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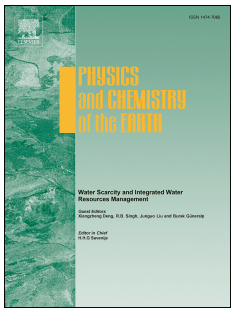

Providing peak river flow statistics and forecasting in the Niger River basin

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Providing peak river flow statistics and forecasting in the Niger River basin

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Abstract

Flooding is a growing concern in West Africa. Improved quantification of discharge extremes and associated uncertainties is needed to improve infrastructure design, and operational forecasting is needed to provide timely warnings. In this study, we use discharge observations, a hydrological model (Niger-HYPE) and extreme value analysis to estimate peak river flow statistics (e.g. the discharge magnitude with a 100-year return period) across the Niger River basin. To test the model's capacity of predicting peak flows, we compared 30-year maximum discharge and peak flow statistics derived from the model vs. derived from nine observation stations. The results indicate that the model simulates peak discharge reasonably well (on average +20%). However, the peak flow statistics have a large uncertainty range, which ought to be considered in infrastructure design. We then applied the methodology to derive basin-wide maps of peak flow statistics and their associated uncertainty. The results indicate that the method is applicable across the hydrologically active part of the river basin, and that the uncertainty varies substantially depending on location. Subsequently, we used the most recent bias-corrected climate projections to analyze potential changes in peak flow statistics in a changed climate. The results are generally ambiguous, with consistent changes only in very few areas. To test the forecasting capacity, we ran Niger-HYPE with a combination of meteorological data sets for the 2008 high-flow season and compared with observations. The results indicate reasonable forecasting capacity (on average 17% deviation), but additional years should also be evaluated. We finish by presenting a strategy and pilot project which will develop an operational flood monitoring and forecasting system based in-situ data, earth observations, modelling, and extreme statistics. In this way we aim to build capacity to ultimately improve resilience toward floods, protecting lives and infrastructure in the region.

Keywords: decision support; extreme discharge; floods; Generalized Extreme Value distribution; infrastructure design; Niger-HYPE

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