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Discussions

Interactive comment on "Relevance of aboveground litter for soil organic matter formation – a soil profile perspective" *by* Patrick Liebmann et al.

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RC3 Comments by Referee #1, 19.01.2020

Introduction I

This is a nice straightforward presentation of a field study investigating the fate of surficial litter-derived carbon as it enters and travels down the soil profile. The introduction presents a good overview of the current scientific understanding and of the study objectives.

Author response

We thank the referee for the efforts and the positive feedback. We further appreciate the comments on alternative set-ups of the experiment.

1. Comment

As mentioned by previous reviewers, it may benefit from acknowledging past studies using radioactive carbon, as well as the few studies using stable carbon to follow the fate of surface litter

Author response

Yes, we agree with this view and modified the introduction in line 63 to 64 to acknowledge previous studies. The detailed response can be found in the reply to Paul Hanson's comment.

Introduction II

The methodological approach is described in sufficient detail, and the results are concisely presented (thank you!). This paper presents a case study-results from a specific soil. There is still value in getting the work published as is, as I agree with the authors that quantitative information on the fate of carbon inputs after they enter soils is still mostly missing.

2. Comment

Out of curiosity, why was that particular study site chosen? For convenience, or was there another more scientific reason?

Author response

The study site was chosen for several reasons. One was that the Research Unit "SUBSOM" involved 9 institutions and groups spread throughout Germany. It was relevant that the location was close to one of the central labs, the Institute of Soil Science in Hannover, where the weekly taken samples were analyzed. Another important aspect was that in a comprehensive pre-exploration of potential study sites, the Grinderwald

proved to be suitable regarding water flow conditions (e.g. high sand content, not too dense, no stagnating water, in sum good water flow conditions) and C distribution (e.g. moderate C in the mineral soil) in the soil profile. Further, we looked for a site with no land-use change during the last century and for an old-growth stand > 100 yrs. And finally, we needed to get permit from the Forestry Administration to install all the equipment and conduct the experiments.

3. Comment

However, I have been trying to wrap my head around the potential broader significance of the presented study. The studied site seems to be affected (to a large extent?) by bioturbation, and a lot of recent carbon was recovered in particulate organic matter. How would the situation be different in the case of soils less affected by soil fauna? Not only in term of the topsoil carbon, but also more importantly in term of DOC leaching and redistribution lower in the profile? Would fluxes then be more important?

Author response

The bioturbation was largely restricted to the top 0-10 cm. We assume that less mixing of POM into the mineral soil would result in an initially higher sequestration of C in the organic layer, e.g. due to retention by the organic layer itself as it was shown by Fröberg et al. (2007) for a coniferous forest floor. It can be expected that if this material would have stayed on the mineral soil, is likely faster decomposed to CO2. Concerning this effect on DOC formation and leaching we can only speculate. But in absolute means, the amount of litter translocated to the mineral soil by DOC is small (about 2 % of the applied litter after 22 months).So the effect on DOC formation and leaching should be also very minor.

Fröberg, M., Berggren Kleja, D. and Hagedorn, F.: The contribution of fresh litter to dissolved organic carbon leached from a coniferous forest floor, Eur. J. Soil Sci., 58(1), 108–114, doi:10.1111/j.1365 2389.2006.00812.x, 2007

4. Comment

Lastly, how would the results look like if the study had been conducted longer? Eighteen months may not be enough time to see redistribution at depth.

Author response

We agree that 18 months likely is not sufficient to detect a considerable translocation as a result of the assumed sorption-microbial processing-desorption cycles form the litter layer down to the deep subsoil. If we think of prolonging the experiment with the exact setting as we used it, i.e. level of 13C enrichment in the labeled litter, we assume that the continuous input of new and unlabeled compounds will rather soon shift the measurable enrichments towards the natural abundance, as we already saw it in the second sampling of our experiment.

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