SOUTH ASIA HYDROMET FORUM

Regional Integrated Multi-Hazard Early Warning System RIMES

WISER Weather and Climate Information Services

Supported by: UK International Development

Partnership | Progress | Prosperity

Met Office

REGIONAL WORKSHOP ON IMPACT-BASED FORECASTING:

Training-of-Trainers and National Demonstration Planning for Temperature-Related Hazards

SAHF IBF Working Group Implementation Plan Project

09-13 February 2026

Kathmandu, Nepal

REGIONAL WORKSHOP ON IMPACT-BASED FORECASTING

Training-of-Trainers and National Demonstration Planning for Temperature-Related Hazards

Trigger and Threshold Development for Temperature Hazards

Khan Md Golam Rabbani

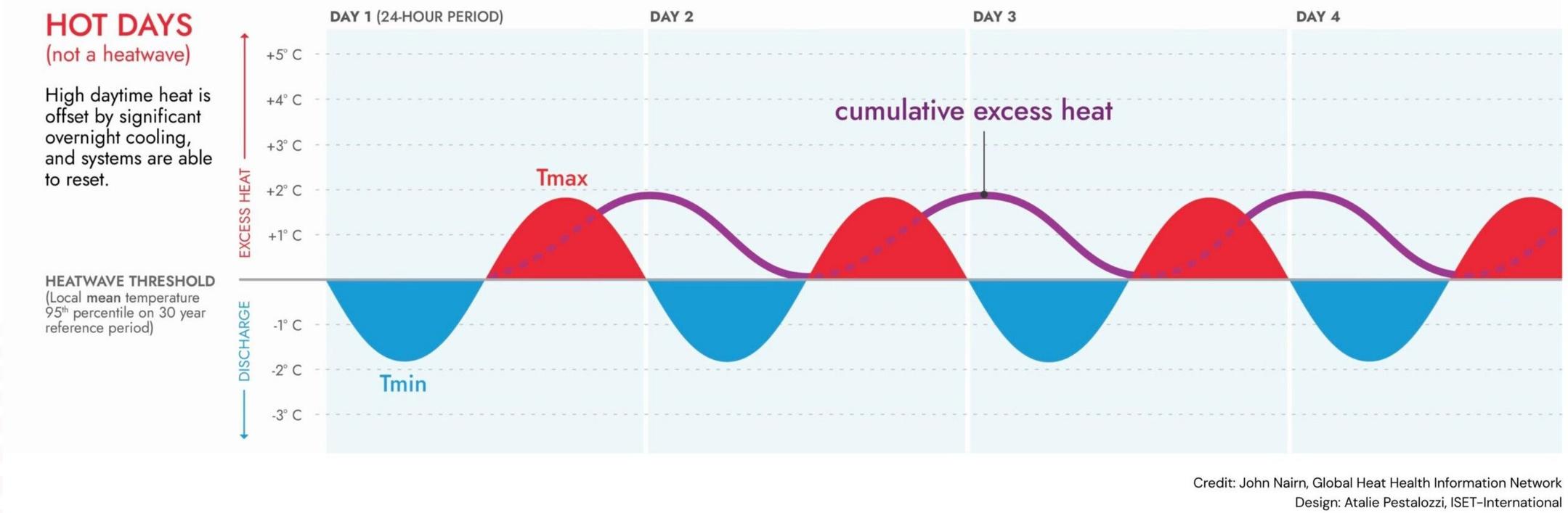
RIMES

What is Heatwave?

Hot Days vs Heatwaves

Hot Days (Not a Heatwave):

When high daytime heat is offset by significant overnight cooling, and systems are able to reset

