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NATIONAL CENTRE FOR HYDROLOGY AND METEOROLOGY  
THIMPHU: BHUTAN

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13 January 2023

## Extended Range Prediction for Bhutan

### Background

Extended Range Prediction (ERP) for Bhutan is prepared with the support from the Indian Meteorological Department (IMD), Government of India. The model used for the system is CFSv2 coupled model (Atmospheric and Ocean model) which runs once every week (Wednesday), with the 16 Ensemble Members at the horizontal resolution of around 25 km, and the products are made available the next day (Thursday). Therefore, the ERP products for Bhutan will be generated every Friday. ERP for Bhutan is carried out for two climate variables, rainfall and temperature.

Generally, the forecast output is produced on a weekly basis for a period of a month for both the variables. The current products available from NCHM are on pilot basis which needs further studies and validation with the ground observations until the product is fully operationalized.



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### Observed weather over last week

Most of the stations across the country showed an increase in maximum and minimum temperature during the first half of the week. No rain was observed in the country for the last week. The table below displays observed real time rain and temperature data from regional meteorological stations over the last week.

| Station  | Parameter | 05 Jan | 06 Jan | 07 Jan | 08 Jan | 09 Jan | 10 Jan | 11 Jan |
|----------|-----------|--------|--------|--------|--------|--------|--------|--------|
| Babesa   | Tmax (°C) | 14.0   | 18.0   | 16.0   | 16.0   | 17.0   | 15.0   | 16.0   |
|          | Tmin (°C) | -6.5   | -7.0   | -5.0   | -2.5   | -7.0   | -6.0   | -5.0   |
|          | Rain (mm) | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |
| Dagana   | Tmax (°C) | 21.0   | 22.5   | 23.5   | 23.5   | 24.0   | 24.0   | 22.0   |
|          | Tmin (°C) | 6.0    | 6.5    | 7.0    | 8.0    | 7.0    | 7.5    | 6.5    |
|          | Rain (mm) | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |
| Chamkhar | Tmax (°C) | 12.5   | 16.0   | 14.5   | 14.5   | 14.5   | 14.0   | 12.5   |
|          | Tmin (°C) | -5.5   | -8.5   | -9.0   | -8.5   | -8.5   | -7.0   | -2.5   |
|          | Rain (mm) | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |
| Deothang | Tmax (°C) | 22.0   | 23.0   | 23.5   | 23.0   | 23.0   | 23.0   | 22.0   |
|          | Tmin (°C) | 10.0   | 11.0   | 11.5   | 12.0   | 11.5   | 11.5   | 11.0   |
|          | Rain (mm) | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |
| Gasa     | Tmax (°C) | 9.0    | 14.5   | 13.0   | 13.0   | 13.0   | 13.0   | 11.5   |
|          | Tmin (°C) | -4.5   | -3.5   | -2.5   | -3.5   | -3.0   | -2.5   | -4.0   |
|          | Rain (mm) | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |



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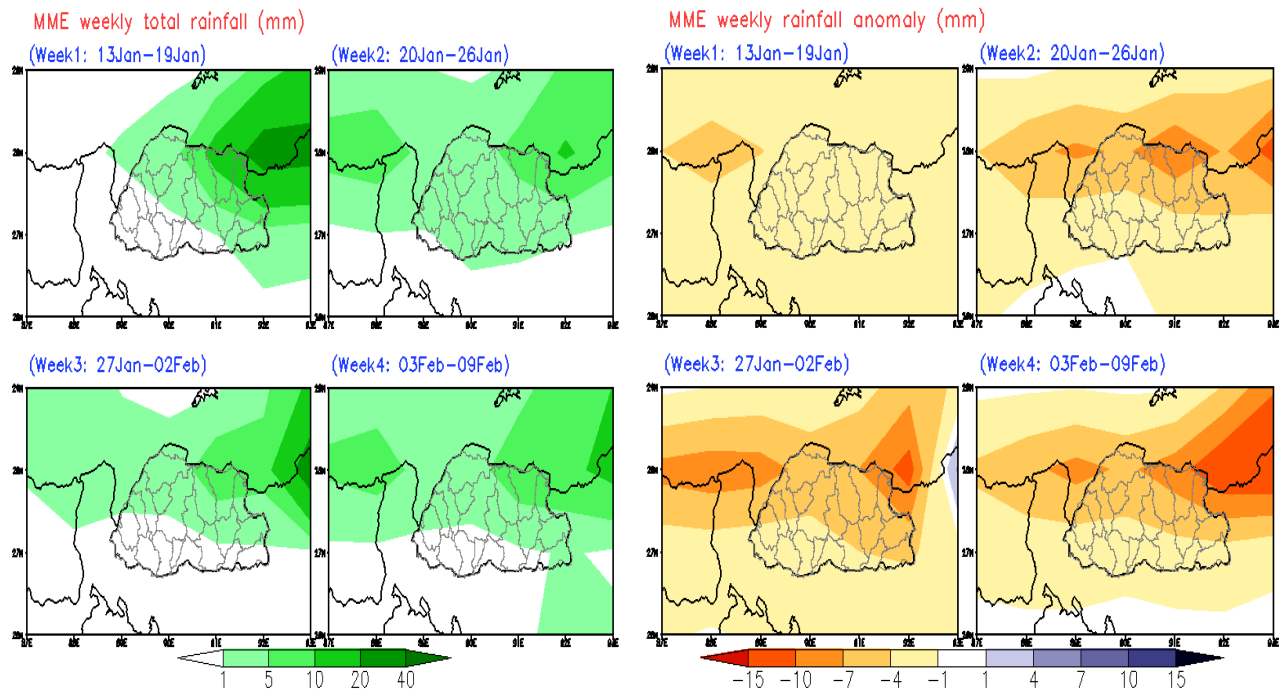
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## Weekly forecast for Bhutan

