Climate of the Past Discussions

Clim. Past Discuss., author comment AC3
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Reply on RC2

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-AC3, 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 #2:

The manuscript 'Overcoming model instability in tree-ring-based temperature reconstructions using a multi-species method: A case study from the Changbai Mountains, northeastern China' is a test of a multi-species approach might improve tree-ring based reconstructions of past climate. The work indicates that, indeed, multiple species can improve the potential for stability issues in reconstructing past climate from tree rings. The grammar is generally good; only a few places where it can be improved – please double check. There are a couple more steps in the analysis that would further strengthen the work.

The primary concern is that this approach is not as novel as stated in the manuscript. First, (García-Suárez et al. 2009) wrote about the value of a multi-species approach. Specifically, they wrote, "Apparent instability in the relations to climate of species like beech. However, we have found that combinations of species are better able to reconstruct climate than single species. Particularly robust are the reconstructions that use ash and beech simultaneously as predictors." Soon after (Pederson et al. 2013) tested this with a greater number of species and developed a table showing the potential for

using multiple species in a reconstruction and discussed findings that indicate species replication might stronger than chronology replication for the improvement and stability of reconstruction statistics. (Alexander et al. 2019) followed up that work by explicitly testing the hypothesis that increased species replication would improve temperature reconstructions. (Maxwell et al. 2011) has demonstrated this, too. Though not discussed in a similar way, the many drought atlases are mutli-species reconstructions and (Frank and Esper 2005) discuss the climate response of a multi-species high elevation network. There is a good amount of groundwork available in the literature for the manuscript developed here.

I am glad to see this kind of testing being replicated in other regions. What is new in this manuscript is that this is being tested in a different region and, especially, in a monsoonal climate. I am just surprised that one or a few of these earlier works are not acknowledged in this manuscript. It has been in the literature for at least 12 years.

To be clear, the author's work here is of value to science because of the region and species. They should, however, acknowledge previous work on a multi-species approach.

Reponses: Thank you for your constructive comments on our manuscript. These comments are valuable for helping us to improve our paper. We will add those literature in to the background of our work and do our best to revise the MS according your valuable suggestions.

Minor Comments

Line 19 – replace 'greatly' with 'can'. It is not evident that all reconstructions are greatly reduced due to instability. End the sentence after the phrase paleoclimate reconstructions and start a new sentence with this remaining text, "This is most notable in areas…"

Reponses: we will do so.

Line 20 – replace "an original" with "a test" as noted above, this is not exactly original.

Reponses: we will do so.

Line 32 – "climates are" should be "climate is"

Reponses: we will do so.

Line 37 – instead of "Tree rings, especially ring widths,", one could write "Information derived from tree-ring records…"

Reponses: we will do so.

Line 39 – instead of ", which" can replace with "and"

Reponses: we will do so.

Line 41 – another citation to go along with Fritts is (Cook and Kairiukstis 1990).

Reponses: we will do so.

Line 58 – "hypothesize" here should be "hypothesis"

Reponses: we will do so.

Line 152 – an R of 0.824 is incredible! I appreciate the authors put in the figure with first differences. They should state the R of that relationship (if they have not. If I have missed it, I apologize).

Figure 3 – it looks like PK does a lot of the work here. It would be interesting to make a PCA of all chronologies to see which ones and which species contribute the most for each period tested.

Reponses: we will do so.

Figure 4b – thank you for showing the first differences. Please note in the manuscript that the trend is doing most of the work with the R2 results.

Reponses: we will do so.

Figure 4c - adding in uncertainty to 4c is recommended. One approach would be to calculate the root mean squared error of the model and show two levels of uncertainty. One or two times the root mean squared error, for example.

Reponses: we will do so.

Line 195 – after and 1956-1982) it would be helpful to the readers if you add something like "according to how we defined warm/cold.

Reponses: we will do so.

Figure 5 – suggestion: what are the spectral properties prior to 1980 vs the entire record? It would be interesting to see how much warming has or has not changed the spectral frequency.

Reponses: we will do so.

Figure 6 - synchronization of temperatures and trends is a characteristic of global warming. Could highlight that fact in the text.

Reponses: we will do so.

Line 272 – consider trying cross spectral analyses to see at what frequencies your recon and the AMO are in sync.

Reponses: we will do so.

Line 315 – Given the general concern I have at the start of the review, rewrite the first sentence as, "We have tested how mixing tree species might improve the accuracy…."

Reponses: we will do so.