



# Heat Wave and Its Potential Impact

*“Strengthening Disaster Communication through media and Information Sharing On Heat Wave”*

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*Department of Hydrology and Meteorology (DHM)*

*5<sup>th</sup> April, 2024, Alpha House, New Baneshwor*



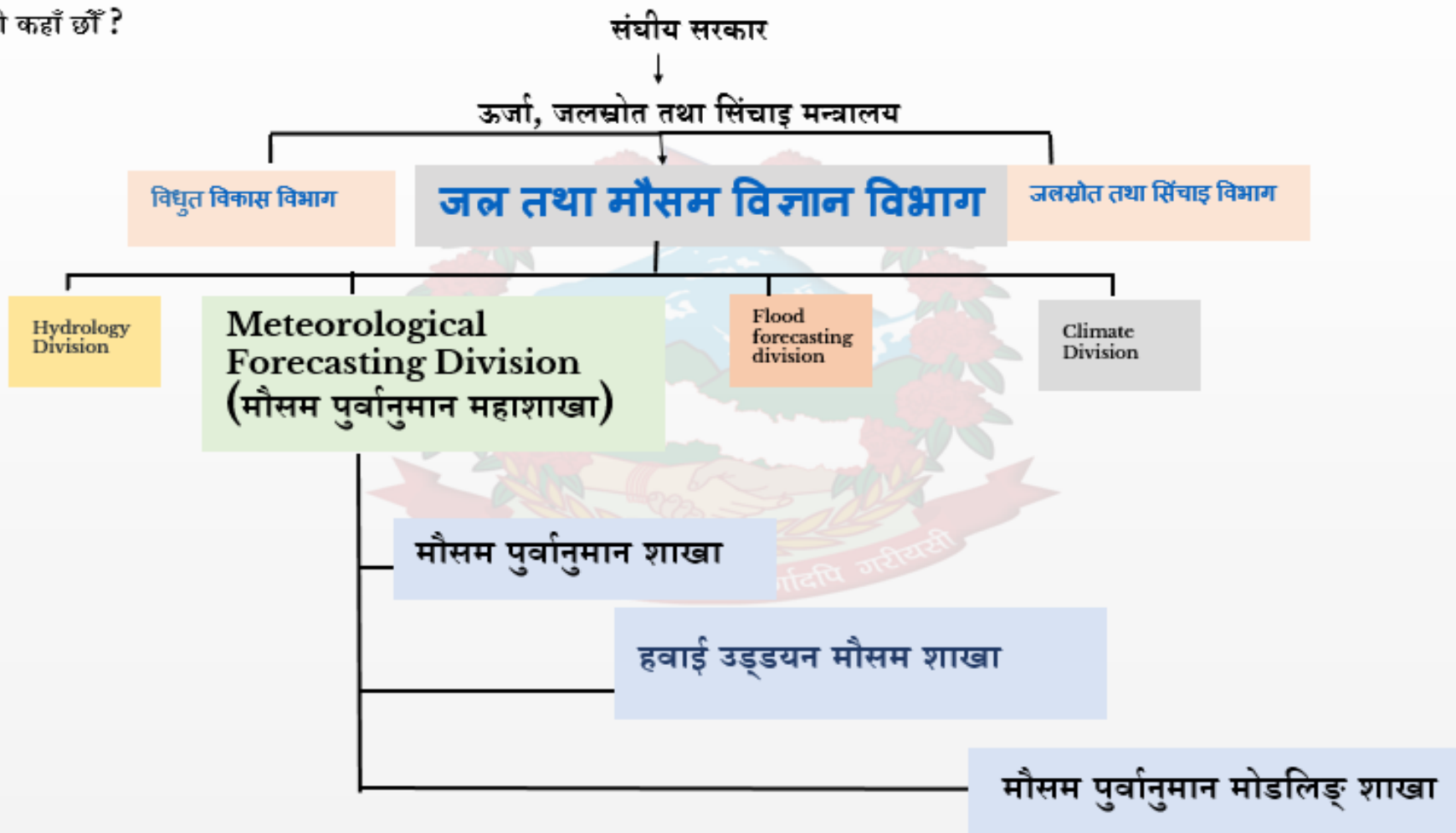
# Outlines:

- Introduction
- Services
- Heat Wave
- Impacts



# Introduction: DHM

हामी कहाँ छौं ?





**Government of Nepal**  
**Ministry of Energy, Water Resources and Irrigation**  
**Department of Hydrology and Meteorology**  
**Meteorological Forecasting Division**

**General weather forecasting section**

**Aviation Meteorological Section**

**Weather forecast Modeling section**

**Instrument calibration and  
maintenance section**

- ✓ **3 sections from TIA and 1 from Babarmahal, head office**





# DHM

## **Fundamental goal:**

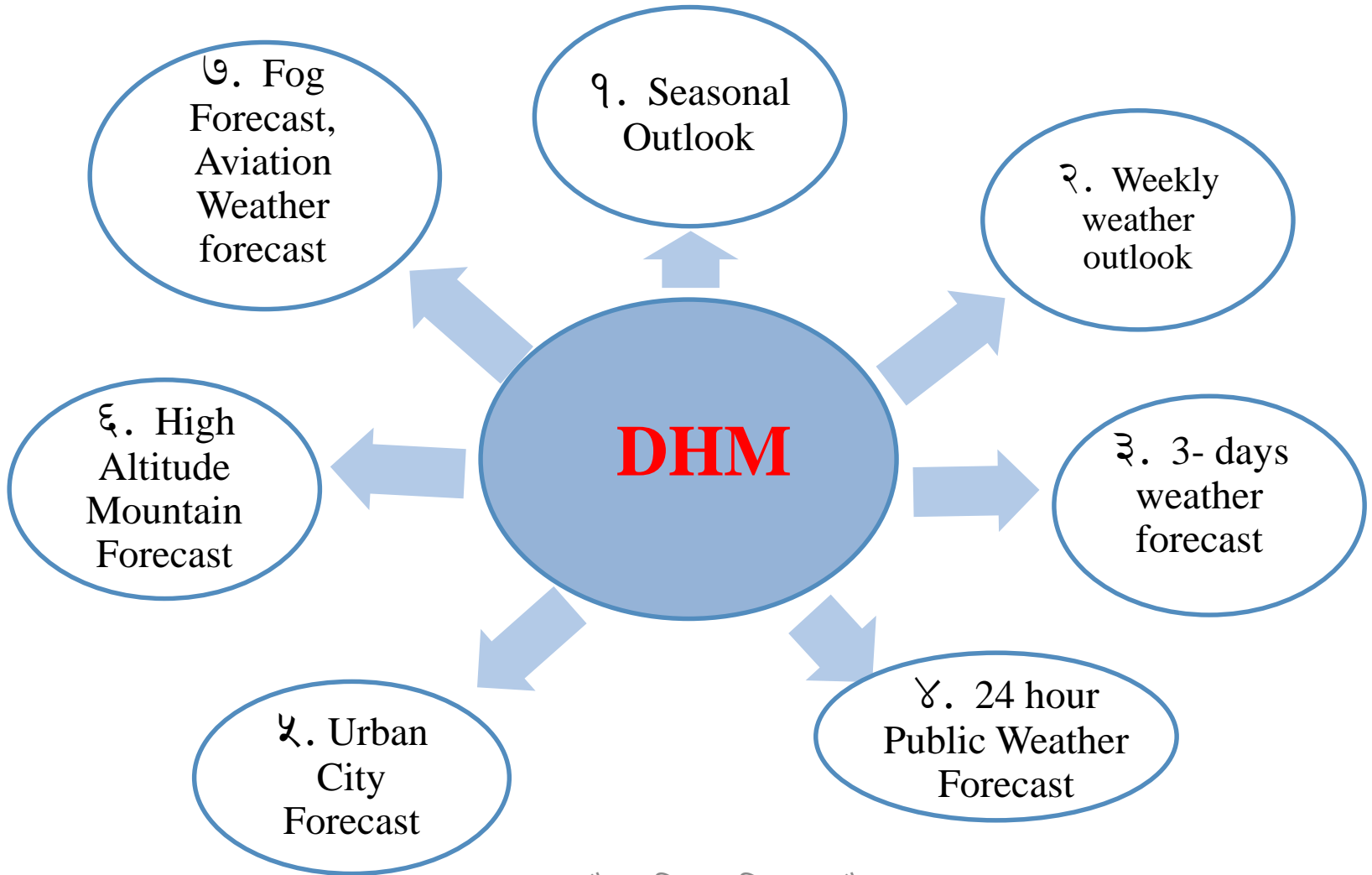
- To save lives and properties from hydro-meteorological disasters.

