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Characterising and projecting precipitation variability and its impact on water resources in the Rufiji basin, East Africa

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High inter-annual variability is a key characteristic of East African precipitation. The frequency and sequence of wet and dry extremes strongly affect the functioning of ecosystems and the profitability of agriculture and hydropower production in the region. Drivers include various land-ocean teleconnections operating at different scales, including the El Niño-Southern Oscillation. These drivers are less apparent in southern parts of the region with uni-modal seasonality, including the basin area of the Rufiji, an economically important river in Tanzania. Future climate is expected to increase climate variability, yet the details of projections of precipitation are highly uncertain. This makes assessment of consequences of changes in future variability a challenge. Here, we compare climate model simulations of precipitation variability with observations in the Rufiji basin. We assess how precipitation variability changes with scale of analysis. We then combine two standard methods of projecting precipitation variability, projected time series and the delta change method, with a novel method of resampling extreme years (including El Niño and La Niña events). Finally, we apply a high-resolution vegetation-hydrological model (LPJml) to the Rufiji basin, to examine how precipitation variability proceeds through the hydrological system. Our results show the differences between the two methods and the spatial scale at which projections of variability can be assumed valid. Improved understanding of variability could support design and management of hydropower and irrigation schemes in the region, and help in maintaining sustainable environmental flows.