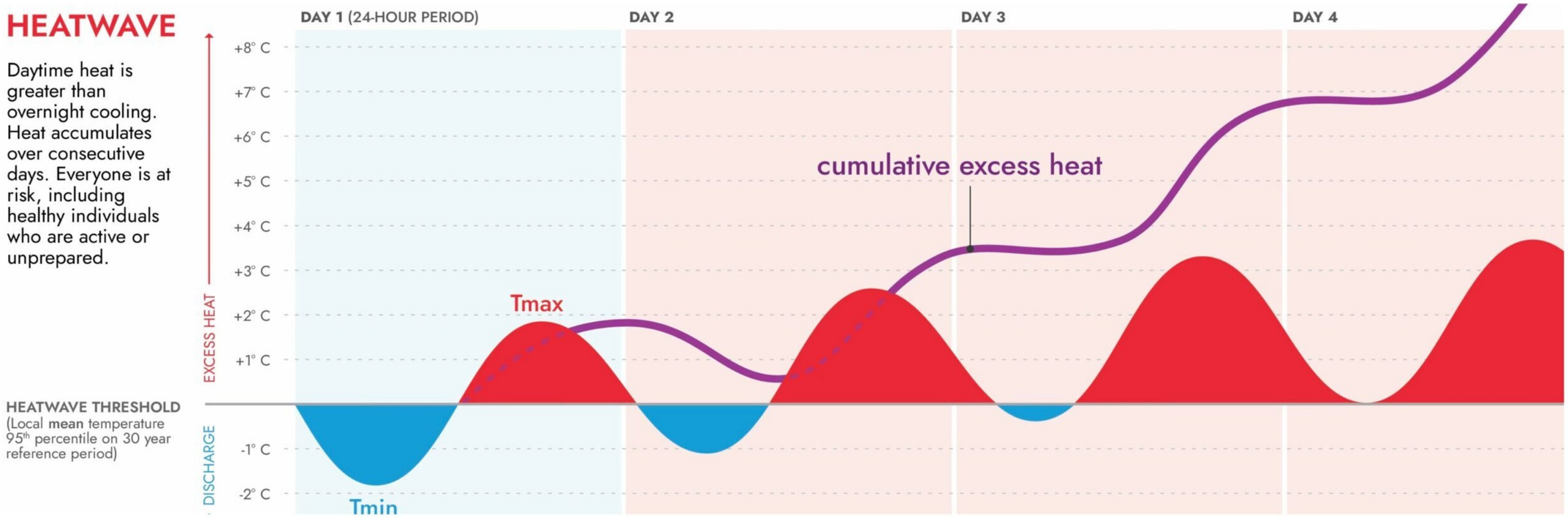


Credit: John Nairn, Global Heat Health Information Network
Design: Atalie Pestalozzi, ISET-International

Hot Days vs Heatwaves

Heatwaves (Low-intensity):

- When nighttime temperatures begin to rise, the cooling window narrows.
- The heat discharge at night becomes smaller than the heat gained during the day. This creates a “staircase” effect where the total heat load on the community increases over time.

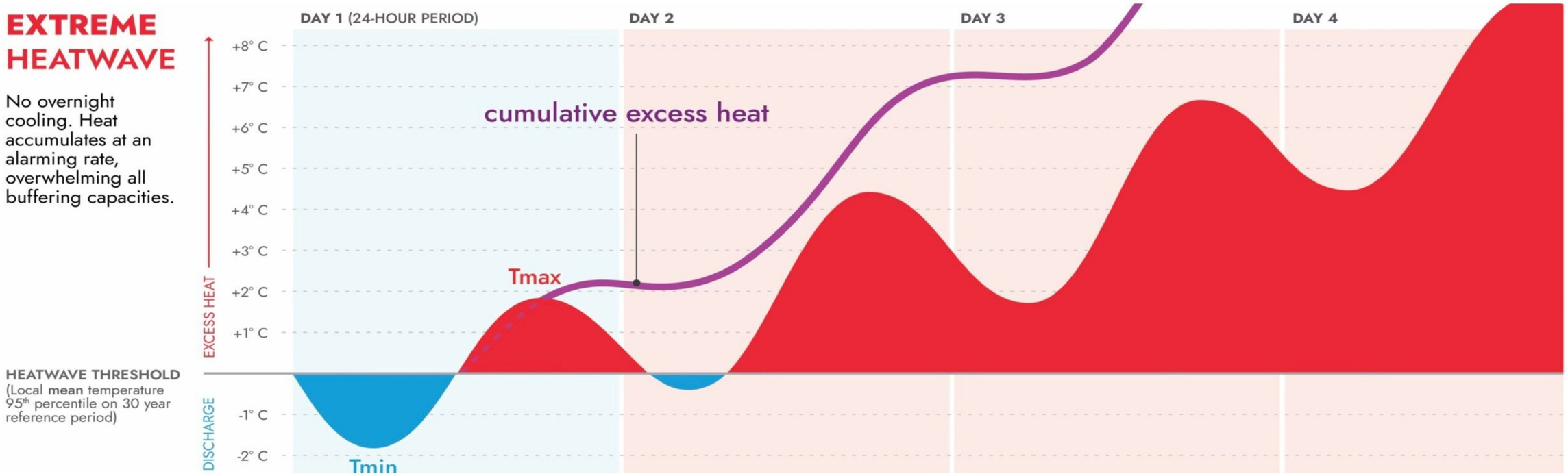


Credit: John Nairn, Global Heat Health Information Network
Design: Atalie Pestalozzi, ISET-International

Hot Days vs Heatwaves

Heatwaves (High-intensity and Extreme Heat):

- When the gap between daytime peaks and nighttime lows continues to shrink, the heatwave enters a high-intensity phase.
- The daily temperature cycle may stay entirely above the local threshold.
- There is no relief; the environment is in a constant state of heat gain. As less frequent, more intense or severe heatwaves develop

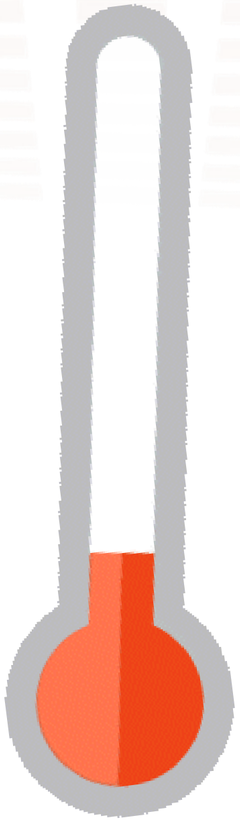


Credit: John Nairn, Global Heat Health Information Network
Design: Atalie Pestalozzi, ISET–International

