

TECHNICAL NOTE

RAINFALL AND TEMPERATURE FORECAST OF BHUTAN For 2020 SUMMER SEASON



**Weather and Climate Services Division
National Center for Hydrology and Meteorology**

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Rainfall and Temperature Forecast of Bhutan for 2020 Summer Season

1. BACKGROUND

The seasonal forecast is prepared using a statistical model called the Climate Predictability Tool (CPT). The rainfall and temperature forecasts for the 2020 summer season are prepared using the data (hindcast and forecast of sea surface temperature) of Global Climate Models as the predictor and observed rainfall and temperature data of Bhutan as the predictants. The forecast is also based on the output/products and information from the World Meteorological Organization's (WMO) Global Producing Centres (GPCs) for long range forecast. The forecast also considers the forecast output from the 16th Session of the South Asian Climate Outlook (SASCOF-16) for the 2020 summer season. Also, global-scale climate phenomena such as ENSO and IODs were considered.

2. ENSO AND IOD CONDITIONS AS PER SUMMER SASCOF-16 2020

As per SASCOF-16, the ENSO is one of the global scale climate phenomena that have a significant influence on the year-to-year variability of the monsoon rainfall as well as surface temperature over South Asia. Weak El Niño conditions had prevailed over the equatorial Pacific from the first quarter of 2019, which turned in to ENSO neutral conditions in the latter part of the 2019 southwest monsoon season. Subsequent warming of sea surface temperatures (SSTs) over the equatorial Pacific, resulted in warm ENSO neutral conditions from October 2019 onwards, which continued till date. The current atmospheric conditions over the Pacific reflect ENSO neutral conditions. The latest forecasts from most of the coupled global models indicate a cooling of SSTs over equatorial Pacific leading to ENSO neutral conditions during the upcoming southwest monsoon season. However, a few climate models indicate weak La Niña conditions to develop during the latter part of the season or thereafter. La Niña (El Niño) conditions are generally associated with stronger (weaker) than normal southwest monsoon over the region.

There is a strong consensus among the experts about the weakening of the prevailing warm ENSO neutral conditions in the equatorial Pacific leading to neutral ENSO conditions, which are likely to continue during the southwest monsoon season. Though few global models are suggesting the slight possibility of the development of weak La Niña conditions in the latter part of the season or thereafter, uncertainty in its development and timing is recognized. Further, it is well-known that ENSO predictions at this time of the year generally have substantial uncertainty due to the so-called spring barrier in seasonal predictability. It is also recognized that in general, neutral ENSO conditions are associated with normal southwest monsoon rainfall over South Asia. However, it is important to note that ENSO status is not the only factor that determines the performance of Southwest monsoon over the region. Other relevant climate drivers such as the state of the Indian Ocean Dipole, tropical Atlantic sea surface temperatures, Eurasian land heating etc. are also important. The relative impact of all these parameters needs to be considered to determine the expected state of the monsoon over the region which is implicitly considered by the dynamical climate models that underpin the present outlook.

3. Conditions over the Indian Ocean

In addition to ENSO conditions over the Pacific, other factors such as Indian Ocean SSTs also influence the South Asian southwest monsoon. At present, basin-wide warming is observed in the Indian Ocean, with the strongest warming in the south Indian Ocean and neutral Indian Ocean Dipole (IOD) conditions are prevailing. A positive (negative) IOD is associated with a stronger (weaker) than normal monsoon. The recent forecasts from coupled global models suggest that these neutral IOD conditions are likely to continue during the monsoon season. However, few climate models indicate the development of weak negative IOD conditions in the latter part of the monsoon season.

4. Snow Cover over the Northern Hemisphere

The snow-covered areas over both Northern Hemisphere (NH) and Eurasia were below normal during last four months (December 2019 to March 2020) with a record below normal snow cover area during the recent two months. The NH snow cover areas during February and March 2020 were fifth and third lowest ever during the respective months in the last 54 years. On the other hand, the Eurasian snow cover area was fourth and third lowest ever during the respective months in the last 54 years. Winter and spring snow cover extent has a generally inverse relationship with the subsequent Asian summer monsoon rainfall.

