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Glacier mass balance reconstruction by sublimation induced enrichment of chemical species on Cerro Tapado (Chilean Andes)

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Abstract. A 36 m long ice core down to bedrock from the Cerro Tapado glacier (5536 m a.s.l., 30°08' S, 69°55' W) was analyzed to reconstruct past climatic conditions for Northern Chile. Because of the marked seasonality in the precipitation (short wet winter and extended dry summer periods) in this region, major snow ablation and related post-depositional processes occur on the glacier surface during summer periods. They include predominantly sublimation and dry deposition. Assuming that, like measured during the field campaign, the enrichment of chloride was always related to sublimation, the chemical record along the ice core may be applied to reconstruct the history of such secondary processes linked to the past climatic conditions over northern Chile. For the time period 1962–1999, a mean annual net accumulation of 316 mm water equivalent (weq) and 327 mm weq loss by sublimation was deduced by this method. This corresponds to an initial total annual accumulation of 539 mm weq. The annual variability of the accumulation and sublimation is related with the Southern Oscillation Index (SOI): higher net-accumulation during El-Niño years and more sublimation during La Niña years. The deepest part of the ice record shows a time discontinuity; with an ice body deposited under different climatic conditions: 290 mm higher precipitation but with reduced seasonal distribution (+470 mm in winter and –180 mm in summer) and –3°C lower mean annual temperature. Unfortunately, its age is unknown. The comparison with regional proxy data however let us conclude that the glacier buildup did most likely occur after the dry mid-Holocene.

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