Warm Night

A warm night is declared only when the maximum temperature remains 40°C or more.
It is defined based on departures of actual minimum temperatures as follows:
Warm night: minimum temperature departure is 4.5°C to 6.4°C
Very warm night: minimum temperature departure is >6.4°C

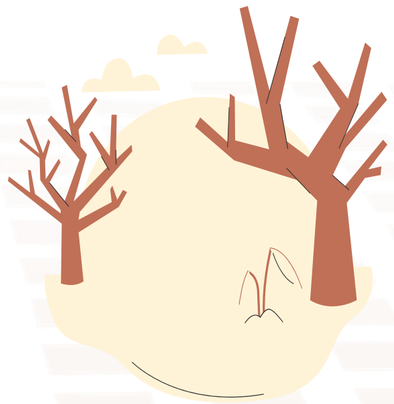
(India Meteorological Department)



Global Heat-event Definition and Type of Threshold

Heatwaves and Health: Guidance on Warning-System Development
WMO-No. 1142

T	temperature	*HI*	Heat Index
AT or Tapp	apparent temperature	*PT*	perceived temperature
Tmax	maximum temperature	*ET*	equivalent temperature
Tmin	minimum temperature	*ITU*	Temperature Humidity Index
Tmean	mean temperature		



Country	*Threshold*	*Thresholds based on historical mortality*	*Excess mortality forecast*	*Duration of heat event included*	*Seasonality or adaptation included*	*Regionally variable thresholds*	*Human expertise*
Australia (Queensland)	*AT*			2 days		✓	✓
Belarus	*T*						
Belgium	*Tmax/Tmin*/Ozone			3 days			
Canada (Toronto region)	Airmass	✓	✓	✓	✓	✓	✓
Canada (Montreal)	*Tmax/Tmin*			✓			
Canada (all others)	*Humidex*			✓			
China (Hong Kong)	*NET*						
China (Shanghai)	Airmass	✓	✓	✓	✓		✓
France	*Tmax/Tmin*	✓		3 days		✓	✓
Germany	*PT*			2 days	✓	✓	✓
Greece	*Tmax*			✓			
Hungary (Budapest only)	*Tmean*	✓					
Italy	Airmass/*Tapp*	✓	✓	✓	✓	✓	
Republic of Korea	Airmass	✓	✓	✓	✓	✓	✓
Republic of Korea (Seoul*)	Airmass	✓	✓	✓	✓	✓	✓
Latvia	*Tmax*			✓			
Netherlands	*Tmax*			✓			
Poland	*Tmax/Tmin*						
Portugal	*Tmax*	✓	✓	✓		✓	✓
Romania	*ITU*						
Slovenia	Forecaster						✓
Spain	*Tmax/Tmin*	✓				✓	✓
Switzerland	*HI*						
United Kingdom (England and Wales)	*Tmax/Tmin*			✓		✓	
USA (synoptic**)	Airmass	✓	✓	✓	✓	✓	✓
USA (all others)	*HI*			2 days		✓	✓

Supported by:

Partnership | Progress | Prosperity

REGIONAL WORKSHOP ON IMPACT-BASED FORECASTING

Training-of-Trainers and National Demonstration Planning for Temperature-Related Hazards

