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# *Interactive comment on* "From leaf to soil: *n*-alkane signal preservation, despite degradation along an environmental gradient in the tropical Andes" *by* Milan L. Teunissen van Manen et al.

**Anonymous Referee #2**

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General comments: The manuscript by Teunissen van Manen et al. aims to improve the understanding of the mechanisms controlling long-chain n-alkane distributions preserved in sedimentary archives. The study analyzes how long-chain n-alkane distributions change in response to incorporation into soils and how environmental parameters such as temperature and precipitation influence alkane distributions. To meet these goals the authors presents long-chain n-alkane data from leaves, necro mass and soils along an altitude transect in the Ecuadorian Andes. The authors conclude that the ACL of long-chain n-alkanes does not systematically change among the three studied n-alkane pools, but that the variability of ACL among soil samples is lower than in leaf and necro mass samples. They also infer a dominant influence of temperature



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on ACL. While the authors present a novel potentially interesting data set representing considerable analytical effort, there are several major issues that need to be addressed and revised. Since the environmental parameters discussed in the manuscript are all correlated to altitude, it is hard to tell which of the parameters control the ACL of alkanes. The authors mention precipitation, temperature and humidity (whereas this parameter barely changes over the transect), but they do not discuss other factors along the altitude transect that could also play a role (e.g. lower atmospheric pressure and thereby pCO2). So the study setup is not ideal to disentangle the environmental factors controlling ACL. The manuscript unfortunately overstates the novelty of its results and does not properly acknowledge previous findings. The authors should carefully review the available literature and to work out which aspects of the study offer new insights and where it contrasts to previous studies. Leaf-litter experiments and previous soil studies for instance showed a shift of ACL during degradation in necro mass and soils (e.g. Wu et al. 2019, OG, Zech et al. 2011, GCA). So it would be worthwhile to discuss why there is no such change in the transect analyzed in this manuscript, while other studies indeed find an impact.

Specific comments: Lines 13-14, 52-54, 257-260: The contention that very little is known about degradation processes altering long-chain n-alkane distributions is not correct and there is ample literature on this issue. For instance, Zech et al. 2011, GCA have systematically studied these processes in litter bag experiments. Schäfer et al. 2016, SOIL studied shifts in long-chain n-alkane distributions between litter and soil samples in a transect across Europe. All of this is unfortunately not discussed in the manuscript. The authors also contend that previous work on soils and necro mass is limited to the four publications given in line 54, which should be expanded.

Lines 32, 33; 38. To call long-chain n-alkanes a new proxy is not correct. The classical paper on leaf-wax n-alkanes by Eglinton and Hamilton 1967 in Science has been published more than five decades ago. Application of n-alkanes as environmental proxy also dates back decades (see for instance Huang et al. 2000, GCA, Rieley et al. 1991,





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Nature,).

Lines 38-40. The authors claim that the relative distribution of n-alkanes can be used to reconstruct past precipitation and temperature. The cited studies show indeed relations between chain-length distributions and temperature or precipitation. But Hoffmann et al. 2013 OG highlight that there is a multitude of factors influencing ACL values and do not suggest to use this as a specific proxy. Other studies have also highlighted the impact of vegetation on ACL (e.g. Rommerskirchen et al. 2006 OG). So the factors influencing ACL are diverse and regionally different, which limits its application as proxy.

Lines 83-89: As one of the altitude induced gradients for their analysis, the authors mention relative humidity. Yet humidity only varies between 96 and 99% and is therefore always close to 100%. So, this parameter is maxed out over the entire gradient and does not show any pronounced variability and is therefore hardly suited to explain variability in alkane distributions.

Lines 203-205 and Figure 3: The authors claim that the long-chain n-alkane distribution among the different sample types does not show a significant difference upon visual inspection of their nMDS plots. It would be great if the authors confirm this finding by applying statistical analysis (e.g. t-test).

Lines 369-370: To conclude from this study that even ancient alkane distributions in sediments are remain constant is a little far fetched The most degraded pool this study analyses are soils. To claim that ancient distributions are constant one would also need to study transport (e.g. aeolian or riverine) to the deposition area and the effects of diagenesis thereafter. In some cases the distributions might indeed be constant, but there are changes during transport, and in response to thermal overprint that have been reported in the past (e.g. Wang et al. 2017, OG) and need to be considered.

Lines 375-378: The authors claim that ACL and to a lesser degree also CPI reflects temperature. Given the large variability shown in Fig. 5 this is again an overstatement.

Since there is a large number of environmental parameters that follow the altitude gradient it is unclear if it is really temperature that controls ACL. If this was indeed the case, the large variability in the regression precludes meaningful statements on past temperature from sediment records.

Technical corrections: Line 12: The word “however” is redundant here and can be deleted.

Lines 15-18: This sentence is convoluted. It is also unclear what the difference between “n-alkane pattern, the n-alkane signal, and the local environmental information reflected in the n-alkane signal” is. Rephrase the sentence and be more specific in your terminology. Later in line 56 more explanation is offered which should be moved to the first occurrence in the text.

Line 22: Is “the primary observed n-alkane signal” the alkane signal observed in the leaf samples. If so, mention this specifically.

Lines 22 and 24: What kind of parameter is meant by “the environment”. Be more specific.

Line 30: As the sentence refers to reconstruction replace soils with paleosols.

Line 66: The word altitudinally is misspelt.

Line 84: Rephrase the second part of the sentence to “including temperature, humidity and precipitation.”

Line 99: Add a space after the number 15.

Line 159-160: It should be mentioned explicitly that the ACL only features compounds of odd carbon chain length.

Line 165: The word “the” before Marzi et al. can be removed.

Line 177: This sentence is on statistical convention. So there are probably better





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references available to support this.

Lines 207: What ratio metrics are meant here? Be more specific.

Line 229: Consider replacing the word complete with perfect.

Lines 273-274: As is, this sentence reads as if there is no odd over even pattern in the Leaf and necro mass samples and should therefore be rephrased.

Line 374: Specify that the leaf wax patterns remain stable.

Appendix B1: The axis labels are hard to read and should be larger or thicker.

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