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# Trends in hydrological extremes in the Senegal and Niger Rivers

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## Résumé

In recent years, West Africa has witnessed an increasing number of damaging floods that raise the question of a possible intensification of the hydrological hazards in the region. In this study, the evolution of extreme floods is analyzed over the period 1950-2015 for seven tributaries in the Sudano-Guinean part of the Senegal River basin and four data sets in the Sahelian part of the Niger River basin. Nonstationary Generalized Extreme Value (NS-GEV) distributions including twelve models with time-dependent parameters plus a stationary GEV are applied to annual maxima of daily discharge (AMAX) series. An original methodology is proposed for comparing GEV models and selecting the best for use. The stationary GEV is rejected for all stations, demonstrating the significant non-stationarity of extreme discharge values in West Africa over the past six decades. The model of best fit most commonly selected is a double-linear model for the central tendency parameter  $\mu$ , with the dispersion parameter  $\sigma$  modeled as either stationary, linear, or a double-linear. Change points in double-linear models are relatively consistent for the Senegal basin, with stations switching from a decreasing streamflow trend to an increasing streamflow trend in the early 1980s. In the Niger basin the trend in  $\mu$  is generally positive since the 1970s with an increase in slope after the change point, but the change point location is less consistent. The recent increasing trends in extreme discharges are reflected in an especially marked increase in return level magnitudes since the 1980s in the studied Sahelian rivers. The rate of the increase indicated by the study results raises urgent considerations for stakeholders and engineers who are in charge of river basin management and hydraulic works sizing.

**Mots-Clés:** Floods, Flood hazard, West Africa, Non, stationarity, Extreme Values, Model selection

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