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Evaluating the performance of remotely sensed and reanalysed precipitation data over West Africa using HBV light

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Water is one of the most crucial natural resources in West Africa, where the livelihoods of large parts of the population rely heavily on rain-fed agriculture. Therefore, the modelling of the water balance is an important tool to aid in water resource management. Precipitation is one of most important atmospheric drivers of hydrological models. However, ground-based observation networks are sparse in Western Africa and a further decline in station numbers due to a variety of reasons such as the deterioration of stations or political unrest has been observed in recent years.

In ungauged river basins, or basins with insufficiently available precipitation data, several studies have shown that remotely sensed or reanalysed precipitation data may be used to compliment or replace missing information. However, the uncertainties of these datasets over Western Africa are not well examined and a need for further studies is apparent. For validation purposes, precipitation datasets are traditionally compared to in-situ ground measurements. This is not possible in ungauged basins. A new approach to assess the quality of satellite and reanalysis data which is gaining popularity among researchers compares different precipitation datasets using hydrological models. In this so-called hydrological evaluation, ground-truth data is no longer necessary in order to validate a product. The chosen model is calibrated for different precipitation products and the simulated streamflow generated for each product is compared to the measured streamflow.

Multiple state of the art satellite and reanalysis precipitation datasets with various spatial resolutions were used in this study, namely: CFSR (0.3125°), CHIRPS (0.05°), CMORPH (0.25°), PERSIANN (0.25°), RFE 2.0 (0.1°), TAMSAT (0.0375°), TRMM 3B42 v7 (0.25°) and TRMM 3B42RT (real time) (0.25°). These datasets were evaluated at the regional as well as local scale using the HBV light conceptual hydrological model for several basins located in West Africa. The streamflow generated by the model was compared to the observed streamflow provided by various German, French and West African agencies in order to assess the performance and uncertainties of each product.

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Keywords: precipitation products, hydrological model, hydrologic evaluation, West Africa