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Real-time subseasonal prediction of cold waves over India

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Cold wave (CW) events over India are usually observed during the boreal winter months, November to February. This study proposes an objective criterion using the actual, departure from normal and the percentile values of the daily gridded minimum temperature (Tmin) data for the monitoring of the CW events over the Indian region and also checks its usefulness in a multi-model ensemble extended range prediction system. The large-scale features associated with these CW events are also discussed.

The CW-prone region has been identified by utilizing this proposed criterion and considering the number of average CW days/year for the entire study period and recent decades. By calculating the standardized area-averaged (over the CW-prone region) Tmin anomalies time series, the CW events are identified from 1951 to 2022. Analyzing the temporal variability of these events, it is seen that there is no compromise in the occurrences of the CW events, even under the general warming scenarios. It is found that the long CW events (>7 days) are favoured by the La-Nina condition, and short CW events (≤ 7 days) are favoured by the neutral condition in the Pacific. Also, the blocking high to the northwest of Indian longitude with the very slow movement of the westerly trough to the east is found to be associated with the long CW events. In contrast, in the case of short events, the blocking high is not so significant. The multi-model ensemble prediction system is found to be reasonably skilful in predicting the CW events over the CW-prone region up to 2-3 weeks in advance with decreasing confidence in longer leads. Based on the forecast verifications, it is noticed that this forecasting system has a remarkable strength to provide an overall indication about the forthcoming CW events with sufficient lead time despite its uncertainties in space and time.