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Imprints of Millennial and Orbital forcing of African climates over the last glacial cycle

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Paleoclimate records across Late Quaternary Africa reveal high amplitude variability between wet and dry conditions. There is abundant evidence that the extents of arid areas and lakes are not static and that during numerous incursions in the past the African continent has hosted vegetation, lakes and rivers not present today. The spatial distribution and timing of these humid arid transitions is complex. This work explores the possible orbital and millennial scale forcing mechanisms which may be involved in producing the complex patterns within our observations.

African monsoon strength is determined by neighbouring sea surface temperatures and the cross continent temperature gradient. Over millennial and longer time scales these factors are controlled by orbital conditions but can also be affected by changes in the thermohaline circulation. Recent work has revealed apparent synchronicity between some lake high stand records and the timing of high latitude Heinrich events. For example lake highstands revealed by dated shoreline deposits from Lake Chilwa, southern Malawi, correlate with the high latitudes Heinrich events.

In this work we ask if and where high latitude events impact African humidity. Specific attention is paid to South African records because their complexity suggest that different regions are sensitive to different forcings. We use a unique suite of equilibrium model simulations covering the last 140,000 years generated using the Hadley Centre model HadCM3. Comparison of possible forcing mechanisms is made against simulations of the 17, 24, 32, 38, 46 and 60 kyr B.P Heinrich events. Heinrich events were forced upon the model by initiating a fresh water pulse of 1 Sv across the region 50-70°N in the Atlantic for 100 years of simulated time. This was sufficient to cause significant thermohaline circulation slowdown in the model and hence provides a mechanism for sea surface temperature change globally. We will show the effects of thermohaline shutdown on African climates.