Heatwave Thresholds in Bangladesh: A Statistical Review

BMD Current Heatwave Definition

⚖ National Thresholds

Mild: 36°C – 37.9°C

Moderate: 38°C – 39.9°C

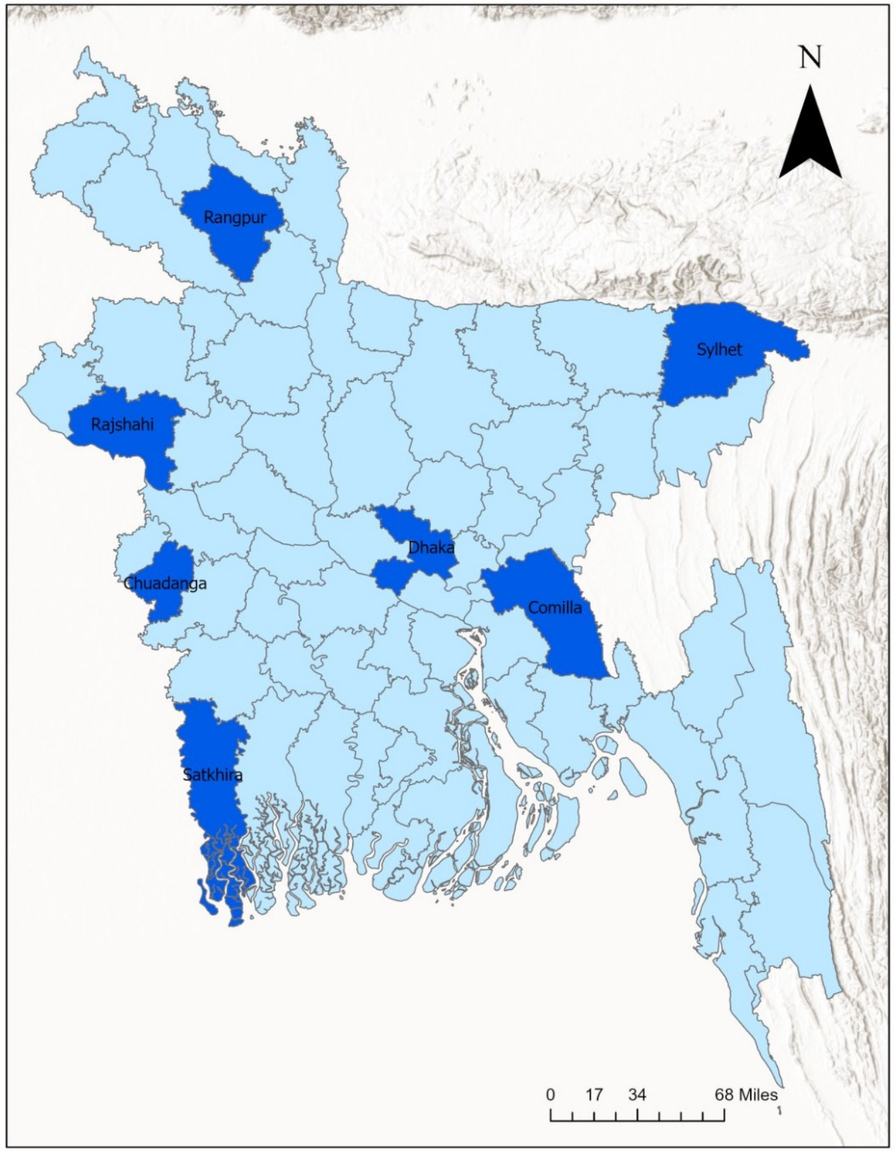
Severe: 40°C – 41.9°C

Very Severe: > 42°C

*Two consecutive days

Study Area: BMD Threshold Analysis

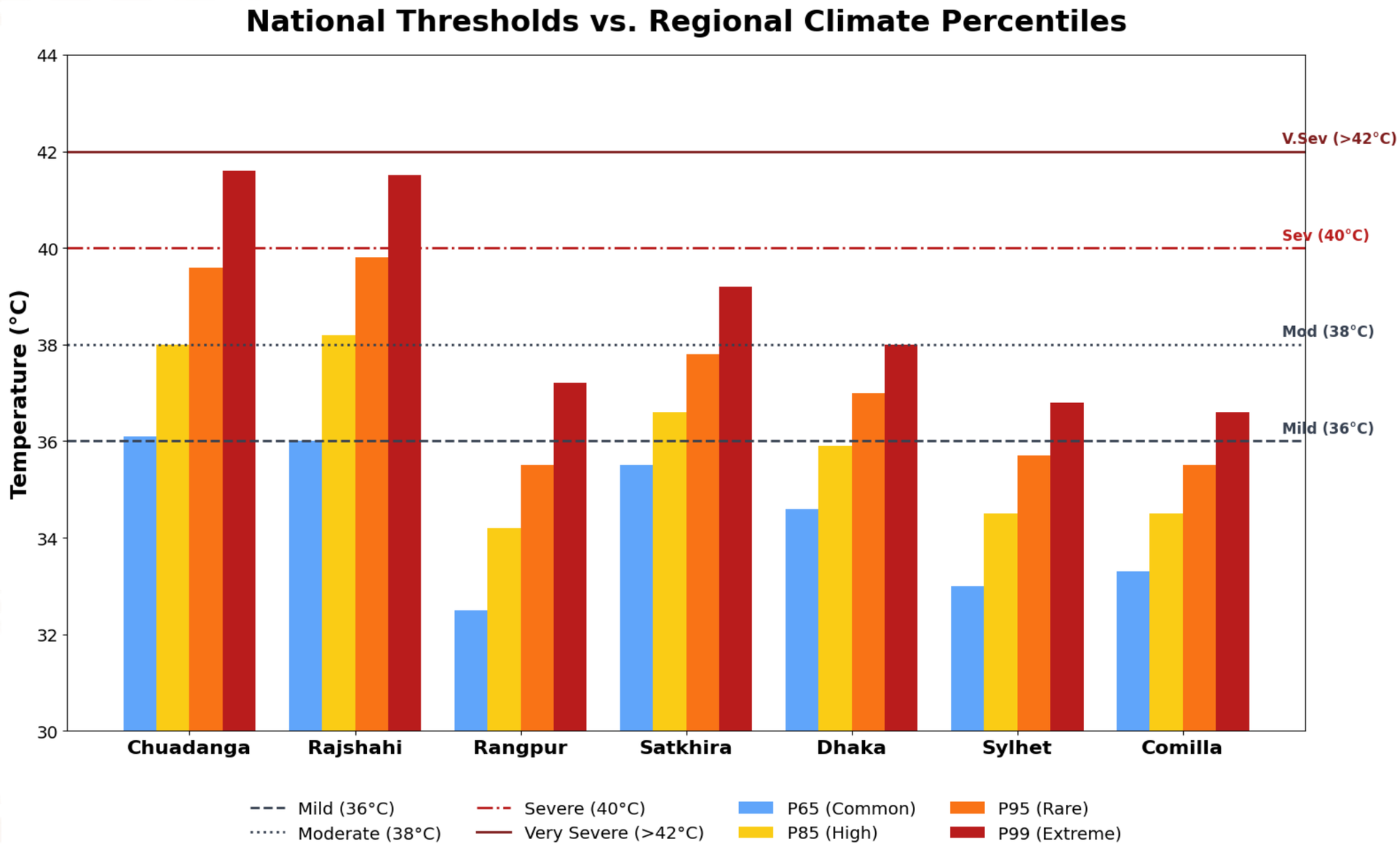
BMD Stations on Three Distinct Region		
Western Stations	**Central Station**	**Eastern Stations**
Rangpur	Dhaka	Sylhet
Rajshahi		Comilla
Chuadanga		
Satkhira		



