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Biogeosciences Discussions

# *Interactive comment on* "Soil profile connectivity can impact microbial substrate use, affecting how soil $CO_2$ effluxes are controlled by temperature" *by* Frances A. Podrebarac et al.

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Here we provide our responses to each part of the reviewer's comments below and following "Response:"

The study rises very interesting hypotheses (priming is not only triggered by exudates but also by inter-layer exchange of C sources, or priming involves mainly C and not N exchange). I think the experimental design is very smart and well designed to test these hypotheses and I think this might be a great contribution to understand a poorly understood process with, perhaps, large implications in terrestrial C cycling That said, I must say that following the story-line of this manuscript has been challenging for



different reasons. First of all, the experimental design is complex and needs some re-writing, trying to make life easier to readers that perhaps are not familiarized with former studies produced by this laboratory. Below some suggestions. Second, wording is sometimes a bit chaotic. The feeling is that the first author of the MS has the hypotheses, results and interpretation in the mind, but still needs to improve the way results and interpretations are reported so readers also understand well the mechanisms involved in this inter-layer priming. Third, I think the study will benefit from some reorganization of results and conclusions (see below some suggestions). Fourth, and even if I think that the experimental design is correct and well justified by the hypotheses, I think that authors should also justified how these results can be extrapolated to field processes, since, e.g. the manipulations of the layers in the experiment (e.g. L layer has been homogenized and pieces has been cut) has for sure huge impact over the functioning of the system. Also, the choice in the length of the experiment (more than a year) should be justified in order to understand how this helped testing the hypotheses. Finally, I think that the conclusion section might be rewriting to really synthesize the re- sults obtained based on the hypothesis launched and explaining potential implications of this identified process on terrestrial C cycling.

Response: Thank you for your careful evaluation of this manuscript and the constructive critique which will guide our revisions and greatly improve this paper.

Specific comments – Introduction: too long, difficult to follow the line of arguments. For instance, the whole paragraph 4 (lines 87 to 106) is key to understand the whole study, but understanding it is extremely challenging. I encourage authors to rewrite it. In general. I think that it can also be shortened substantially by integrating better the ideas instead of fragmenting them into different paragraphs (8 in total, too much!)

Response: We will work on integrating the main ideas covered in the introduction section and shorten that section.

Experimental design is poorly explained o The study is built based on results reported

in former manuscripts and even if the authorâĂšs made the effort to explain what was done in the past, it is still difficult to follow a study that built on former studies. I suggest to use a small scheme of the experimental design, showing also the two different approaches (isolated and whole experiment) and the tubes used. This will greatly help readers to understand how this study have put together results reported in other studies. Poor explanations lead also to potential misinterpretations. For instance, it is not clear whether the total amount of soil used in isolated and whole experiments was similar. This should be well explained because If not, it might be interpreted that higher C losses of “modeled” versus “predicted” comes from the fact that isolated soil layers might experience more oxidation and C losses because surface/volume ratios differ and diffusivity of O2 and CO2 changes due to layer thickness

Response: It is clear from this feedback in addition to the other reviewer's feedback that we relied too heavily upon the previous publication and in doing so have left out key information necessary to accurately communicate the findings of this study. We agree a figure illustrating the experimental design would help in this regard. For example, such a figure and a bit more detail will help convey that the total amount of soil used within the whole and isolated experiments was in fact similar and the surface/volume ratios in each constrained by the use of the same microcosm tubes. We will provide a new figure and revise the methods section to provide more information required to clarify the experimental design.

AuthorâĂšs assume readers knows very well what the alkyl C and O alkyl C or the THAA fractions of the total carbon or total nitrogen pools means, process-based. Why those fractions and their ratios were used in this study to interpret results should be well explained in the materials and method section.

Response: Agreed, we will add an explanation within the Methods section that ties each of the measurements made to the hypotheses being tested.

On top of that, it is clear that both fractions of the C pool (alkyl C and O alkyl C) and



their ratio are very important to understand results, but only part of the results are presented in the MS while the other half has been included only in supplementary materials, which makes also difficult to follow the argumentation

Response: This is a similar concern raised by the other reviewer. It is abundantly clear that pulling the O-Alkyl-C results figure into the main body of the paper would be helpful in clarifying the results and key findings of this study. We will do that.

Results section. I think the result section might be improved too. For instance, and parallel to Figure 3 (initial values for each horizon) it might help readers to understand the story-line and justification of results to show a Figure where to see the absolute changes in the different fractions/ratios shown in Fig 1. This is a part of the results complementary to the relative changes shown in Figs 3-5 that may help understand how the different fractions has been depleted and where. For the same reason, results from Fig S4 seems to give complementary information to those obtained in Fig 5. But to follow the argumentation you need to switch from the MS and the supplementary material.

Response: This comment and the previous make it clear that it would be easier on the reader were we to simply provide all 6 of the same datasets as expressed in the 6 panels of Fig.1 rather than just the three provided in Figs. 3-5. We will amend the results to reflect that change as well as organizing around the three key N based measures and the three key C based measures. If possible this might be done by constructing two new figures each with three sets of panels providing those absolute changes as recommended. Either way we will incorporate these figures into the main text as suggested here.

Discussion section is too large. Actually IâĂšve identified a whole section (section 4.2) that seems utterly speculative with no data on fungal or bacterial activity available in this experiment., I am sure that the whole section can be reduced to a couple of sentences. Overall, the feeling is that the discussion can be substantially reduced in

length

Response: We will edit the discussion substantially to excise extraneous discussion points and better focus on the main point that the study supports and the potential implications.

Conclusions. Conclusion section should be re-written to show better the main findings and the potential consequences for the terrestrial C cycling of identifying this process. The study will also gain from including and extra Figure synthesizing the whole complexity of the study into a Figure that explains the mechanisms identified based on the different results obtained.

Response: We will revise the conclusion section to clarify the main finding and implication. We will also generate a conceptual figure that addresses the point you raise here and anticipate that figure may also be constructed to aid us in clarifying the hypotheses posed, how they link to the measures made, and at the same time clarifying the main findings.

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