri,Balbatti,Yalgod,Alur,Bilwar,Karkihalli,Sathkhed,Balbatti,Nelogi,Hippergas.N.,Jeratgi,Ankalga,Baluandgi,Kallur,Itga,Mandewal,Nedalagi,Ranjangi,Hulluru,Yedrami,Aralagundi,Malli,Kadkol,Kuknoor,Kuralgera,Magengera,Wadgera,Kachapura,Sumbad,Dumadri,Hangerga	46

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	SEDAM	Sedam,Habal,Malkhed,Kurgunta,Neelhalli,Kukkunda,Yadaga,Telkur,Adki,Batgera,Lingampalli,Madkal,Ranjole,Kodla,Dugnoor,Handerki,Jakanpalli,Kolkunda,Madna,Udgi,Benakanahalli,Sindanmadu,Mudhol,Kanagadda,Itkal,Medak,Motakpalli,Ribbanpalli,Chandapur	29
BIDAR	AURAD	Aurad,Badalgaon,Ekalara,Ekamba,Chintaki,Chiklijanwada,Jojana,Nagamarapalli,Sundal,Gudapalli,Dabakac.,Chikhli,Hokarna,Murkiwadi,Bhandarkumtha,Bonthi,Chimmegaon,Kamalnagar,Diggi,Donagaon,Holasamudra,Madhanur,Sonala,Torna,Belakuni,Santpur,Koutha,Jambagi,Wadagaon,Shembelli,Pashapur,Thanakushanur,Belkunichaudri,Chandoori,Dhupatamahagaon,Hedagapur,Balat,Khed,Mudhol,Korekal,Ladha	41
	BHALKI	Bhalki,Siddeshwar,Dadgi,Gorachincholi,Joladabka,Madakatti,Ambesanghvi,Halburga,Dhannura,Janthi,Malachapur,Konamelkunda,Kanaji,Kosam,KhatakChincholi,Dawargaon,Chalakapur,Morambi,Byalahalli,Varavatti,Kurubakhelgi,Enikoora,Lakangaon,Telgaon,Bhatambra,Methimelkunda,Shivani,Talwad,Gonagapur,Lanjawada,Dhonadapura,Nittur-Buzurg,Beeri,Balur,Beeri,Saigaon,Alwal,Tugaonhalsi,Mehkar, Wanjarkhed, Inchur, Attarga	42

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	BIDAR	Bidar, Aliabad , Chimkod , Gadgi ,Malegaon ,Chillargi , Bagadhal, Chatnalli , Ranjolakheni , Rekulgi , Sangolagi , Sirsi(A), Kadawad , Aurad(S) , Mandakanalli , Bidar South, Astoora , Chitta , Malkapur , Amalapur , Janwada, Allambar , Chambool , Yeranalli , Marakhal , Srimandal , Kamthana, Yadlapur , Anadur , Kolar, Kapalapur(A) , Manalli, Markunda , Nagora , Sindola , Baroor , Hokrana(B)	37
	BASAVAKALYAN	Basavakalyan,Narayanapur,Betbalalkunda,Dhannura,Morakhandi,Paratapur,Kitta,Hulsur,Mirkal,Gadigoundgaon,Belura,Gortha,Togalur,Muchalamba,Kohinoor,Batgiri,Ladwanti,Bhosaga,Ujlam,Matala,Gundur,Algud,Chandakapur,Ghotala,Sastapur,Mudabi,Eklura,Harkud,Chikkanagaon,Kalkhora ,Rajeshwar,Khedgi,Tadola,Niragudi,Islampur,Yerabhag,Yerandi,Rajola,Hanamanthavadi	39
	HUMNABAD	Humnabad,Hallikhed,Hudagi,Kallur,Dhummanasur,Manik nagar,Nandgaon,Sindhankera,Bhimalkhed,Changler,Mannaehelli,Udabanalli,Meenkera,Chitgoppa,Itga,Mustari,Talamadgi,Belkera,Kodambal,Rampur,Dubalgundi,Ghatboral,Ghodwadi,Kanakatta,Sultanabad,Chandanahalli,Shedol,Jalasangi,Hallikheda,Sitalagera,Benchincholi,Dakulgi,Madargaon,Nirna,Muttangi,Udbal,Mangalgi	37