## **Scopes:**

- Contribution to the global exchange of meteorological data on a regular basis.
- Issue meteorological forecasts for public, mountaineering expedition, civil aviation and agriculture.
- Conduct special studies required for the policy makers and for the development of meteorological sciences in the region.
- Promote relationship with national and international organizations in the field of meteorology.

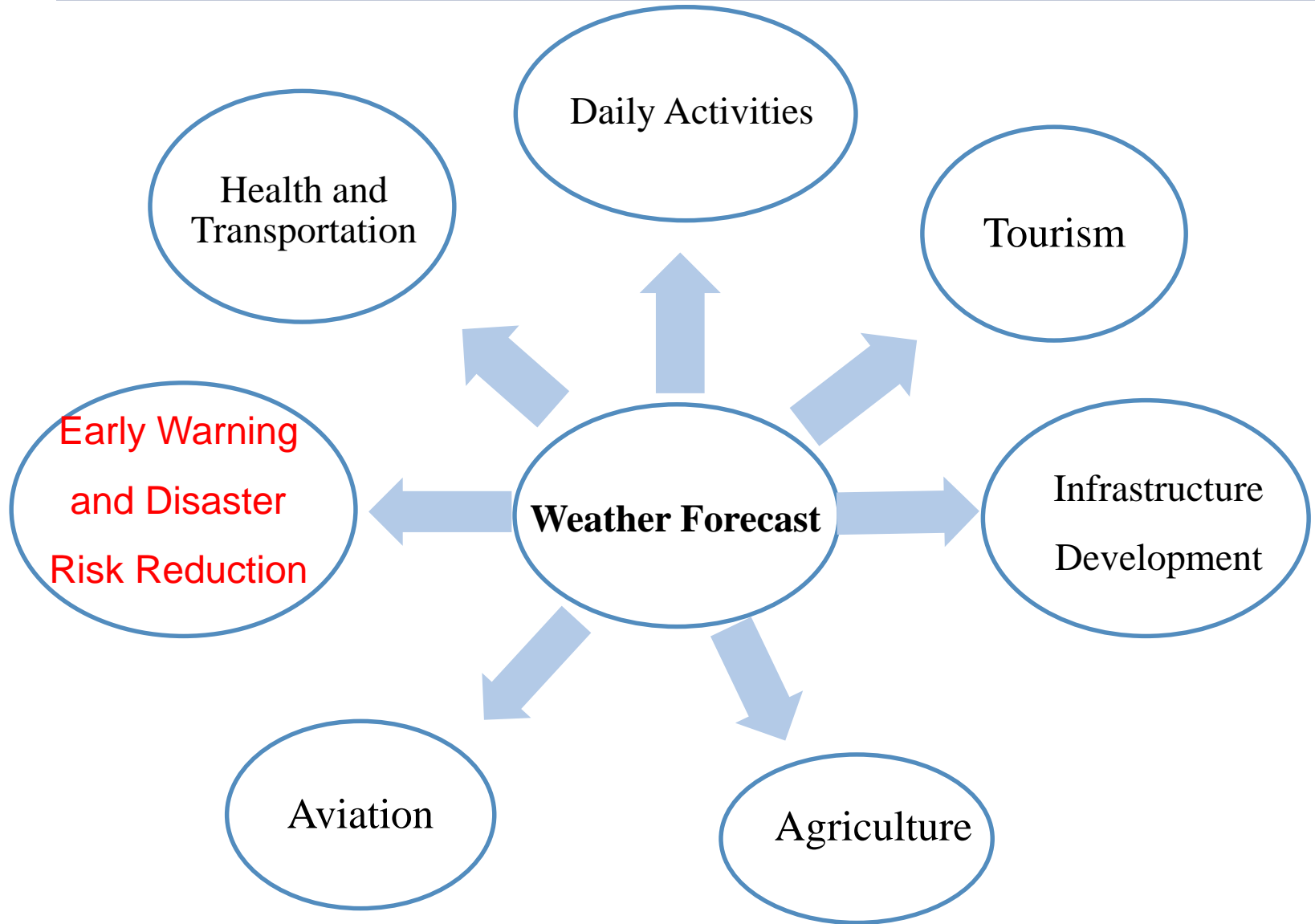


# Current Forecasting Services





# Weather Forecast why??





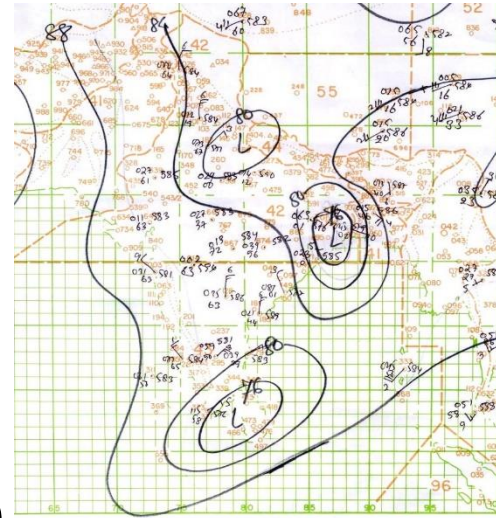
# Current Forecasting Tools

## • Observations

- Data from Synoptic stations (16 Stations)
- Data from AWS stations
- Satellite imageries from weather satellites
  - Himawari 8 (Himawari Cast system)
  - FY 2E (SWAP)

## • Synoptic Map Analysis

- Surface map ( 00,03,06,09,12,15 UTC)



