Reconstructing past glacier extents in the Chilean Altiplano (18.5°-19° S)

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Chronologies of glacier extents in the tropical Andes have been used to reconstruct past hydroclimate conditions during the Pleistocene and Early Holocene. Glaciers can be linked to specific climatic conditions by determining and analysing the equilibrium line altitude (ELA) at regional scales. In the tropical Andes, this approach has been used more frequently for glaciers in regions like Bolivia and Peru but little is known about past glacier extents in the Chilean part of the Central Andes. Today, glaciers in the Chilean Altiplano are very scarce, and the some few are mostly limited to single volcanic peaks (e.g., Parinacota or Acotango) covered by ice caps descending to altitudes of 5600-6000 m. Nevertheless, little attention have received moraine landforms and glacial deposits found below the modern ELA, which necessarily account for past climate conditions that favoured glacier formation and the extension of larger ice caps. Here, we present the first detailed map of glacial landforms from the Chilean Altiplano between 18.5° and 19°S. Our mapping is based on high-resolution satellite imagery and morphometric analysis implemented through a 10m Tandem-X digital elevation model supported by field observations. We reconstructed glacier extents using GIS-tools and quantified ELA locations based on the AAR method. In the study area, two, sometimes more levels of terminal moraines can be observed around the highest peaks. Glaciers have been present at all orientations with reconstructed ELA at a range between 4500-4700 m asl. ELA altitudes show significant altitudinal trends between northern and southern orientations and generally increase from West to East within our study area. Comparison of our preliminary results with existing ELA records and moraine dating available from neighbouring regions allows for a first discussion on the timing of glacier extents as well as potential implications for the hydro-climatic conditions across the Central Andes during the Pleistocene. Since ELA values from our study region are similar to those from the Bolivian Altiplano, we tentatively suggest that certain glacier extents were synchronous with major pluvial phases that resulted in glacier advances, but still, further investigation is required.