Station-wise Tmax Climatology (1992-2021)

Station	Tmax (°C) (Max)	Tmax (°C) (Mean)	P65 (°C)	P85 (°C)	P95 (°C)	P99 (°C)	Rounded (mild to v.severe)
Rangpur	39.7	31.32	32.5	34.2	35.5	37.2	33/34/36/37
Rajshahi	43.3	34.73	36.0	38.2	39.8	41.5	36/38/40/42
Chuadanga	43.5	34.96	36.1	38.0	39.6	41.6	36/38/40/42
Satkhira	43.4	34.33	35.5	36.6	37.8	39.2	36/37/38/39
Dhaka	40.2	33.41	34.6	35.9	37.0	38.0	35/36/37/38
Sylhet	39.2	31.52	33.0	34.5	35.7	36.8	33/35/36/37
Comilla	39.2	32.24	33.3	34.5	35.5	36.6	33/35/36/37

Station-wise Rounded Percentile Thresholds vs BMD



Zone 1: Western Hotspot Region

Chuadanga & Rajshahi

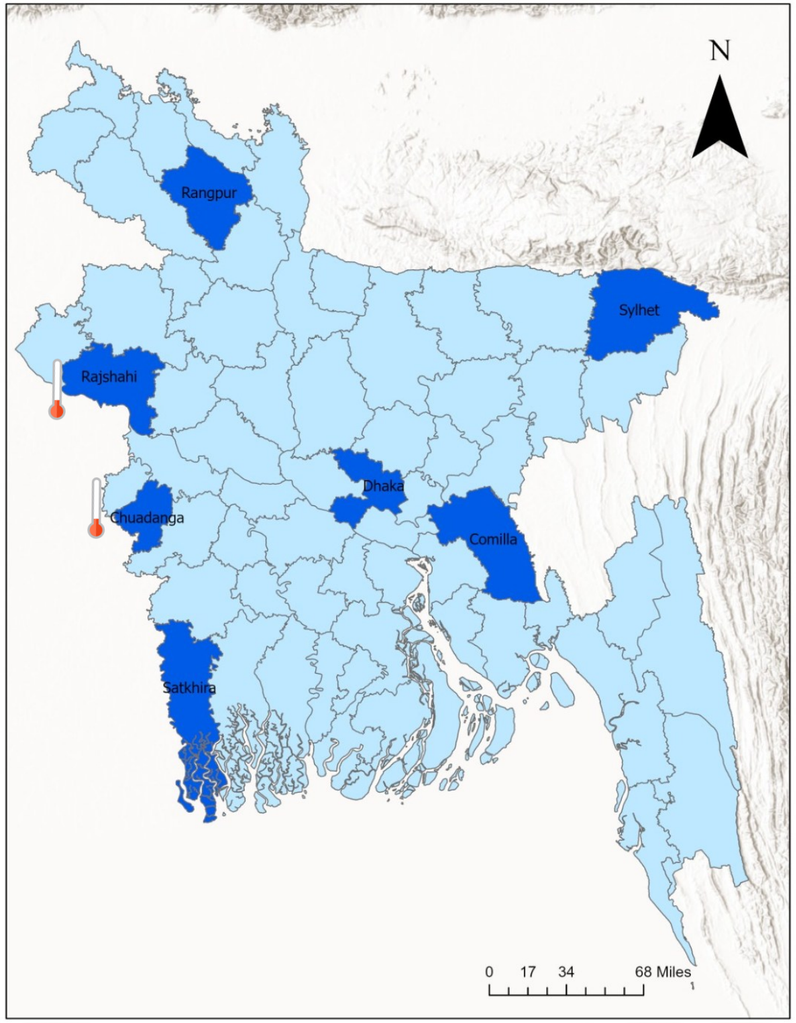
These regions historically record the highest temperatures in the country.