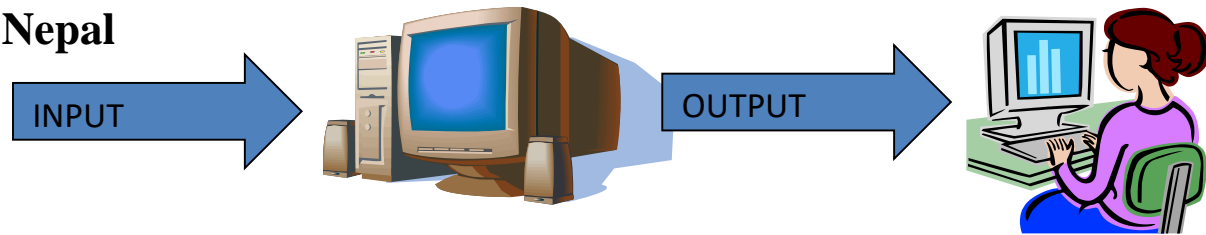
## • Numerical Weather Prediction Models

- WRF-EMS Modelling System
- WRF & WRFDA
- Global model like ECMWF, GFS, ICON etc

## • RADAR (3) – Covering whole Nepal

## • Radiosonde – 1 ( Kirtipur)

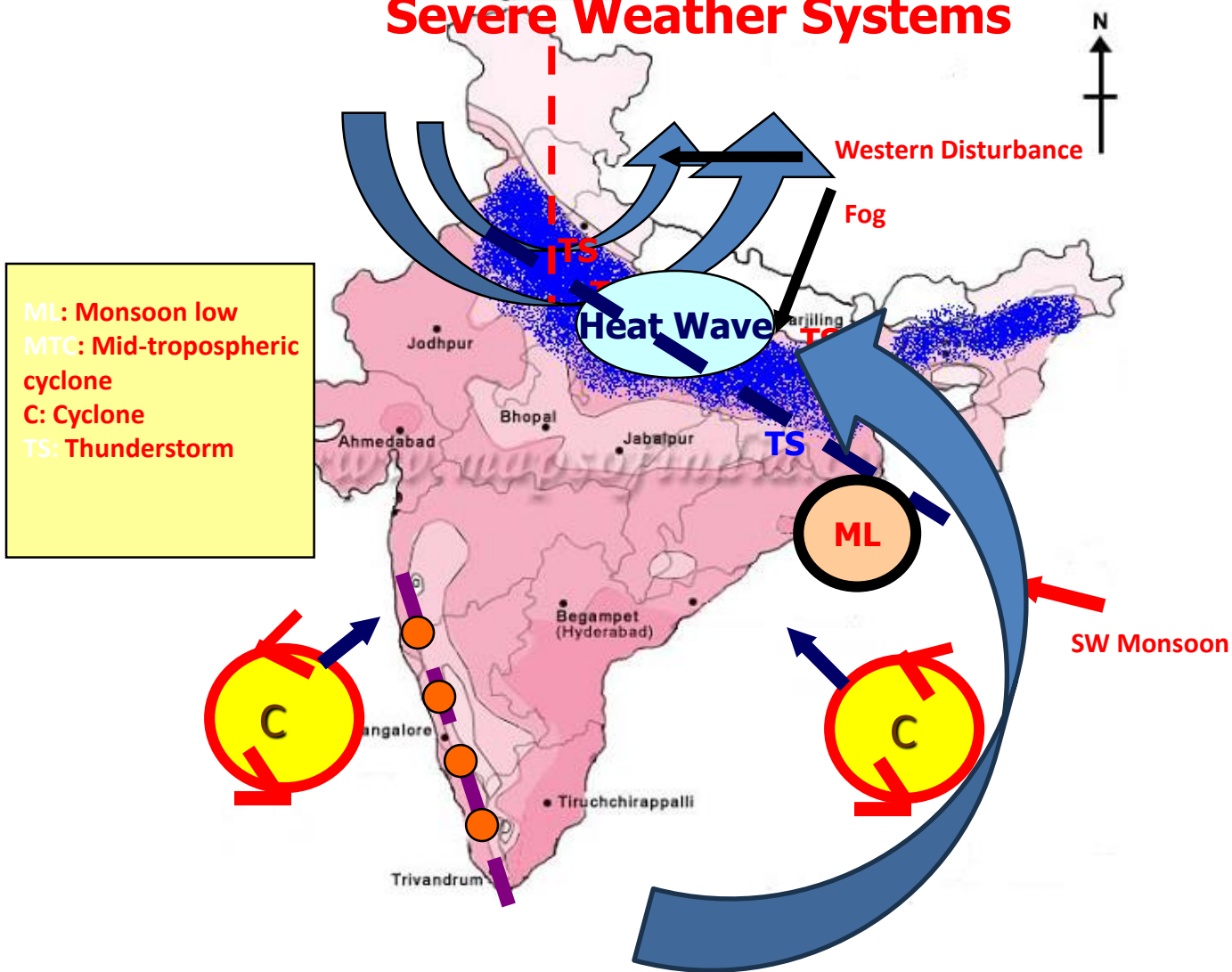
## • Hydro-Met Workstation





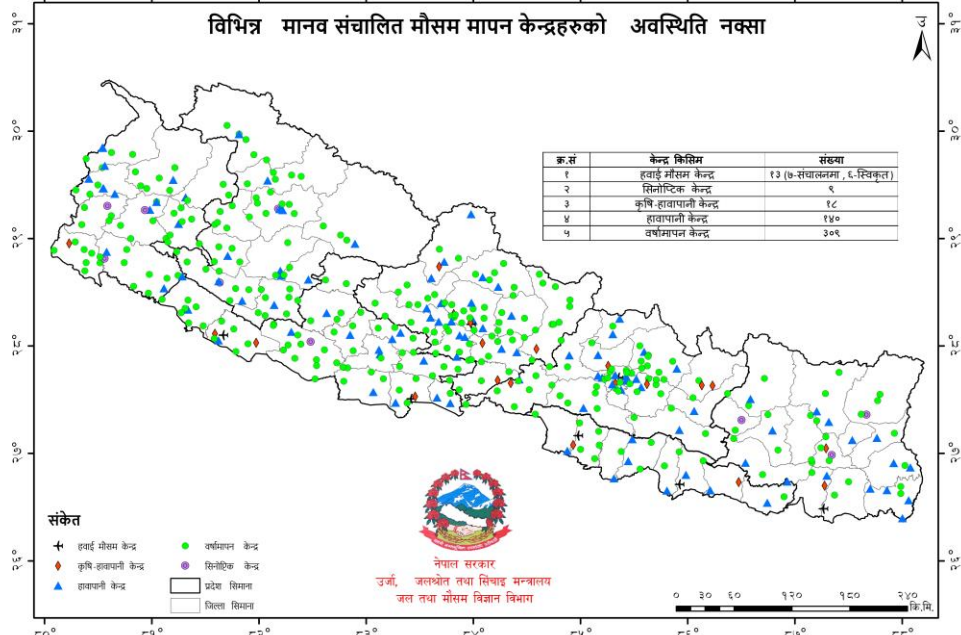
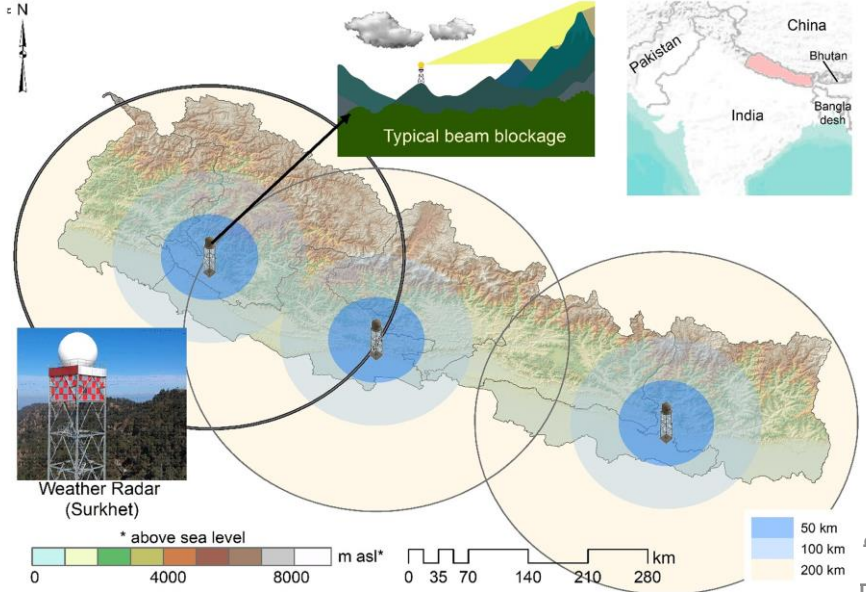
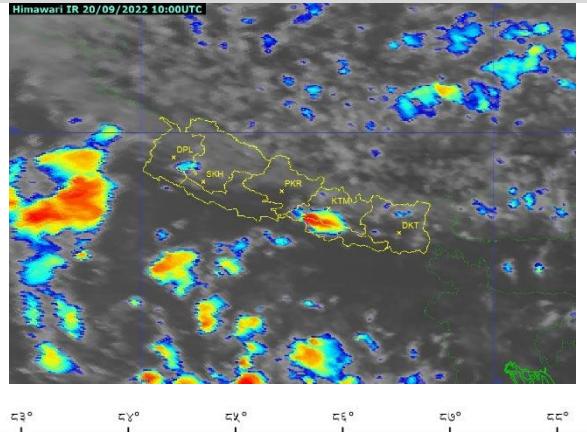
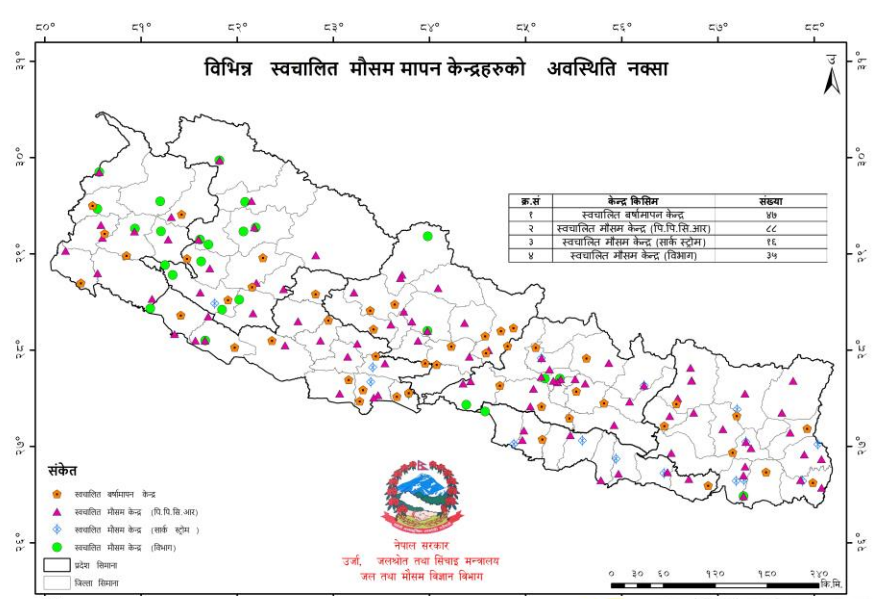


# Severe Weather Systems





# How??



विज्ञान त्वाभाग, मासम  
पूजागुनान महाशाखा



# Forecasting Methods (Used in MFD)

## • Conventional Synoptic Approach

Forecast methods based upon analysis of a set and/or series of synoptic charts

- Surface map (00, 03, 06, 12, 15 UTC)

## • Numerical Weather Prediction

- NWP @DHM : WRF EMS 3.4 & WRF 4.1.2
- RIMES, ECMWF, NCEP (GFS), etc

