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Biogeosciences Discussions

Interactive comment on "Carbon turnover in cell compartments and microbial groups in soil" *by* Anna Gunina et al.

Anonymous Referee #2

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Contributing to the understanding the C turnover of different cell compartments is certainly a valuable goal. This manuscript reports the findings of a 3-50 day incubation experiment where 13C from glucose is followed into the cytosol, PLFAs and amino sugars. They set out to test three hypotheses: (1) turnover times increase in the order cytosol>PLFA>amino sugars; (2) incorporation of 13C is faster for bacterial than fungal markers; (3) "due to amino sugars have long turnover times and are mainly dominated in microbial necromass, all incorportated 13C can be related only to living biomass and allow estimate percent of replaced C in amino sugars of living organisms. I am concerned about the limitations brought by sampling intensity and analysis of the data and mostly that the findings that were possible with this study don't really allow for testing the hypotheses presented. Probably as a result. A lot of what's presented in the Discussion is not critical or essential and it's either general, repetitive or tangential.

1. Hypothesis 1 could not really be tested given the duration and intervals of sampling during the experiment. Glucose gets processed, incorporated, lost and recycled into PLFA already in the first two days (e.g. Ziegler 2005) and this can vary with soil and environmental conditions. Starting measurements after 3 days leaves us without any information of when the peak of uptake took place (thus when time zero for decomposition started) and when recycling started which would matter for trying to estimating turnover. Then on the other end, 50 day was not sufficient time for the aminosugars to finish building up and start decomposing, as the authors discuss. Perhaps the data can be used to answer a different question. From Figure 2, we don't know how good the model fits were (it would be important given there were three points and large error bars).

2. Hypothesis 2 is about differential incorporation by bacteria and fungi (who incorporates it faster). AGain, missing the first three day is pretty critical (Ziegler 2005 clearly shows this). There are already many experiments that have assessed "initial" incorportation of 13C into biomarker lipids and we wouldn't then need 50 days incubation for this. Also, I am surprised that there was no effect of time on the composition of the PLFA as 50 days is quite a long time for microbes and PLFA profiles tend to be more sensitive to time than any other driver, and, C depletion in 50 days of an incubation would be substantial.

3. Hypothesis 3 is hard to follow. I tried but was not able to understand it.

4. In the Introduction, the paragraph comprising Lines 96-108 is a very convoluted and hard to follow, however, it refers to the main rational for carrying out this study.

5. I don't understand why there was not an attempt to estimate ks for the PLFAs. That would be the main purpose of this approach, in my view. Also, how can the VAM be building up 13C, if they are mycorrizhae? This probably suggest the marker was indicating a saprotroph, not mycorrhizae, which is known to happen in soils.

6. About the aminosugars, what we still don't know and doesn't get explored and

discussed, yet, it would be the most interesting is: which builds up more per unit of C assimilated (this would be an indication of which may contribute more to SOC building), or in other words a measure of enrichment/recovery.

7. Glucose is likely to behave differently to other C substrates, therefore I would restrict the title and Discussion to glucose (not carbon).

8. The rationale for the difference found in turnover time between the cytosol and PLFA is really not convincing and not well supported. Both active and dormant organisms have a membrane and if they're not active they wouldn't be picking up the 13C.

9.The explanation for why more 13C was in the bacterial than non-bacterial lipids completely ignores anything about their ecology or physiology.

10.Describing what fatty acids were more or less abundant (section 3.3.) is not really informative as these data don't reflect absolute abundances and these patterns of abundance are more or less the same for a lot of soils.

11. I would replace the term 'incorporation' with 'recovery' which seems to be what they calculated.

12.I find it surprising that soil moisture would be "essentially constant" across 50 days.

Minor methods comments The rational for the amount of C added is not presented. Not clear if the field collected soil column had or not vegetation. I don't understand the "assignment of fatty acids to distinct microbial groups by factor analysis".

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