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

Anonymous Referee #1

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Zhang et al. present a reconstruction of January to August minimum temperatures based on Qilian juniper ring-width chronologies from Qilian Mountains, North-Western Tibetan Plateau, China. The paper presents a new ring-width chronology reaching as far back as 450 AD. The chronology is considered suitable for climate reconstruction from AD 670. The authors compare the ring-width chronology to climate data from two nearby meteorological stations finding January to August minimum temperatures explaining the highest proportion of variance of the tree ring series. Hence the ring-width chronology is used to reconstruct January to August temperature of the last 1300 years. The reconstruction is then compared to other climate reconstructions and possible forcing mechanisms are discussed. The paper is well written and meets the criteria for publication in CP after considering some points mentioned below.

Response of Qilian juniper to climate:

The authors mention two papers that reconstruct temperature using Qilian juniper. In one study Qilian juniper ring-widths reflect December to April temperatures, in the other study ring-widths reflect previous September to April temperatures. In this study January to August temperatures are reconstructed. Qin et al. (2013) find precipitation to be limiting for growth of Qilian juniper. Could the authors explain why Qilian juniper is sensitive to so different climate variables in different places? The authors provide a short discussion in chapter 4.1. I think this manuscript would greatly benefit from further explanations.

Is there a possibility to exclude changing growth limitations (seasons and from temperature to precipitation) during the reconstruction period?

Figs 3 and 7(a): The period $\sim$1925 – 1940 looks very interesting. The ring-width chronology experiences a massive trend and inter-annual variability seems rather low (as far as this is visible from the figure). Is this trend as well found in other tree ring series? Why is the inter-annual variability so low? Could the authors expand on this very interesting period?

Calibration issues:

To me it remained unclear what (beside the highest r value) the motivation for reconstructing over an eight month period is. In this eight month period May and March are included, two months that seem (partly) precipitation sensitive. The influence of JJA temperatures on ring-width seems almost as strong as the influence of January through August temperatures. Could the authors as well calculate partial correlations for T JJA when the influence of T JFM has been partialled out, and vice versa?

P 351 lines 3-6: In an earlier section the authors mention the short calibration period that makes a split period approach impossible. In this section the authors are, in fact, splitting the calibration period in a period 1960 – 1984 and 1985 – 2011. For univariate

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(ordinary least squares) regression, regression parameters (a and b) and Pearson's r are directly related (b = r * sy / sx, and a = ymean– b * xmean). Therefore, I think the authors should decide whether a split period approach is possible or not. If they decide it is possible, they should use classical RE and CE statistics and as well give the correlation coefficient and p-value for the period 1960 – 1984.

P 351 lines 7-8: The authors mention a discrepancy between tree-ring data and meteorological data between 1960 and 1984. This discrepancy might indeed be caused by lower quality of meteorological data prior to 1985. A possibility of testing this hypothesis is to compare the (temperature) data of the two stations prior to 1985. Is the correlation between the two stations lower prior to 1985? Liu et al. (2007) don't find significant inhomogeneities among five stations including Zhangye. According to Liu et al. (2007) the Zhangye record starts in 1951 (with some missing values up to 1953). Is the data quality so low that the authors decided to omit these data?

P 351 lines 15- 20: 'Regardless the issues in the earlier part of the calibration period, the evaluative statistics in Table 3 indicated that our regression model was stable and reliable, and was acceptable to reconstruct the annual-to-centennial variability...' I do not think a leave-one-out approach is sufficient to substantiate this claim. Perhaps the authors could leave out 10 or even 15 consecutive years. Good performance under slightly less favourable conditions would increase the credibility of the calibration model. Unfortunately, the ring-width chronology is at its high end between 1960 and 2011. Therefore the reconstructions for most of the period before 1900 are at or beyond the end of the calibration space.

As mentioned by the authors temperature variations are less nicely depicted between 1960 and 1985. Considering the entire tree-ring chronology the values for the period 1985 – 2011 are all in the fourth quartile.

Page 350 line 5 why is the correlation calculated for 1962 – 2011 and not for 1960 – 2011?

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MTM:

P 352, lines 10 -14. How is the massive trend (non-stationarity) in the 20th century affecting the MTM spectrum? Could the authors run the spectral analysis for data from AD 700 to AD 1900?

I am not an expert on MTM and significance tests but I nevertheless have a question on this topic: Are the significance levels indicated valid for one single test i.e. if the scientist is interested in the significance of the 11-year band, or are these levels accounting for multiple testing since all frequency bands are tested for significance?

The comparison to other reconstructions and forcings isn't fully satisfactory. Many frequency bands > 10-year are significant. Since solar cycles have very wide frequency bands (DeVries–Suess cycle 170–260 year), it would be surprising if none of the significant frequencies were in the solar bands. Additionally, the use of wavelet coherence analysis is possibly a more straight forward approach for comparisons between reconstructions and forcings.

References:

Liu, X. H., Shao, X. M., Zhao, L. J., Qin, D. H., Chen, T., and Ren, J. W.: Dendroclimatic tem-perature record derived from tree-ring width and stable carbon isotope chronologies in the middle Qilian Mountains, China, Arct. Antarct. Alp. Res., 39, 651–657, 2007.

Qin C, Yang B, Melvin TM, Fan Z, Zhao Y, et al. 2013. Radial Growth of Qilian Juniper on the Northeast Tibetan Plateau and Potential Climate Associations. PLoS ONE 8, e79362. doi:10.1371.

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