SOUTH ASIA HYDROMET FORUM

RIMES

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Weather and Climate Information Services

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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

Supported by:

REGIONAL WORKSHOP ON IMPACT-BASED FORECASTING

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

Impact-Based Forecasting for Temperature Extremes in Bhutan/ National Centre for Hydrology and Meteorology

Pema Syldon

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1. National Demonstration Plan Overview

A1. Proponent Information	• NMHS (Lead): National Centre for Hydrology and Meteorology • Sector Agencies: - Department of Public Health Ministry of Health, - Department of Agriculture and Department of Livestock Ministry of Agriculture and Livestock, - Department of Human Settlement Ministry of Infrastructure and Transport, - Khesar Gyalpo University of Medical Sciences of Bhutan, - Department of Local Governance and Disaster Management, Ministry of Home and Cultural Affairs, - Thromde/Municipal Offices - Schools and National Service Academies
A2. Focal Contacts	• NMHS Lead Focal (overall): Ms. Pema Syldon, Senior HydroMet Officer, psyldon@nchm.gov.bt, +975 1737 6662 • Sector Co-Lead: Ms Sonam Yangchen, syangchen@health.gov.b, +975 17966900
A3. Demonstration Project Title	: Impact- Based Forecasting for Temperature Extremes in Bhutan
A4. Geographic Scope	Covering the whole country with the 20 districts.
A5. Seasonal Focus	o Heat o Cold o Both
A6. Duration of Demonstration	Start- End (05/2026- 04/2027) Heat-focused demos: May- August 2026 (implementation); Sep-Oct 2026 (review) Cold-focused demos: Dec-Feb 2027 (implementation); Mar- April 2027 (review)

2. Temperature Risk Context and Intended Outcomes

Key temperature-related risks in pilot area (who is affected, when, where, how)

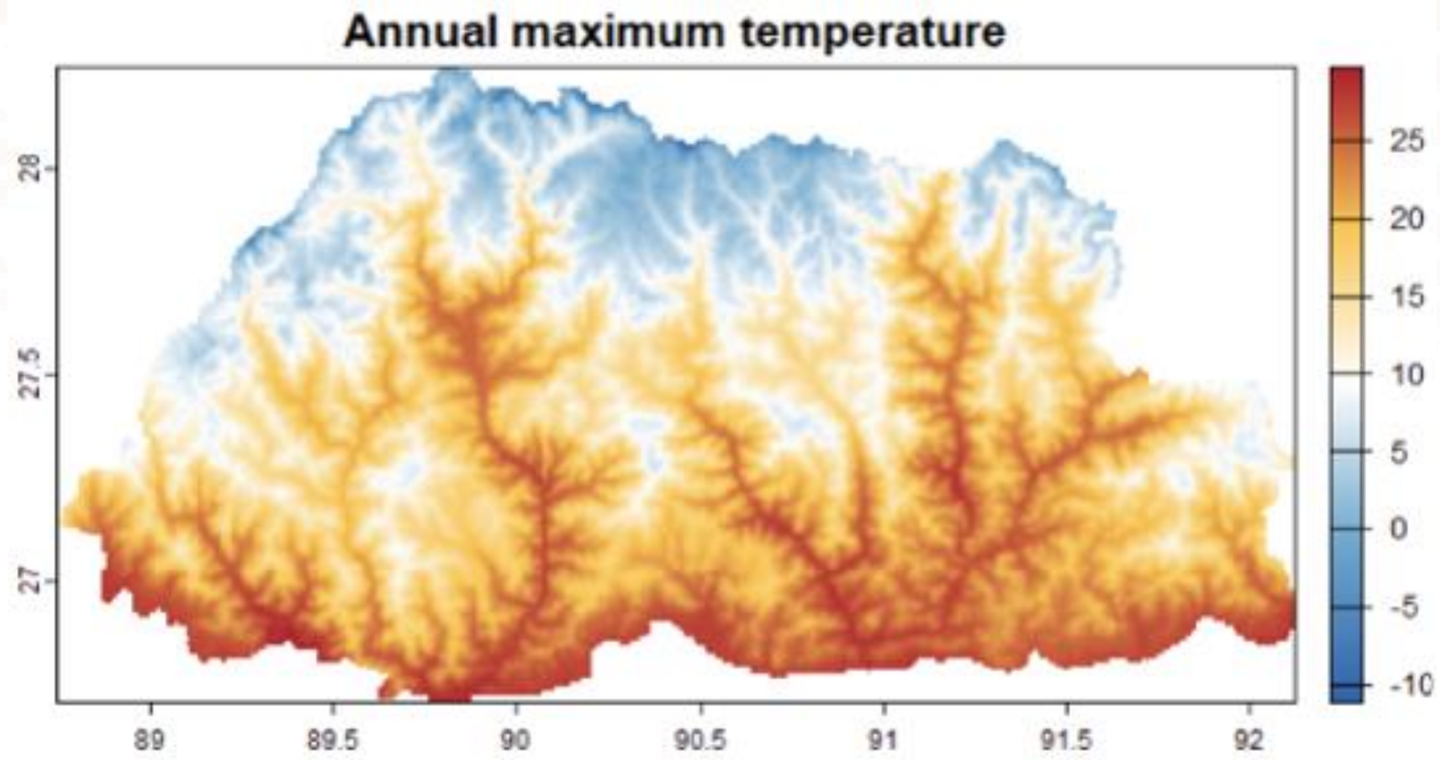
- Heat related risks are becoming significant mostly across the southern parts of Bhutan with more frequent warm spells.
- Cases of mortality are not recorded. However, cases of dehydration and heat exhaustion have been on the rise.
- Cold spells during the winter seasons impact the households in the northern and higher altitude areas

