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Interactive comment on “Microbial carbon recycling: an underestimated process controlling soil carbon dynamics” by A. Basler et al.

Anonymous Referee #4

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For the editor/authors,

This is a review of the manuscript titled “Microbial carbon recycling: an underestimated process controlling soil carbon dynamics”. The work presented in this paper nicely compares mean residence time (MRT) and the chemical composition of different fractions of soil organic matter (SOM). The authors present a useful framework for thinking about SOM turnover in terms of stabilization versus recycling processes occurring in soils. They demonstrate this framework using sugars. I think this manuscript is ready for publication pending some minor revisions. My comments mainly revolve around how the authors frame their study (in the introduction), and how they synthesize their results (in the discussion). I would like to see more information in the Introduction that compares and contrasts the authors’ stabilization/recycling dynamics with other work

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that talks about physical protection, microbial access, and chemical recalcitrance as processes controlling SOM turnover. I think the authors' framework dovetails nicely with existing literature, but this is not clear the way it is written. Second, I think the authors could do a better job synthesizing their results in both the context of their stated hypotheses, as well as existing theory. I have more detailed comments below.

Abstract

Page 9730, lines 9-11: First word of sentence needs to be capitalized. Also, perhaps I'm missing something here but it seems like this reason doesn't follow if it's a cycle? After reading the rest of the abstract I get what you are saying, but this sentence was rather confusing the first time through.

Page 9730, Line 15: Be more specific here, what kinds of sugars?

Introduction

I do like casting this issue in terms of stabilization versus recycling of OSM. However, there are lots of hypotheses out there that use different language/words but are in essential agreement. I feel like you could do little more to put stabilization/recycling in context. Talking about physical protection, chemical recalcitrance, and accessibility is good start, but I think you need to expand on this topic a bit.

Page 9731, Lines 1-2: You need some literature references here if you are going to establish this as a paradigm in your narrative.

In the last paragraph of the introduction it seems like you are defining a system where plant-derived sugars are not subject to recycling. Therefore, by definition almost, microbial-derived sugars will be more affected by recycling processes. You need to clarify what, if any pathways exist for recycling of plant-derived sugars. My apologies if this information is there and I just missed it.

Results

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Page 9737, Lines 9-11: These data on sugar-C related to total C in oPOM seem to figure prominently in the abstract, they should be presented explicitly, in some fashion, in this section (putting data not shown is not acceptable).

Page 9737, Lines 14-18: I'm not an expert on sugars in plants and soils, so it's not clear to me that there is a standard set of sugars that are only found in plants and not microbes. Could you add some information on what sugars are typically used to differentiate between plant and microbial inputs, as well as how you determined, in your system, which sugars were plant-derived and vice-versa?

Page 9738, Lines 25-27: I don't see the data on the contribution of maize to the extractable C anywhere in the paper. Perhaps I missed it?

Discussion

Restructure the discussion so that you are synthesizing, not just repeating, results. This happens throughout this section, but is particularly evident in the first part of the first paragraph of this section. Also, simply stating that your findings agree with those of others is not adequate synthesis.

There seems to be differences in how sugars are referred to throughout the paper. In some places abbreviations are used, but not in others. For those not familiar with the abbreviated names of these sugars, using the full name would reduce confusion.

Page 9740: I would like to see more discussion on how SOM fraction quantity and MRT support existing aggregate hierarchy hypothesis. You present these two findings separately in the discussion, but they actually complement one another quite well, and if discussed together would present a nice synthesis.

Interactive comment on Biogeosciences Discuss., 12, 9729, 2015.

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