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The use of oxygen isotopes of diatom silica in a decadal to centennial palaeonvironmental reconstruction

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The Lateglacial-early Holocene transition from the Lago Chungará record (northern Chilean Altiplano) is made up of laminated sediments composed by light and dark pluriannual couplets of diatomaceous ooze. Light sediment laminae accumulated during short-term diatom blooms whereas dark sediment laminae represent the baseline limnological conditions during several years of deposition. Diatom oxygen isotope data (_18Odiatom) of dark diatom laminae from Lago Chungará show evidence that the Lateglacial-early Holocene transition (11,990-11,475 cal years BP) occurred in a series of decadal-to-centennial wet–dry oscillations. Dry periods are marked by relatively high isotope values whereas wet episodes are indicated by lower isotope values. This fact is supported by data on allochtonous inputs and water availability curves from Lago Chungará previously published (Giralt et al. 2008). They highlight the sedimentological and environmental processes that occurred during these wet and dry episodes. The delta_18Odiatom record documents at least two episodes of increased effective moisture at a centennial-scale (ca.11,800 and 11,550 cal years BP) and only one important period of increasing aridity (between ca. 11,990 and 11,800 cal years BP). However, up to seven wet episodes and at least six dry events at a decadal scale are superimposed to the normal conditions. The spectral analyses of the delta_18Odiatom values suggest that these changes could be triggered by both El Niño-Southern Oscillation (ENSO) and solar activity. Time-frequency analysis shows that the activity of these two forcings was more intense during Lateglacial than during the onset of the Holocene. This last period could be governed by La Niña-like conditions that correspond to wet conditions over the Andean Altiplano.