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Interglacial African hydrological cycle - an isotope modelling study

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Tropical and subtropical African climate experienced changes in the hydrological cycle on orbital time scales. The Eemian interglacial maximum and mid-Holocene were times of increased Northern-Hemisphere summer insolation and increased seasonality. In the present study, we use the results of a fully coupled ocean-atmosphere general circulation model (AOGCM), which includes a module for the direct simulation of 18-O and Deuterium in the hydrological cycle. The direct modelling approach allows a physically consistent interpretation of the modelled climatic anomalies of the Eemian and mid-Holocene compared to pre-industrial conditions. We show that changes in monsoon strength can be interpreted as a consequence of changes in land surface temperatures, which in turn affect the geostrophic balance. Zonal transport of moisture from the Atlantic across the African continent was enhanced during the Eemian. The response of the modelled isotopic composition of precipitation shows depleted values in regions of increased precipitation, which can be interpreted as a combination of the continental effect and amount effect proposed by Dansgaard(1964). This interpretation is extended to other regions influenced by annual precipitation cycles, such as the marigins of the Arabian Sea. Here, we also observed isotopically depleted Eemian rainfall and attribute this to the amount effect, since the distance from the source (Arabian Sea) to the destination is short.