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Extending discharge time series in West Africa using hydrological modeling and satellite altimetry

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Long-term discharge time series are indispensable for water resources management, for detecting climate change, and for analyzing anthropogenic influences on catchment hydrology. Over West Africa though, most discharge time series extend to the early 2000s only, due to the steadily declining number of operating gauging stations. Therefore, the evaluation of satellite altimetry for deriving river discharge has moved into focus during the last years.

Here, we evaluated altimetry measurements (Jason-1, Jason-2, Envisat) for the rivers Niger and Black Volta at river crossings not included in public data bases due to limited river width. Rating curves were estimated from measured discharge as well as solely from morphological charateristics of the river. Since there is, if any, only a short overlap period between measured discharge and altimetry, we additonally used discharge simulated by the rainfall-runoff model GR4J. In this scope, we calibrated and validated GR4J against measured discharge and, subsequently, generated time series of daily discharge data for the period 1980 to 2014.

In most cases, discharge time-series derived from altimetry show good agreement with simulated and (when available) measured discharge. This study confirms the value of satellite altimetry for applications also in the case of smaller rivers.