Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-251-RC2, 2019

Biogeosciences Discussions
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Interactive comment on "Leaf wax n-alkane pattern and compound-specific δ^{13}C of plants and topsoils from semi-arid Mongolia" *by* Julian Struck et al.

Anonymous Referee #2

Received and published: 10 December 2019

The authors of this manuscript investigated the link between several environmental parameters (mean annual temperature, mean annual precipitation, and aridity index) and molecular and stable carbon isotope compositions of leaf wax n-alkanes extracted from modern higher plants and topsoils along 2 broad transects in Mongolia. The manuscript provides much needed molecular and stable isotope data for that area and will be of interest to biogeochemists, paleoecologists, and paleoclimatologists studying past climate change in the arid zones of central Eurasia. The manuscript fits within the scope of Biogeosciences Discussions and should be published in this journal provided the authors address the following issues:

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MAJOR POINT TO ADDRESS

First, lumping topsoil n-alkane data when looking at Transects I and II

Transect II The data shown in Fig. 4 and Fig. 5 for Transect II has a lot of scatter. The transect includes 3 different areas A, B, and C, with area B corresponding to an altitudinal transect. Could this scatter be the result of additional factors controlling the molecular and d13C data along the altitudinal transect in addition to those that play role along the W-E transect (i.e. A, through B (only sites 22, 23, 24, 25) through C)? Could the altitudinal transect sites be plotting separately?

Transect II + Transect I A similar issue could be the reason for a large scatter in the d13C data in Fig. 6 (top 2 sections). There is a lot of scatter at $\sim$ - 6C MAT, $\sim$ 210 mm MAP, and $\sim$ 0.28 AI. Could this be caused by multiple factors (in addition to those plotted along the X-axis) controlling the d13C values of n-alkanes along and within these transects? Can the data be plotted separately to provide a more nuanced assessment?

OTHER MINOR ISSUES

Line 34 (here and similar issues throughout the manuscript) “an enrichment of leaf wax d13C” d13C values are numbers. Values can’t be enriched or depleted. Please re-phrase. 13C-enriched leaf wax perhaps?

Lines 82-83 “the topsoils were sampled together with the dominant plant species, which comprise the woody shrub Caragana spp. . . .” How the dominance of these species was assessed? Is there any previous study concerning species distribution in the area covered by this project? Or is it a subjective assessment?

Line 90 “Total lipids . . . of plants” What part(s) of plant was(were) extracted? Just leaves or was it together with the stem and roots?

Line 107 “were 0.1 per mil the standard deviation” Is there an “and” missing? Also, does it make sense to report d13C values in Suppl. Mat to the second digit after the

decimal point, if the reported std. dev. is 0.1 per mil, i.e. no better than the first digit after the decimal point?

Lines 110-111 “n-alkane concentrations . . . were calculated as the sum of n-C25 and n-C35” Why was n-C23 excluded? It is a major n-alkane in Larix sp.

Lines 118-119 “A normalised n-alkane ratio . . . n-C29 and n-C31”; lines 177-178 Please explain the significance of this ratio. If this refers to trees/shrubs vs. grasses, why not to include n-C27 and n-C33, respectively?

Line 165 “in line with previous regional studies” Specify what regions were covered by these studies previously? Is it similar to the region covered in this project?

Line 169 “the findings of Wang et al. (2018b) from China” What part of China? It is a big country with multiple climatic and ecological zones.

Line 202-233 Section “The leaf wax signal from plants to topsoils along transect II” This section could be broken down into several paragraphs to make it easier to follow. Also, why not to give a number for this and the next (starting on line 234) subsections? 4.3.1 and 4.3.2 perhaps?

Lines 223-224 “Compared to the plants, . . . d13C isotopes of the topsoils are slightly more enriched” What does “d13C isotopes” mean? Please rephrase. Also, I don’t see this from the graphs in Fig. 5. The d13C values of n-C29 alkane in soils aren’t really that different from those in Caragana and Larix spp. The absence of this “enrichment” is particularly evident when looking at the d13C values of n-C31.

Line 237 “chapter 4.4” I’d call it a section rather than a “chapter”.

Lines 248-249 “are in agreement with climatic control and the fact that higher temperatures reduce the decarboxylation pathway and the formation of n-alkanes (Shepherd and Griffiths 2006)” I don’t think this explanation works here. The cited paper evaluates the effect of stress on various factors that control leaf wax biosynthesis within plants. The subject matter of this section is n-alkane content of soils. There are multiple other

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reasons, in addition to the biochemical ones within the plant, that could play a role in the distribution of n-alkanes along the transects studied.

Lines 257-258 “In contrast, compound-specific d13C correlated significantly with climatic parameters.” There is a lot of noise in the d13C data. Please discuss possible reasons for the scatter. See the MAJOR POINT above.

Line 272 “Mongolian plants show” It is a peculiar way of referring to these plants. Using their species names and mentioning that they were sampled in Mongolia would be a better way of describing them.

Lines 276-277 “for reconstructing vegetation changes in Larix sp.” Sounds awkward. Please re-phrase.

FIGURES

Figure 1 Please remind the reader what SRTM DEM stands for so that there is no need to look for this information in the text. Also, make the font and the arrows showing the location of Transect I and Transect II thicker to make them standout more.

Figure 2 Make the bar representing the scale (0-500) less prominent. That’s one of the first things that draws reader’s attention when you look at the map. Instead, highlight A, B, C better, so that the title of each map is not hidden among all the other text on the maps.

Figure 3 Please specify whether the n-alkane data shown in the bar graphs represents all the plants collected along the Transects I and II or only a subset.

Figure 4 Remind the reader what kind of “n-alkane ratio” is plotted here.

Figure 5 Specify that “compound-specific” refers to n-C29 and n-C31 alkanes.

Figure 6 Which homologues were included in the calculation of n-alkanes concentrations? What ratio of n-alkanes are the authors referring to?

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