- Numerical weather forecasting approach (WRF model output running by DHM generates forecast up to 72 hours.)

[←BACK TO TOP-LEVEL](#)

Area: small

[Switch to large](#)

Products:

2m temperature: 00 06 12 18

1h precipitation: 00 06 12 18

Total precipitation: 00 06 12 18

Max 10m Wind: 00 06 12 18

Clouds: 00 06 12 18

Wind gust: 00 06 12 18

2m Dew Point: 00 06 12 18

Mixcap: 00 06 12 18

0 TC: 00 06 12 18

Sat brightness: 00 06 12 18

Observations: 00 06 12 18

use:

rental height: 00 06 12 18

rental height: 00 06 12 18

rental height: 00 06 12 18

rental height: 00 06 12 18

Biratnagar Airport: 00 06 12 18

Biratnagar Airport: 00 06 12 18

Dhangadhi Airport: 00 06 12 18

Dolpa Airport: 00 06 12 18

Gaunam Buddha Airport: 00 06 12 18

Jumla Airport: 00 06 12 18

+7h

+6h

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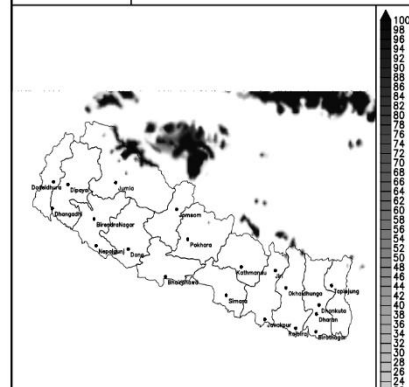
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Foot: Mon 21 MAR 19:00Z

