

Referee #1 Comments:

This manuscript studied litter and native soil organic matter decomposition under different redox conditions. Their results showed decomposition of litter and native soil organic matter responded differently to redox manipulation. They revealed microbial consumption of organic matter was more oxidized compounds under anoxic condition. Their results also suggest recalcitrant organic C pool rather than labile organic C pool was significantly affected by redox condition. These findings are interesting and contribute to our knowledge of C dynamics under redox fluctuations. This manuscript is well-written and is recommended to publish after a minor revision.

Thank you for the encouragement!

Only several suggestions here for improvement:

1. when describing the result from Fig. 6, please also describe and discuss the NOSC change over time within the same treatment. I assume the NOSC were same across all treatments at the beginning on Day 0. On Day 44 NOSC were still same across all treatments. So NOSC in all treatments decreased from Day 0 to Day 44 with the same level. Just under static anoxic condition this decrease was slower than other conditions. You may discuss on this.

We did not find significant changes of NOSC values between day 20 and 44. We have added this result to the text (Line 290). We agree with the reviewer that the mean NOSC value would start with the same value and likely decrease over time due to the consumption of relatively oxidized compounds. Unfortunately, we did not analyze samples from day 0 with the FTICR-MS method. Thus, we don't have the capacity to compare the NOSCs between day 0 and other days.

2. you may calculate priming effect of SOM decomposition caused by litter addition and compare between four redox conditions.

Thank you for this suggestion. We did not include microcosms with only soil. Therefore, it is impossible to estimate the priming effects based on our current data.

3. in Fig. 4 γ was much higher in static anoxic condition than other conditions. Maybe add discussion on this.

We will add the following text in the discussion on Line 360:

“Our modeling analysis also shows that the size of the fast-cycling pool was larger in the static anoxic treatment than in other treatments, which is consistent with the observation that a high litter decomposition rate was maintained for an extended period time under anoxic conditions. Larger fast-cycling pool was also in line with the increased DOC concentrations under anoxic conditions. These findings support our interpretation that Fe reduction released labile C from organo-mineral complexes, which could be degraded anaerobically.”