

## ***Interactive comment on “Cambial-age related correlations of stable isotopes and tree-ring widths in wood samples of tree-line conifers” by Tito Arosio et al.***

### **Anonymous Referee #1**

Received and published: 23 December 2020

General Comments. Thank you for the opportunity to review “Cambial-age related correlations of stable isotopes and tree-ring widths in wood samples of tree-line conifers” by Arosio, Ziehmer-Wenz, Nicolussi, Schlüchter, and Leuenberger, bg-2020-406. This study takes advantage of the large Alpine Holocene Tree-Ring Dataset to examine effects of age on the correlation between tree-ring width (TRW) and stable isotope ratios of hydrogen, oxygen and carbon. The manuscript extends an excellent study by a similar group of authors (Biogeosciences 17, 4871-4882, 2020) which found an influence of age on stable isotope ratios of oxygen and hydrogen but not carbon. Correlations between stable isotope ratios and TRW are relevant and within the scope of BG, but this paper seeks to explore the effect of age on these correlations, a narrow

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and difficult subject given the known strong and non-linear effects of age on TRW. The dataset is apparently well-collected and impressive in its temporal coverage (9000 years) and replication (7604 samples). The approaches are standard, but the methods and assumptions appear to be valid and clearly outlined. The main conclusion, well supported by the data, is that the correlation between TRW and isotope ratios of hydrogen and oxygen is affected by age in the first 100 years. This is not surprising given that TRW is known to be strongly affected by age and that the same authors have already shown that isotope ratios of oxygen and hydrogen are affected by age. More detail in some of the methods would be helpful as described below. The authors give proper credit to related work, the title clearly reflects the contents of the paper, and the abstract is reasonably clear. The overall presentation is concise and well-structured, but problems with the English grammar make much of the writing unclear. Mathematical formulae, symbols, abbreviations and units are correctly defined and used. I have no suggestions for combining or eliminating major sections. The references and the supplementary material are appropriate.

**Specific Comments.** The authors find that the correlation between TRW and isotope ratios of hydrogen and oxygen, but not carbon, are affected by age in the first 100 years. These correlations are strongly affected by the method used to detrend the TRW data for age. More precisely there is a strong difference between the results of linear and spline detrending. The spline but not linear detrending is addressed in lines 143-144. The authors need to explain the difference between these two detrending approaches. Is it possible the cause of this difference is that in the linear case detrending was applied to both the isotope and TRW data, while in the spline case detrending was applied only to the TRW data?

For both species in the first 75 cambial years, the hydrogen isotope ratio is negatively correlated with TRW and the oxygen isotope ratio is positively correlated with TRW for both raw and linearly detrended data (Fig. 1, panels a, b, d, and e). The authors present an interesting and well-referenced explanation of this pattern in the Discussion.

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On the other hand, this pattern leads to the expectation that there should be a negative correlation between the hydrogen and oxygen isotope ratios for both species over the same time period. Fig. 2 panels a and d show this for pine but not larch. Please explain.

Line 13 states “no trends” were found in adult trees. Please be more specific. Trends against what variable? Cambial age?

Line 55 states “To avoid a geographical effect that can lead to artificial trends, we have normalized the isotope values of each tree by subtracting the tree mean from each value”. This is a reasonable approach as long as the variance does not change as a function of the mean. Is that the case?

Line 63 describes the linear detrending of the isotope and TRW values, but omits the variable against which this detrending was applied. Is this variable cambial age?

Line 67 says default settings were used for the spline detrending. Given that this detrending is central to the results, it would be useful to provide details of these settings. For example, what was the spline stiffness? Did you use the ratio or difference method to calculate residuals, etc.?

Line 95 states two patterns are different. How are they different?

Line 123 states “the correlation between the TRW and the two water isotopes of all the trees, not divided in cambial age classes, were non-significant.” This is inconsistent with Figure 1 panels a, b, d, e, and f, which all show significant correlations between TRW and water isotopes where all age classes are combined.

Lines 124-126. Good point.

Technical Corrections.

Line 16. Replace “year” with “years”.

Line 29 refers to “the two species” but the species are not introduced until the following

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line.

Lines 32-33. Replace “along the cambial age” with “as a function of cambial age”.

Line 34. Insert “have” before “analysed”.

Line 46. Replace “spanning” with “combining” and insert “from individual trees” after “tree-rings”.

Lines 75-79 simply explain the contents of Figure 1. This information belongs in the figure caption, not the Results Section.

Line 82. Replace “did neither change” with “changed neither”

Line 84. Replace “Similar is the pathway for correlations between TRW and d18O (Fig. 1 b,e) with positive” with “Similarly, TRW and d18O (Fig. 1 b,e) show positive”.

Line 86. Replace “with respect to” with “than”

Line 128. Replace “are” with “is”, delete “of”, and replace “works” with “work”.

Line 130. Replace “age” with “trees”.

Line 134. Replace “was” with “has been”.

Line 138. Insert “to” after “leading”.

Line 143. Insert “the” before “growth”

Line 147. Replace “The correlation, between dD and d18O, changed during the juvenile phase in both phases with parallel trends. . .” with “That the correlation between dD and d18O changed during the juvenile phase in both species. . .”.

Line 151. Replace “described before” with “already known”.

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