

## ***Interactive comment on “Millennial Minimum Temperature Variations in the Qilian Mountains, China: evidence from Tree rings” by Y. Zhang et al.***

**Anonymous Referee #2**

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In the manuscript “Millennial Minimum Temperature Variations in the Qilian Mountains, China: evidence from Tree rings” Zhang et al. present a new temperature reconstruction based on tree-ring width reaching from 670 AD to present. The authors properly use a wide range of dendro-climatological methods to draw a comprehensive picture of temperature variability in the study region. The reconstruction is compared to other regional but also global reconstructions and possible forcings are discussed that could have led to the observed variability. Overall this study meets all criteria as well as the aims and scope of “Climate of the Past”; it is well written and well structured. However, I suggest major modifications before acceptance.

My main general concern is the focus on the minimum temperature. It is mentioned in a few places that correlations between tree-ring width (TRW) and mean temperature are

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nearly as high as correlations between TRW and minimum temperature. Is there a tree-physiological reason why growth should be related to a monthly temperature minimum that possibly covers just a very short period of the entire month? Or are minimum and mean temperature just very highly correlated and minimum temperature shows coincidentally slightly higher correlations? Also, why should temperatures from January to April influence growth? Maybe due to extended snow cover? The choice made in this manuscript seems to be just a statistical hunt for highest correlation and I miss a sound scientific argumentation for the choices that have been made. It is mentioned only once in section 3.3 that the authors reconstruct “monthly minimum temperature anomalies, averaged over the months January to August”. I found the mostly used term “mean minimum temperature” not very clear. Finally in the comparison with other records, the minimum temperature reconstruction is discussed as if it would be exactly the same as a mean temperature reconstruction.

Therefore, I would suggest to either focus on the mean temperature reconstruction instead of the minimum or at least show more results for how minimum and mean temperatures are related and then explain a possible mechanism why trees should respond to one temporally short monthly minimum or an average of a few monthly minima rather than average temperatures during the growing season.

My second general concern is in regard to the spectral analysis. The strongly autocorrelated TRW is expected to have a red spectrum. Much more details about the applied method are needed, for instance with regard to how the red spectrum is taken into account in the decision which frequencies show significant peaks. I would be very careful trying to discuss a 500-yr cycle. Data treatment such as detrending might have influenced the low-frequency variability of the reconstruction, especially if chronologies have a length of around 500 years. You should also check how the 20th century temperature trend influences the spectral characteristics.

Finally, not all readers of “Climate of the Past” will be experts in tree-ring research. Thus, I strongly suggest to explain the methods and statistical skill measures in more

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detail, e.g. what is a “response function”, “subsample signal strength”, “Rbar”, “EPS”, etc. and how are these interpreted.

Detailed Comments

Page 342

Line 6: “pre- and current growing season” You just analyze the previous year starting in October when the growing season was probably already finished!

Line 6: “with minimum temperature” do you mean daily or monthly or yearly or ... minima?

Line 18: “28.8-66.2, 113.6-169.5” wide ranges of significant peaks, see also general comments on spectral analysis above.

Line 21: Last sentence is very vague

Page 344

Line 5: “different with those” -> “different from” or “in comparison to”

Line 11” Why was it controversial if samples where temperature or precipitation sensitive?

Line 14 ff: “Whether . . .” TRW reconstructions, which have to be detrended and otherwise statistically treated, have been shown to often not properly capture the full spectrum of climate variability. Will they be able to answer that question here?

Line 27: “We hope” I would use another expression

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Line 14: -1.5 to – 0.7

Line 23: “healthy” -> “living” and maybe say a word about the age distribution

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Line 4: here you say the mean correlation between all cores would be 0.6. In Table 2 you write 0.312. What is correct?

Line 20: How can a growth trend be corrected with a horizontal line? In general say why many different function had to be used to remove the growth trend and how you have chosen the functions.

Page: 347

Line 6: Maybe add a note on how these stations on very different elevations compare and why you also choose the station at so much lower elevation than the tree-ring site.

Line 11: Is there no way to obtain data from the closed station if there is one existing?

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Line 2: “Compare . . .” sentence is not clear.

Line 4: “subset of 2-station means” do you mean a subset of certain months?

Line 15: “is derived”

Line 19: “covers”

Line 22: “mean” before you said it would be the “median”

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Line 16 to 20: delete, just repetition of previous paragraph

Line 21: “correlation”

Line 21: rephrase, not clear that you generate a mean of the two stations for all temperature variables.

Line 23: What is “mean Tmin”

Line 26: Why?

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Line 2: Is Tmean also significant?

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Line 8: Do you have any indication for issues with early instrumental data?

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Line 8: Has Qilian data been degraded to 3-yr averages before calculating correlations?

Line 27: "inner-year" -> "intra-annual" ?

Page 355

Line 16: "mediaeval" -> "medieval". The medieval climate anomaly is mostly defined to last longer than 1100, maybe add some comment here.

Page 356

Line 12 ff: Why do you discuss the ENSO cycle extensively if you do not find any correlation between ENSO reconstructions and your temperature reconstructions but you do not discuss cycles in thermal contrasts, westerlies, etc. although you briefly mention them as possible causes of the observed frequencies?

Line 16: " has been" -> "can be identified"

Line 26: or it means that ENSO is not responsible for the 2-yr frequency!

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Line 15: Do you mean the 11-yr sun spot cycle when you talk about the 22-yr cycle?

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Line 10: delete "to us"

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Maybe mark the 21 volcanic eruptions in the reconstruction plot

Page 359

Line 19: "relationships"

Figures

Check label sizes, very different sizes make small text hard to read in the current printer-friendly pdf version.

Figure 1

Strange odd numbers on elevation scale

Figure 3

Rbar has not been explained in text

Figure 4

Maybe just show the average of the two stations as all there parts of the plot are very similar

Figure 6

Is it mean or minimum temperature?

Figure 7

Labels and titles could be improved and duplicate scale removed

Figure 8

Is the "temperature anomaly" (top) again the "minimum"?

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Interactive comment on Clim. Past Discuss., 10, 341, 2014.

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