

Modelling the long-term impact of climate change on rainfall–runoff processes over a large Sudano-Sahelian catchment

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Abstract A conceptual hydrological model is implemented over the last 50 years on a large poorly gauged Sudano-Sahelian catchment. The purpose is to simulate the rainfall–runoff relationship over this period that has been subjected to important hydro-climatic changes. A calibration/validation exercise is performed via a lumped and semi-distributed model with a 10-day time step. Simulations based on fixed and variable parameters are compared through a multi-criteria analysis using a variety of goodness-of-fit indices. In the variable parameter option, the subsurface runoff and deep infiltration parameters are constrained by the spatio-temporal variability of a smoothed pluviometric index. The simulation results show that model efficiency is significantly improved by the integration of variable parameters. They also show a decrease of the simulated subsurface runoff and deep infiltration during the 1970s and the 1980s, which can be essentially attributed to the persistent rain deficit since the 1970s. This trend will have led to a drastic decrease of the deep water recharge and of base runoff contribution to flood composition.

Key words climate change; catchment behaviour; hydrological modelling; HydroStrahler; River Bani, West Africa