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Climate induced hydrological changes in the Chinese Gobi Desert during the last 250 kyr

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A 230 m long sediment core from the centre of the Gaxun Nur Basin, Gobi Desert, NW China provides evidence for climate induced changes in water balance during the last glacial cycle. Millennial-scale and short-term variations of geochemical precipitates and grain size show that freshwater fluxes from the Tibetan Plateau by surface runoff were the main controlling factor for lake evolution in the Tibetan dry forelands for about the last 250 kyr. Periods of positive water balance with strong lake extension and reverse developments generally coincide with changes in the global ice volume and with oxygen-18 records from Tibet and Greenland as well, documenting the close relationship between environmental conditions in remote desert regions of NW China and orbitally forced Northern Hemisphere high mountain mid-latitude and high-latitude climates on a regional and global scale. Our data imply that both the East Asian summer monsoon and the extra-tropical westerlies are the major feedback mechanisms for effective moisture supply over NW China.

During the 10-kyr-long interglacial warm-moist substage 5.5 summer monsoon moisture dominated owing to its strong northward shift beyond the modern limit. At that time a large and slightly saline lake filled the entire Gaxun Nur basin as a result of strong river inflow from the Tibetan catchment by meltwater supply and by enhanced summer monsoon precipitation. Aeolian transport was weak. The Eemian-Interglacial in the Gaxun Nur region started at about 129 kyr BP, with favourable environmental conditions between 128 and 121 kyr BP, and terminated around 119 kyr BP, documented by a strong climate shift towards dry conditions and enhanced mobilization of aeolian sand.

During interstadial climates, contemporaneous with D/O events in Greenland ice

cores, both wind systems most likely supplemented each other, while in transitional phases towards cold conditions, moisture supply by the westerlies seems to have dominated. Cold-dry stages, recorded in the Gaxun Nur core, are synchronous with the global climate. They induced strong lake level declines and promoted aeolian transport of exposed lake sediments southward due to the enhanced winter monsoon. Loess records from the Chinese Loess Plateau confirm that the temporal distribution of loess mobilization recorded in the Gaxun Nur sediments was synchronous with depositional phases on the Loess Plateau.