

Interactive comment on “The extra-tropical NH temperature in the last two millennia: reconstructions of low-frequency variability” by B. Christiansen and F. C. Ljungqvist

Anonymous Referee #1

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Review of “The extra-tropical NH temperature in the last two millennia: reconstructions of low-frequency variability” by Christiansen and Ljungqvist

Summary and recommendation

The authors present two multi-proxy temperature reconstructions for the Northern Hemisphere North of 30°N. One reconstruction reaches back to 1 AD; the other reconstruction spans the period 1500 to 1960. The authors use the LOC method to reconstruct temperature back in time which conserves low-frequency variability. The

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amplitude between MCA and reference period of 1880-1960 is +0.7 K whereas the amplitude between the LIA and the reference period is -1.1 K. This is larger than in other reconstructions.

Overall the paper is nicely written and well structured. Still I have some major concerns regarding the results presented. An important critic is that the authors indicate that the reconstructions consists of 32 proxies for the one starting in 1 AD and 91 for the 1500-1960 AD, which is not true as after the screening only roughly half of proxies are used. So before accepting the paper this has to be clarified throughout the manuscript. In this respect I recommend to remove all the time series which are not included in the reconstructions from Figs. 1,2,3 and highlight them in the table 1.

So my recommendation is that the paper is acceptable after major revisions.

Major comments

1. As mentioned the reconstructions are based on fewer proxies than e.g. indicated in the abstract. Please remove the proxies not used from the Figures.
2. Abstract (l7) and elsewhere: The definition of local temperature is not clear. As far as I understood it the authors use 5°x5° data in the study so local is somehow misleading. To me local temperature data refer to nearby weather station.
3. Another major caveat is the selected reference period. First it is not clear why the authors use this period, it would be helpful if they use standard periods like 1960-1990 or so, then the amplitudes would be more comparable to e.g. Frank et al. (2010, Nature). What is the temperature difference between NH 0-90°N and NH 30-90°N during the reference period 1960-1990? This could help the reader to better understand the amplitudes given and to compare it to other reconstructions.
4. The simple averaging over e.g. 16 proxies might lead to errors in the reconstructed NH mean, see point 9 (minor comments).

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Minor comments

1. Abstract: Please explain acronyms used: LOC, LIA
2. 3992, 27: "can help us to understand"
3. 3994, 11: Please explain LOC also in the main text.
4. 3994, 17: I do not understand what is meant by 50-yr smoothed?
5. 3995, 13-14: Please explain why the proxies are log-transformed.
6. 3995 27: Significant correlations with what???
7. 3996 4: Please end the sentence with a dot.
8. 3999, top: What is the influence of the filter used in this study. Running averages might lead to unrealistic spectral peaks. I am not sure if another filter e.g. Gaussian filter might be better.
9. 4000, 19: The authors simply average the 16 'regional' temperature reconstructions to obtain the NH mean (North of 30°N). In particular for this reconstruction this might lead to misleading results, as not every sight might equally contribute to the NH mean. This could be solved by using the correlation structure of the sights to generate weights and estimated the NH mean. Please test this weighting by using the HadCRUT3 data.
10. Figs 5,6,7,8: I suggest to include the HadCRUT3 30-90°N mean as well as the selected grid boxes and then the weighted (as suggested in point 9) mean to see how well they reconstruction fits observations.
11. 4008, 29: There are several other groups performing millennium scale simulations which could be included in this list: Hofer et al. (2011, ClimPast), Swingedouw et al. (2011, ClimDyn)
12. Table 1, caption: Please specify what is correlated? Proxy with closest grid point

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from HadCRuT3 temperature? Is the correlation based on filtered data if so the running mean might lead to potentially wrong correlations.

13. Fig.6 Why is there a strong difference between the reconstructions in the period 1600-1700 AD

14. Fig.8, caption: On the one hand the authors write that the reconstruction is based on all proxies then it is written that only those are selected which show a significant positive correlation?

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