Response to editor

Dear authors,

Thank you for your efforts in revising your manuscript. The reviewers seem satisfied with the corrections made. Reviewer 1 is nevertheless concerned about the reference to other datasets, and I agree with him. While some of the comments were indeed very detailed on methodological issues, you could have made some minimal attempts to better contextualize your study and make broader comparisons, for example with other paleoclimate proxies, d13C records, or by showing greater awareness of the sources of d18O variability over time. Acknowledging that there are other sources of paleoclimate reconstructions and that they could have an impact on the current paper would at least show concern for broader scientific issues. Please consider this important issue in the final revision of your manuscript in order to lead me to accept your article for publication. All the very best

Denis-Didier Rousseau

CP co-editor in chief

Dear Editor,

Thank you for taking the time to read and review our paper. Thank you for your appreciation and suggestions that will help us improve our manuscript. We have reviewed all the comments raised by you and by the reviewer and provided a point-by-point response below.

We improved the new version of the manuscript according to your and the reviewer's suggestions. We added a new section (Section 3.6) where we analyzed also the large-scale drivers of summer VPD over the last 400 years, by using the monthly paleoclimate reanalysis. This section represents a new insight into the relationship between summer VPD and large-scale atmospheric circulation, a relationship that has been neglected so far or at least not treated directly, but also allows us to compare our reconstruction with different climatic datasets.

We also significantly improved section 3.5, and we compared our reconstruction with a newly published dataset (e.g. Treydte et al. 2023). The correlation results between our reconstruction and the new dataset indicate very good agreement between those two datasets, which validated again the robustness of our reconstruction.

We acknowledge in section 4 the open-source of the $\delta^{13}C$ data, as a limitation factor for our reconstruction, and its potential for future studies.

The introduction section was also improved. New sentences were added to address more detailed the sources of the $\delta^{18}O$ in tree-ring cellulose. We also indicated the relationship between the variability of $\delta^{18}O$ in precipitation (and hence soil water and trees) and $\delta^{18}O$ in tree-ring variability was studied and results have been published in multiple papers. We also indicated that the relationship between intra-annual tree-ring $\delta^{18}O$ data from the ISONET network and $\delta^{18}O$ in precipitation was previously studied and results are published in a different paper (Balting et al., (2021)), therefore there is no need for such analysis in the current paper.

In summary, we have considered all the addressed comments and suggestions, and have made significant revisions to the manuscript to address these concerns. We added the new analyses, included a comparison with a new dataset, acknowledged the existence of the carbon isotope data, and improved the explication of the sources of the $\delta^{18}O$ in tree-ring cellulose.

We believe that these revisions have significantly strengthened the manuscript and better address the concerns raised by the reviewers and the editor. We are confident that the revised manuscript provides a comprehensive and informative overview of our summer $\delta^{18}O$-VPD reconstruction and its implications for understanding past climate conditions, therefore we hope that the improved version of our manuscript is suitable for publication in the Climate of the Past journal.

Thank you for your consideration.

On behalf of the all (co)-authors,

Viorica Nagavciuc

Response to Reviewer 1

I have read the revised manuscript reconstructing VPD from tree-ring d18O values, both with respect to evaluating the revision on its own merits, but also with evaluating the adequacy of the revisions requested by the peer-reviewers.

We want to thank the reviewer for the appreciation/suggestions/comments/feedback that will help us improve our manuscript, and for taking the time to read and review our paper. We have reviewed all the comments and suggestions and provided a point-by-point response below. The reviewer's comments are shown in black and the replies are shown in red.

In the first case, the revised paper is well-written and is a valuable and important contribution. The tightly focused manuscript makes a nice contribution to the literature as a data product. Overall I am supportive of it being published with revisions that better contextualize the paper with respect to other sources of data.

We want to thank the reviewer for their appreciation of our work.

On the second case, some of the reasonable suggestions remain available for revision in a way that could improve the paper.

For example, the response on the δ13C. Because the d13C data has been published, one can, minimally and qualitatively, evaluate the current paper's results with those published in other papers. Similarly, the point on changing δ18O of precipitation (and hence soil water and trees) wasn't adequately dealt with. What the reviewers are asking for is to make some attempt to compare this new data product to other lines of evidence to assess how well it fits with other data. The goal is to improve the paper. This need not require writing a new manuscript, but rather adding some discussion at strategic points that at least attempt to address the questions raised, which are also likely to be raised by readers of the paper. The strict focus on only tree-ring studies is also a lost opportunity to show that the VPD reconstruction has broader applicability.

We improved the new version of the manuscript according to the reviewer's suggestions.

We added a new section (Section 3.6) where we analyzed the large-scale drivers of summer VPD over the last 400 years, by using the monthly paleoclimate reanalysis. This section represents a new insight into the relationship between summer VPD and large-scale atmospheric circulation, a relationship that has been neglected so far or at least not treated directly, but also allows us to compare our reconstruction with different climatic datasets.

We also significantly improved section 3.5, and we compared our reconstruction with a newly published dataset (e.g. Treydte et al. 2023), and obtained a very good agreement between those two datasets, which validated again the robustness of our reconstruction.

Section 4 was also improved, and we acknowledge the $\delta^{13}C$ data set as already open-source data and as a limitation for our manuscript, as well as the potential pf other paleo-proxy records.

The link between the variability of $\delta^{18}O$ in precipitation (and hence soil water and trees) and $\delta^{18}O$ in tree-ring variability was studied and results have been published in multiple papers. We also indicated in the introduction section that the relationship between intra-annual tree-ring $\delta^{18}O$ data from the ISONET network and $\delta^{18}O$ in precipitation was previously studied and results are published in a different paper (Balting et al., (2021)), therefore there is no need for such analysis in the current paper.

The lines 46-57 are a nice addition, but still need some work to avoid run-on sentences.

In the revised version of the manuscript, we improved this section and rephrased some sentences to avoid run-on sentences.

L89: sentence is unclear/awkward “However, δ18O features the δ18O….” Clarify/rewrite. Do you mean “However, cellulose δ18O is related to chloroplast δ18O…”? That is how I interpret what was written.

Thank you for this comment, that was an error typing which has been corrected in the revised version of the manuscript.

The correlations around line 385, while statistically significant, are small, and much of the relationship between the variables remain unexplained. This limitation of the data should be referenced back to later in the manuscript, when discussing how robust our understanding of VPD (from δ18O) and other tree-ring based paleoclimate proxies actually is (or isn’t). The paragraph on L410 is a good place to state that, while “satisfactory”, the reconstruction still has limitations and unexplained variations.

In the revised version of the manuscript, we improved the aforementioned section and pointed out the straightness and weakness of the obtained correlations as suggested by the reviewer.

To test the robustness of our reconstruction, we also compared it, in the revised version of the manuscript, with a new data set (e.g. Treydte et al. 2023). In terms of VPD, our reconstructions show a high and significant correlation with the aforementioned reconstructions (see Lines 469-503 in the revised manuscript).

In agreement with the reviewer's suggestion, we improved the limitation section of our manuscript.

L517: recorded not recoded

Modified as suggested.