

Author responses to the review of Referee #1 of the Biogeosciences manuscript bg-2019-251: ‘Leaf wax *n*-alkane patterns and compound-specific $\delta^{13}\text{C}$ of plants and topsoils from semi-arid Mongolia’

By Julian Struck, Marcel Bliedtner, Paul Strobel, Jens Schumacher, Enkhtuya Bazarradnaa, Roland Zech

We are thankful to referee #1 for the detailed and constructive comments on our manuscript, and we will revise it accordingly.

Please find below our point-to-point response to the review of referee #1. Referee comments are given in *black italic font*, our response to each point in blue regular font. Resulting changes are given in *blue italic*.

Anonymous Referee #1:

General comments

*The study “Leaf wax *n*-alkane pattern and compound-specific $\delta^{13}\text{C}$ of plants and topsoils from semi-arid Mongolia” by Julian Struck and colleagues presents novel data on content and isotopic signatures of plant waxes along two climate transects in Mongolia. Generally, the study is written in a clear and understandable way. The methods used are standard within the respective research community and the execution from sampling to data analysis seems robust. Also, the presentation of data in terms of figures and tables is clear and straightforward understandable.*

→ We are very happy about these positive comments on our manuscript.

A major issue with the language is that the clarity could be improved at instances when comparisons are made. Here, it is often just stated that something is “higher” or “larger”, but it is often missing “compared to what”. Most of the time this could be traced from the sentence before, but I would suggest to always add this information in the same sentence for clarity. Thus, please check again the whole manuscript for statements where comparisons are made.

→ We have checked the manuscript and adjusted sentences with comparisons for clarity.

*Another major issue concerning the science is that (especially in the conclusions section) contradicting statements are made. Here, it is stated that *n*-alkane homologue patterns are not influenced by climatic parameters, although they are strongly correlated to OEP, which is actually a numerical representation of (changes in) the homologue patterns. Thus, I suggest to carefully review this section, since in the present form it is unclear and contradictory.*

→ You are right, and we have to be more specific in the discussion that we have used the term *n*-alkane homologue patterns in terms of typical *n*-alkane distributions for different plants or plant-groups. E.g. typical *n*-alkane homologue pattern for grasses/ herbs show a dominance of *n*-C₃₁ and *n*-C₃₃ and deciduous trees/shrubs *n*-C₂₇ and *n*-C₂₉.

Specific comments

1.) L2 There are previous studies, which looked at *n*-alkanes in (semi-)arid regions. Just as a singular example (there are others): Feakins and Sessions (2010 in *Geochimica et Cosmochimica Acta*). Thus, I suggest to remove or rephrase this bold statement.

→ We have rephrased this statement and refer especially to the semi-arid/arid regions of Mongolia.

2.) L29 Please specify “additional paleoclimatic information”.

→ We added ‘about drought stress conditions’

3.) L44-47 The paragraph does not fit very well here. Maybe it would be better to incorporate in the section L24-37?

→ We have incorporated the sentence dealing with the temperature correlation in the section L34-37.

4.) L117 Please check equation 2 again. It is not clear what “v27” stands for.

→ We have corrected it to *n*-C27.

5.) L168-170 How did *Artemisia* grow in your study area: herbaceous or woody shrub? Please specify.

→ Along transect II, *Artemisia* plants grow both as herbaceous plants and as perennial ‘shrubby’ plants with a woody base (e.g. *Artemisia frigida*). Our dataset includes *Artemisia frigida* samples and herbaceous *Artemisia* samples. Unfortunately, most samples could only be determined on a plant genus level (*Artemisia* spp.). We have included a specification in section 2.1 Geographical setting and sampling: “*Artemisia* spp. summarizes different herbaceous species and perennial ‘shrubby’ species with a woody base (e.g. *Artemisia frigida*).”

6.) L189 Please give reference to the figure where the data is shown.

→ Done.

7.) L190 Why “except *Larix*”? Please specify.