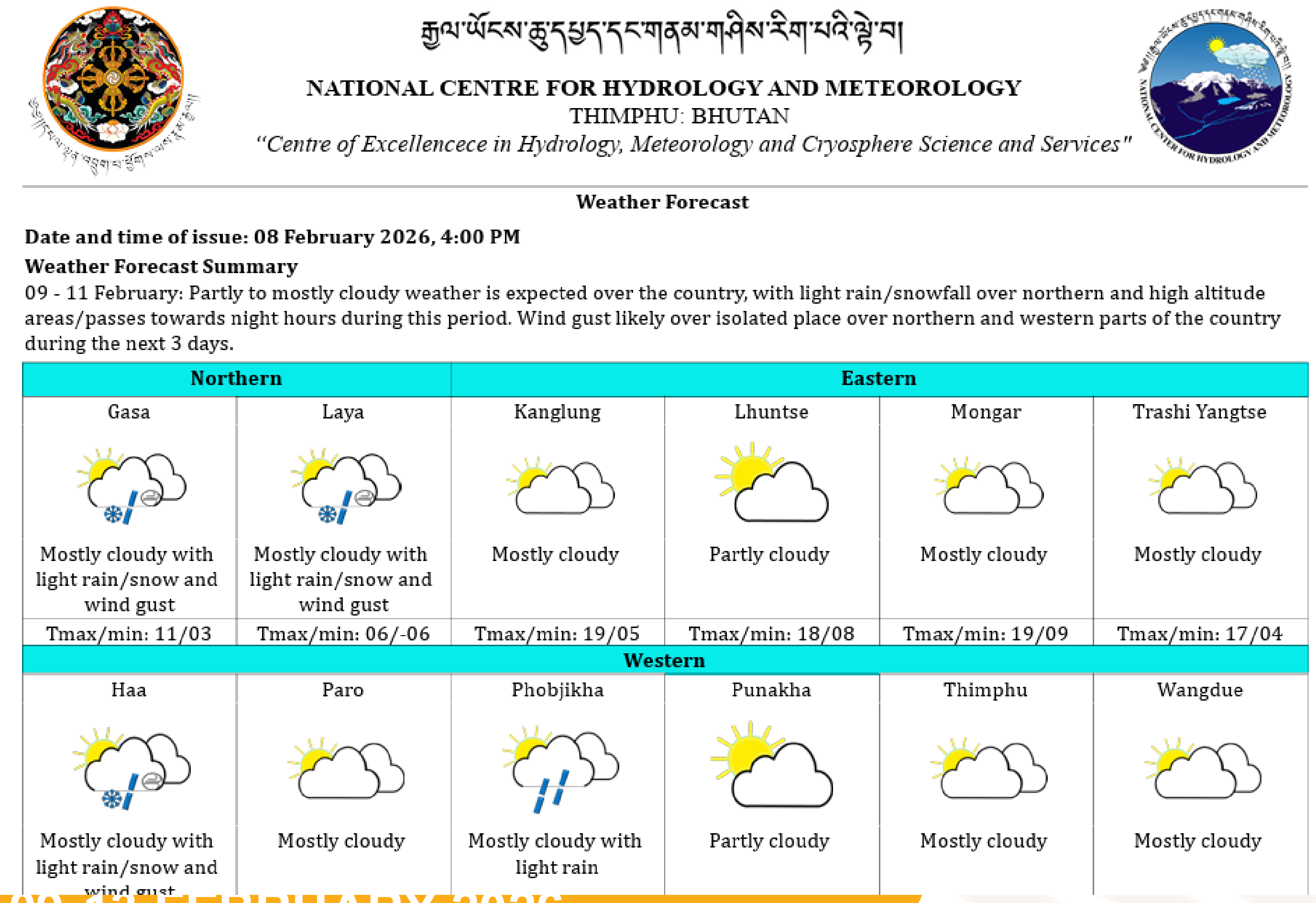
Main gaps in current advisories / decision-making

- Current advisories provide general weather information but lack localized, impact- based guidance for different sectors.
- Implementing temperature- based IBF would help translation of general weather outlook into impact-based sector specific advisories which would reduce risk and improve preparedness.

