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Merging of satellite precipitation products: A quantile based Bayesian model averaging approach

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A multitude number of satellite precipitation products developed as an alternative to ground-based measurements. However, these products suffer from considerable errors and uncertainties due to their retrieval algorithms and sensor capabilities. The uncertainties vary from region to region depending on the topography and also with the rainfall intensities. This study evaluated the accuracy of Tropical Rainfall Measuring Mission (TRMM3B42), Integrated Multi-satellitE Retrievals for GPM (IMERG), Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks - Climate Data Record (PERSIANN-CDR), Climate Prediction Center morphing method (CMORPH), Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) and European Centre for Medium-Range Weather Forecasts Reanalysis 5th Generation (ERA5) during the monsoon season over the coastal Vamsadhara river basin in India. We have also developed a quantile based Bayesian model averaging (QBMA) to merge these products. QBMA is compared with traditional methods, namely, simple model averaging and one outlier removed. Two cases of merging, each with three sub-cases, were experimented: In the first case, we combined various for of TRMM (Linear Scaling bias-corrected, Local Intensity Scaling bias-corrected) PERSIANN and CMORPH. In the second case we had various combination of IMERG (Linear Scaling bias-corrected, Local Intensity Scaling bias-corrected), CHIRPS and ERA5. In all the cases, the coefficients were calibrated using 2001 to 2013 daily monsoon rainfall data and validated for 2014 to 2018. The results indicate that linear scaling bias-corrected QBMA outperformed the other methods in the first case. For the second case, the one outlier removed method performed better in terms of the correlation coefficient. However, the relative root mean square error is lowest for linear scaling bias-corrected QBMA. The second case outperformed the first case. Our results imply that the improvement of accuracy depends on the method and products used in merging.