

## ***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***

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Received and published: 15 December 2011

First we want to thank Oliver Bothe for his interesting and constructive comments which we definitely will take up in the revised version of the paper.

Comments 2 and 3: These major comments regard the possibility of regional biases in the two-millennia long reconstruction. The worry is particular on the influence of the four east Asian proxies: China Stack (14), Dulan (21) East China (25) and Tibetan Plateau (79), which all are of decadal resolution. To address this question we have repeated the two-millennia long reconstruction shown in Fig. 5 without these four proxies. The resulting reconstruction based on 12 proxies is shown in Fig. A below (blue

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curve) together with the original reconstruction from Fig. 5 (black curve). We find only small changes in the low-frequency variability while the high-frequency variability has increased some as expected. The changes in the low-frequency variability is generally within the confidence levels shown in Fig. 5.

Oliver Bothe also mentions the possibility of different influences of high and low latitude proxies. Of the 32 proxies considered for the two-millennia long reconstruction 13/19 are positioned south/north of 60°N. Of the 16 proxies that pass the screening these numbers are 7/9. We have repeated the reconstruction based only on the 7 proxies south of 60°N. Again we find, see Fig. B below, only moderate changes in the variability on the lowest frequencies, while more variability has been introduced to the high-frequencies as expected from the small number of proxies.

Thus, it seems that the regional influence is small which is also in agreement with Fig. 9. We find similar results for the 500-year long reconstruction.

Comment 1: Unfortunately the LOC reconstruction method only reconstructs low-frequency variability confidently while high-frequency variability is overestimated. This makes validation exercises difficult with only 80-100 years of observations. This is one reason why we use the ensemble pseudo-proxy method to investigate the quality of the method and to provide confidence levels on the reconstructions. A reviewer of Christiansen and Ljungqvist 2011 suggested that we performed a leave-one-out cross-validation test of the correlation between the reconstruction and NH temperature based on annually resolved proxies. This test and its results are described in the last paragraph of section 8 of Christiansen and Ljungqvist 2011. We find almost similar results when repeating the test on the reconstructions in the present paper.

Comment 4: It is true that the present two-millennia long reconstruction is somewhat colder in AD 1200-1400 than the reconstruction in Christiansen and Ljungqvist 2011. However, the differences seem to lie within the 95 % confidence levels. In the revised version we will include the reconstruction of Christiansen and Ljungqvist 2011 in

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Fig. 5 to ease the comparison. The reconstruction in Christiansen 2011 shows larger variability than both the reconstruction in the present paper and the reconstruction in Christiansen and Ljungqvist 2011. However, the reconstruction in Christiansen 2011 was basically meant as an illustration (as mentioned in both Christiansen 2011 and Christiansen and Ljungqvist 2011) and was not expected to be particularly robust because of the limited number of independent points in the calibration period as it was based on a limited number of proxies of only decadal resolution.

Comment 5: The numbering of the proxies for the 2k reconstruction in Fig. 7 is wrong! For some reason they all have been incremented by 1. Thanks for pointing this out.

Comment 6: In the revised version we will experiment with including the other two-millennia reconstructions in Fig. 7.

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Interactive comment on Clim. Past Discuss., 7, 3991, 2011.

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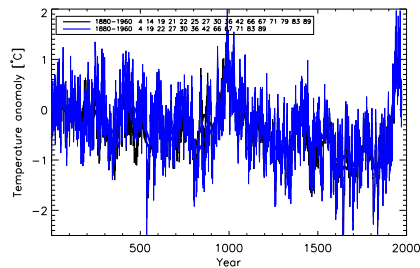
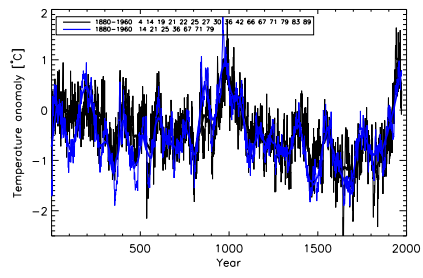


Figure A. Black curves are the reconstruction from Fig. 5. Blue curves are similar reconstructions when the four east Asian proxies have been excluded. The included proxies are given in the legend. Thin curves are annual values, thick curves are 50-year smoothed. Calibration period is 1880-1960.

Fig. 1.

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**Figure B.** Black curves are the reconstruction from Fig. 5. Blue curves are similar reconstructions when only proxies south of 60°N are included. The included proxies are given in the legend. Thin curves are annual values, thick curves are 50-year smoothed. calibration period is 1880-1960.

**Fig. 2.**

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