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Decadal to multidecadal variability in long- and short-lived hydrological extremes in sub-Saharan Africa

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Sub-Saharan Africa is affected by a high-level of temporal and spatial climate variability, with large impacts on water resources, human lives and economies, notably through hydrological extremes, such as floods and droughts. Using a newly reconstructed 65-year daily streamflow dataset of over 600 stations distributed throughout sub-Saharan Africa, we first highlight that the frequency, intensity and duration of hydrological extremes are strongly impacted by decadal to multi-decadal variations. However, the key factors driving such decadal to multi-decadal variability remain poorly documented and understood. To address this research gap, we first compile information on local-scale (precipitation, temperature, soil moisture) and large-scale (e.g., El Niño–Southern Oscillation, Atlantic Multidecadal Variability) drivers. Then, by using relative importance analysis and multiple datasets, we investigate the contribution of large-scale versus regional-scale processes in driving decadal to multi-decadal variability in floods and droughts. Results show that the changes in flood and drought characteristics are significantly linked to modes of climate variability in the Pacific, Indian, and Atlantic Oceans. Although flood and drought characteristics are significantly correlated, the influences of large-scale climate variability on them are non-linear. Meanwhile, local-scale factors impacting floods and droughts are variable throughout the sub-continent. Our results highlight the role that changes in rainfall, soil moisture and temperature play across the major watersheds in sub-Saharan Africa.