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Intensity and amplitudes of humidity during the past 900 ka at the SE Tibetan Plateau

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We investigate paleoclimate fluctuations during 900-30 ka at the SE Tibetan Plateau based on a high-resolution lacustrine record from Heqing basin in NW Yunnan (SW China). Multivariate statistical and time series analyses of multi-proxy data from a 168m-long drill core, mainly magnetic parameters and carbonate content, in combination with results from a catchment study, allow us to develop a scenario for explaining the parameter variation in terms of humidity changes. This scenario is based on carbonate weathering in the catchment (limestones are predominant), characteristics of soil formed on the bedrock, relative changes of sediment transport by wind and surface water, low-temperature oxidation of magnetite, and grain-size selective dissolution of ferrimagnetic particles, related to wetter and drier conditions. Cluster analysis reveals four different phases with transitions at 670-630 ka, 380-320 ka, and 80 ka. We further resolve amplitude and intensity variations of weathering by a humidity index (HI) obtained through convolution of carbonate content, the magnetic grain-size parameter ARM/SIRM, and a magnetite/hematite measure (S-ratio). Strong amplitude variations relate to 100 ka eccentricity cycles. We may explain these variations by relative stronger and weaker influence of the Indian summer monsoon (ISM) that together with the East-Asian summer monsoon (EASM) affects the region of the SE Tibetan Plateau. Stronger orbital variations are likely in periods of stronger ISM because of its inter-hemispheric driving forces. During 630-380 ka we observe the strongest eccentricity amplitudes of the HI. When the influence of the ISM in the region weakens, not only orbital amplitudes will reduce but also moisture supply becomes less. A period of prevailing drier conditions is indicated in our HI record between 320-80 ka after which the HI suggests a quick return to clearly more humid conditions. Our study emphasizes the capability of magnetic parameters for paleoclimate reconstruction. Comparing our findings to other results we find that the HI variation provides complementary information to the ISM index of An et al. (Science 333: 719-723, 2011).