→ We have deleted this statement because *Larix* sp. is also within the typical range of C3 Plants.

8.) L198-199 Please rephrase the sentence: “no significance” is redundant and it could be clearer

→ We have deleted the term significant and changed the sentence to “While no differences are found between the $\delta^{13}\text{C}$ values of the grasses/herbs and woody shrubs, only *Larix* sp. is enriched up to 2‰, but still in the range of C₃ plants.”

9.) L243-267 The whole paragraph shows an extensive use of the word “strong correlation”. Could you please state (maybe already in the methods section), when you consider a correlation as “strong”? Is there a R² threshold which you apply? Please specify.

→ We have rephrased this paragraph in terms of the word “strong correlation”. We have not applied any R^2 threshold. The goodness of fit is based on the weighted R^2 values and comparisons were done relative to each other under consideration of the p-values.

10.) L252 Please elaborate a bit more on the link with livestock grazing, since this is not obvious.

→ We agree with referee #1 that the former version was misleading. We have changed the structure of the paragraph. The link to livestock grazing is now described after the variations of n-alkane concentrations. Due to the fact that biomass production decreases with increasing aridity, the n-alkane concentration in topsoils become reduced since less organic material is incorporated into the topsoil. n-Alkane concentrations in the topsoils become even more reduced with intensified livestock grazing, because less biomass will be incorporated.

11.) L265 I would remove the statement that the R^2 of 0.683 “seems to be even stronger” than the R^2 of 0.691. In my opinion they are similar.

→ We agree. The statement has been removed.

12.) L267 Please define WUE at some point (if not already done). I guess it is “water use efficiency”.

→ It's defined in the introduction as water use efficiency.

13.) L288 It sounds contradicting that you state “the n-alkane homologue patterns from the topsoils are not influenced by climatic parameters, and thus the n-alkane ratio can reliably be used to detect and reconstruct differences between the vegetation forms of grasses and woody shrubs”. First, in the sentence before you state that n-alkane concentrations and OEP values are significantly correlated to climatic parameters. Second, what do you mean with n-alkane homologue pattern (the sum of n-alkanes concentrations, ACL, OEP or n-alkane ratio)? Please check again, since in the present form the sentence is unclear and contradictory.

→ We have used the term n-alkane homologue patterns in terms of typical n-alkane distributions for different plants or plant-groups. E.g. typical n-alkane homologue pattern for grasses/ herbs show a dominance of n-C₃₁ and n-C₃₃ and deciduous trees/shrubs n-C₂₇ and n-C₂₉. We have specified our statement and defined what we mean with n-alkane homologue patterns in this case.

14.) L294 Please specify what you mean with “detailed identification of plant species”.

→ We agree and changed the sentence to “should include a detailed identification of plants regarding different species of each plant genus.”

15.) L296 Again also here: It is contradictory when you state that “homologue patterns are not biased by climatic influences”, although you show correlations of OEP with climate and describe these as “strong” in your discussion. In the end, OEP etc. are just numerical representations of the homologue pattern. Thus, please clarify the contradiction.

→ We have changes homologue patterns to ACL and n-alkane ratio

16.) L298 Maybe “can be potentially used”, to weaken the conclusion a bit.

→ We agree

17.) Figure 3 The sentence “Plants originate from transect II.” Is redundant and can be removed.

→ This is correct, we removed it.

18.) Figure 6 Please indicate which regressions are linear and which are polynomial. Also I would suggest to add the p-values along with the R2, to clarify the significance of the fit.

→ We have added the p-values along with the R² values. Linear and non-linear regressions have now different colours and are described in the Fig caption. We have checked all regressions and based on the p-values we have chosen linear or non-linear regressions.