Intended outcomes of the demonstration

1. Temperature related advisories and warnings are issued
2. Public and sectors at risk are informed on the impact and what action to take
3. Reduced temperature related impacts





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NATIONAL CENTRE FOR HYDROLOGY AND METEOROLOGY

THIMPHU: BHUTAN

"Centre of Excellencece in Hydrology, Meteorology and Cryosphere Science and Services"

Weather Forecast

Date and time of issue: 08 February 2026, 4:00 PM

Weather Forecast Summary

09 - 11 February: Partly to mostly cloudy weather is expected over the country, with light rain/snowfall over northern and high altitude areas/passes towards night hours during this period. Wind gust likely over isolated place over northern and western parts of the country during the next 3 days.

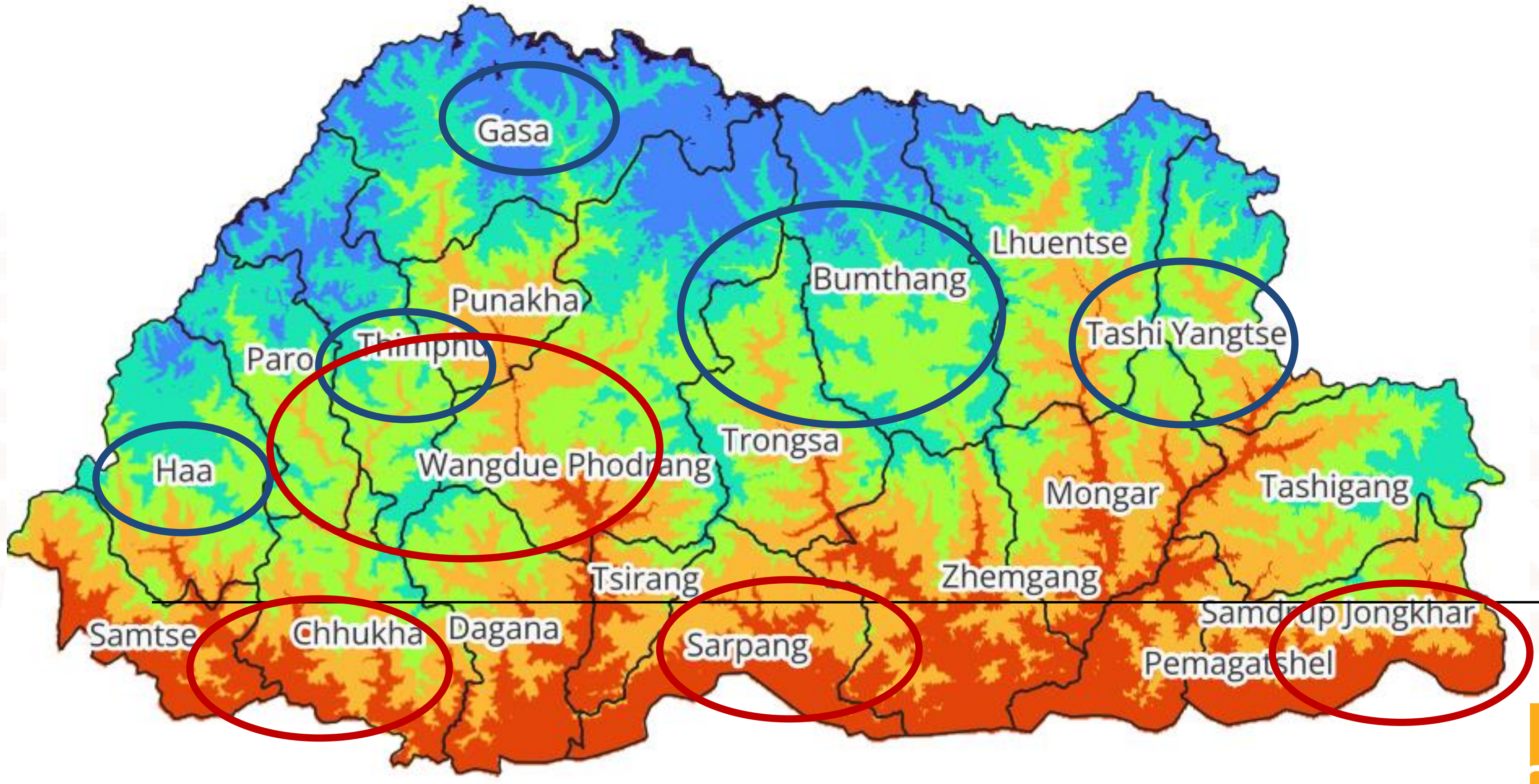
Northern		Eastern			
Gasa	Laya	Kanglung	Lhuntse	Mongar	Trashi Yangtse
Mostly cloudy with light rain/snow and wind gust	Mostly cloudy with light rain/snow and wind gust	Mostly cloudy	Partly cloudy	Mostly cloudy	Mostly cloudy
Tmax/min: 11/03	Tmax/min: 06/-06	Tmax/min: 19/05	Tmax/min: 18/08	Tmax/min: 19/09	Tmax/min: 17/04
Western					
Haa	Paro	Phobjikha	Punakha	Thimphu	Wangdue
Mostly cloudy with light rain/snow and	Mostly cloudy	Mostly cloudy with light rain	Partly cloudy	Mostly cloudy	Mostly cloudy