5. Summer Season Outlook from International and Regional Climate Centres

5.1 PRECIPITATION

5.1.1 WMO lead Centers

Probabilistic multi-model ensemble forecast from Global Producing Centres (GPC) of WMO shows near-normal rainfall over Bhutan during June-August 2020.

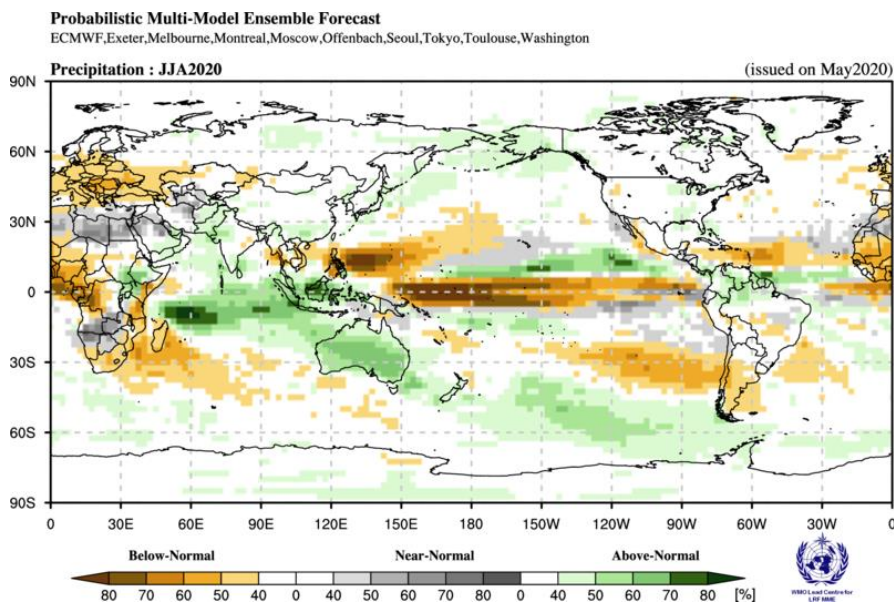


Figure 1 JJA precipitation forecast from all GPCs

5.1.2 International Research Institute for Climate and Society (IRI)

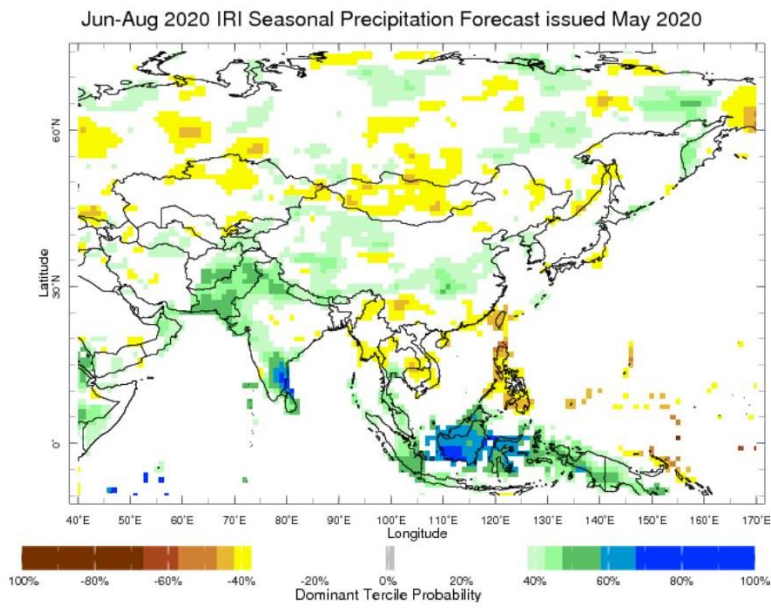


Figure 2 IRI forecast for precipitation JJA

The IRI forecast for June-August 2020 indicates near-normal rainfall across Bhutan.

5.1.3 MMCFS of India Meteorological Department

The Monsoon Mission Coupled Forecasting System (MMCFS) of precipitation from the India Meteorological Department indicates normal rainfall during June-August 2020 in Bhutan.