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
VIJAYAPURA	VIJAYAPURA	Vijayapura,Aniapura,Hadagalli,Hannutagi,Hittinahalli,Hegadihal,Sarvad,Shivanagi,Toravi,Honaganahalli,Madabhavi,Jamanal,Kumatagi,Honaganahalli Gp), Hittinahalli Farm,Bobleshwar,Kakhandaki,Kumthe,Halagani,Kambagi,Arjunagi,Karajol,Nidoni,Bolachikkalaki,Hebbalahatti,Tiganibidari,Tonshyal,Mamdapur,Hosur,Jainapur,Devaragennur,Gunadal,Nagathan,Kannur,Aliyabad,Aheri,Baratagi,Gunaki,Jumbagi,Tidagundi,Makhanapur,Tikota,Arakeri,Takkalki,Kanamadi,Honawad,Siddapur-K, Babanagar,Bijjaragi,Ghonasagi,Jalageri,Kotyal,Lohagaon,Tajapur,Babanagar	55
	INDI	Indi,Agarkhed,Hirebevanur,Rugi,Shirshad,Tamba,Chikkabenur,Miragi,NadaKD,Salotagi,Tenihalli,Alur,Lalasangi,MasaliBK,Khedagi,ArjunagiBK,Gubbewada,Ingalagi,Sangogi,Tenihalli,Ballolli,Horti,Pandnurhalli,Anjutagi,Atharga,Benakanahalli,NimbalKD,Tadavalaga,Ahirasang,Babalad,Basanal,Bhatagunaki,Hadalasang,Hanjagi,Koluragi,Lachyan,Zalaki,Chavadihal,Hingani,Kapanimbaragi,GundanaTanda,Chadchan,Jigjivani,Loni,Nivaragi,Baradol,DevarNimbaragi,Dhulakhed,Halasangi,Hattalli,Inchageri,Nandaragi,Revatagaon,Umarani,Umaraja	55

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	SINDGI	Sindgi,Chattarki,Golageri,Kokatanur,Rampura-Pa,Kannolli,Bandal,Chandakavate,Yankanchi,Handiganur, Gubbewad,Sungathan,Byakoda,YaragalB.K,Guttaragi,NagaviBK,Almel,Devarnavadgi,Gabsavalgi,Kadani,Korahalli,Balaganur,Bagalur,Bammanahalli,Devanagaon,Malaghan,Moratagi,Hikkanagutti,Kakkalameli,Ramanahalli,DevarHipparg i,Kalkeri,Kondaguli,Haranal,Aski,Bekinal,Chikkarugi,Hitnalli,Hunadhyal,Kerutagi,Korawar,Jalawad,Manur,Mulasavalagi,Yalagod,Honnalli,Turakanageri,Neeralagi	48
DHARWAD	NAVALGUND	Navalgund,Morab,Belvatgi,Kalwad,Alagawadi,Yamanur,Halkusagal,Hebbal,Javur,Thirlapura,Shirur,Shirkol,Gumgol,Chilakawada,Annigeri,Gudisagar,Hallikeri,Shelvadi,Bhadrapur,Shishvinahalli,Ibrahimpur,Nayakanur,Tadahal,Tuppadakurahatti,Nalawadi,Navalli,Saasvihalli	27
YADGIR	SHAHAPUR	Shahapur,Hattigudur,Rastapur,Sirwal,Naganatagi,Sagarb,Anabi,Kannekollur,Hurasagundagi,Doranahlli,Gurusanagi,Khanpur,Kurkunda,Naykal,Chatnalli,Ibrahimpur,Gaddesugur,Tekharal,Gogi,Chymanal,GogiK,Mudabool,Hotapet,Hosakera,Madraki,Ukkinal,Vanadurga,Kakkasgera,Hayyala Buzurg, Tadabidi, Kadumgera B, Kollur M,T Wadagera,Aikur,Beernur,Gundgurthi,Wadagera,Bedebemabali,Konkal,Halagera,Bilhar,Gonal,Ullesugoor,Tumakur	44

District Name	Taluk Name	Gram Panchayat Names	No.of GPs
	SHORAPUR	Shorapur, Devaragonal , Devikera, Hemanoor, Khanapur , Pethammapur , Sugoor , Arkera(K) , Waganagera , Aldal , Badyapura , HUNASAGI, Chikkamadanur , Agni , Arkera(J) , Baichabal , Kamnatagi , Kolihal , Wajjal , Kachakanur , Kirdahalli , Kakkeri, Devatakala , Devapur , Tinthni , Hebbal(B) , Kembhavi, Yalagi , Karadakal , Malla(B) , Malagatti , Naganoor , Parasanahalli , Yevoor , Yaktapur , Heggandoddi , Kodekal, Malur , Narayanpur , Bailkunti , Baradevanal , Geddalamari , Hagaratagi , Jogundabhavi , Marnal , Rajankollur , Karekal , Teerth	48
	YADGIR	Yadgir,Ramasamudram,ArkeraK,Mundargi,Arakera,Mudnal,Thanagunda,Haligera,Warkanalli,Musturu,Balichakra,Kauloor,Kalebelgundi,Killanakera,Madhavar,Malhar,Yalheri,Goudagera,Jinkera,Gurmatkal,Kandkur,Chandriki,Chapetla, Gajarakot,Kakalwar,Paspul,Putpak,Hattikuni,Motanahalli, Bandalli,Allipur,Yaragol,Honagera,Konakal,Ajalapur,Anapur,Chinnakar,Jaigram,Minasapur,Yalsatti,Saidapur,Banala, Kadechur,Belgundi,Anur,Heganagera	46

Table 14: District wise details of No. of Gram Panchayats having 95th percentile of Maximum Temperature of 43 deg C and above in the State.