3. Stakeholders, Roles, and Coordination Approach

Phase	Key Coordination Activities	Lead & Partners
Before the Target Season	- Pre- season coordination meetings to agree on thresholds, products, and early actions - Identify sector focal points and communication channels - Draft temperature- specific SOP (starting with NCHM- stakeholders)	NCHM, DoPH, DoA, DoL, DHS, KGUMSB, DLDGM, Thromde/Municipal Offices
During the Target Season	- Regular forecast briefings and consensus discussions at NCHM - Issuance of Remark / Advisory / Warning based on severity - Sector agencies interpret advisories and implement agreed early actions - Dissemination through NCHM platforms, Media, and local government networks	NCHM, DoPH, DoA, DoL, DHS, KGUMSB, DLDGM, Thromde/Municipal Offices Media, CSOs, Academy
After the Target Season	- Joint review meetings to assess product usefulness and actions taken - Document lessons learned and user feedback - Refine thresholds, products, and early actions	NCHM, DoPH, DoA, DoL, DHS, KGUMSB, DLDGM, Thromde/Municipal Offices

4. Pilot Areas and Target Groups

Pilot locations	Sector / Target Group	Key Impacts of Concern
Heatwave: Thimphu, Paro, Wangdue, Gelephu, Phuntsholing, Samdrup Jongkhar **Cold wave:** Gasa, Haa, Thimphu, Bumthang, Trongsa, Tashiyangtse	Health (Patients, Hospitals, DoPH)	Heat exhaustion, dehydration, heat stroke; hypothermia and respiratory illnesses; increased hospital visits
	Outdoor Workers (Construction, Field Workers)	Heat stress, fatigue, dehydration; cold stress, reduced mobility, safety risks; productivity loss and accident risk
	Students (Schools, Academy)	Heat illness during outdoor activities; cold-related illness; reduced learning comfort
	Farmers (Agriculture)	Crop heat stress and water demand; frost damage to crops; livestock heat and cold stress; farmer fatigue



5. Data, Indices, Triggers and Thresholds

Key data inputs currently available	Current Progress	Challenges and gaps
30 years climate data/NCHM	- 30 years climate data compilation has been completed in January 2026 - Tmax and Tmin climatological can be revised with the 30 years data.	- Heat and cold impact data archival is limited
Exposure or vulnerability data, sector-specific information	- Building footprint/ DHS: acquired - Urban centers and town/ DHS; acquired - Education centers and schools/ NLCS; acquired - Health centers/ NLSC: acquired - Villages and major villages; NLCS; acquired - Land use land cover data/NLCS: acquired	- Discussion on heat and cold related reports at hospitals, schools/ DoPH - Discussion on compilation of crop damage and livestock due to heat and cold/ DoA - Population distribution and density, health and demographic indicators, socio-economic data are requested from NSB - GEDSI data inclusion

5. Data, Indices, Triggers and Thresholds

Indices or indicators currently used and being considered

- Daily maximum temperature (Tmax)- based climatic thresholds, derived using a percentile method, currently used for heatwave monitoring since last year 2025 on experiment
- Operationalize from 2026 summer
- Planned extension of thresholds to cold spells, particularly using minimum temperature (Tmin) and persistence of cold conditions
- Exploration of multi- variable indices (e.g., heat index, apparent temperature, wind chill) to better reflect human and sectoral impacts
- Development of sector- specific thresholds for health, agriculture, outdoor workers, and schools
- Consideration of regionalized thresholds to account for altitude, terrain complexity, and urban- rural differences

