

Interactive comment on “Recent climate variations in Chile: constraints from borehole temperature profiles” by Carolyn Pickler et al.

Anonymous Referee #1

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The manuscript attempts to reconstruct the ground surface temperature for the past 500 years from inversion of select borehole temperature-depth profiles collected during the past decade from Chile, a poorly studied region in South America. Out of 31 T-z profiles considered in the study, nine profiles were finally selected for inversion following reasonable criteria. Further, the study intends to compare the results with the available meteorological data for the region, past climate inferences based on proxy data, and model simulations for central Chile and southern South America to determine climate trends for northern Chile.

The great majority of ground surface temperature reconstructions reported in literature have been derived from borehole temperature profiles in the low- and mid-latitude regions in the Northern Hemisphere (e.g., Europe, North America, Canada, India). In

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contrast, the Southern Hemisphere is under-represented in borehole climate change studies. This study attempts to cover this important gap with available datasets, and would be a valuable addition to published literature on the subject. However, the authors are advised to consider the following comments while submitting a revised manuscript.

The introduction section is rather long. The text could be tightened at a number of places, highlighting the shortcomings of previous work and how this paper addresses those shortcomings. Key references to similar studies from other regions (Europe, North America, Canada, India, etc.) may be cited.

Results of inversion: The T-z profiles at Inca de Oro appear to be relatively less perturbed when compared with the other boreholes. However, the conclusion of up to 2.2 oC warming, starting after 1960, followed by a long period of cooling is disturbing. This may not represent regional warming but could indicate local site effects. Other aspects that could be elaborated and/or investigated include, for example, (i) the choice of the lowermost 100 m for the linear regression, (ii) thermal conductivity contrasts in a borehole column, and (iii) the choice of small time interval of 20 years for parameterization of the time before present. The rock formations met with in the boreholes are not provided in the manuscript. Inversion of other T-z profiles in the north central Chile produces quite variable GST signatures.

Discussion: The manuscript reports very recent and relatively large GST warming preceded by a long cooling period from analyses of a few borehole T-z profiles from Chile. There is also large variability in the GST reconstructions between sites. From the relatively small dataset, it is difficult to infer whether this represents the regional scenario in South America. Comparisons are made with one meteorological station record at Copiapó airport located ~100 km away from Inca de Oro. The record spans the time interval 1950-present, which is too short for comparing with a 500 year history. The authors may want to explore other meteorological station records in the region. Also, the recent warming could be discussed along with the information on land use changes

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in the region during the past few decades.

Minor comments

1. Tables 1, 2 and 3 could be combined into one table. If space is limited, this table could go as electronic supplement. 2. Table 1. Qualify the last column header 3. Figure 1. Add a few place names for reference. 4. Table 5. To values may be shown up to one decimal place (to me, the second decimal digit is sometimes quite uncertain). 5. Fig. 14 may be deleted or included as electronic supplement.

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