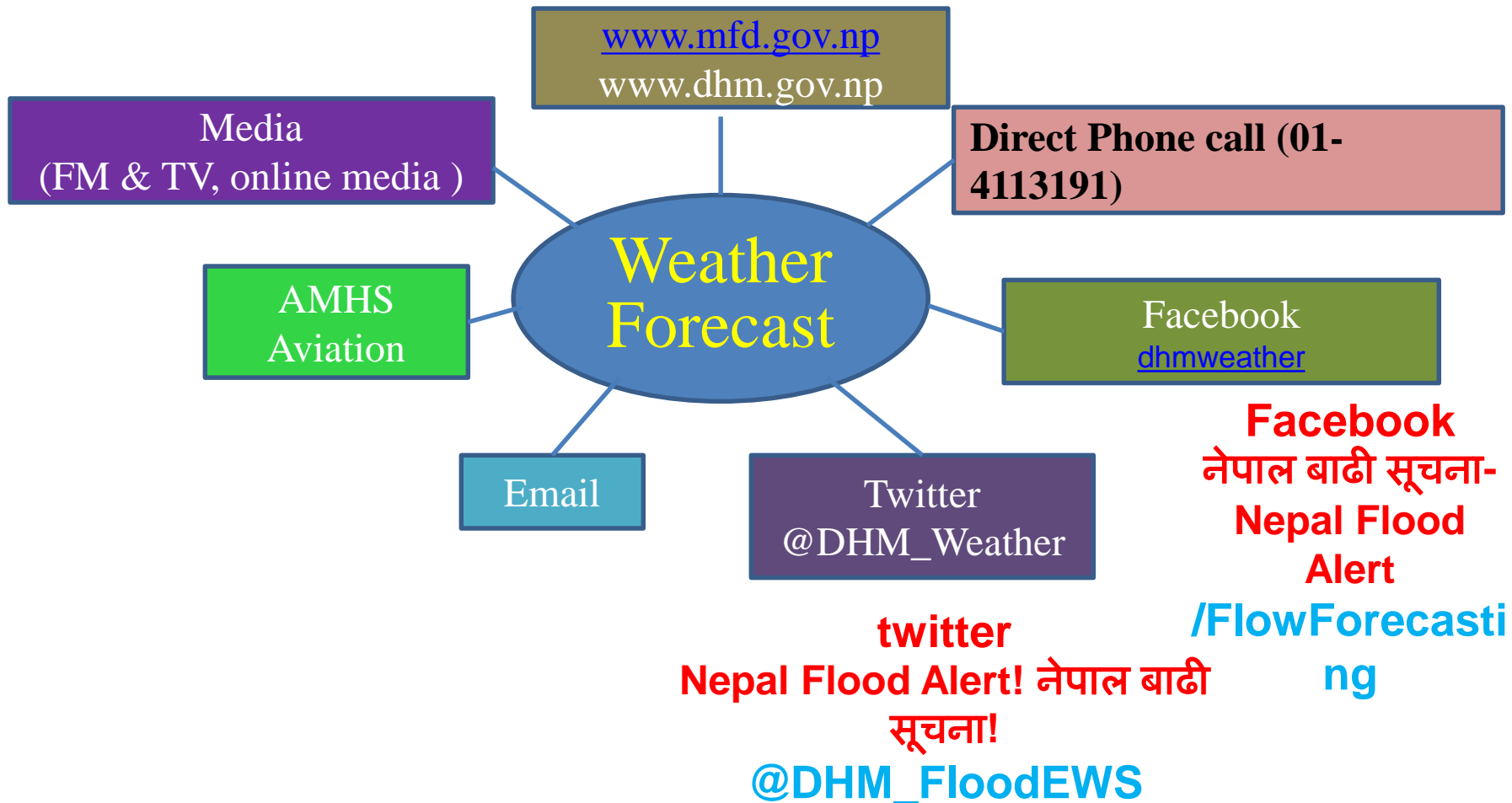
Total cloud cover [%] (shaded)

Sea level pressure [hPa] (contours)





# Forecast Dissemination Mechanism





# Heat Wave

- It is a weather phenomenon when an abnormal temperature rises in a period more than the normal maximum temperatures that occur during the summer season.
- According to World Meteorological Organization, a heat wave is defined as five or more consecutive days of prolonged heat in which the daily maximum temperature is higher than the average maximum temperature by 5 degrees Celsius or more.

## Meteorological Factors:

- **Transportation / Prevalence of hot dry air over a region** (There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region).
- **Absence of moisture in the upper atmosphere** (As the presence of moisture restricts the temperature rise).
- **The sky should be practically cloudless** (To allow maximum insulation over the region).
- **Large amplitude anti-cyclonic flow over the area.**





# Heat Wave

- Occurring mainly during April to June and in some rare cases even in July.
- The peak month of the heat wave over Nepal is May and June.
- predicts heat wave based on synoptic analysis of various meteorological parameters and from the consensus guidance from various regional & global numerical prediction models like, WRF, GFS, GEFS.
- **Hot days:**  $t_{max} \geq 90$  percentile
- **Very hot days:**  $t_{max} \geq 95$  percentile
- **Extreme hot days:**  $t_{max} \geq 99$  percentiles
- **Mild Heat Wave:** Hot days  $\geq$  Consecutive 3 days
- **Moderate Heat Wave:** Very Hot days  $\geq$  Consecutive 3 days
- **Extreme Heat Wave:** Extreme Hot days  $\geq$  Consecutive 3 days



# Some records on Heat Wave

- All time extreme: Dhangadhi- **46.4 °C** on 5th June 1995.
- Nepalgunj: **45 °C** on 16th June 1995.

## Historical record break

In this year, several stations broke the previous record of extremes of temperature and precipitation.

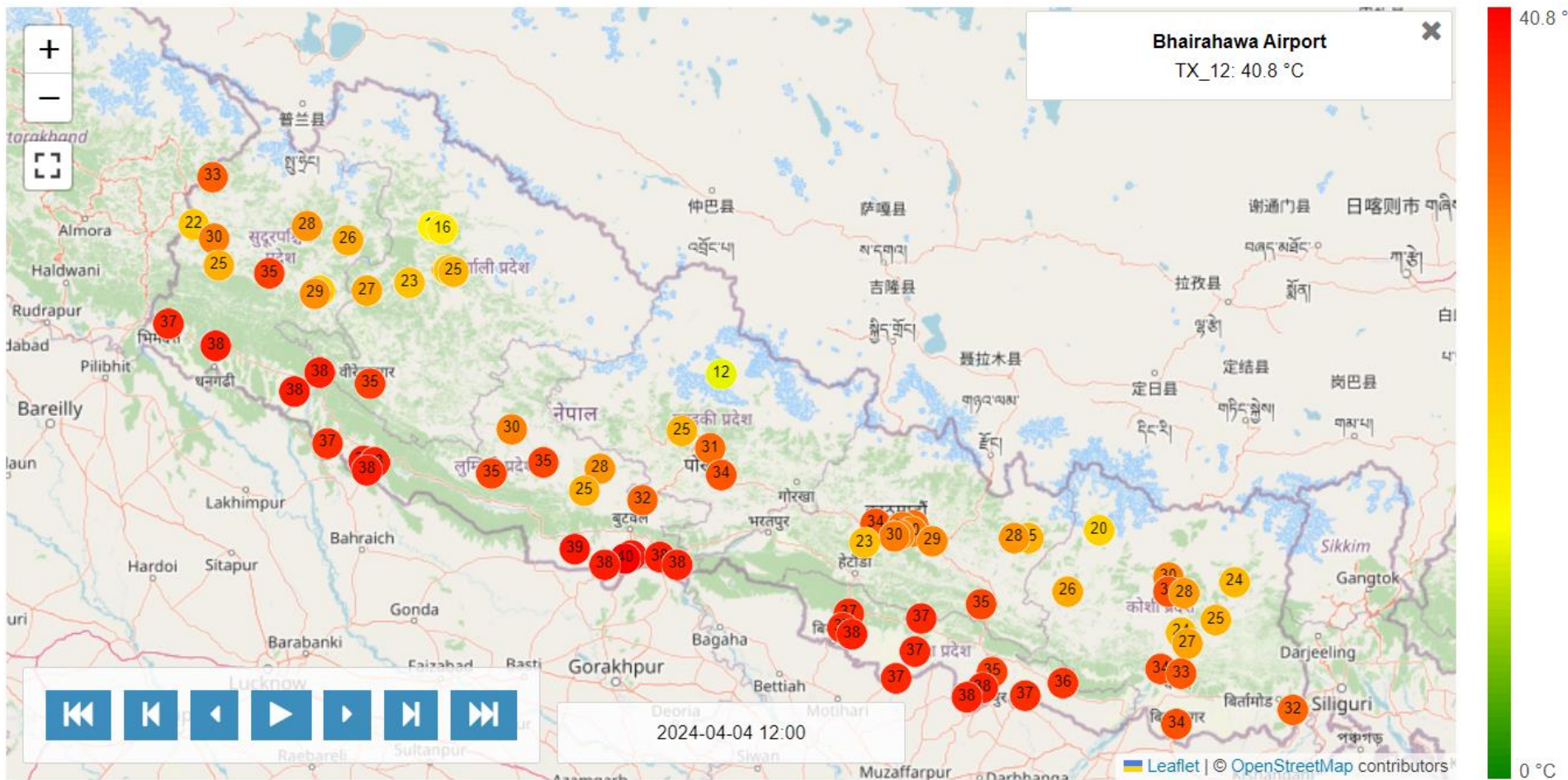
List of stations breaking previous record of ever-recorded highest daily maximum temperature in 2023.