Dzongkhags/ regions	95 percentile	Whenever the maximum temperature remains in the T95 (95 percentile) or more and minimum remains 5°C or more above normal For region– half or more than stations	Departure of maximum temperature from normal is + 5°C or more for the region, and above the T95 for 2 consecutive days For region– half or more than stations	Departure of maximum temperature from normal is + 6°C or more for the region, and above the T95 for 2 consecutive days For region– half or more than stations
Gasa	23	Mountain region: 26 deg C	Mountain region: 26 deg C	Mountain region: 26 deg C
Haa	22.5			
Paro	27			
Thimphu	29.5			
Bumthang	24			
Trongsa	28			
Dagana	27			
Tsirang	25.5			
Trashi Yangtse	28			
Mongar	30			
Zhemgang	26			
Lhuentse	34.5	Plain region: 32 deg C	Plain region: 32 deg C	Plain region: 32 deg C
Wangdue Phodrang	32			
Punakha	34			
Samtse	32			
Phuntsholing	35			
Gelephu	33			
Tashigang	29			
Pema Gatshel	28			
Samdrup Kongkhar	31			

These steps reflect our transition from hazard-based temperature monitoring toward operational, impact-based forecasting

5. Data, Indices, Triggers and Thresholds

Operational Limitations and Uncertainties

- Thresholds rely mainly on daily maximum temperature, with limited consideration of humidity, night- time stress, wind, and cold- wave persistence
- Cold- wave thresholds are not yet developed,
- Limited impact data (health, agriculture, productivity) constrains development of robust impact- based triggers
- Complex terrain, urban effects, and local forecast uncertainty affect the reliability of national- scale thresholds
- Only two people to working for weather forecasting

Technical and Institutional Assistance Needed

- Support to develop multi- variable, sector- specific heat and cold thresholds, including indices suitable for high- altitude and urban areas
- Assistance with downscaling and bias -correction to address complex mountainous terrain and local variability
- Facilitation of technical workshops, training, and inter- agency coordination to operationalize thresholds

6. From Forecast to Action: Products, Communication & SOPs

Aspect	FORECAST	IBF PRODUCT	EARLY ACTION	ACTOR
1. Core IBF Flow	Temperature forecasts (model + observations); threshold monitoring; consensus forecasting	Impact-based Remark / Advisory / Warning; impact maps; forecast briefings	Preparedness and protective actions triggered by severity	NCHM, DoPH, DoA, DoL, DHS, KGUMSB, DLDGM, Thromde/Municipal Offices, Media, Schools/Academies
2. Products and Intended Users	Severity and confidence assessment	Public advisories; sector bulletins; localized impact visuals	Users interpret guidance and prepare accordingly	
3. Actions and Response Assumptions	Lead time varies by location and event	Clear, simple, sector-relevant messaging	Responses depend on capacity, awareness, and local context; some uncertainty	
4. SOPs / EAP Linkages	Thresholds inform activation levels	Products aligned with roles and responsibilities	Trigger-based actions tested and refined during pilot	

7. Assistance, Guidance, and Support Required

Discussion Questions

- How can we transition from percentile-based thresholds to impact-oriented, sector-specific thresholds with **limited impact data?**
- How to include **limited exposure, vulnerability data, sector-specific** information/ impact tables- operational example, methodology
- What are effective approaches for defining **cold-wave thresholds in high-altitude and valley regions**? methodology
- How to develop **multi- variable**, sector- specific heat and cold thresholds, including indices suitable for high- altitude and urban areas

Areas Where Expert Input Is Most Valuable

- Refinement of temperature indices, thresholds, and triggers (heat and cold)
- Design of sector- specific early actions and impact- based communication products
- Strengthening coordination mechanisms and user engagement processes

7. Assistance, Guidance, and Support Required

Targeted Support from RIMES / UK Met Office

- Technical guidance/methodology on threshold development, validation, and product design
- **Financial support** for stakeholder consultation and workshops at home country
- Support for evaluation, documentation, and scale- up planning

Immediate Next Steps

- **Refine** temperature thresholds for heat and development for cold- from the knowledge from this workshop
- Initiate **IBF capacity workshop for sector consultations** for integrating sector information in refining the thresholds, at home country- require financial support (at least 2-3 workshops; capacity building, integration of information, threshold development)

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THANK YOU!