



## Long-term response of the mountain cryosphere to climate change – a comparative perspective of the Andes of central Chile and the European Alps

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Over the last two decades the importance of the Andean cryosphere, particularly as water resource, has been recognized in both the scientific literature and the public sphere. However, in contrast to the European Alps, lack of field studies and limited knowledge regarding long-term cryosphere evolution has precluded basic knowledge for water-resource management and planning, particularly in the Andes of central Chile, a region that has been experiencing accelerated warming and a dramatic drought spell.

Using detailed glacial geomorphological mapping as well as new geochronologic and geophysical data we unravel the ice evolution in four Andean basins: Río Limarí (31° S), Río Aconcagua (32° S), Río Maipo (33° S), and Río Rapel (34° S). The Andes of central Chile hide a striking mosaic of Quaternary landforms where climate, cryosphere, and tectonics converge. The findings from our analysis suggest glacier advances during the pre-last glacial period and the Last Glacial Maximum (LGM, ~26–17 ka), between 9–12 ka, ~2700 a cal BP, ~850 a cal BP, and ~600 years ago. Geomorphological evidence and geochronological data suggest at least two glacier advances to nearly the same extent, first by the 13th to 16th centuries and then by the early to mid-19th century. Since then, a gradual pattern of distinct moraine ridges as observed in several catchments denotes a rather active and gradual ice demise. A larger glacier extension than today is also documented during the first half of the 20th century.

Finally, we discuss ages and their paleoclimate implications in the light of previous work in the region. Glacier chronologies in the southern mid-latitudes are suitable to track past latitudinal variability of the southern westerly winds (SWW) through the last glacial period and into the Holocene. For the latest Holocene, we note net humid and cold atmospheric conditions in central Chile between the 13th century and the mid-19th century. We conclude with an interhemispheric comparison of glacier chronologies from the Andes and the European Alps.