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Interplay between the Indian Ocean Summer Monsoon and the Westerlies at Nam Co, southern Tibet, based on sedimentary lipid biomarkers within the past 24 ka cal BP

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The interplay between the Indian Ocean Summer Monsoon (IOSM) and the Westerlies influences the lake systems at the Tibetan Plateau. However, the spatio-temporal extension and intensity of these air masses in the past is still scarcely investigated, especially in the Last Glacial Maximum. We present results from a sediment core from Nam Co, one of the longest paleorecords on the Plateau enabling the investigation back to the Last Glacial Maximum. Different organic geochemical proxies are applied to reconstruct the monsoon-forced hydrological and environmental changes in different climatic periods (Last Glacial Maximum, Heinrich 1, Bølling-Ållerød, Younger Dryas, Early Holocene). Isoprenoid glycerol dialkyl glycerol tetraethers (iGDGTs) are used as a temperature proxy, while the hydrogen isotopes (δD) of n-alkanes are used as a hydrological proxy.
Based on the δD proxies, the aquatic signal lags the terrestrial one due to specific ecological thresholds which in addition to climatic changes can influence the aquatic organisms. Because the terrestrial vegetation reacts faster and more sensitive to changes in the monsoonal and climatic system, the δD of n-C29 and the reconstructed inflow water signal represent an appropriate IOSM proxy. In general, the interplay of the different air masses seems to be primary controlled by solar insolation. In the Interglacial, the high insolation generates a large land-ocean pressure gradient and strong monsoonal winds with the strongest IOSM occurring in the Early Holocene. In the glacial period, however, the weak insolation promotes Westerlies which may block the weaker IOSM and influence the Tibetan Plateau. Our results provide new insight into the variable IOSM and illustrate a remarkable shift in the lake system from the glacial to the interglacial period.

Keywords: n-alkanes; iGDGTs; hydrogen isotopes (δD); Indian Ocean summer monsoon; temperature; precipitation; time lag; driving forces