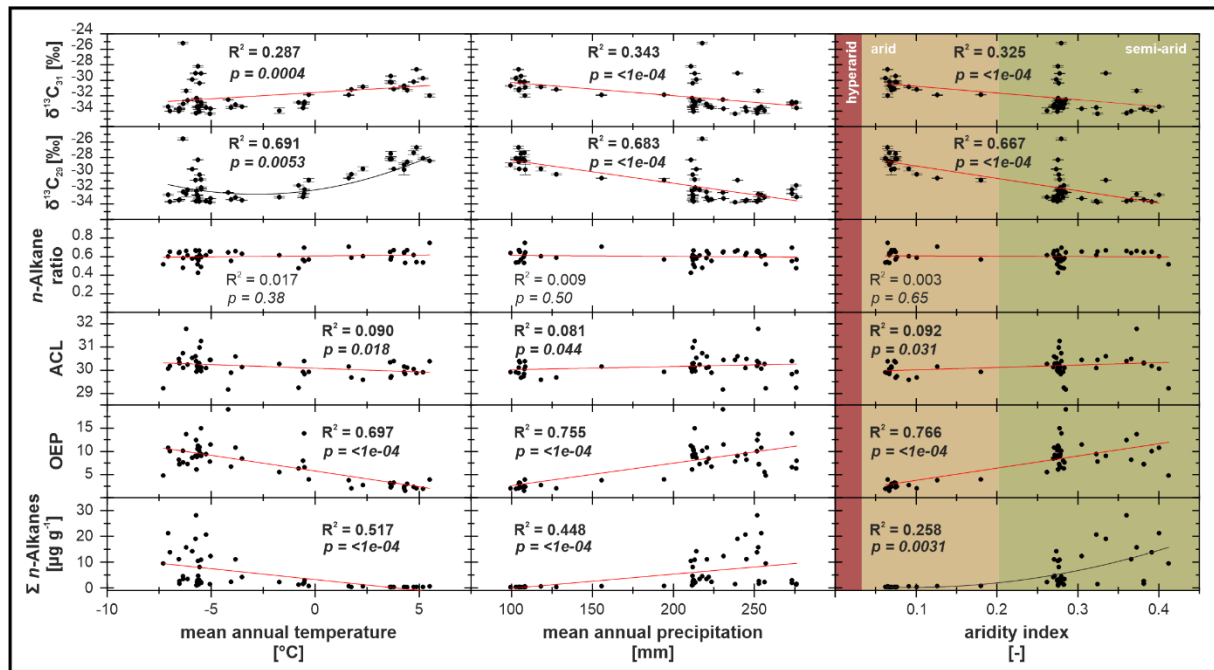


Figure 6. *n*-Alkane concentration, OEP, ACL, *n*-alkane ratio and compound-specific $\delta^{13}C$ (*n*-C₂₉ and *n*-C₃₁) from Mongolian topsoils plotted against climatic parameters (MAP, MAT, AI). Red trend lines illustrate linear, black lines polynomial regressions. Bold values indicate significance ($\alpha = 0.05$).

19.) Table 1 Check decimal places in last row

→ We have changed it to three decimal places (0.000).

Technical corrections

Title "patterns" → corrected

L1 "patterns" → corrected

L11 "correlated" → corrected

L16 "are synthesized" → corrected

L21 *check order of references and hyphenation* → We checked the order of all references. Now they are all sorted alphabetically / Hyphenation is done by the Copernicus LATEX template

L67 *check order of references* → We checked the order of all references. Now they are all sorted alphabetically

L88 "accelerated" → corrected

L89 "dichloromethane" → corrected

L102 "Agilent" → corrected

L110 *delete "sediment", since it is either soil or plant material* → adjusted

L142 "Table 1 shows" → corrected

L249 *Check brackets on reference* → corrected

L250 *Maybe better: " : : OEP, which is strongly correlated : : :"* → We agree

L269 "patterns" → corrected

L272 "patterns" → corrected

L277 *Two points at end of sentence* → corrected

L288 "decrease with increasing" → corrected

L288 "patterns" → corrected

L292 *delete "for"* → done

L294 *Two points at end of sentence* → corrected

Additional adjustments

L146 *valuess* → values

Figure caption of fig 1 → we changed black cycles to black/white cycles