### 1. Rainfall Prediction



Week 1 (13 January - 19 January), Week 2 (20 January - 26 January), Week 3 (27 January - 02 February) and Week 4 (03 February - 09 February)

Below normal rainfall is expected throughout the region.



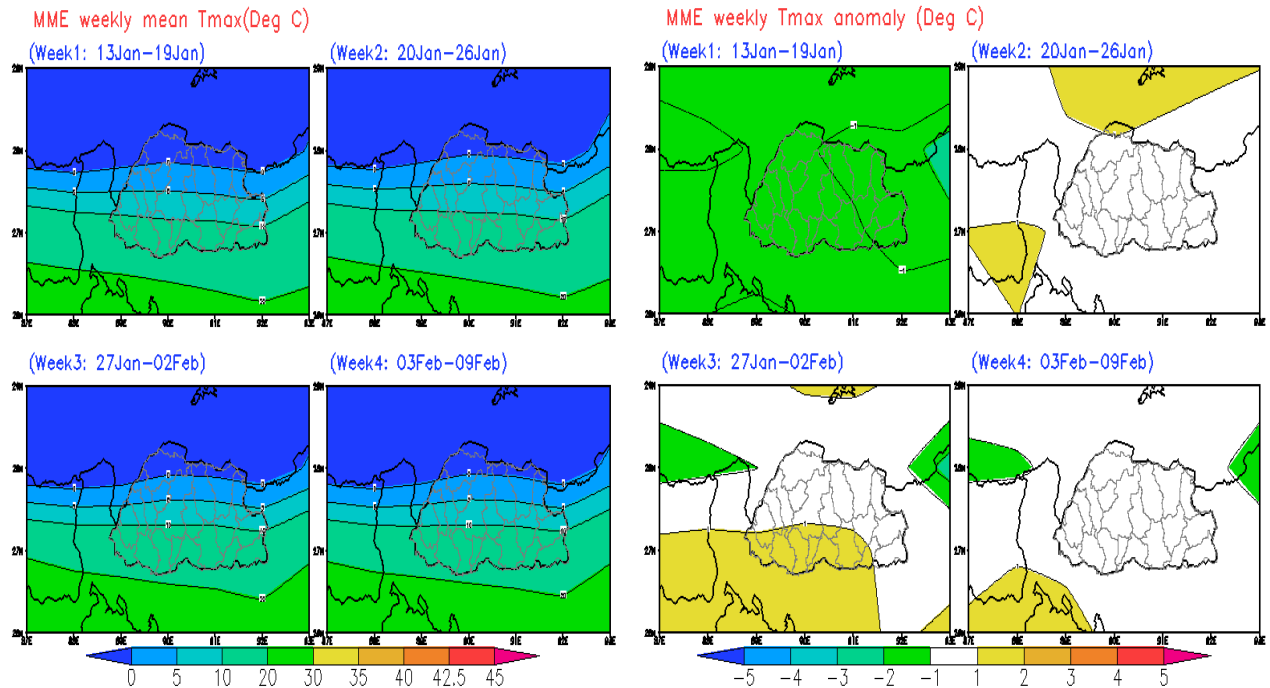
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## 2. Maximum Temperature Prediction



### Week 1 (13 January - 19 January)

Below normal maximum temperature is expected across the country.