S.N.	Station Name	District	Record break maximum temperature (°C)/Date	Previous highest maximum temperature (°C)/Date
1	Bandipur	Tanahun	35.7/2023-06-08	35.5/2018-06-12
2	Chatara	Sunsari	40.7/2023-08-01	40.5/2016-04-25
3	Chautara	Sindhupalchok	35.6/2023-06-23	34.8/2011-04-26
4	Dharan Bazar	Sunsari	39.3/2023-06-07	38.8/2013-04-12
5	Dumkauli	Nawalparasi-East	44.8/2023-06-09	43.7/1979-06-05
6	Gorkha (Birechowk)	Gorkha	39.0/2023-06-08	38.0/2014-05-08
7	Janakpur Airport	Dhanusha	42.5/2023-06-09	42.2/1989-05-07
8	Kanyam Tea Estate	Ilam	30.0/2023-06-03	29.0/1973-07-10
9	Okhaldhunga	Okhaldhunga	32.5/2023-06-09	30.9/1999-04-28
10	Rampur	Chitwan	43.5/2023-06-08	43.2/1989-05-06
11	Simara Airport	Bara	42.6/2023-06-08	42.4/1979-06-02
12	Siraha	Siraha	42.5/2023-06-08	41.5/2012-05-15



# Current Status

- Central and Western Nepal – Temperature more than 35 °C.
- Bhairahawa: 40.8 °C on (Yesterday).



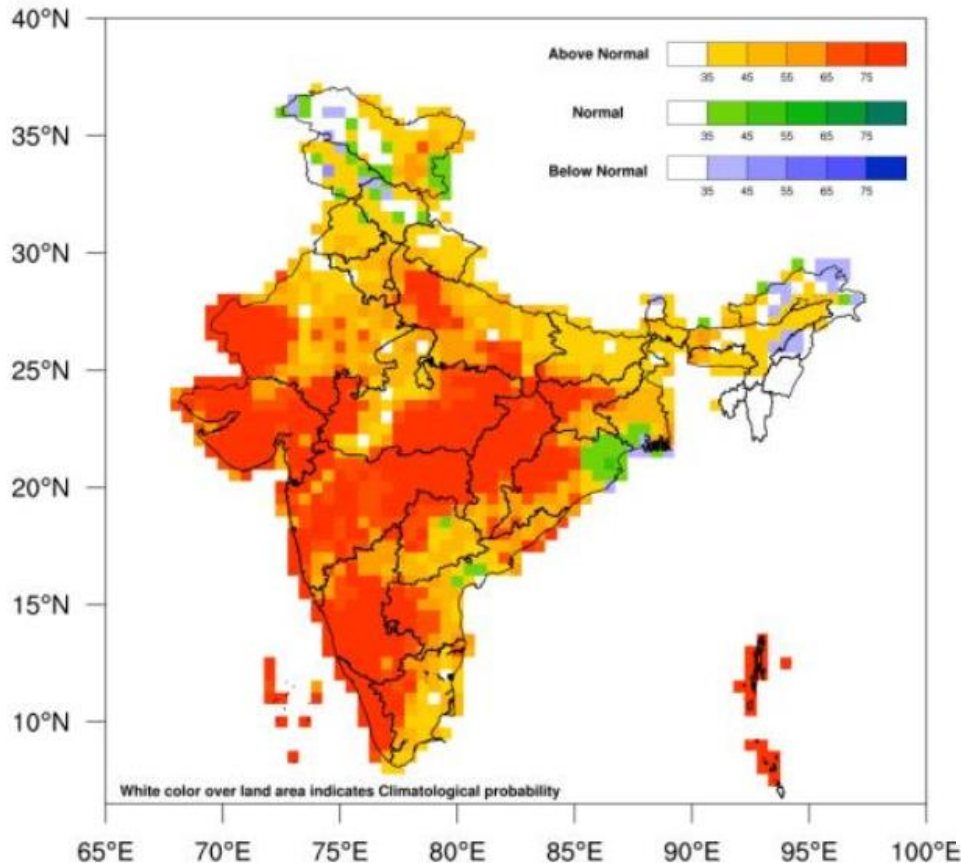




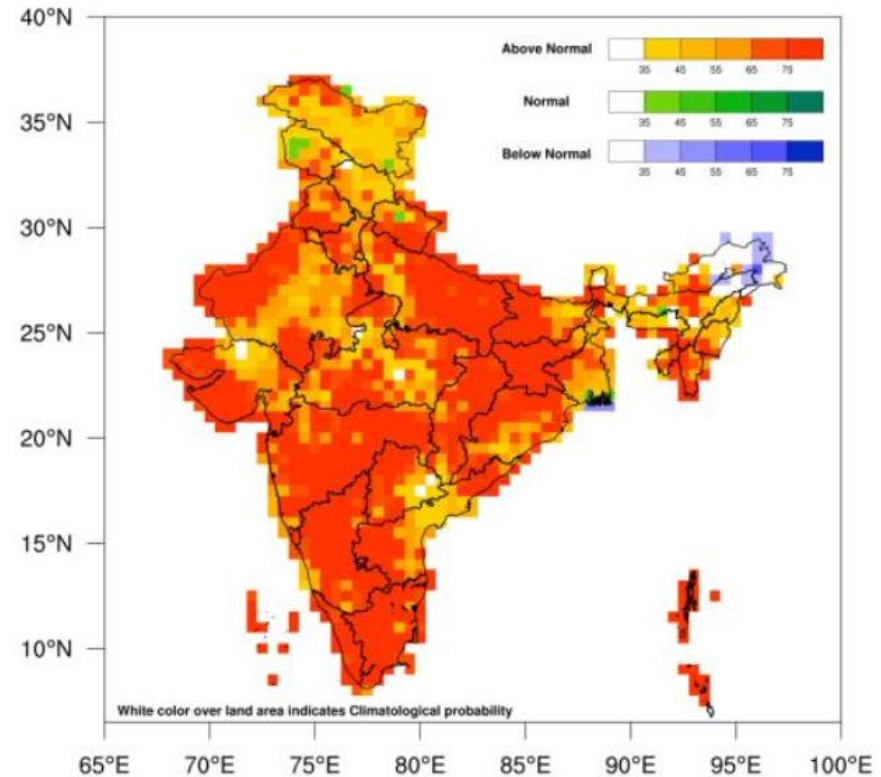
# Heat Wave 2024

- Above normal maximum temperature is likely to prevail.
- Normal to above normal minimum temperature is likely to prevail.

