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Climate of the Past
Discussions

Interactive comment on "Leaf wax *n*-alkane distributions record ecological changes during the Younger Dryas at Trzechowskie paleolake (Northern Poland) without temporal delay" *by* Bernhard Aichner et al.

Anonymous Referee #2

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The manuscript "Leaf wax n-alkane distributions record ecological changes during the Younger Dryas at Trzechowskie paleolake (Northern Poland) without temporal delay" by Aichner et al. uses high-resolution records of n-alkane distribution and pollen, and lower resolution d13C analyses, during the last deglacial period to address whether n-alkanes reflect plant community changes. This is a well-written paper describing an impressively detailed dataset, and the data support the conclusions. This paper is a step towards developing quantitative paleohydrological reconstructions using compound-specific hydrogen isotopes, and as such is an important contribution to the literature.

An assumption that is widely made regarding leaf waxes is that mid-chain n-alkanes reflect aquatic plant productivity and long-chain n-alkanes reflect terrestrial plant productivity, with longest chain lengths potentially being produced by grasses and herbs. These assumptions are mainly based on analyses of modern plants. Very little work directly compares n-alkane distributions with plant ecosystem composition as reflected by different proxies in sediment archives, so this study is a nice test of that assumption. In addition, if one can use n-alkane chain lengths to determine or control for plant community changes when interpreting leaf wax isotope measurements, then the analyses are simpler and less expensive than analyzing pollen or macrofossils in addition to n-alkanes.

The authors use appropriate methods, which could be clarified with a couple minor text additions, detailed below. These methods and results support their two main conclusions: 1. Changing measures of chain length distributions may be influenced by multiple different factors, and should therefore be examined carefully, in terms of which individual n-alkane chain lengths are actually changing, and 2. "ACL and ratios of n-alkanes are suitable integrative proxies to track major and abrupt vegetation changes in a local setting."

Substantive comments:

1. Changes in pollen and n-alkanes in the same sediment samples are indisputable. The authors should be a bit clearer about age uncertainties when comparing their record to proxy records from other archives. For example: p 13 line 5: the authors mention a lag here, but do not mention a lag for previous intervals. The age model uncertainty varies throughout the record, but at all times in this record, the uncertainty is enough to influence timing & interpretations/comparisons with other records. p 12 line 5: The discussion of the timing of the longer ACL at 13.2 to 13.0 ka: age uncertainty at this time period is $\pm$250 years or so (based on visual inspection of the age model in Supp Fig. 1). The age model uncertainty should be acknowledged in the discussion, as the age model uncertainties in each of the records means that the events can't be

assumed to be synchronous. p 12 line 9: Similarly, the conclusion about the timing of the YD onset 170 years after GS-1 onset: the age uncertainty at 12.6 ka in this record appears to be about ±150 years, so the lag could mainly be due to age model uncertainty. This should be acknowledged in the text. If the authors have evidence to suggest that the lag at this site is real, this would be a good place to present that.

2. Carbon isotopes: Isotopic measurements can be influenced by instrument drift through time. In addition, isotopic measurements can be strongly influenced by linearity (i.e., the size of the individual peaks being measured) (Kornfeld et al., 2012). The linearity effect is stronger for smaller peaks. Because the authors report d13C data on n-alkanes of widely varying concentrations in the same sample, these peaks are likely subject to strong changes in linearity, especially the smallest peaks (C23, which differs the most from the other n-alkane chain lengths in its d13C value). How do the authors account for drift and linearity effects in their d13C analyses? Do they run standards at varying concentrations and correct for the linearity effect? This is important to state, as these effects can dramatically impact isotope values. If the authors do not control for the effects of drift and linearity, they should also state that, as that limits the degree to which the values can be interpreted.

3. I have a question about each conclusion that would be helpful to clarify in the text: Conclusion 1: As far as I can understand from these results, it seems as if taking this type of data the next step and making a quantitative interpretation of compound-specific hydrogen isotope ratios still requires an independent record of plant ecology (i.e., pollen or macrofossils). Simply knowing, for example, that ACL increased because the long chain lengths increased doesn't allow for an interpretation of the ecological shift, as this shift could have been caused by one of several different plants in an ecosystem. Is that correct? If so, it could be helpful to clarify that independent ecosystem reconstructions will still be required for future quantitative isotope interpretations. If not correct, then the opposite can be clarified in the text. Conclusion 2: This dataset is a really nice illustration of the similar timing of pollen and n-alkane concentrations. These data do

not address whether ecological changes lag climate changes, correct? Perhaps the authors could point that out in the conclusion, as a reader may be inclined to interpret the data as such.

Minor comments:

Fig 1 a: what are the blue lines? I'm confused by the legend: it seems like the white lines with triangles are the kettle holes, but they're listed in the key as subglacial channels? I don't see the symbol for a kettle hole anywhere on the map. Can the symbols be clarified?

p 13 line 1: I think the authors mean 11,540 years ago

p 13 line 24: ACL is increasing through this Early Holocene interval, not decreasing, as stated in the text

Reference: Kornfeld, A., Horton, T. W., Yakir, D., & Turnbull, M. H. (2012). Correcting for nonlinearity effects of continuous flow isotope ratio mass spectrometry across a wide dynamic range. Rapid Communications in Mass Spectrometry, 26(4), 460–468. https://doi.org/10.1002/rcm.6120

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