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Discussions

Interactive comment on "Alpine Holocene Tree-Ring Dataset: Age-related trends in the stable isotopes of cellulose show species-specific patterns" *by* Tito Arosio et al.

Anonymous Referee #2

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The manuscript "Alpine Holocene Tree –Ring Dataset: Age-related trends in the stable isotopes of cellulose show species-specific patterns" by Arosio and co-workers assesses the age-related trends in the stable isotopic compositions of about 200 tree ring samples collected from the Alps. The total period covered by these samples is approximately the Holocene, though individual samples span up to several hundreds of years.

One of the problems in tree ring width analysis is that the ring width often varies with the age of the tree. Thus the non-climatic factors come into play. This problem, to some extent, is encountered in the case of the isotopic records of tree rings as well. Though

the effect of the age on tree ring width is removed by employing statistical techniques, a similar procedure, however, is not so common among the isotope dendroclimatologists. In this study, the authors argue that the age-related trend in isotopic data, especially during the early years of tree growth, is quite prevalent. For example, d18O of tree ring showed inconsistent patterns during the juvenile period of tree growth. So these authors propose a methodology whereby the detrending issue could be avoided. They analyzed a large number of tree ring samples. They suggested that detrending of the tree ring isotopic record is not necessary if the isotopic values are plotted against the cambial age.

But various issues need to be fixed before such a method is applied. For example, which factors are mainly responsible for introducing the so-called age effect in the isotopic values of tree ring cellulose? Why is the result not similar for both oxygen and hydrogen? Since the pathway for both H and O is essentially the same, that is the soil water, then why the d18O and d2H trends sometimes show opposite behavior? Then follows the next question: unless the mechanism is reasonably understood, how can one propose a method to fix the problem? It is known that during environmental stress, such as in a drought season if a particular ring becomes thin, the corresponding d13C would be high. So a long term increasing trend in d13C may be indicative of a prolonged dry condition. But the question may be asked, whether the trend arises as a result of tree ring aging. So the mechanism of causing an age-related trend in an isotopic record must be understood well. In this context, it may be said that the 14C records of tree ring also show age-related trends. But other than the physiological aspect, a physical process, the decay of the radioactive carbon is known to cause such a trend. Hence, by applying a decay correction scheme, the age-related trend on 14C tree ring records can be easily corrected.

In this work, the authors show that isotopic records, especially d18O and d13C, when plotted against the cambial age are not susceptible to age-related trends after a threshold period characterized by juvenile growth. However, the method does not apply to

hydrogen isotopes. Hence it may not offer a comprehensive solution.

As mentioned earlier, long term trends in isotopic values are not considered significantly affecting the paleoclimatic interpretation. Hence they are not typically removed. The authors should give evidence that such practice needs reconsideration so that they can justify their work. Other issues:

The authors have presented all three isotopic records, viz d13C, d18O, and dD, but their inter-relation has not been discussed. d18O and d13C in biological systems (such as corals) often show a strong positive correlation, indicating the presence of kinetic fractionation, and in turn it shows a non-climatic effect. Hence such kind of analysis may be helpful in this context. Similarly, the relation between d18O and dD should also be examined.

Minor issues: Though the manuscript is in general, written well, it contains grammatical errors. (i.e, Line 170-171).

Referencing is not done correctly, pls check Line 308-309.

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