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Quantification of the Gumera Catchment's Mountain Hydrological Processes in Ethiopia

Authors : Tewele Gebretsadkan Haile

Abstract : Mountain terrains are essential to regional water resources by regulating hydrological processes that use downstream water supplies. Nevertheless, limited observed earth data in complex topography poses challenges for water resources regulation. That's why satellite product is implemented in this study. This study evaluates hydrological processes on mountain catchment of Gumera, Ethiopia using HBV-light model with satellite precipitation products (CHIRPS) for the temporal scale of 1996 to 2010 and area coverage of 1289 km2. The catchment is characterized by cultivation dominant and elevation ranges from 1788 to 3606 m above sea level. Three meteorological stations have been used for downscaling of the satellite data and one stream flow for calibration and validation. The result shows total annual water balance showed that precipitation 1410 mm, simulated 828 mm surface runoff compared to 1042 mm observed stream flow with actual evapotranspiration estimate 586mm and 1495mm potential evapotranspiration. The temperature range is 9°C in winter to 21°C. The catchment contributes 74% as quack runoff to the total runoff and 26% as lower groundwater storage, which sustains stream flow during low periods. The model uncertainty was measured using different metrics such as coefficient of determination, model efficiency, efficiency for log(Q) and flow weighted efficiency 0.76, 0.74, 0.66 and 0.70 respectively. The research result highlights that HBV model captures the mountain hydrology simulation and the result indicates quack runoff due to the traditional agricultural system, slope factor of the topography and adaptation measure for water resource management is recommended.

Keywords : mountain hydrology, CHIRPS, HBV model, Gumera
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