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Intense precipitation during the African Humid Period inferred from east Saharan fossil rivers: Implications for human dispersal

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During Late Quaternary time, the paleoclimate of the eastern Sahara was punctuated by multiple pluvial periods, then dramatically and cyclically transformed to hyperarid conditions, receiving less than 2 mm/yr of precipitation at present. Geologists, climate modelers, and archaeologists, therefore, have used various proxies to reconstruct past climates during that time, a crucial period for human habitation and migration. These reconstructions, however, lack the precipitation pattern during those pluvial periods, which represents a significant control on weighing the hypotheses of human migrations and occupations. Here we reconstruct the chronology and paleohydrology of a set of fossil rivers expressed by ridges in the modern landscape due to differential erosion. Our ^{14}C and Optically Stimulated Luminescence (OSL) ages of sediments preserved in these ancient rivers cluster within the last African Humid Period (AHP; ca. 14.8 – 5.5 ka BP) and hence support more significant fluvial activity during this distinct humid epoch. Based on median grain size (D_{50}), paleochannel geometry, and drainage area, paleohydraulic reconstructions indicate that typical precipitation intensities of 55–80 mm/h occurred during sediment transport events. When combined with previous annual rainfall estimates, we find that such rainfall intensities were likely 3–4 times more frequent during the AHP. These climatic perturbations may have rendered some parts of the Nile River Valley inhospitable for occupation, driving humans to migrate away in the northwest and west of the Nile Valley between 10.2 and 7.2 ka BP. Ultimately, our results, along with the archeological data, tell a tale from the past of the dramatic climatic changes that our planet undergoes, demonstrating the critical role of climate in sustaining human populations.