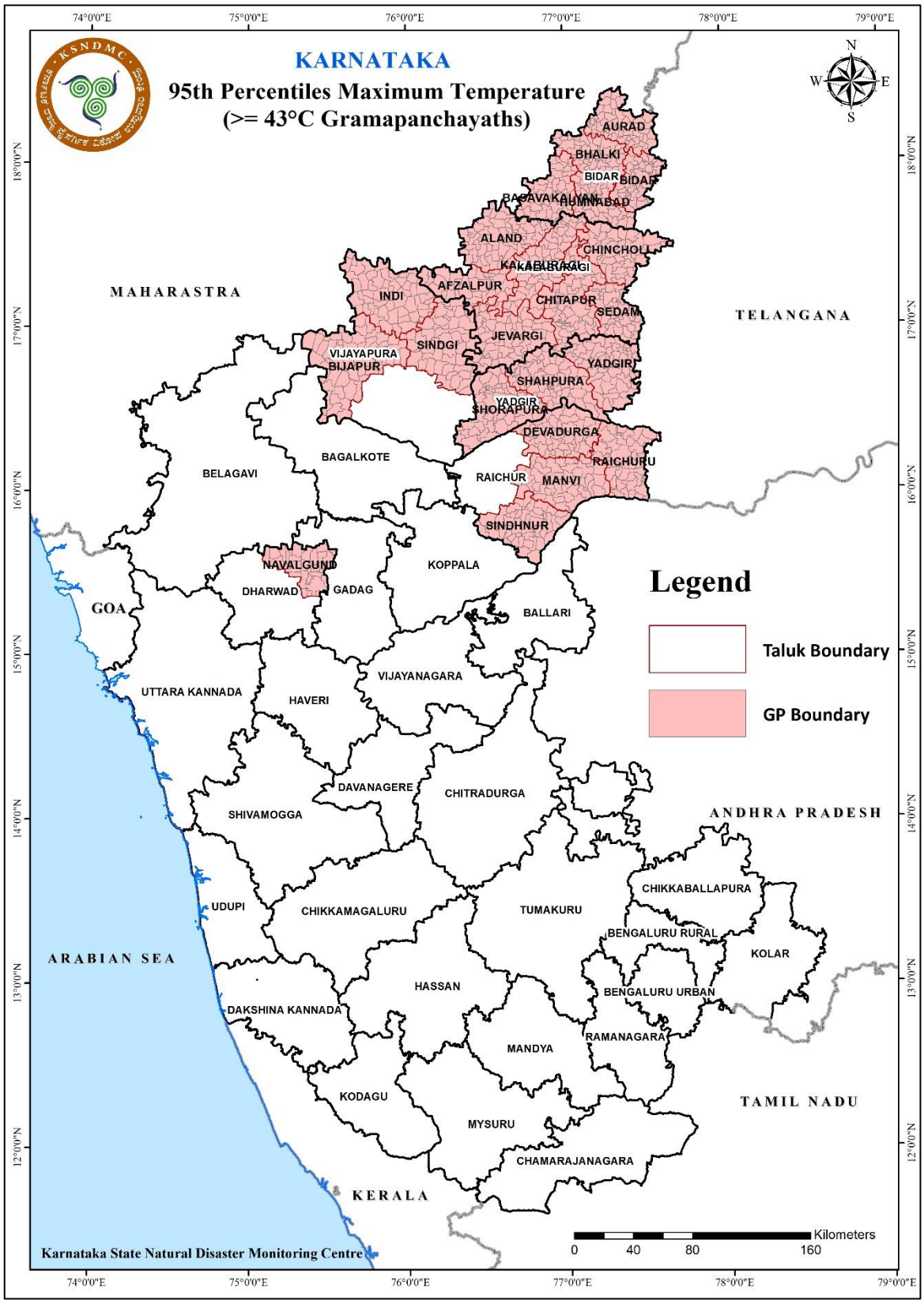


Fig 14: Map indicating the 95th percentile maximum temperature >=43 °C Grampanchayath