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Comparison of two global datasets of TRMM and WFD with rain gauge data in driving Large-scale hydrological modelling in Beas River, North India

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In recent years, large-scale hydrological models have increasingly been used as a main assessment tool for global/regional water resources. During past two decades, numerous datasets have been developed for global/regional hydrological assessment and modeling, but these datasets often show differences in their spatial and temporal distributions of precipitation, which is one of the most critical input variables in global/regional hydrological modeling. This paper aimed at comparing the consistency and difference of two widely used global precipitation datasets in North India, i.e. Tropical Rainfall Measuring Mission (TRMM) 3B42 dataset and the Water and Global Change (WATCH) Forcing Data (WFD), and evaluating the performance of the large scale hydrological model (WASMOD-M) in simulation of water balance of Beas River basin in North India with these two global datasets as inputs. The study was carried out in the following steps. Firstly, the spatial–temporal distribution of TRMM and WFD precipitation in North India was compared by using four statistical analysis methods, which include Mann-Kendall method for testing whether these two datasets reveal the same temporal variability as gauging dataset, Kolmogorov-Smirnov test for testing whether these two datasets follow the same distribution pattern, and T and F test for testing whether they have the same mean and variances with those of gauging data. Secondly, the spatial–temporal distribution from rain gauging data in Beas river basin was taken as a benchmark, to compare and bias-correct the TRMM and WFD datasets. Thirdly, these two adjusted datasets were used to drive the large scale hydrological model (WASMOD-M) in water balance simulations of Beas River basin for the period of 1997-2001 when the two datasets overlap. The modeling results were compared and assessed based on the indices of Nash-Sutcliffe coefficient (NS), absolute value of the volume error (%) (VE), the performance measure of flow-duration curve based on evaluation points (EPs) by using equal interval of flows ( ), and visual inspection of the flow duration curves (FDCs). Finally, the water balance for the North India was calculated using the two global datasets as input and with regionalized model parameter values based on the calibrated values of 7 gauged catchments in Beas River basin. In every step, emphasizes were paid on the discussion of the consistency and difference resulted from using the two global datasets and gauging data. The approaches and results presented in this study contribute to the limited literature of regional hydrological modeling.

Keywords: global datasets, TRMM, WFD, Large-scale hydrological model, rain gauge