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Precessional and glacial-interglacial hydroclimate changes in southwestern Africa over the past 140ka: insights from the hydrogen and carbon isotopic composition of sedimentary plant leaf waxes

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The evolution of hydroclimate in southwestern Africa continues to be debated. Reduced southern hemisphere summer insolation (i.e. during the early-Holocene) is expected to have reduced monsoon strength, causing drier conditions. However, it has also been suggested that the early-Holocene was wetter than today in southwestern Africa. The effect of glacial conditions is similarly puzzling: it is not clear whether glacial conditions caused a northward shift of mid-latitude westerlies, or a southward shift of tropical rain-producing systems, as is commonly expected based on climate model simulations. Here we investigate the climate of southwestern Africa using terrestrial climate proxies taken from a marine sediment core located at 23°S off Namibia. The core extends back to the Last Interglacial, allowing us to test the effect of insolation over several precessional cycles and to test the effect of glacial conditions versus the Holocene and the Last Interglacial. We analysed (1) δD of leaf-wax n-alkanes - a proxy for continental rainfall amount and moisture source and (2) δ13C of leaf-wax n-alkanes - a proxy for vegetation type. Our data suggest that decreased southern hemisphere insolation (i.e. during the early-Holocene) gave rise to drier conditions in southwestern Africa, due to a more northerly position of tropical rainfall systems. Conversely, glacial conditions were wetter in southwestern Africa, probably due to a more southerly position of tropical systems, rather than a northward shift of the mid-latitude westerlies.