Findings: National thresholds align well here.

99th Percentile: Approx. **42°C** (Matches "Very Severe").

36°C Context: Represents the top 35% of summer days. It is a common hot day, not an outlier.

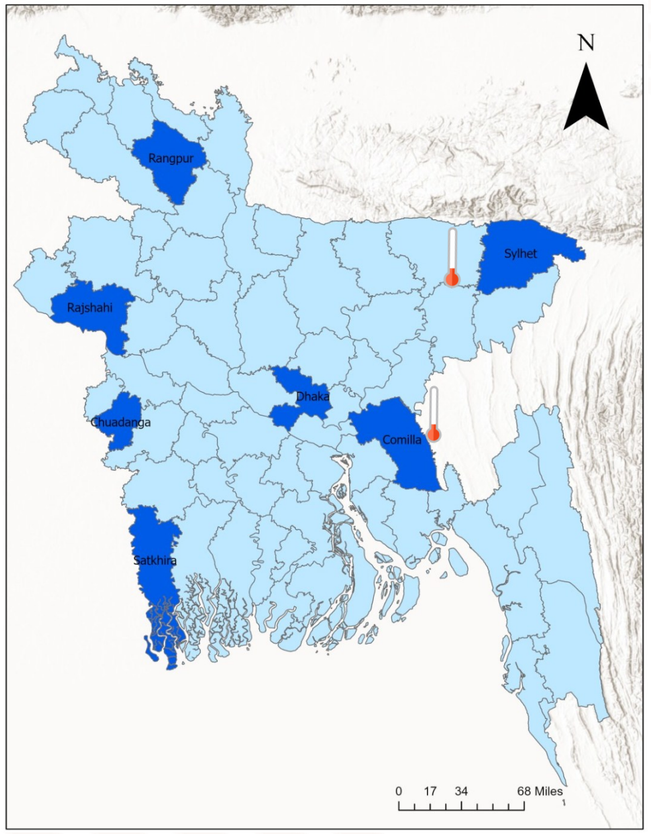
Conclusion: The current system was likely designed based on this specific climate zone.



Zone 2: The Cooler Region

Station/ Region	95th Percentile (Extreme)	99th Percentile (Record)	Current BMD "Mild" Threshold	Assessment
Sylhet	~ 36.0°C	~ 37.0°C	36.0°C	Threshold Too High
Comilla	~ 35.0°C	~ 37.0°C	36.0°C	Threshold Too High
Rangpur	~ 35.5°C	~ 37.5°C	36.0°C	Threshold Too High
Rajshahi (Reference)	~ 40.0°C	~ 42.0°C	36.0°C	Aligned

In humid, northeastern districts (Sylhet, Comilla), the distribution of maximum temperatures is notably lower.



Zone 3: Urban & Coastal

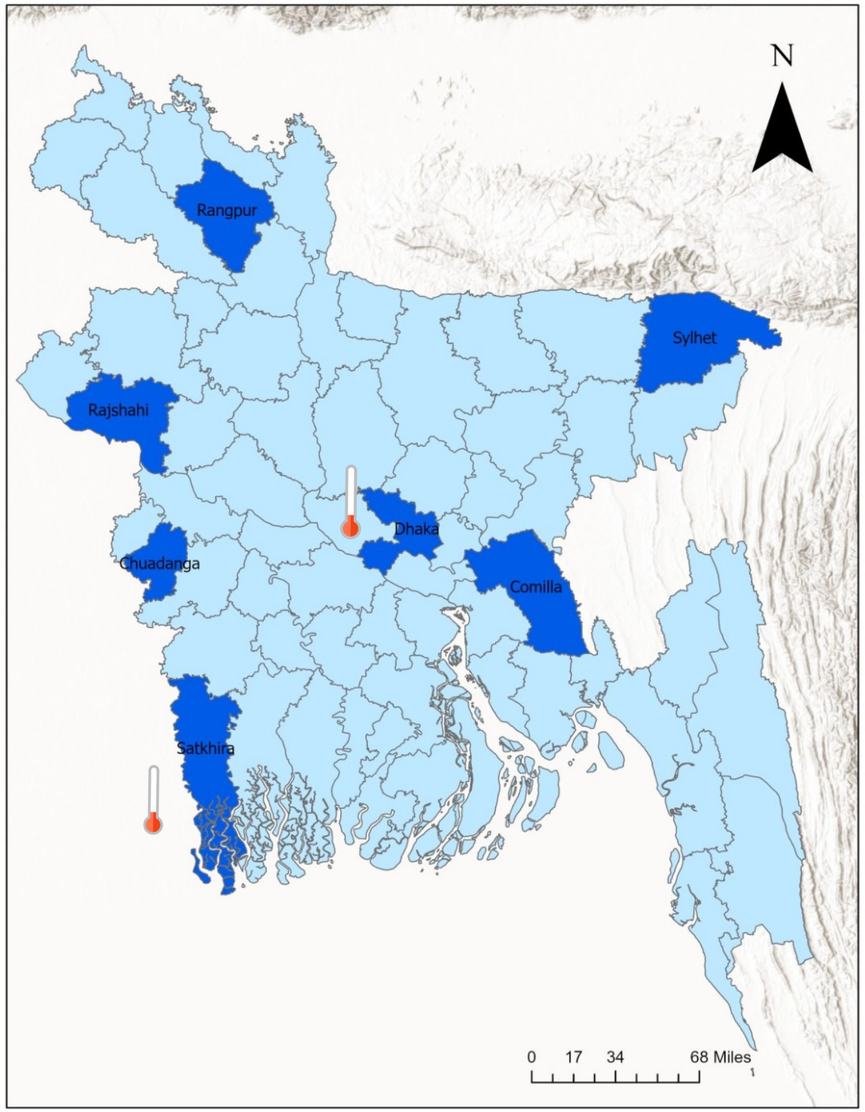
Dhaka (Urban Heat Island)

