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Interactive comment on "Stable carbon and nitrogen isotopic composition of leaves, litter, and soils of various tropical ecosystems along an elevational and land-use gradient at Mount Kilimanjaro, Tanzania" *by* Friederike Gerschlauer et al.

Anonymous Referee #3

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Review of manuscript bg_2018_407: "Stable carbon and nitrogen isotopic composition of leaves, litter, and soils of various tropical ecosystems along an elevation and land-use gradient at Mount Kilimanjaro, Tanzania" by Gerschlauer et al.

This paper describes the isotopical signature of soils and above ground material in 12 ecosystems at Kilimanjaro. The data obtained is based on a comprehensive sample collection and thus hold a great potential in describing isotopical differences among the

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ecosystems. And as an isotopical description of the ecosystems the study surely has fine value, but in order to draw some of the conclusions in the paper, my view is that additional data are needed to fully support those statements. In the general comments below I have tried to suggest some additional data, which the authors ought to include strengthening the paper. I advise the editor to ask the authors for a major revision of the manuscript.

General comments: (1) The authors have a strong focus on using differences in 13C and 15N natural abundance to explain how the different ecosystems work. I really lack some information or estimates of biomass production and balances (both C and N) for the ecosystems. Both for C and N, the input and output of matter would have strong effects on the cycling of those elements, and thus this information is needed to understand/justify the conclusions of the paper.

For example, the authors talk about “tight N cycles” for some ecosystem, but 15N natural abundance cannot stand alone to justify such statement. There we need to include both N inputs and input form, and N removals. It is for example well known that animal manure would affect the 15N natural abundance of soil, and thus, if some of the present ecosystems have grazing animals or animal manure is used e.g. in the homegarden, then this would most likely affect the N signature of the soil. Likewise, for C, we would need to know the annual biomass production to really understand the different 13C natural abundances.

Therefore I ask that the authors in the revised manuscript give actual number or estimates of C and N input and output balances, specify any N fertilizer additions, and make use of this information to support the differences in isotopic signatures.

(2) In the abstract the authors end with a statement regarding “rising temperatures in a changing climate”. When I read the manuscript “rising temperatures in a changing climate” is not really clear from the text – please help the reader to understand how this study can say something about “rising temperatures” – many of you ecosystems differ

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not only in temperature due to the elevation gradient, but also to e.g. management. Thus, I find it hard to directly understand how “rising temperatures” are covered, unless you can specify that the same ecosystem with similar management is studied at two or more points at the elevation gradient.

In fact, please thoroughly consider your statements regarding “temperature”. For example in line 357 you state that “we suggest that . . .increasing temperatures in a changing climate may promote C and N losses” – come on folks isn’t that common text book knowledge?

(3) The data from the 12 ecosystems are clustering with the six forest together and the other six ecosystems differing from them. I don’t think that all of the statements and comparisons across such clustered data are fair. For example the 13C and 15N natural abundance in forest ecosystems are very alike in spite of quite different temperatures, precipitation, soil C and N contents (Fig. S2 and S3). This to me is interesting – why are they so similar in signature in spite of these differences?

I ask that the authors are more cautious in the data interpretation with such clustered data – as in please don’t try to make “correlations across ecosystems”, and put some words on where ecosystems have similar isotopic fingerprints. (And why do you forget about the C3 – C4 story in your discussion and presentation of the results?).

(4) The ”Helichrysum” ecosystem seems to confuse the authors (and thus also the readers of the manuscript). In one place (line 162-163) the sandy nature is used to ”unquestionably” explain soil C and N contents, at another place (line 247-249) lignin is the explaining factor, and in the correlation analysis (Fig. 4, Table S2) also temperature is strongly correlated to the cycling of C and N in this ecosystem. This is confusing, and here I further miss that the authors reflect on their studied ecosystems – the “Helichrysum” ecosystem is a sub-alpine system – where I would guess that temperature play a strong role, not only in C and N turnover processes, but also in biomass production. Thus, I ask the authors to be consistent in their explanation – and please give an

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estimate of the biomass production in the ecosystems, so that the reader gets a better picture of the production across the ecosystems.

(5) Table 1 give some basic information regarding the ecosystems. Among other the organic C content, which for the forest ecosystems are at 20-40%. This is quite high. Please clearly specify whether you sampled the O-layer or the upper mineral layer of those soils?

Specific comments: - Title: I would say it is not tropical ecosystems all the way up Kilimanjaro, therefore I think you should consider removing “tropical” from the title.

- In 2.1. Study sites, please include information regarding variables that can affect the C and N signatures. That could be input of N via biological N2 fixation or animal manure (or other fertilizer) and it could be C via biomass production. For example, was the agroforestry based on N2-fixing trees? - In 2.2. Sampling and Analyses. Please make a statement on whether root fragments were visible in the sieved soil. And please in the discussion reflect upon whether unrecovered root material could have affected the soil isotopic signatures (e.g. by using the enrichment of leaves as a proxy for the enrichment of unrecovered roots). - Line 218-219. Please remove this sentence – it is not justified by the figure – there is too much clustering. - Figures and Table: Please keep the same order of the ecosystems all through, and if possible please add the abbreviations for the ecosystems to the legend inside the figure in Figure 1. Also please consider identifying the C3 and C4 dominate ecosystem when presenting 13C natural abundance data. - Figure 5: I don’t think I understand what I can learn from this figure. Please explain better or delete it.

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