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Bias correction and merging satellite based rainfall products: experiences from Brahmaputra and Kinu basins

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A large number of catchments around the world lack hydro-meteorological data of sufficient spatial and/or temporal resolution, which is a major constraint to implementing there efficient water resources management. Advances in remote sensing provide opportunities to access alternative data, including satellite based rainfall estimates (SBRE), which can be used in hydrological studies of ungauged basins. Currently, there are a number of SBRE freely available. Some of them have been considered in the present research: 1) Tropical Rainfall Measuring Mission (TRMM), 2) Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN), 3) Climate Prediction Center (CPC) Morphing Method (CMORPH), 4) Integrated Multi-satellitE Retrievals for GPM (IMERG, of the Global Precipitation Mission). In this research different SBREs were compared with gauge rainfall in two basins: Brahmaputra (a very large basin) and Kinu (a small one). The particular choice of the basins was also to explore the effect of spatial scale of the basins on the applicability of the SBREs. At daily scales the errors of all SBREs were rather high for both basins and with higher temporal scales, for example, at weekly scale, errors of most products dropped substantially. At smaller spatial scales, for example, at 0.250x0.250 (approximately 25kmx25km), the errors were also high. When averaged over a larger area errors dropped. Errors were correlated with rainfall magnitudes and higher errors were observed with larger rainfall values. Bias correction using the Ratio Bias Correction method partially removed the systematic bias. However, the gauge data in both catchments were not sufficiently long to effectively remove the bias. Subsequently, merging of different SBREs was explored. In general, it is expected that merging increases overall accuracy in cases of uncorrelated estimators. Three different merging methods were considered, namely, Error Variance, Simple Averaging and Inverse Error Variance Weighting. For both catchments merging of SBREs improved accuracy. For Brahmaputra basin the Error Variance method was found to provide the best results whereas for the Kinu basin the Inverse Error Variance Weighting was better than the other methods.

Keywords: Merging, rainfall, remote sensing, Brahmaputra, Kinu