

## ***Interactive comment on “Composition of eroded carbon during its journey through a tropical watershed: a clue to the question whether it is source or sink of CO<sub>2</sub>” by C. Rumpel et al.***

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We thank the two reviewers for their constructive comments that helped improving our manuscript. Here is the answer to the major points of the reviewers:

Reviewer 1:

1) The manuscript is generally well written, sometimes a bit lacking the focus (e.g. introduction, see below). It is obvious that the authors are capable of writing well. However, some sentences (see below) do not make sense, which gives the impression of partly careless preparation.

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Response: we addressed and improved the sentences pointed out by the reviewer

2) The main study design is not clear to me. There are plots or rather investigations on different scales. It is not obvious, that larger scales actually mean longer transport and thus longer degradation time. I would like to see a figure where the sampling sites along the tributary of the Mekong can be seen, so that the reader can follow distances between sampling points. From the description it is not clear, if and how suspended sediments were sampled. Further I was wondering how the organic material is actually captured within the stream. Did you use sediment traps? Or suspended sediment samplers? If you just used buckets, what was your measurement frequency and how can you quantify your sediment discharge (as you claim in paragraph 2.4). If you talk about transport along the watershed, do you mean within the stream? Are you talking about suspended sediments?

Response: More information on the study design and sampling procedure was given. We included a figure showing the sampling points at the different scales. If we talk about transport along the watershed, we mean transport of material with rainwater during rain events capable of generating discharge at all sampled scales. We sampled suspended sediments after each rainfall event. More detailed information on the sampling procedure was added to the manuscript.

3. How do you know that from small to large scales there is no additional source of carbon contributing to your EOM in the stream? These new sources might have different composition.

Response: Our hypothesis is that within these watersheds with similar landuse, the EOM sampled at the different scales will represent changes occurring due to transport at the different spatial scales.

4. The aim of a comparison of horizontal and vertical transport of EOM is not clear to me. The degradation of molecules during horizontal transport is obviously a very different process to the transport and degradation of SOC within a soil profile. In the

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latter case there is no detachment and transport in the sense of erosion involved. Thus, these are hardly processes which can be compared directly and even if so, I cannot see the sense, usefulness or aim of this comparison.

Response: We think that it is very interesting comparing vertical and horizontal transport because both affect the fate of SOM in the environment. While the compositional changes are similar, both processes occur at different timescales thus informing us on chemical SOM forms likely to survive the different processes yielding maybe a similar end product.

5. Stabilisation of EOM along the transport gradient does not necessarily mean quantitative degradation of the organic matter involved. In your title you raise the question of eroded carbon being a source or sink to CO<sub>2</sub>. But I am not so sure that your data really indicates degradation of carbon and release of CO<sub>2</sub>. Alteration of organic molecules does not necessarily means substantial CO<sub>2</sub>-loss.

Response: We agree with this remark of the reviewer. Alteration of organic molecules is likely to occur through microbial degradation processes, involving CO<sub>2</sub> loss. However, we do not have any quantitative information on this. Moreover, erosion processes may also lead to fractionation of the organic matter through preferential deposition of material. Therefore, we changed the title. It reads now: Composition changes of eroded carbon at different spatial scales in a tropical watershed suggest export of degraded material.

Abstract: Methods and measurement design is missing. Last sentence (line 9 -12) not clear. Why would radiocarbon measurements indicate that the transformation of the soil carbon was not during pedogenesis but during transport along the watershed?

Response: Ok, Material and measurement design was added and the last sentence changed to reflect better our findings: Radiocarbon measurements indicated ageing of EOM from the plot to the watershed scale and therefore the export of EOM may concern stabilised SOM compounds, which are enriched during the journey through

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the watershed.

Introduction: Line 5 – 22: reads like a collection of literature results and it is not really clear what the message is. What is the aim and focus of this paragraph? Line 1 (next page): SOC transport leads to massive soil loss? Does not make sense.

Response: Ok, the paragraph has been changed to give it a focus. The sentence in line 1 has been corrected.

Methods Line 15: Alfisols: could you also give WRB classification, please? Line 23: sentence does not make sense. The climate is marked by a study area? Paragraph 2.2 line 11: "Thus the different observation points. ...? which different observation points? How does your study design look like? Where are your observations points? Please include a figure with distances between sampling points. Paragraph 2.4: how did you capture sediments? Sediment traps? Suspended sediment samplers? Line 16-18: delete and just state, that you use g/m<sup>2</sup> to compare the different scales

Response: Ok, all issues were addressed. WRB classification was given sentences were corrected, a figure was added showing the sampling points. The sampling procedures was described and the lines 16-18 deleted.

Results: Line 7: different C/N: significant differences? Which test did you use? Line 12: larger scale = longer transport? Line 23 – 26: sentence not clear Last page line 16: sentence? ...illustrated by an increasing..? ... Line 21: initial not initially

Response: We added information on statistical testing to the Material and Method section. All other queries were addressed and sentences reworded.

Table 1: could you give MRT in addition to C14 activities?

Response: Ok, was done.

Figures: fonts are much too small. Not readable!

Response: Ok, were corrected.

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Reviewer 2

This is an interesting paper as it reports on a multi-scale assessment of soil and carbon redistribution. The paper examines the evolution of the biochemical composition of eroded SOC from the plot to the catchment scale. Overall, the paper is well written and I have no issues with the main gist of the paper. The experimental setup is original and the framework that is used in the discussion of the results (whereby erosion-induced (lateral) changes are compared to vertical differences in soil profiles) is novel.

Response: thank you!

However, in my opinion the manuscript is very short and in some sections insufficient information is presented and some issues lack an in-depth discussion: (i) the complex layout of the plots is described in a few sentences. This setup requires an improved description of this layout and some basic information on the locations of the plots/weirs within the geomorphic cascade. Adding a descriptive table or a figure/map where this information is given could be very informative.

Response: We added a figure showing the sampling locations.

An important issue that I could not fully understand from the text is how the data were temporally integrated: are the reported results based on the average values of the 34 storm events? This is not clearly explained.

Response: No the data were collected using samples from 5 major rainfall events distributed over the rainy season. This information was added to the sampling description.

i) one of the objectives is to compare the erosion-induced changes in biochemical composition with vertical profile differentiation. This is interesting but this objective does not follow logically from the information presented in the introduction. A short paragraph that provides context for this specific objective should be considered.

Response: Ok, a short paragraph on this specific objective was added to the introduction.

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The following items should be discussed in more detail: (iii) the manuscript only addresses qualitative changes at different spatial scales. What is needed to give quantitative estimates of fluxes and in particular sink vs source behavior?

Response: Ok, a short paragraph was added to the discussion.

(iii), the link between changes in EOM characteristics and sink-source behavior is not well-defined.

Response: Ok, we do not longer discuss the sink-source behaviour with regards to EOM characteristics..

(v) based on fig 2: is it possible that fresh plant derived material enters the aquatic system and that this may explain, at least partially, the observed jump in  $\delta^{13}C$ ?

Response: No, this is not possible, as plants in the region are C3 and therefore the  $\delta^{13}C$  should jump in the other direction (become more negative) if plant litter is added.

vi) the authors should consider to provide some additional guidance for fig 3

Response: Ok, we added text to the presentation of the results and changed the figure heading.

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Interactive comment on Biogeosciences Discuss., 10, 18175, 2013.

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