

EVALUATION OF THREE DIFFERENT MODEL CONCEPTS TO SIMULATE THE RAINFALL-RUNOFF PROCESS IN A TROPICAL HEADWATER CATCHMENT IN WEST AFRICA

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ABSTRACT

The aim of this study was to test three different model concepts in order to evaluate their applicability their ability to simulate the runoff-generation process in West Africa. For this evaluation one lumped conceptual model (UHP), one TOPMODEL-based approach (TOPLATS) and one physically based hillslope model (SIMULAT-H) was used. The three model concepts were tested in two sub-catchments of the Aguima catchment in central Benin: the Upper Aguima (3.2 km²) and the Lower Aguima (16.5 km²). The evaluation of the models revealed that TOPLATS is not applicable in tropical watersheds with flat relief without modification of the groundwater table algorithm. An extreme overestimation of the simulated discharge was observed for wet years due to the expansion of the saturation areas as a result of a high groundwater table. The physically-based model SIMULAT-H showed good results for the simulation of the hydrological processes. Due to the high input data requirement the model is only applicable in well-investigated catchments with good databases for model parameterization. The model is suitable for simulation of hydrological processes at the local scale in tropical regions.

The discharge simulation of the conceptual UHP-model was satisfactory for the Lower Aguima catchment for all considered years, with model efficiency and R² larger than 0.6. While the water budget was modelled correctly, over- and under-estimations were observable for the peak discharge. Due to the limited data requirements of the UHP model, it is suitable for application in watersheds with limited input data, especially for long-term simulations which focus on the quantification of the water balance.