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Discussions

Interactive comment on "Tree-ring reconstruction of seasonal mean minimum temperature at Mt. Yaoshan, China, since 1873 and its relevance to 20th-century warming" *by* Y. Liu et al.

Y. Liu et al.

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Reply to Anonymous Referee #4

general comments This manuscript presents a reconstruction of December-June minimum temperatures for a site in the Central Plains of China, based on tree-ring data. There are several issues that the authors need to address before it may be considered to be published in CP. Specific comments First of all, I do wonder about the choice of target season (December-June). I do not buy the authors claim that this is "logical and easy to understand" (p. 869, line 3). From the correlation analyses (Fig 4), it is evident that there are strong correlations with T in February- April and June, but not in the

other months. I would also assume that there would be distinct differences in weather patterns and between the winter monsoon period, spring and the onset of the summer monsoon (June), which may not at all be linearly related? I would advise examining this (i.e. redoing the correlation analysis) by removing the trend in the data. I would like to see some rationale for reconstructing minimum temperatures.

[Reply] The target season we chose is no problem, because we have examined different months' combination, and ring width has the highest correlation with the minimum temperature from December to June (r=0.631). Although in figure 4 the temperature shows the strong correlation from February to April, the correlation is only 0.59 when combined them together, and this value is not high enough for reconstruction. This paper is dealing with the minimum temperature reconstruction and nothing to do with summer monsoon. The results of the correlation function analyses tell us that in the study area, the minimum temperature from December to June is the very important limiting factor for tree growth, and this is the reason.

Why do the authors choose to standardize the data using RCS? This is a method that is used to preserve low-frequency variability and more suitable for long chronologies (multi century). The authors may be familiar with the potential pitfalls when using this method, such as spurious end effects, and personally I would not use it for such short records as presented here.

[Reply] We examined different detrending methods, and the RCS produced the best results of the correlation analyses. So we preferred to use it.

I also question the usage of individual cores rather than tree-averages when calculating the EPS values. This clearly will boost the numbers, and from Fig. 2, I have a feeling that the "reliability" of the chronology weakens considerably prior to the early 1900s. Also, why is the sample depth dropping after the 1970s? What is the possible effect on the chronology of this?

[Reply] 1) The EPS assesses the degree to which the chronology represents a hypo-

thetical chronology based on an infinite number of cores (Briffa, et al., 1995; Cook, et al., 2000, 2002). Many researchers like to use the number of cores, instead of trees, during the EPS calculation. Following references are to name just a few. 2) Because some trees died after 1970s and some cores were incomplete near the end.

References: Briffa KR, Jones PD, Schweingruber FH, Shiyatov SG, Cook ER, 1995. Unusual 20th-Century Summer Warmth in a 1,000-Year Temperature Record from Siberia. Nature 376, 156-159. Cook ER, Buckley BM, D'Arrigo RD, Peterson MJ, 2000. Warm-season temperatures since 1600 BC reconstructed from Tasmanian tree rings and their relationship to large-scale sea surface temperature anomalies. Climate Dynamics 16, 79-91. Cook ER, D'Arrigo RD, Mann ME, 2002. A well-verified, multiproxy reconstruction of the winter North Atlantic Oscillation index since AD 1400. Journal of Climate 15, 1754-1764. Esper J, Shiyatov SG, Mazepa VS, Wilson RJS, Graybill DA, Funkhouser G. 2003. Temperature-sensitive Tien Shan tree ring chronologies show multi-centennial growth trends. Climate Dynamics 21, 699-706. Singh J, Yadav RR, Wilmking M, 2009. A 694-year tree-ring based rainfall reconstruction from Himachal Pradesh, India. Climate Dynamics, 33,1149-1158. Shao X, Xu Y, Yin ZY, Lliang E, Zhu H, Wang S, 2010. Climatic implications of a 3585-year tree-ring width chronology from the northeastern Qinghai-Tibetan Plateau. Quaternary Science Reviews 29, 2111-2122. Sano M, Buckley BM, Sweda T, 2009. Tree-ring based hydroclimate reconstruction over northern Vietnam from Fokienia hodginsii: eighteenth century mega-drought and tropical Pacific influence. Climate Dynamics 33, 331-340.

Another striking thing is the overall lack of correspondence between reconstructed and observed D-J Tmin (Fig. 6 & 7). While there is quite a strong positive trend in the observations, there much less trend in the tree-ring data. Also, the inter-annual agreement is quite weak. This suggests that the reconstruction neither captures the recent trend, nor the more extreme years. Could this be an indication of the choice of target season not being optimal? Assuming that the warming trend is larger in winter, and that the trees contain more of a spring signal, it may be wise to choose the latter as the

target.

[Reply] We have examined the correlation between ring width and February-April minimum temperature as you suggested, the r value is only 0.59 (the explained variance is 34.8%), and obviously lower than that of December-June minimum temperature (0.631, e.v. = 39.8%). So the target season we selected is correct without doubt. We think the comparisons in figure 6 and 7 are good. We all know that, worldwide, you never can expect tree-ring reconstruction capturing all (100%) extreme events. Tree ring, at bottom, is a climatic proxy, not an observation data. It would be very good if the tree-ring reconstruction could retrieve the most climatic information. You can look at all tree-ring papers to check this point. The very important thing is the validation of calibration and verification. In our manuscript, the calibration and verification were all significant, and passed the statistical tests. Hence, from the point of view of dendroclimatology, we can use this tree-ring data to reconstruct the December-June minimum temperature for the study region.

I know that it is more or less standard practice to do spectral analysis on tree-ring data, but when it is just briefly (and not very convincingly) discussed, I feel that it is redundant.

[Reply] Yes, the spectral analysis on tree-ring data is the fundamental procedure in the most dendro-papers. We feel this is necessary part in our paper.

Basically the discussion is weak and needs to be improved, especially page 871.

[Reply] We have made improvement. See Line 348-359 and 371-379.

The language needs to be checked throughout (especially the abstract and introduction

[Reply] The manuscript before submission was edited for English expression and grammas by an American professional editing service (AJE, American Journal Experts). Could you please give us details of your corrections?

Out of curiosity: the authors suggest that the historical documents are biased. Can

this be quantified and put in relation to the large uncertainty of the tree-ring based reconstruction?

[Reply] In our revision, we removed the comment about historical documents.

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