Comments to the Author

This manuscript by Wang et al. presented an important and interesting study of the effects of REOs labeling process and sieving methods on aggregate turnover and carbon dynamic. Researching soil aggregates and associated biogeochemical processes is a very time-consuming and laborious work, with the complex REOs labeling process makes it to be more difficult. Recently, studies focusing on aggregate turnover show a rising trend, while less researches have reported the role of labelling and sieving processes played in affecting aggregate turnover and soil C dynamics, which may obscure or even magnify the effect of treatments. Dividing the labeling process from the incubation (or other treatments) thus is pivotal for accurately assess the real aggregate turnover dynamics and soil C dynamics. Indeed, the authors found that labeling process and sieving method affect aggregate turnover and soil C fractions (particularly labile C fraction, i.e., DOC, MBC) more intensively than incubation. However, the text has low readability. The logic is very confusing, and the authors seem unable to catch the highlights and key points of the story. Additionally, some key information about the calculations do not show in article. I very appreciate with the work and its significance the authors done. However, I feel a pity that the authors show the story in a not good way. So, I do not recommend the publication of the article in SOIL. The best result is resubmission after major revision.

Introduction

The introduction does not align well with the topic. The article aims to reveal the effects of labeling process and sieving method on aggregate turnover and soil C dynamics. However, in the introduction, relating statements are rare, and the authors paid more attention to some unrelated points. For example, the soil types previous REOs studies has been used. Is the soil type (Andisols) very important? I do not think so. In my opinion, the authors should show us the shortage in REOs labeling studies (i.e., overlooks the effects of labeling process and sieving method) and its importance in assessing aggregate turnover dynamic and soil C dynamics, possible effects of labeling process and sieving method on aggregate turnover and soil C dynamics and how do them, and the potential relationships between aggregate turnover and soil C dynamics.

L39-42 why do you mention the concept of “humus”? does your study involve the chemical stability of SOM? the POM and HF you studied are fractioned by physical and density fraction method, not by acid or alkaline or thermal hydrolysis, right? Although they have different functions, they are commonly regarded from a perspective of physical stability/protection.

Materials and methods

L81-84: more details of the soil properties show be shown, such as SOC, soil texture and etcs.

L84-85: “soil sampled by a core at five random locations”. What’s the diameter of soil core? How large the region of soil sampling? Given that soil is highly heterogenous, how representative are the five cores?

L87: you separated three aggregate size classes (0.25-2, 0.053-0.25, <0.053mm), why there have four REOs? One is redundant?

L95: I doubt that you can broke down to pass the soil through a 2-mm sieve just by hand without other tools after oven-dried. The wet-dry cycle of labeling process had clumped the soil.

L114: how do you add the 13 ml of ultrapure water to avoid the rewet effect on aggregate turnover?

L119-120: more details of the incubation. The top of box is open or close?

L175: where is the calculation of aggregate turnover rate? I can not find in the Appendix S1.

Results:
The authors showed lots of information in the text, without emphasizing the important information associated with the topic. For example, the effectivity of REOs labeling in tracing aggregate turnover has been widely proved, it is not an important information here. So, Fig.3 can be put in appendix rather than in text, and associated text should be more concise. Figs. 1 and 2 also can be merged.

L194: why the format of Table 1 differs from other tables? And I feel uncomfortable with the unit in Table 1. g kg^{-1} soil for TOC, fPOM, oPOM and HF and mg kg^{-1} soil for MBC and DOC are more commonly used.

Fig.7: Why do not show the absolute value of soil C fractions such as MBC and DOC? I think use the absolute value is more clearly than the proportions of them in SOC (the values are too low) to assess the effects of REOs labeling and sieving methods.

Discussion:
I completely agree with the comments of another review about the discussion.

Besides, for section 4.3, authors paid more attention to discuss the aggregate turnover dynamics, where is the discussion of comparing the effects of labeling process and sieving method on aggregate turnover? I think it is the key point needing to be discussed.

L334-338: explaining why wet sieving removes most fPOM. Does the dry sieving reduce fPOM because of the removal of fine roots and debris? The fine roots and debris should be removed before experiment, them were not pick out clean?

Some problems of format at L345, 351, 361.

L394-395: If the relationship between oPOM and aggregate fractions is important, please discuss it more in-depth, not just depict the result. If it is not important in this study, it is not necessary to show.

L415: “The HF generated by aggregate breakdown cannot accumulate into aggregates, allowing it to accumulate on the outside and consequently increase the proportion of fPOM”, please attach the reference. I do not think the accumulation of HF can increase fPOM. They are varying in size, density and properties (e.g. C/N), two different concepts. The soil continuum model (Lehmann, J., Kleber, M., 2015. The contentious nature of soil organic matter. Nature 528: 60-68) suggested that

fPOM can be degraded into HF with microbial processing, and it is an irreversible process.

Conclusion

Do not simply repeat the results, but show the main findings and implications.