

## ***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.***

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We are grateful to Reviewer 1 for their positive and helpful comments that have helped with the development of our manuscript. Below we respond directly to each of the suggestions in turn:

1. Reviewer 1 notes that roots make up a significant proportion of organic carbon found in soils, and asks if the study should have included the analysis of roots. We accept the reviewer comment. One of the aims of the paper is to study whether the discoveries made in plant wax n-alkanes (for example, Bush and McInerney, GCA, 2013; Feakins et al., OG, 2016) are also reflected in soils (a more degraded stage of n-alkane substrate).

C1

For this reason, we chose to compare the n-alkane patterns from leaves to necromass and soil samples in this study. We agree root input of n-alkanes can be substantial in soils, however, we wish to note that the degree to which this influences the overall n-alkane pattern observed is subject to ongoing scientific debate. The article cited by the reviewer (Rasse et al., P&S, 2005) focuses on the stabilization of bulk soil organic matter, rather than the specific n-alkane fraction. The bulk soil organic matter need not, and based on present scientific insights (e.g. Lehmann & Kleber, Nature, 2015) does not, reflect the same distribution of origin as the n-alkane fraction. For instance, while root input may be important for bulk organic matter, the amount of n-alkanes produced by roots is usually much lower than by leaves (e.g. Jansen & Wiesenberg, SOIL, 2017). Furthermore, if root input dominated the n-alkane patterns in the soil in our study, we would expect a different n-alkane pattern in the soils when compared with the n-alkane patterns of the leaves and necromass (Jansen et al., OG, 2006). However, we do realize that the rationale behind comparing n-alkanes from leaves, necromass and soils was not clear in our initial version of the manuscript. We will strengthen the wording of the rationale and aim as well as the interpretation of the results accordingly.

2. Reviewer 1 expresses concerns with the rationale behind comparing leaf n-alkanes to soil n-alkanes, considering modern soils contain both modern and ancient organic matter, and that ancient organic matter may not derive from the same plants as those found at the site today. We agree with the reviewer that soils contain organic material of varying ages and potentially incorporate material from plant assemblage different to the current one. However, we expect that the majority of the organic material in our soil samples was derived from the modern vegetation, because our soils samples were derived from the upper 5 cm of the soil (immediately below the leaf litter layer). We are therefore confident that our soil samples represent organic material derived from vegetation similar to modern. Regardless, knowing the exact source vegetation of the n-alkanes is not relevant in this study, as the aim of our manuscript is to explore whether the n-alkane patterns degrade, as the substrate degrades (rather than whether the parent vegetation n-alkane patterns are reflected in the soil n-alkane patterns). See

C2

also our rationale in the previous comment. Based on our findings we argue that the relationship between plant and soil n-alkanes is unlikely to be direct, that it seems likely that soil specific processes such as microbial reworking, source mixing, and spatiotemporal averaging make it hard to link modern plant wax n-alkane knowledge to soil or sedimentary n-alkane knowledge (and thus agree with the reviewer comment). We recognize that the manuscript rationale, aim, and conclusion can be featured more prominently and we will alter the respective sections accordingly. We will also add a section into the rationale clearly communicating why we sampled the upper part of the soils.

3. Reviewer 1 notes that there is uncertainty in the relationship between the n-alkane signature and climate. We agree with Reviewer 1's observations of Figure 5 that the scatter is high; however, we feel that our interpretation of the data is valid because we do not link the magnitude of the shifts in n-alkane patterns to reflect magnitude of change (such as a specific temperature range), but rather focus on the direction of change. We will more clearly explain in the text that our results should be seen as a proof-of-principle of a new proxy focusing on a qualitative assessment of the direction of change over time that still needs further development. We will further include a statement that acknowledges the uncertainty in these correlations, and what this implies for the further development of our findings into a future palaeoecological proxy (section 4.3).

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