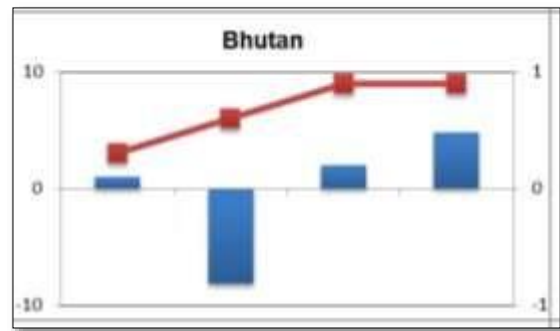
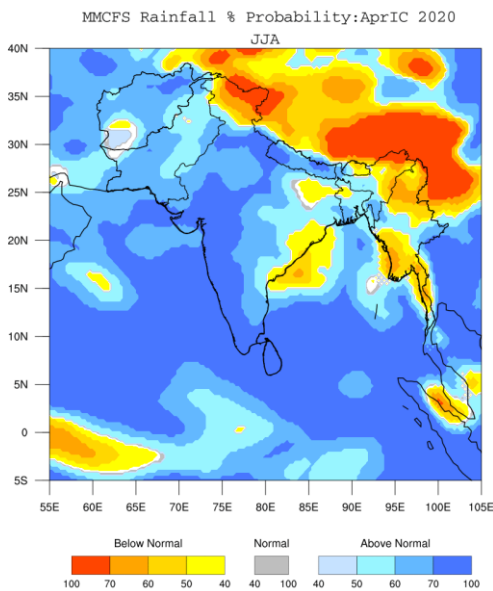


Figure 3 MMCFS precipitation forecast JJA

5.1.4 Precipitation forecast from NCHM using CPT: June – September 2020

The CPT forecast from NCHM shows near normal to slightly below normal rainfall in most parts of Bhutan during June-September 2020 (figure 4). The Country as a whole is expected to receive normal rainfall (figure 5).

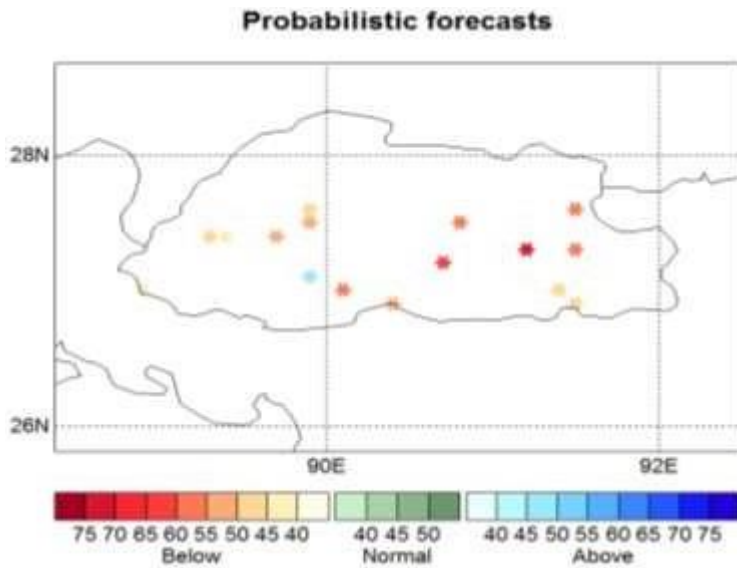


Figure 4 Point wise precipitation forecast for Bhutan JJAS

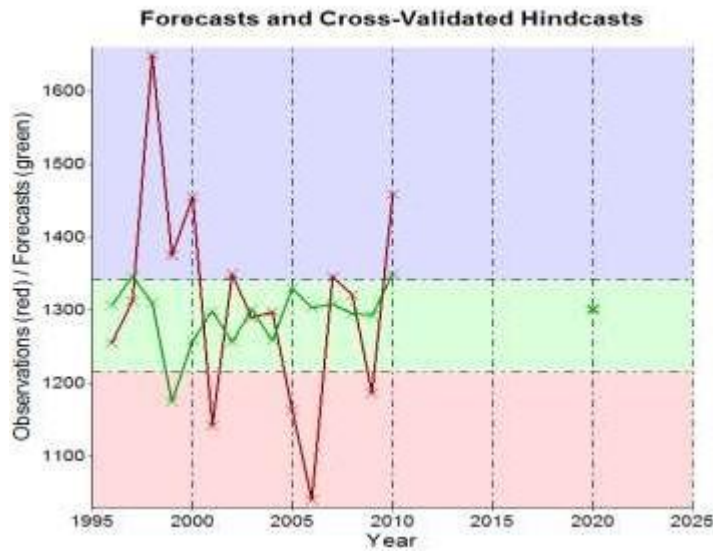


Figure 5 Average rainfall forecast for Bhutan JJAS

5.2 TEMPERATURE

5.2.1 WMO lead Centers

Probabilistic multi-model ensemble forecast from all GPCs of WMO indicate above normal temperature during June-August 2020.

