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Interactive comment on "Recent climate variations in Chile: constraints from borehole temperature profiles" *by* Carolyne Pickler et al.

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Response to comments by Anonymous Reviewer #2

We thank the reviewer for his/her constructive and thoughtful comments. We do agree with several points that he/she has made and we shall include his/her suggestions in the revised manuscript.

1. *Introduction describes very clearly lack of paleoclimate records in Southern Hemisphere compared to the Northern Hemisphere and highlighting requirements of more paleoclimate records from Southern Hemisphere as well as in South America. However, it would be worth to cite some recent works related to*

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borehole studies from Australia i.e. Suman et al. 2017 and Suman and White, 2017 that addresses some of the drivers of paleotemperature variations in Tasmania, Australia and may have similar influence in other place of Southern Hemisphere.

Thank you for pointing out these references. We shall include them in the revised manuscript.

2. *Page 7 Line 4, "boreholes near significant topography were also rejected" is not clear. What does mean by significant topography? Specific topographic parameter i.e. slope, aspect or relief and their influence on borehole temperature data and/or temperature reconstruction should be used. Please make it clear.*

   It has been shown that topography distorts the temperature isotherms (Jeffreys, 1938): a positive topography leads to a reduced temperature gradient and an increased apparent warming signal (e.g., Blackwell et al., 1980; Guillou-Frottier et al., 1998). Profiles were assumed to be affected by topography and rejected rejected if they were near a slope of 5% or more at distance comparable to borehole depth. This will be clarified in the revised manuscript.

3. *Temperature reconstruction from northern coastal Chile (Michilla) did not show any temperature change in last 500 years. Is this supported by any other proxy results from surrounding area. If not, could you please double check 20th Century warming signal minimised by any other external driver or systematic thermal conductivity variations?*

   There is an absence of proxy data for northern coastal Chile (Michilla). Regarding perturbations due to thermal conductivity, we have no thermal conductivity data for the new holes but noted no change in the lithology. Also Springer and Förster (1998) did not note any significant change in thermal conductivity for their boreholes. The region has remained desertic and has not been affected by environmental changes (deforestation, land use) that could explain the

warming signal. Furthermore, a strict selection criteria was established to ensure boreholes influenced by topography or water flow were excluded from the study.

The CRUTEM4 grid centered at 22.5S 72.5W covers northern coastal Chile and includes meteorological stations at Iquique (∼260 km N of Michilla), Mejillones (∼55 km S of Michilla) and Antofagasta Cerro (∼80 km S of Michilla). Unfortunately, the record for all the stations is very short (less than 100 years. From these data (Figure 1), a climate signal is observed. However, it could have not been persistent/strong enough to be reconstructed using borehole temperature profiles.

4. *There should be more meteorological records in that region. It would be worth to compare borehole reconstruction with an average of set of surrounding meteorological records not just one station record.*

   See answer to previous comment. There is an absence of freely available meteorological records for the region. The majority of available records span only 10-20 years and are not useful for our study. However, we undertook further analysis using data from the CRUTEM4 (Jones et al., 2012) for the northern coastal Chile (Michilla) and northern central Chile gridpoints. These datasets comprise air surface temperature records on land that have been compiled on a $5x5^{\circ}$ grid. As outlined above, the CRUTEM4 grid centered at 22.5S 72.5W covers northern coastal Chile. The data span 1900 to 2016 and include stations at Iquique (∼260 km N of Michilla), Mejillones (∼55 km S of Michilla) and Antofagasta Cerro (∼80 km S of Michilla). The grid centered at 27.5S 72.5W covers north central Chile and includes stations at La Serena, Vallenar, Copiapó, Caldera but the data span only the years 1940 to 2016. In Figures 1 and 2, a decrease in temperature (∼1-2 K) can be seen in the early-mid 1990s, consistent with meteorological data from Copiapó. This will be discussed further in the revised manuscript.

5. *Conclusion states spatial variation of paleoclimate in northern Chile but there is*

no discussion regarding this in Discussion section. It would be worth to discuss spatial variations with available data in Discussion section.

A discussion of the spatial variations in available data will be undertaken in the Discussion section.

References

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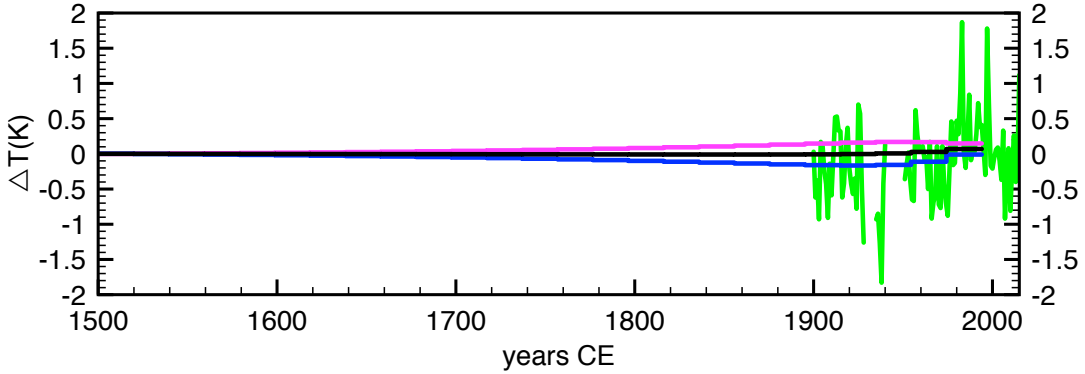

Fig. 1. GST history and meteorological data from the CRUTEM4 for northern coastal Chile (Michilla), presented with respect to the 1961-1990 mean

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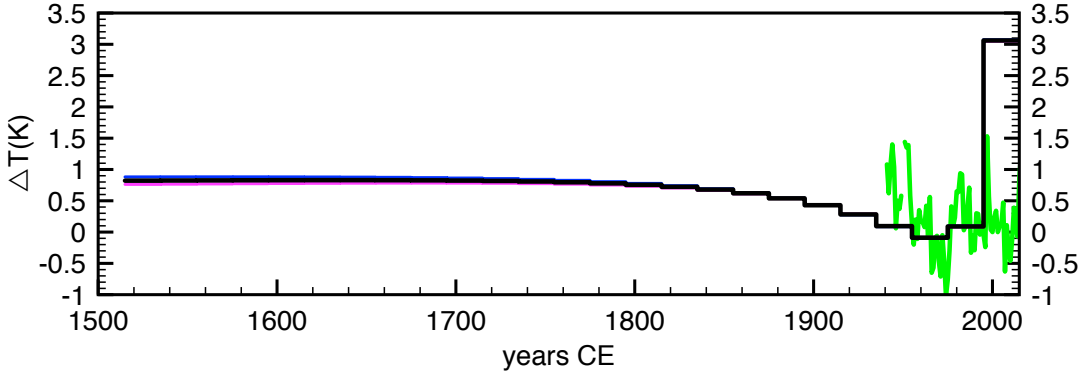

Fig. 2. GST history and meteorological data from the CRUTEM4 for Inca de Oro, presented with respect to the 1961-1990 mean

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