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Response of regional climate and glacier ice proxies to El Niño-Southern Oscillation (ENSO) in the subtropical Andes

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El Niño-Southern Oscillation (ENSO) is an important element of earth's ocean-climate system. To further understand its past variability, proxy records from climate archives need to be studied. Ice cores from high alpine glaciers may contain high resolution ENSO proxy information given the glacier site is climatologically sensitive to ENSO. We investigated the signals of ENSO in the climate of the subtropical Andes in the proximity of Cerro Tapado glacier (30˚08'S, 69˚55'W, 5550m a.s.l.), where a 36 m long ice core was drilled in 1999. Several proxy records derived from this ice core were studied with regard to their relation to local and regional climate as well as to ENSO. We used annual and semi-annual precipitation and temperature time series from regional meteorological stations and interpolated grids for correlation analyses with some ENSO indices (SOI, Niño 3.4 index, CEI) and ice core-derived proxies (net accumulation, stable isotope ratio δ^{18}O, major ion concentrations). This resulted in a spatial distribution of regional ENSO-teleconnection patterns of different intensities. Only in the western, i.e., Mediterranean Andes precipitation is higher (lower) during El Niño (La Niña) events, especially at higher altitudes depending on the latitudinal shift of the subtropical jet stream and frontal activity during austral winters. However,

temperature anomalies respond to ENSO more stably in space and time, being higher (lower) during El Niño (La Niña) events in most of the subtropical Andes all year long. Glacier ice proxies are found to be predominantly connected to eastern Andean summer rain climate, which contradicts previous studies and the modern mean spatial boundary between subtropical summer and winter rain climate derived from the grid data. Only major ion concentrations seem to be altered by ENSO via local temperature, indicating a reduction of sublimation and mineral dust input during El Niño years due to a lower water vapour gradient between snow and air.