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Assessment of future streamflow changes in major rivers of West Africa

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Although being one of the most vulnerable regions of the world to climate change, impact studies in West Africa, especially concerning water resources, are still scarce compared to other regions such as Europe, North-America or Asia. Therefore, we investigate in this study how climate change may affect the main rivers of West Africa (Niger, Volta, Senegal) using the global LISFLOOD model. This hydrological rainfall-runoff model, extensively used for pan-European assessments, has been recently set up and calibrated for Africa, allowing such impact analysis. Here, LISFLOOD is set up on a 0.1*0.1 degree grid for the period 1991-2050. Quantifying the uncertainty in climate impact studies is now a fundamental task, especially in West Africa where the agreement among rainfall projections is low. We therefore employ an ensemble of climate experiments originating from 8 different GCM/RCM combinations obtained from the EU FP6 ENSEMBLES project (SRES A1B scenario). Prior to forcing LISFLOOD, bias in the precipitation and temperature fields (Tmin, Tavg and Tmax) is removed with a quantile mapping method using as target the WATCH Forcing Data. In order to take into account the high population growth in West Africa we also account for projected changes in water use. Results first focus on changes in average streamflow conditions and how these changes affect water availability, expressed by the Water Exploitation Index. Second, and as underlined by the recent SREX IPCC report (2012), we show the impacts on extreme events (droughts and floods) using relevant indices such as the 100-year return period flood.