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Shifting of Western Disturbances winter precipitation over Western Himalayas

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The Indian Himalayan region receives an enormous amount of precipitation due to synoptic weather systems known as Western Disturbances (WDs). WDs are east-ward propagating systems embedded in the Subtropical Westerly Jetstream (SWJ). The main objective of this study is to investigate the change in magnitude and dynamics of WDs precipitation over the western Himalayan region. In this study, different observational datasets (IMD, AHRODITE, GPCP, GPCC, and ERA5) were selected to compare and assess the magnitude of WDs precipitation for the period 1987–2020 during the winters (DJF: December, January, and February). Further, to examine the structure of WDs precipitation at the pressure level of 200hPa, ERA5 Reanalysis datasets having a similar resolution of 25 km with the gridded dataset of the Indian Meteorological Department (IMD) are used for the analysis. WDs moisture sources from the Arabian Sea are assessed at 23 pressure levels (1000–200 hPa) for further understanding of WDs dynamics. Our study shows the daily shifting of WDs precipitation towards February during the winters and an intriguing decrease in daily WDs precipitation in recent years. During the study, we found that WDs precipitation contributed a significant amount of precipitation (~80%) over the Western Himalayan region of the Indian subcontinent. Using Theil-Sen method, trend analysis was performed, showing a decreased trend of WDs precipitation in recent years. The present findings indicate that WDs have changed their precipitation characteristics and dynamics due to climate change. The number of active WDs days is decreasing. Our results show there is enough moisture present over the Bay of Bengal region other than WDs which helps in sustaining and replenishing glaciers over the Indian Himalayan region.