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A Method for Bias Correction of Remotely Sensed Precipitation across Western Ghats Region of India

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The systematic and random errors in different remotely sensed (RS) precipitation products varies spatially and seasonally. Error characterisation of the satellite precipitation products is vital for improved hydrologic and climatic modelling as precipitation is the key component of surface and subsurface hydrologic system. In this study, a new approach is developed for the bias correction of different satellite and processed rainfall products across Western Ghats region of India. The Western Ghats are mountainous ranges of about 1600 Kms length parallel to west coast of peninsular India, which consists the largest tropical rainforest in India. Many studies have reported that most of the RS rainfall products are underestimated in Western Ghats region. In the present study, a multiplicative error distribution model for the entire Western Ghats for each of the RS precipitation products used is developed. Quality controlled interpolated gridded rain gauge data from Indian Meteorological Department (IMD) is used as the base. The IMD rainfall data is cross validated with available rain gauge data in the Western Ghats region. The bias correction of four multisatellite high-resolution precipitation products namely, Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN), Tropical Rainfall Measuring Mission (TRMM) Multisatellite Precipitation Analysis (TMPA) precipitation products, 3B42 version 7 and TMPA-3B42RT (Real Time) version 7 and Precipitation data from NASA (National Aeronautics and Space Administration) Modern-Era Retrospective Analysis for Research and Applications (MERRA) is performed in this study. The multiplicative monthly bias factor for each grid cell of Western Ghats is generated with the IMD rainfall as reference and it is found that the monthly multiplicative error for Western Ghats fluctuates around a common mean for each of the grid cell. Based on this a rainfall multiplicative error distribution is generated for each month for the Western Ghats regions. Systematic errors in rainfall were corrected using this distribution and the efficacy of error-corrected rainfall is evaluated with the help of conceptual rainfall-runoff models. The results depict that the proposed method helps to reduce the bias in different rainfall products and provide improved runoff estimations at Western Ghats.