Dhaka's historical 99th percentile is **~38°C**. While 38°C is a record-breaking event for the capital, it is classified only as "Moderate" by national standards.

Satkhira (Coastal)

Moderated by the Bay of Bengal, a temperature of **38°C** represents the 99th percentile (Extreme).

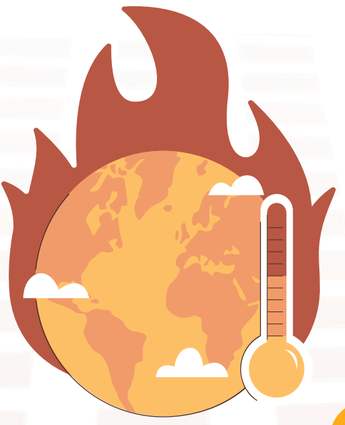
Key Takeaway:
Residents in these areas experience "Extreme Heat" at temperatures significantly lower than the national "Severe" threshold of 40°C.



Contrast Between Local Extreme" (95th Percentile) vs. National "Mild" Threshold (36°C)

The **Black Line** represents the National Threshold (36°C). Bars represent the local 95th Percentile (Dangerous Heat).

Note: **How Sylhet and Comilla experience dangerous heat *before* reaching the national line.**



Risks in Current Forecasting

False Negatives

A forecast of **35°C in Comilla** triggers no warning, despite being a near-record event. This results in gaps in disaster preparedness.

Desensitization

In Chuadanga, temperatures >36°C are routine. Frequent "Mild Heatwave" warnings may cause the public to ignore them over time.

Impact Gap

Modern meteorology prioritizes **Impact-Based Forecasting**. The current system fails to capture the human impact of a 35°C day in a cooler region.

Significance of Findings & Observations

General Public

Heat Is Relative: Extreme heat does not mean the same temperature everywhere. What feels normal in one region can be dangerous in another.

Why It Matters: Heat warnings and safety actions should depend on local conditions, not just temperature numbers.

Agriculture and Livestock

Region-Specific Heat Stress: Crops and livestock are adapted to local climates (for e.g., irrigation timing, crop protection, and livestock shading or cooling). In cooler regions, heat stress can begin at lower temperatures (e.g., 35 °C in Sylhet) than in hotter regions (e.g., 38 °C in Rajshahi), even though the absolute temperature is lower.

Energy and Infrastructure

Local Demand Surges: Electricity use can rise sharply at different temperatures in different regions. In cooler districts, even 35 °C can trigger high demand for fans, cooling, and irrigation, putting stress on the power grid without any national heatwave alert.

Disaster Management and Urban Planning:

Region-Specific Heat Risk: Heat danger depends on local conditions, not just temperature. In cities like Dhaka, high humidity and the urban heat island effect make 35–38 °C extremely hazardous, even if temperatures do not reach 40 °C.

Significance of Findings & Observations

Heat Inertia

Recovery/Reset Time Matters: Even after temperatures drop, people need time to recover from heat stress. Public health systems should continue monitoring, medical support, and community care for several days after a heatwave event, because health impacts do not end immediately when a heatwave is over.

Sectoral Implications

Under-Detection Forecast

When forecasts rely only on fixed national temperature thresholds, extreme heat in cooler regions can go unrecognized. For example, a 35 °C forecast in Comilla, may not trigger a heatwave warning, even though such temperatures are near-record and locally dangerous.

Forecast Verification and Public Trust

When communities in cooler regions (e.g., Sylhet) experience severe heat impacts at 35 °C without any official warning, people may feel that the meteorological service failed to alert them, even though national heatwave criteria were technically not met. This can undermine public trust in forecasts.

Resource Allocation and Response

Relying on uniform thresholds for heatwave forecasting may misdirect attention. The current system tends to focus warnings on established “hotspots” in the west and southwest, which do require vigilance. However, emerging or less obvious heatwave areas might be overlooked.