Maximum Temperature Outlook for April to June 2024 Season



Minimum Temperature Outlook for April to June 2024 season



05/05/2024

जल तथा मासम विज्ञान विभाग, मौसम  
पूर्वानुमान महाशाखा

Source: IMD



# Health Impact on Heat Wave

- Typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke. The signs and symptoms are as follows:
- Heat Cramps: swelling and Fainting generally accompanied by fever below  $39^{\circ}\text{C}$  i.e.  $102^{\circ}\text{F}$ .
- Heat Exhaustion: Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- Heat Stoke: Body temperatures of  $40^{\circ}\text{C}$  i.e.  $104^{\circ}\text{F}$  or more along with delirium, seizures or coma. This is a potential fatal condition



# Preparation for Heat Wave

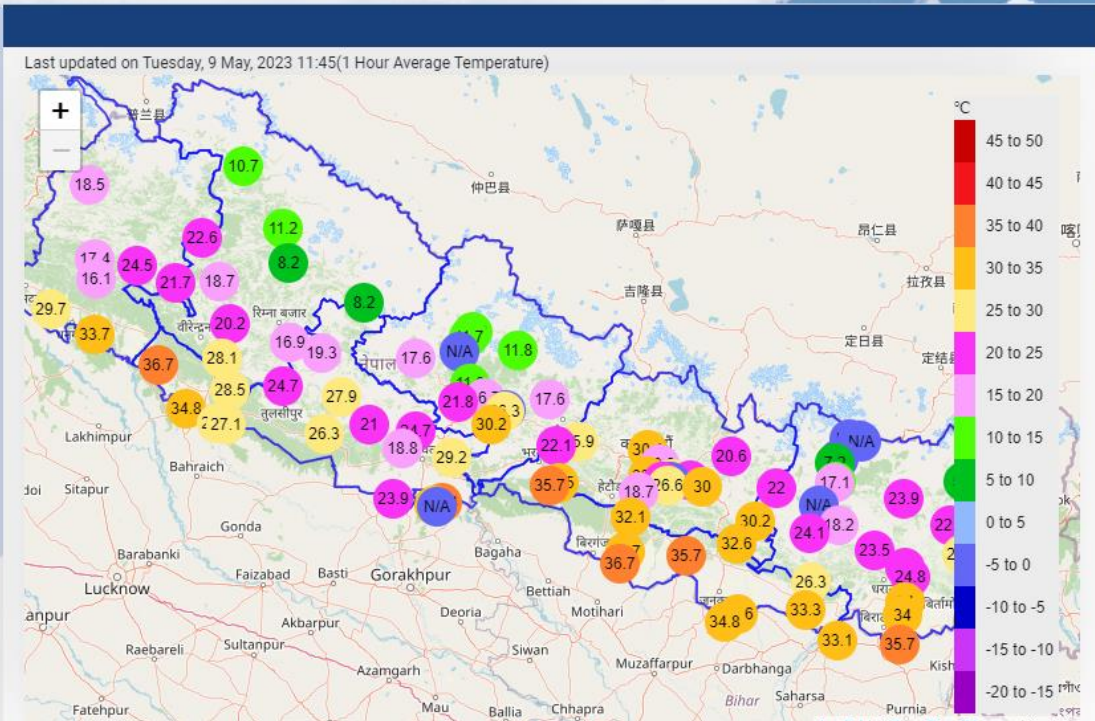
- **Emergency Kit** (Water bottle, Umbrella/ Hat or Cap / Head Cover, Hand Towel, Hand Fan, Electrolyte / Glucose / Oral Rehydration).
- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Drink sufficient water and as often as possible, even if not thirsty
- Wear lightweight, light-coloured, loose, and porous cotton clothes. Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.
- If you feel faint or ill, see a doctor immediately.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. which helps to re-hydrate the body.
- Use fans, damp clothing and take bath in cold water frequently. etc



# Temperature Monitoring

- Meteorological Observations
- Meteorological Forecast
- Hydrological Observations
- Hydrological Forecast

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# Special Weather Bulletin

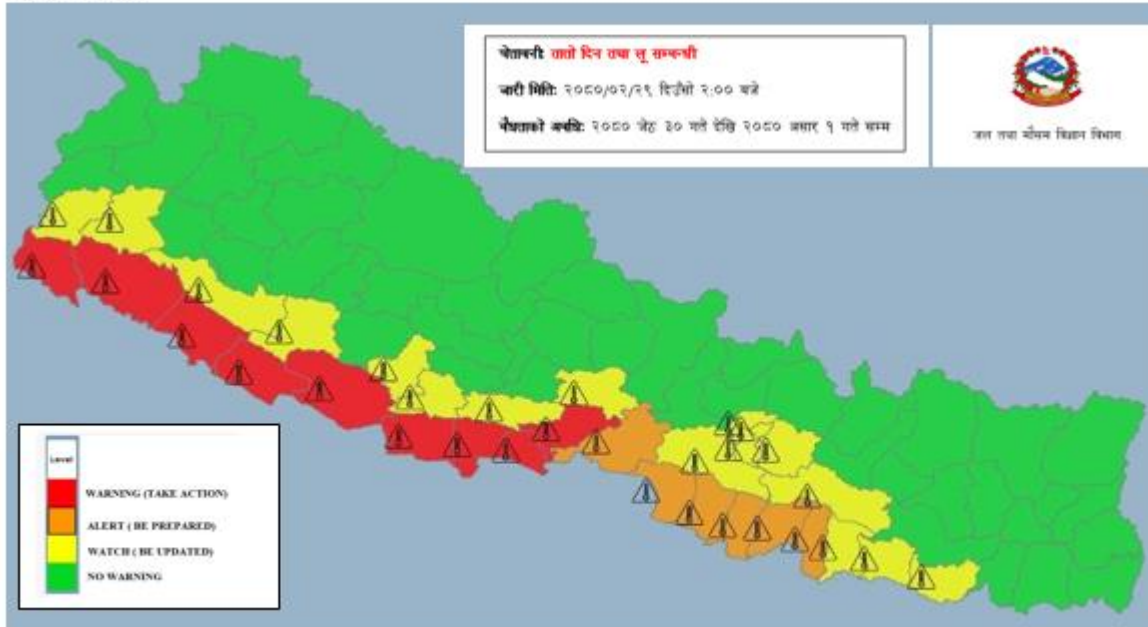
- 4 Heat wave bulletin in 2080 .
- Jestha 19, Jestha 24, Jestha 29, Asar 01

