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On the influence of extreme rainfall and antecedent soil moisture on flood hazards in Africa

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The African continent is severely impacted by floods, with an increasing vulnerability to these events in the most recent decades. Our improved preparation against and response to this hazard would benefit from an enhanced understanding of the physical processes at play. A database recently compiled on Africa allows to conduct studies at the continental scale: the African Database of Hydrometric Indices (ADHI: https://doi.org/10.5194/essd-2020-281). Daily river discharge data have been extracted for 399 African rivers to analyze the seasonality of observed annual maximum discharge. In addition, extreme precipitation from CHIRPS and ERA5, and soil moisture from ERA5-Land between 1981 and 2018 have been also considered as potential flood drivers. The database includes a total of 11,302 flood events, covering most African regions. The analysis is based on directional statistics to compare the annual maximum river discharge with annual maximum rainfall and soil moisture. Results show that the annual peak flow in most areas is more strongly associated with the annual peak of soil moisture than of extreme precipitation. In addition, the interannual variability of flood magnitudes is better explained by the variability of annual maximum soil moisture or the precipitation summed over 5 days prior to an event, than by changes in the annual maximum daily precipitation. These results have important implications for the design of efficient flood forecasting systems or the investigation of the long-term evolution of these hydrological hazards.