

Hydrologic Evaluation of High-Resolution Satellite Precipitation Products: Case Study of Dabus Watershed, Ethiopia

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Abstract

Accurate measurement of rainfall is vital to investigate the spatial and temporal patterns of rainfall at various scales for rainfall-runoff modeling. However, accurate and consistent precipitation measurement are relatively sparse in many developing countries like Ethiopia. Nevertheless, satellite rainfall products may serve as important inputs for modeling in an area with scarce field data for a wide range of hydrological applications. In this study we evaluate the high resolution satellite precipitation products for hydrological simulation, the Climate Hazards Group Infrared Precipitation with Stations (CHIRPS) and Tropical Rainfall Measuring Mission (TRMM) Multisatellite Precipitation Analysis (TMPA_3B42v7) satellite rainfall products for stream flow simulation at daily temporal and $0.25^\circ \times 0.25^\circ$ spatial resolution. The study area is located in Dabus watershed, Abbay Basin, Ethiopia. We applied a non-linear power law to remove the systematic error of satellite precipitation estimates for input in to HEC-HMS hydrologic model for runoff generation. The Performance of the satellite rainfall and hydrologic model was evaluated using Nash Sutcliffe efficiency (ENS), coefficient of determination (R^2), relative volume error (RVE), and percentage error of peak flow (PEPF) objective functions. The result of HEC-HMS model performance revealed R^2 of 0.78, ENS of 0.69 for CHIRPS_2 and R^2 of 0.79, ENS of 0.76 for TMPA_3B42v7 satellite rainfall products during calibration periods. Our result indicated that the HEC-HMS model well predicated catchment runoff for both satellite precipitation products.

Key words; Satellite rainfall products, CHIRPS_2, TMPA_3B42v7, HEC-HMS, Bias correction, Abbay Basin, Ethiopia.

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