Climate of the Past Discussions

Clim. Past Discuss., author comment AC1
https://doi.org/10.5194/cp-2021-2-AC1, 2021

Reply on RC1

Liangjun Zhu et al.

Author comment on "Overcoming model instability in tree-ring-based temperature reconstructions using a multi-species method: A case study from the Changbai Mountains, northeastern China" by Liangjun Zhu et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-2-AC1, 2021

Dear editor, dear referees,
We are so sorry for this late reply. Thank you for your constructive comments on our manuscript. The comments were valuable for helping us to revise and improve our paper, as well as the important guiding significance to our future research. We will do our best to improve the MS according your suggestions.

On behalf of the authors
Yours sincerely
Liangjun

Reply to Anonymous Referee #1:
The authors presented a 259-year long (from AD 1757 to 2015) April-September minimum temperature record reconstructed from tree-ring widths from six sites in Changbai Mountains of northeastern China. Different from traditional method that mainly use a single tree species for dendroclimatological reconstructions, the authors reconstructed the target temperature using tree rings combined from two species. They demonstrated the appropriateness of the method by comparing the tree growth-climate relationships in two single species and their combinations, and showing that the association of tree rings with regional April-September minimum temperature was stronger using data from combination of the two species than from each of the single species. From the temperature reconstruction, they identified the warm and cold periods in the past and discussed the linkage of the regional temperature variability with Atlantic Multidecadal Oscillation (AMO). I am not expertised in AMO. The following comments are mainly about tree rings.
My major concern is on the biological basis of combining tree-ring data from the two species.
1. Line 144: “Significant correlations between P. koraiensis and F. mandshurica chronologies, however, only exist for some sites”. What’s the reason for these un-correlations? And what is the biological rational for combining the tree-ring data from such un-correlated site chronologies?
Reponses: P. koraiensis and F. mandshurica are different species and they have different response to main climate factors. The results of tree growth-climate relationships show a contrasting sensitive pattern of tree growth to minimum temperature (Tmin). We found that the FM is more limited by Tmin in the high Tmin period, while the PK more like limited

by Tmin when low Tmin period. The biology for this practice is that, when the Tmin is high (warming period), factors other than April-September Tmin join together to limit tree growth of PK, thus the wide rings in PK no longer act as reliable signal for the target temperature. While the Tmin is low (cold period), other factors may join together with Tmin to limit tree growth of FM, thus the narrow rings in FM no longer act as reliable signal for Tmin. This is the biological rational for we combining the tree-ring data of two species even there do not correlated in some sites.
2. Line 153: "However, there is a differential temporal instability in the growth-climate relationship between P. koraiensis and F. mandshurica" and Fig. 3. It seems to me that the differential temporal instability in the growth-climate relationships between the two species was not removed in the combined regional chronology, rather, it was simply mixed. It is still unclear how the correlation coefficients between tree rings and temperature increased from 0.672 and 0.762 for the two single species to 0.824 for mixture of the two species. If this question is not answered, it is hard to be applied for other studies. What I guess is that the combined chronology was smoothed by the mixing which favored correlation coefficients for time series with obvious trends. Curiosity: As shown in Fig. 3, the lower correlations in growth-climate relationship appeared for high values of the species PK and for low values of the species FM. I suggest the authors to have a try for removal of these high values of PK and low values of FM (the level of high or low depends on authors' definition) in development of the combined chronology. The biology for this practice is that, when PK grows wide (and FM grows narrow), factors other than April-September minimum temperature join together to limit tree growth, thus the wide rings in PK (and narrow rings in FM) no longer act as reliable signal for the target temperature. I am not sure about the correctness of this suggestion but the authors could have a try. This means you are taking actions (rather than simple mixing) to deal with the temporal instability.
Reponses: we will try your suggestion to test if it is work.
Minor points:
4. Title: please consider if the "overcoming model instability" and "multi-species" are appropriate.
Reponses: we will revise the title.
5. Line 40: "however", is there a turning between the two sentences?
Reponses: we will do so.
6. Line 42: "reduction in tree-ring indices and temperature sensitivity", reduction in tree-ring indices or reduction in sensitivity of ...?
Reponses: we will do so.
7. Line 53: "Pinus" or "P.".
Reponses: we will do so.
8. Line 58: "frequent"?
Reponses: we have deleted it.
9. 1, the map at right: the site name of the top line: a typo?
Reponses: we will replot the figure.
10. 2: right bottom: how about draw the trend line from the year 1986?
Reponses: we will plot new figure.
11. Line 125: "greater than (less than) high than": a typo?
Reponses: we will do so.
12. 3: The level of significance for correlation coefficients should be tested differently for time series with a trend and without a trend.
Reponses: we will do so.
13. Line 222: "consistent" with
Reponses: we will do so.
14. Line 231: "possibility" or reliability?
Reponses: we will do so.
15. In the early period of the reconstruction (close to AD 1757), how many sites are from PK and how many from FM?
Reponses: 3 sites for FM and 2 sites for PK can reach the AD 1757.