### Week 2 (20 January - 26 January)

Normal maximum temperature is expected throughout the region.

### Week 3 (27 January - 02 February)

Above normal maximum temperature is expected across the southern region and normal maximum temperature is expected for the remaining region.

### Week 4 (03 February - 09 February)

Normal maximum temperature is expected throughout the region.



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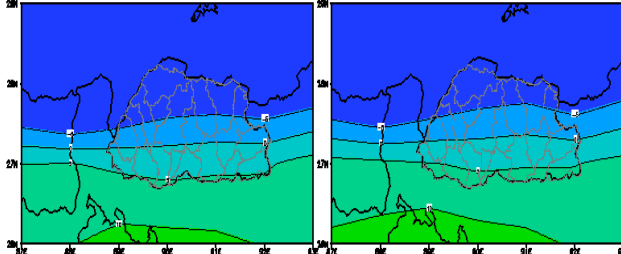


### 3. Minimum Temperature Prediction

MME weekly mean Tmin(Deg C)

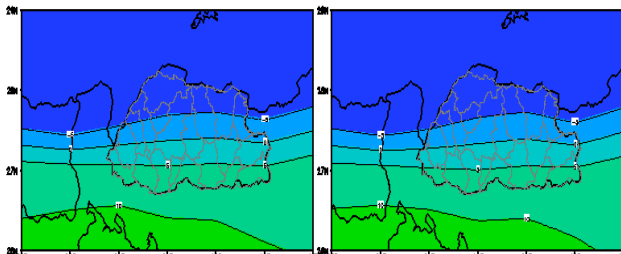
(Week1: 13Jan-19Jan)

(Week2: 20Jan-26Jan)



(Week3: 27Jan-02Feb)

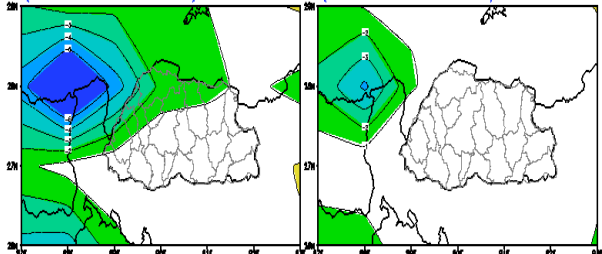
(Week4: 03Feb-09Feb)



MME weekly Tmin anomaly (Deg C)

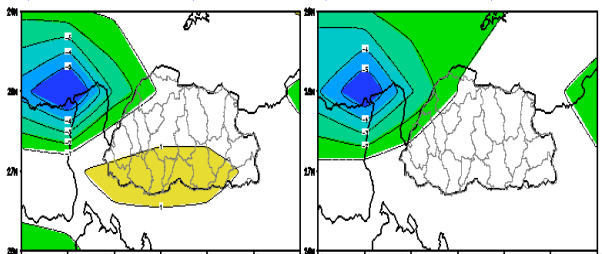
(Week1: 13Jan-19Jan)

(Week2: 20Jan-26Jan)



(Week3: 27Jan-02Feb)

(Week4: 03Feb-09Feb)



#### Week 1 (13 January - 19 January)

The northern and western region can expect below normal minimum temperature however, the remaining region can expect normal minimum temperature.

#### Week 2 (20 January - 26 January)

Normal minimum temperature is expected across the country.

#### Week 3 (27 January - 02 February)

Above normal minimum temperature is expected across the southern region, and the rest of the region can observe normal minimum temperature.

#### Week 4 (03 February - 09 February)

Normal minimum temperature is expected across the country.

#### Summary

- The rainfall is likely to be below normal for all the weeks.
- The maximum temperature is likely to be below normal for the first week and normal for the remaining three weeks.
- The minimum temperature is likely to be normal for all the weeks.



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### Classification of rainfall for 24 Hours

|                          |                             |
|--------------------------|-----------------------------|
| No rainfall              | 0.0 mm                      |
| Very light rainfall      | 0.1 to 0.9 mm               |
| Light rainfall           | 1.0 to 10.0 mm              |
| Moderate rainfall        | 11.0 to 30.0 mm             |
| Heavy rainfall           | 31.0 to 70.0 mm             |
| Very heavy rainfall      | 71.0 to 150.0 mm            |
| Extremely heavy rainfall | Equal or more than 151.0 mm |