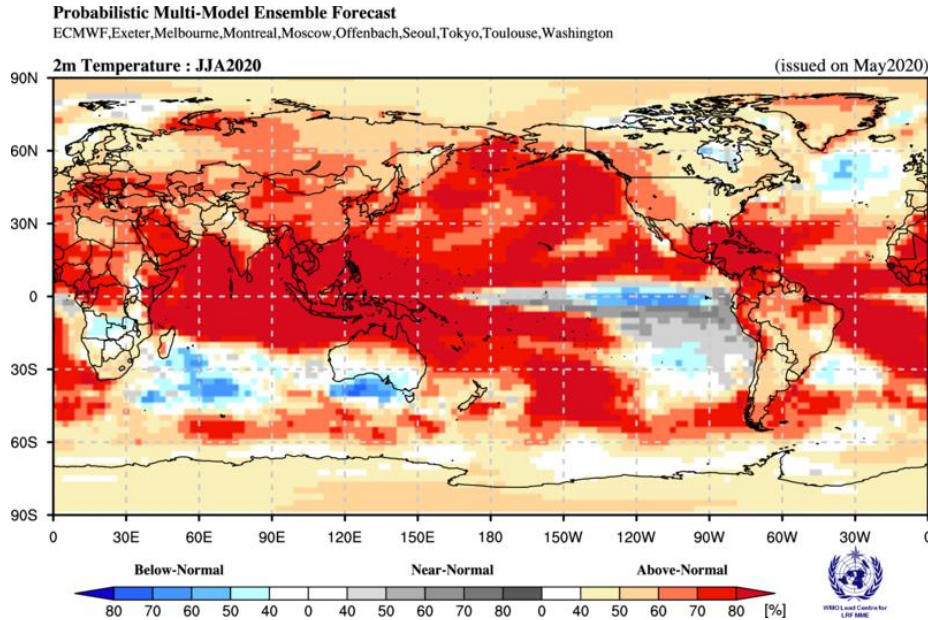


Figure 6 Temperature forecast from GPCs JJA

5.2.2 MMCFS of India Meteorological Department

MMCFS temperature forecast from IMD shows above normal temperature during June-August 2020 across Bhutan.

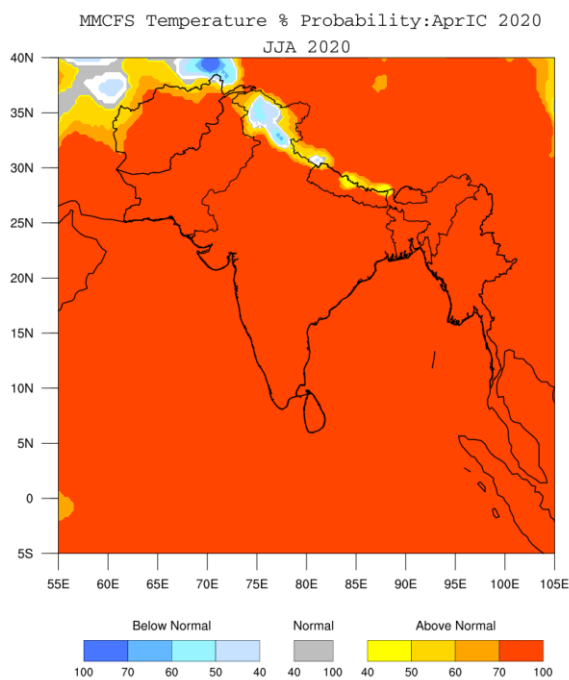


Figure 7 MMCFS temperature forecast JJA

5.2.3 Temperature Forecast from NCHM using CPT: June - August 2020

The temperature forecast from NCHM using CPT shows above normal temperature during June-September 2020 across Bhutan.

