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Climate of the Past Discussions

Interactive comment on "Centennial-scale precipitation anomalies in the southern Altiplano (18° S) suggest an extra-tropical driver for the South American Summer Monsoon during the late Holocene" *by* Ignacio A. Jara et al.

Anonymous Referee #1

Received and published: 20 March 2019

This study presents a Holocene pollen record from a lake in the Chilean Altiplano. Overall this is an interesting record that deserves being published, in particular because it stems from a region where our understanding of past changes in climate is still rather rudimentary. I only have a few major comments and a number of smaller edits related to minor grammatical errors.

Main comments:

There is very little discussion (and no Figures) explaining the age-depth relationship

of this sediment record. There appear to have been significant corrections (reservoir effect) applied to the data, but there is little to no supporting information on how exactly the core was dated and how the chronology was established. If I understand correctly, the dating is based on only 3 radiocarbon dates. I understand that the chronology was established and discussed in an earlier paper, but nonetheless, to aid with the interpretation, more information is required to assess the chronological uncertainties in this part of the core.

There are significant uncertainties associated with the age chronology of both Sajama and Huascaran ice core records. Hence I do not have too much faith in the discussion comparing the Chungara record with the data from these two sites (section 5.3). It might be better to compare your record with higher resolution and more accurately (U/Th) dated ice core or speleothem records instead. For example the Holocene record produced by Kanner et al. (2013) from Huagapo cave is located closer to your site than Huascaran, is of much higher resolution, and much better age-constrained. The same is true for the Quelccaya ice core record, although it does not cover the full Holocene. Furthermore, the Huagapo cave record is more consistent with your data, also showing a clear switch from wet conditions at 2 ky BP to much drier conditions peaking around 1.5 ky BP.

While I agree that the main changes affecting the pollen record were driven by precipitation rather than temperature changes over the course of the Holocene, the estimated maximum temperature change in the region (0.8 C) is almost certainly too low. The region has seen significant glacial advances and retreat phases during the Holocene (e.g. Jomelli et al., 2011), most notably associated with the Little Ice Age (LIA) period (e.g. Rabatel et al., 2013). Although the LIA glacial advance in the region may have been partially caused by increased moisture, it is quite clear that the temperature reduction in the region must have been larger than the 0.8 C cited in the paper. Jomelli et al. (2011) based on glacial modeling, for example, estimate a regional LIA cooling of 2.1 C. The reported cooling of 0.8C is an estimate that is based on a large-scale

circum-tropical average and should not be applied to any single location. Data from local glacier reconstructions provide much better, regionally applicable constraints.

Page 13: Again, I would caution regarding the direct comparison of high-resolution, accurately dated records such as the lake record from Pumacocha (annually resolved for the last 2.3 ky years) and ice core records which are poorly resolved and have age uncertainties that are orders of magnitude larger. The disagreement between these records is likely due to chronological uncertainties rather than different climate sensitivities of the isotopic record, which would be very difficult to explain. In fact, over the period where the chronological control is strong, ice core records (Quelccaya), speleothem records (Huagapo, Palestina) and lake records (Pumacocha) are in agreement. Furthermore, evidence from observational calibration studies on Sajama (Hardy et al., 2003) and ice core forward modeling (Hurley et al., 2016) clearly document that Andean ice core d18O is a faithful recorder of precipitation and the South American summer monsoon strength and that the isotopic signal associated with temperature changes is inconsistent with what is being recorded in the ice core record (Hurley et al. 2019).

Minor edits: Line 43: 'period of instrumental' Line 45: 'makes is difficult' Line 66: 'of exploring', 'and assessing' Line 79: 'have produced' Line 95: 'originating' Line 121: 'plants' Line 122: 'cactus' Line 123: 'representative' Line 145: 'has no' Line 179: 'superimposed on' Line 211: 'based on' Line 245: 'values for' Line 280: 'vegetation cover' Line 321: 'trends indicate' Line 326: 'notable rise' Line 344: 'notable strengthening' Line 342: ' discussed in Sect. 5.1' Line 348" replace 'turns out clear' with 'is evident' Line 349" 'seem at odds' Line 369: 'south of' Line 437: 'Keimig' Line 446: 'southeastern' Line 460: 'reflecting a' Line 479: 'requested from' Line 485: 'they have no' Line 487: 'was funded by' Line 689: 'wind fields'

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tion on Nevado Sajama, Bolivia. J. Geophys. Res., 108, D22, 4693, doi: 10.1029/2003JD003623.

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