

## Reply to Anonymous Referee#1

We thank Anonymous Referee#1 for her/his constructive comments and suggestions on our manuscript, which help to improve the MS and allow us to expand the discussion on some aspects.

*Referee: “Coupled isotopes of plant wax and hemicellulose markers record information on relative humidity and isotopic composition of precipitation”, The Authors of present manuscript conducted a major revision of the manuscript. In general the manuscript has been improved. The whole manuscript has been revised accordingly to reviewer’s suggestion and is now more comprehensible. However, some other comments the authors have not addressed too much, especially samples and soil characters. There are still some comments and critical points that should be considered.*

*Abstract: I also wonder the last sentence (conclusion), which is too long and unclear. Just “support to the coupled  $\delta^2\text{H}_{\text{lipid}}$  and  $\delta^{18}\text{O}_{\text{sugar}}$  biomarker approach”, what are the new observations? What are the improvements on the well-known approach? So, I still suggest the authors put forward a clearer conclusion according to the new observations.*

Response: Following the recommendation of Reviewer#1, we rewrote the abstract in order to improve readability. Amongst others, we now state explicitly that “compared to single  $\delta^2\text{H}_{n\text{-alkane}}$  or  $\delta^{18}\text{O}_{\text{sugar}}$  records, the proposed coupled  $\delta^2\text{H}_{n\text{-alkane}}\text{-}\delta^{18}\text{O}_{\text{sugar}}$  approach will allow a more robust reconstruction of  $\delta^2\text{H}/\delta^{18}\text{O}_{\text{precipitation}}$  and additionally the reconstruction of RH changes/history in future paleoclimate research.”

*Introduction: The section is informative, and the objective is now clearer.*

*Method: The depth and some general physic-chemical characteristics of topsoil should be included. Why “The soil samples were air-dried in the field and later in an oven at 50 oC”? How long the time of air-dried and over-dried? Some references are needed. “: : the field replications were merged to one composite: : :”, so there are no replicates. I suggest the authors give the readers more convinced reasons.*

Response: We now included/refer our readers to Tuthorn et al., 2014: “(for soil type and total organic carbon contents please see Table 1 of Tuthorn et al., 2014)” and included that drying of the samples was carried out for several days. We are not aware of respective references for drying soil samples.

Furthermore, we now explain in more detail that “The sampling site heterogeneity was checked for the  $\delta^{18}\text{O}_{\text{sugar}}$  analyses and in most cases did not exceed the analytical uncertainty (Table 2 in Tuthorn et al., 2014). Therefore, the field replications were merged to one composite sample per study site for  $\delta^2\text{H}_{\text{lipid}}$  analyses.”

*“For samples 1–12, an additional purification step with silver nitrate columns was carried out in order to eliminate unsaturated compounds. The chromatograms of the other sampled displayed no requirement for this purification step.” Why?? What are the differences among samples?*

Response: According to our knowledge certain microorganisms produce unsaturated hydrocarbons. However, given that we are not aware of any respective systematic studies for soils, we cannot answer this question of Reviewer#1.

*I still wonder that there are only 20 samples; I don't think it is correct to calculate them to a general model. Please explain it more clearly.*

Response: Please note that the coupled  $\delta^2\text{H}_{n\text{-alkane}}\text{-}\delta^{18}\text{O}_{\text{sugar}}$  model is not based on the 20 samples analysed in this study for  $\delta^2\text{H}_{n\text{-alkanes}}$  as assumed by Reviewer#1 (and Reviewer#2). Indeed this is a conceptual model (see title of the respective subchapter 2.4) and for further details on the model we refer our readers to Zech et al. 2013 at the end of the chapter. The 20 samples from the presented Argentinean climate transect are rather used for validating the conceptual coupled  $\delta^2\text{H}_{n\text{-alkane}}\text{-}\delta^{18}\text{O}_{\text{sugar}}$  model.

→ Following the request of Reviewer#1 and in order to make this more clear, we (i) slightly changed the title and included amongst others “ – a climate transect validation study”, (ii) restructured and reformulated the abstract, (iii) reformulated introduction chapter and the aims of our study and (iv) partly rewrote the conclusion chapter.

*Results and discussion: There are sufficient data, figures and tables. I suggest the authors depart these two parts to make the change tendencies and their exploitations much clearer. In the present status, much more observations had not well explained.*

Response: Given that all three current subchapters of the Result and Discussion chapter contain discussion aspects, we prefer to maintain the current structure of our MS.

#### References:

- Tuthorn, M., Zech, M., Ruppenthal, M., Oelmann, Y., Kahmen, A., Valle, H.c.F.d., Wilcke, W., Glaser, B., 2014. Oxygen isotope ratios ( $^{18}\text{O}/^{16}\text{O}$ ) of hemicellulose-derived sugar biomarkers in plants, soils and sediments as paleoclimate proxy II: Insight from a climate transect study. *Geochimica et Cosmochimica Acta* 126, 624-634.
- Zech, M., Tuthorn, M., Detsch, F., Rozanski, K., Zech, R., Zoeller, L., Zech, W., Glaser, B., 2013. A 220 ka terrestrial  $\delta^{18}\text{O}$  and deuterium excess biomarker record from an eolian permafrost paleosol sequence, NE-Siberia. *Chemical Geology* 360-361, 220-230.