नेपाल सरकार  
ऊर्जा, जलस्रोत तथा सिंचाइ मन्त्रालय  
जल तथा मौसम विज्ञान विभाग  
मौसम पूर्वानुमान महाशाखा  
विशेष बुलेटिन : ततो दिन तथा लू सम्बन्धी बुलेटिन - ३ (Hot days & Heat wave Bulletin - 3)  
(जारी मिति : २०८०/०२/२९ दिउँसो २: ०० बजे)

## हालको अवस्था :

विगत केही दिन देखि देशका अधिकांश भू-भागहरू विशेष गरि मध्य तथा पश्चिमी भू-भागको अधिकतम तथा न्यूनतम तापक्रम वृद्धि भइरहेको देखिन्छ। काठमाण्डौ उपत्यका लगायत देशका अन्य उपत्यकाहरूमा समेत तापक्रममा क्रमिक वृद्धि भइरहेको देखिन्छ। देशका मध्य तथा पश्चिम तराईका भू-भागमा लगातार अधिकतम तापक्रम चार्लिड डिग्री सेल्सियस (४०°से) वा सो भन्दा बढी मापन भएको छ।

## चेतावनी नक्सा



- विशेष मनसुन बुलेटिन
- विशेष शितलहर बुलेटिन
- विशेष तातो हावा लू सम्बन्धि बुलेटिन
- भूकम्प प्रभावित क्षेत्र विशेष बुलेटिन
- हिउँदे मौसमको विशेष बुलेटिन



# Weather Forecast Terminology

## Terms used in Weather Forecasting in Nepal

बादलको अवस्था (Cloud condition)	सफा (Fair)	No cloud in the sky
	मुख्यतया सफा (Mainly fair)	1/8 to 2/8 (25%) sky covered by cloud
	आंशिक बदलि (Partly cloudy)	3/8 (26%) to 4/8 (50%) sky covered by cloud
	साधारणतया बदलि (Generally cloudy)	5/8 (51%) to 6/8 (75%) sky covered by cloud
	अधिकांश बदलि (Mostly cloudy)	6/8 (76%) to 7/8 (88%) sky covered by cloud
	पूर्ण बदलि (Cloudy)	8/8 (100%) or all sky covered by cloud

वर्षाको प्रकृति (Nature of Rain)	Temporary or Brief (क्षणिक वर्षा)	Weather phenomena occur for short span of time usually less than two hour
	Continuous (लगातारको वर्षा)	Weather phenomena occurring regularly and more often throughout the time duration
	Intermittent (रोकिदै हुने वर्षा)	Rain occurring and reoccurring at certain intervals
	Widespread (व्यापक वर्षा)	Weather phenomena extensively throughout an area during specified time duration

वर्षाको संभाव्यता र यसको क्षेत्र (Rainfall probability in percentage and its coverage)	<10%	None used	Isolated	at one or two places (एक-दुई स्थानमा)
	10-30%	Slight Chance	Widely Scattered	at a few places (थोरै स्थानमा)
	30-50%	Chance/possible	Scattered	at a some places (केहि स्थानमा)
	50-80%	Likely	Fairly widespread	at many places (धेरै स्थानमा)
	>80%	More likely	Widespread	at most places (अधिकांश स्थानमा)

संभावित वर्षाको मात्रा (%) = आंकलन X क्षेत्र, जहाँ आंकलन भन्नाले कुनै स्थानमा वर्षा हुन सक्ने संभावना (%) जनाउँदछ भने क्षेत्र भन्नाले तोकिएको स्थानको वर्षा हुन सक्ने संभावित भू-भाग (%) जनाउँदछ। उदाहरणका लागि कुनै स्थानको ८०% क्षेत्रमा ५०% वर्षाको आंकलन गरेको अवस्थामा सो स्थानको संभावित वर्षाको मात्रा (%) = ०.५ X ०.८ = ४०% हुन आउँछ।

वर्षाको मात्रा (Rainfall amount based on total accumulated rainfall during 24 hrs)	Light rain(हल्का वर्षा)	less than 10 mm
	Moderate rain(मध्यम वर्षा)	10 mm or more but less than 50 mm
	Heavy rain (भारी वर्षा)	50 mm or more but less than 100 mm
	Very heavy rain(धेरै भारी वर्षा)	100 mm or more but less than 200 mm
	Extremely heavy rain(अति भारी वर्षा)	200 mm or more

समयसिमा (Time Period)	Today (आज)	6 AM to 6 PM
	Morning (बिहान)	6 AM to Noon
	Afternoon (अपरान्ह)	Noon to 6 PM
	Late afternoon (अपरान्हको उत्तरार्ध)	3 PM to 6 PM
	Evening (साँझ)	6 PM to 9 PM
	Night (राति )	6 PM to 6 AM (Next day)



# जनताको जीवन र सम्पत्तिको रक्षा

हामी गम्भीर मौसमी घटनाहरू हुनबाट रोक्न सक्दैनौं तर हामी केही हदसम्म जनताको जीवन र सम्पत्तिको रक्षा गर्न सक्छौं ।

- मौसम पूर्वानुमानमा सुधार
- मौसम अनुकूल दैनिकी र सेवाहरूमा परिवर्तन
- पूर्वानुमान प्रसार संयन्त्रमा सुधार
- जनचेतना अभिवृद्धि



यसका लागि सबै सरोकारवालाहरूबिच सहकार्य गर्न आवश्यक छ ।



## Limitations and way forward

- Lack of research institutes compared to other countries," don't even have a research unit, and not enough human resource .
- So, more attention and investment is required from the government side.
- It is essential to establish a constant monitoring system for tracking weather data and develop an appropriate mechanism to activate alerts for heat waves.
- Collaboration with different NGO, INGO, research institute for research and development.
- Human Resources, Budget allocation & Capacity Development





# Contact

विभागको वेबसाईट:

[www.dhm.gov.np](http://www.dhm.gov.np)

मौसम पूर्वानुमान महाशाखाको वेबसाईट:

[www.mfd.gov.np](http://www.mfd.gov.np)

फोन: ०१-४११३१९१ (२४ घण्टा नै जानकारी लिन सकिने)

फेसबुक: Mfd Weather Forecast ([www.facebook.com/dhmweather](https://www.facebook.com/dhmweather))

पेज: Meteorological Forecasting Division, Department of Hydrology and Meteorology

टुईटर: Nepal Weather Forecast ([www.twitter.com/dhm\\_weather](https://www.twitter.com/dhm_weather))

Email: [mfddhm@gmail.com](mailto:mfddhm@gmail.com)

प्रभावमा आधारित मौसम पूर्वानुमान (IBF) सम्बन्धि जानकारीका लागि: [mfdibf@gmail.com](mailto:mfdibf@gmail.com)

बाढी पूर्वानुमान महाशाखाको वेबसाईट:

[www.hydrology.gov.np](http://www.hydrology.gov.np)



# धन्यवाद !!

## जिज्ञासा तथा सुझावहरू ??