

Interactive comment on “North American regional climate reconstruction from Ground Surface Temperature Histories” by Fernando Jaume-Santero et al.

Anonymous Referee #1

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The manuscript presents a temperature reconstruction over the last 500 years in North America based on borehole temperature profiles. This is by now a well established method of past temperature reconstruction, which in contrast to other reconstructions is not based on indirect indicators, but rather uses present direct temperature measurements in boreholes. The reconstruction span is limited by the depth of the borehole analysed here. The reconstructions are compared to other temperature reconstructions based on dendroclimatological data and on pollen assemblages that were part of the PAGES-2K reconstructions for the North American continent. The main conclusion is that the borehole reconstructions sort of agree with the tree-ring and pollen-based reconstructions.

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The manuscript is well-written and well structured, and although it represents an incremental advance in the field, my recommendation is that it can be published after some minor revisions. I have some suggestions both on the manuscript and on the contents that the authors may want to consider.

1. The methodological section seems to me too long. The methods to derive temperature histories from borehole temperature profiles are well known and I think that this section can be reduced, supported by citation of existing literature. In my understanding, the present study is not introducing any methodological novelty so that this section should just present a summary of the methods for the sake of completeness.

2. On the other hand, I found the comparison to dendro and pollen reconstructions a bit too short. There are clear agreements between all tree, but also some discrepancies that may be worth noting (the manuscripts succinctly acknowledge some of these differences) and discussing. For instance, it seems clear that the temperature difference between the long-term preindustrial mean and present are larger in the borehole reconstructions than in the other two. What could be the reason ? It seems to me that this is a systematic results when comparing the reconstructions of the Northern Hemisphere mean by Huang, Pollack and others and the multi-proxy reconstructions. Is this a seasonal bias of the proxies ? Is this due to the different spatial coverage ? I would suggest to compare all three reconstructions together with the observed temperature trends in the 20th century, spatially resolved over North America. This is partly shown in Figure 8, so what I would find interesting is to have three maps of the long term trends over North America: boreholes, tree-rings and HadCRUT4) or any other observational data set). This can shed some light on the origin of the preindustrial minus present differences, for instance if one of the reconstruction under or overestimates the observed trends.

3. As a more minor note, the readability of the abstract could be improved, specially the first half, maybe having in mind a non-expert reader.

Other points

4. All of them presented as departures from the 1904-1980 temperature mean (Figure 6). However, the reconstructed GST warming signal for the past 200 years is greater than results from pollen reconstructions, coinciding with the findings of PAGES 2k-PMIP3 group (2015).

It is not clear whether this discrepancy was also found by the Pages2K, or that the borehole reconstructions now agree better with the Pages2K results than the pollen reconstructions.

5. Figure 8 indicates a warming trend of $\sim 1-2$ C in most parts of North America during the last 200 years. This is consistent with previous studies (Huang et al., 2000; Harris and Chapman, 2001; Beltrami et al., 2003). A cooling trend is observed in central California. Stevens et al. (2008) shows how this differs from the output of the ECHO-G model and postulates that it is the result of intensive irrigation in California's central valley, which could drive a regional cooling signal (Kueppers et al., 2007). A similar cooling signal is observed in British Columbia which might be associated with irrigation in the Fraser Valley.

This point is related to my previous point 2. What are the observed trends in California ?

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