

Clim. Past Discuss., referee comment RC2
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Comment on cp-2021-135

Anonymous Referee #2

Referee comment on "Climate signals in stable carbon and hydrogen isotopes of lignin methoxy groups from southern German beech trees" by Anna Wieland et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-135-RC2>, 2022

General comments

As reviewer 1 states, tree-ring lignin methoxy $\delta^{13}\text{C}$ and $\delta^2\text{H}$ is an interesting and new methodology, and it may offer additional information about past climate compared to traditional tree-ring widths, density and cellulose isotope ratios, and therefore readers of this journal may find this manuscript worthwhile. However, discussion of this manuscript misses some important points readers may wish to know.

As a non-specialist of tree-ring lignin methoxy groups, I wanted to read more about the comparison between traditional tree-ring cellulose isotope ratios and tree-ring isotopes of lignin methoxy groups, however, such comparison was not sufficiently described in the manuscript. I think majority of the readers of this manuscript will be those who study tree-ring isotopes and therefore I think authors should add more information about the difference between the two.

For example, compared to cellulose deposition, lignin deposition to cell walls happens at the latter part of the growing season and duration of lignin deposition to cell walls is longer than that for cellulose, which may explain the correlations observed in this study (Ln 16-19). Authors should discuss more about the physiological background of the correlations observed in

this study.

Specific comments

Ln 16-19 "The calibration of $\delta^{13}\text{C}_{\text{LHM}}$ chronologies against instrumental data reveals highest correlations with regional summer ($r = 0.68$) and mean annual temperatures ($r = 0.66$), as well as previous-year September to current-year August temperatures ($r = 0.61$)"

What about EPS? Did you or any previous studies compared traditional tree-ring isotope ratios and tree-ring isotopes of lignin methoxy groups?

Ln 24 "large-scale temperatures" Why dHLM reflects larger scale temperature than dCLM? Can this be explained partly by the fact that hydrogen isotope ratios of precipitation reflects larger scale temperature of this area?

Ln 31-32 "Weather and climate parameters affect the physiological process within these tree rings."

As far as hydrogen isotope ratios are concerned, weather and climate (temperature) also affects hydrogen isotope ratios of precipitation, which eventually affects tree ring d2H. This is not physiological, but a hydrological process.

Ln 54-55 "Therefore, the temperature dominated signal in $\delta^2\text{H}$ precipitation (Dansgaard, 1964) is reflected in $\delta^2\text{H}_{\text{LHM}}$ values as has been demonstrated for mid-latitude sites (Anhäuser et al., 2017a; Greule et al., 2021)."

Is d2H precipitation not affected by the amount of precipitation (of a single precipitation event)? Please explain.

Ln 57-60 "Wang et al. (2020) found significant correlations between $\delta^2\text{H}_{\text{LHM}}$ values and April-August temperatures ($r = 0.58$ to 0.7) for two coniferous species (*Larix gmelinii*, larch and *Pinus sylvestris* var. *mongolica*, pine) from a permafrost forest in northeastern China."

Lignin deposition takes place over a longer period of time than cellulose deposition. Therefore, I expect tree-ring lignin to reflect temperatures over a longer period of months compared to tree-ring cellulose from the same tree. April-August seems longer than those for tree rings, which usually shows correlations to summer (June-July) climatic variables in my impression. If such comparison is possible, then please add more explanation here about the difference between cellulose and lignin.

Lines 63-64 "The carbon of each annual tree ring has its origin in the atmospheric CO₂"
What about the origins of hydrogen of each annual tree ring? Please explain.

Ln 137-138 "The maximum differences between two individual cores of the same tree ranged from 1.54 for F1 to 3.26 mUr for F2"
Did you calculate expressed population signal for d13CLM? If so, how was it compared to tree rings from the same trees?
Is d13CLM more coherent than d13C of tree rings?

Ln 418-419 "However, our results also indicate that temperature reconstructions based on stable isotope ratios of tree ring lignin methoxy groups are sensitive to low inter-series correlations."

Does this mean inter-series correlations for lignin methoxy groups were lower than those for tree-ring cellulose? Please write more about the comparison between carbon and hydrogen isotope ratios of tree-ring lignin methoxy groups and tree-ring cellulose, because it is an important information for readers to judge if analysis of tree-ring lignin methoxy groups are worth trying.

Figure 2 Why does moving Rbar suddenly decreases around 1940? Is it possible that one of your samples are wrongly dated after 1940?

Figure 5 If you calculate temperature from Hohenpeissenberg with temperature all over Europe, then I think you will find similar results, because temperature shows similarity over wider regions compared to precipitation. So I think this is self-evident. What do you think?

Technical corrections

Ln 13 "skilful" sounds strange. What about "less successful"?

Ln 37 "For a more detailed overview of its applications in paleoclimate research, readers can refer to following studies"

Ln 41 Change " a-cellulose" to " α -cellulose" or "alpha-cellulose".