

Clim. Past Discuss., referee comment RC1
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Comment on cp-2021-2

Anonymous Referee #1

Referee 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-RC1>, 2021

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.

- 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?
- 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.

Minor points:

- Title: please consider if the "overcoming model instability" and "multi-species" are appropriate.
- Line 40: "however", is there a turning between the two sentences?
- Line 42: "reduction in tree-ring indices and temperature sensitivity", reduction in tree-ring indices or reduction in sensitivity of ...?
- Line 53: "Pinus" or "P.".
- Line 58: "frequent"?
- 1, the map at right: the site name of the top line: a typo?
- 2: right bottom: how about draw the trend line from the year 1986?
- Line 125: "greater than (less than) high than": a typo?
- 3: The level of significance for correlation coefficients should be tested differently for time series with a trend and without a trend.
- Line 222: "consistent" with
- Line 231: "possibility" or reliability?
- In the early period of the reconstruction (close to AD 1757), how many sites are from PK and how many from FM?