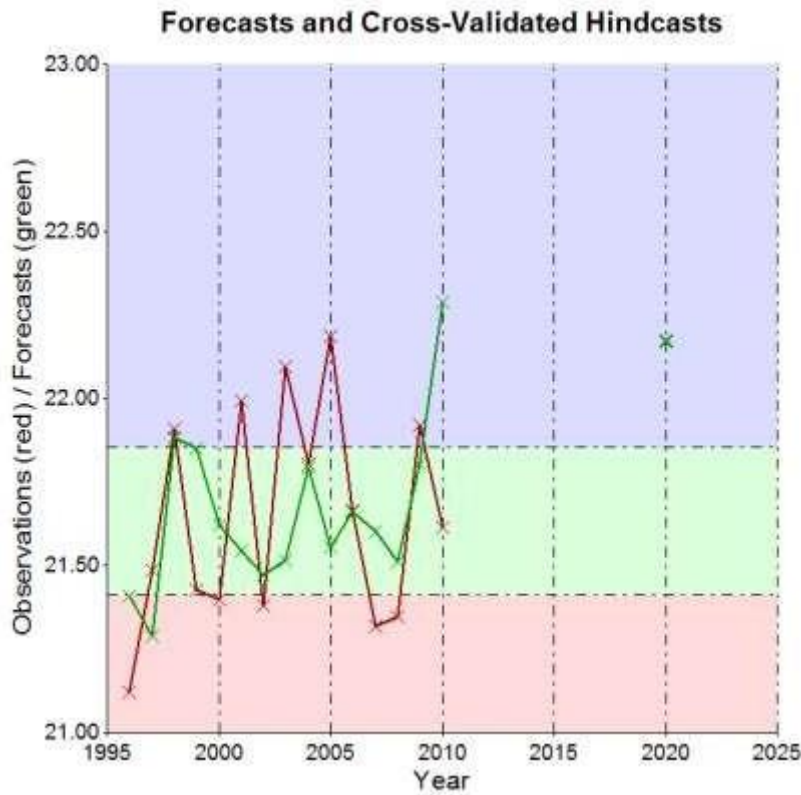


Figure 8 Temperature forecast for Bhutan JJAS

6. Conclusion

The rainfall during the 2020 summer season will most likely be normal to slightly below normal. For the temperature, it is most likely be above normal. It is to be noted that the forecast is provided as an average across the country and therefore, slight deviations in the forecast are expected from the point or station wise forecasts.

References:

- i. India Meteorological Department WMO Regional Climate Centre. (2020). *Consensus Statement on the Forecast for the Summer Season (June – September 2020) Precipitation and Temperatures over South Asia*, Pune, India.
- ii. India Meteorological Department. (2020). *Seasonal Climate Outlook for South Asia*.
- iii. WMO Lead Center for Long-Range Forecast Multi-Model Ensemble. (2020). Retrieved from
https://www.wmolc.org/seasonPmmeUI/plot_PMME

RELEASE NOTE

Date of Issue: 28 May 2020

Precipitation and Temperature Outlook for 2020 Summer Season

The outlook for rainfall and temperature for the summer season is for the months of June to September (JJAS). The forecast was prepared using a statistical model (Climate Predictability Tool) with inputs such as the Sea Surface Temperature data from the Global Climate Models and Observed Data (Rainfall and Temperature) of Bhutan. For the temperature, the average of the maximum and minimum temperature was used. Also, the outputs from the 16th Session of South Asian Climate Outlook Forum (SASCOF-16) for 2020 summer season, and the seasonal probabilistic multi-model ensemble forecast from the Lead Centers of World Meteorological Organization for Long-Range Forecast were used.

Rainfall Forecast for 2020 Summer Season

Normal is the average rainfall for the summer season (JJAS) of Bhutan from 1996-2019. The summer rainfall in Bhutan during the 2020 monsoon season is likely to be normal to slightly below normal. Rainfall is mostly expected to be similar to last year.

Temperature Forecast for 2020 Summer Season

Normal is the average temperature for the summer season (JJAS) of Bhutan from 1996-2019. The summer temperature in Bhutan during the 2020 monsoon season is likely to be normal to above normal.

Onset of 2020 Southwest Summer Monsoon

The onset of the 2020 southwest summer monsoon in Bhutan is expected around the 3rd Week (15-18) of June with an error of ± 7 days.