Public Health

Acclimatization: Populations in cooler districts suffer heat stress at lower temperatures (34-35°C) because they are not adapted to 40°C.

Hidden Risk: Lack of warnings at 35°C in Sylhet can lead to unpreparedness for heat stroke and dehydration.

Agriculture

Crop Stress: Crops and livestock in different regions are adapted to local normals.

Livestock Impact: Cattle in Sylhet may suffer heat stress at significantly lower temperatures than those bred in the hotter western plains.

Sectoral Implications

Response-Specific Thresholds Determination

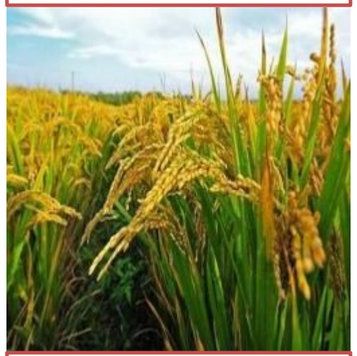
Negative Human Response (Mortality & Morbidity): All synoptic-based systems in the USA are based on 24 years of mortality data, the French system is based on 33 years of mortality data to quantify a “baseline” or normal daily value. From this baseline, daily “anomalous mortality” can be calculated and correlated with weather conditions.

Trigger: The threshold is exceeded in situations where at least one excess death is predicted (e.g., in Toronto, the threshold is when an excess death is at least 65 per cent likely).

Key Takeaways: Countries like India & Pakistan can utilize Negative Human Response based threshold whereas countries like Bangladesh can adhere to single-parameter (Tmax) based threshold.

Sectoral Implications

Sector-Specific Thresholds

Crop: Rice (Aus/Aman/Boro)	Crop: Maize	Crop: Mustard	Crop: Wheat
			
Ideal for growth Day Temp: 20°C - 36°C & Night Temp: 20°C -23°C	**Fertilization Hampered** If Flowering period : Max Temp: 35°C<	**Optimum** Min Temp: 25°C Max Temp: 35°C	**Detrimental Effect** Max Temp: 30-35°C

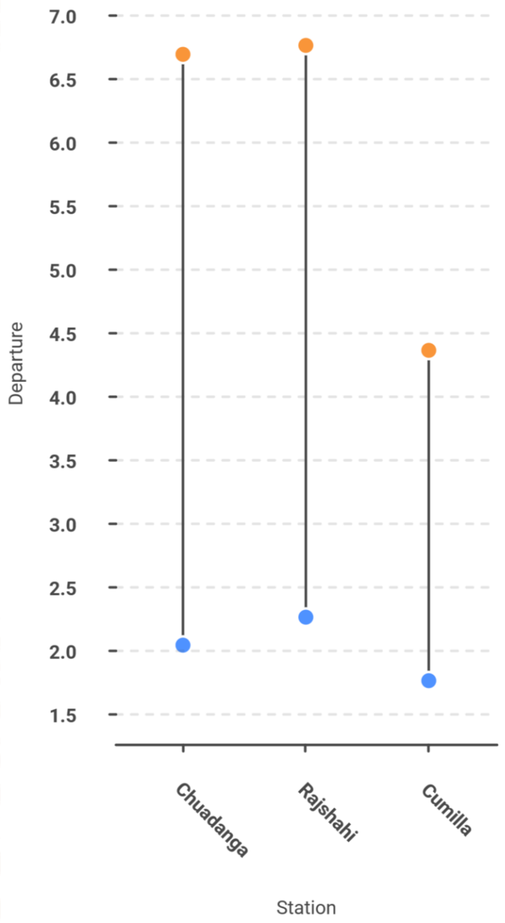
Thoughts & Recommendation

1. Region-Specific Thresholds using Daily Maximum Temperature

- BMD could define a heatwave in cooler regions at a slightly lower absolute threshold (say, 34 °C or 35 °C for mild category in places where that is extraordinary), or use a percentile-based threshold. This ensures the definition of a heatwave reflects unusual heat relative to each location's climatology.
- BMD should transition to criteria that reflect local climatology for Plains, Hills & Coastal region. We recommend adopting **Percentile-Based Thresholds**.
  - **Proposed Rule:** Issue warning if Temp > 90th or 95th Percentile for 2 consecutive days.
  - **Result:** 34°C triggers alert in Sylhet; 38°C in Rajshahi.

2. Thresholds based on Departure from Normal

- BMD should transition to criteria that reflect departure from local climatology.
  - **Proposed Rule:** Issue warning if Temp. Departure attains certain values for 2 consecutive days.



Points to Ponder

SOUTH ASIA HYDROMET FORUM

Regional Integrated Multi-Hazard Early Warning System
RIMES

WISER
Weather and Climate Information Services

Supported by:
UK International Development
Partnership | Progress | Prosperity

Met Office

REGIONAL WORKSHOP ON IMPACT-BASED FORECASTING

Training-of-Trainers and National Demonstration Planning for Temperature-Related Hazards

THANK YOU!