

Thank you to the reviewer and editor for the final comments on our manuscript.

The final reviewer minor comments have been addressed and regarding the final comment on false priming, we have now included a new paragraph within the false priming section to address this.

“False priming refers to a reduction in the effective turnover time when the input of carbon into the soil increases. It was named ‘false priming’ as it can look like the increase in heterotrophic respiration that occurs when a soil microbial community is stimulated by the addition of labile carbon or nutrients (‘true priming’). However, ‘false priming’ is arguably a misleading term because it is a real effect. It arises as a result of a change in the relative quantities of carbon turning over at different rates, which occurs transiently in response to an increase in the input of carbon into the soil. In the context of our three-box model, for example, the turnover rates of each individual box do not change. However, because each box responds differently to the increase in NPP, a difference in the average or effective turnover (i.e. as defined in Equation 1) is seen. The effective soil carbon turnover time is a measure of how long carbon remains in the soil. However, it cannot necessarily be assumed that all carbon will take exactly the same amount of time to be re-released. Different types of litter input (e.g. lignin vs carbohydrate) take different amounts of time to decompose (Krishna et al. 2017). Similarly, vertical gradients in temperature throughout the soil result in variations of turnover time within the system (Koven et al. 2017). The effective carbon turnover time is an average of these distributions of turnover times and an increase in the amount of fast turnover carbon in the system relative to slower turnover carbon results in it decreasing. As it has been shown here, this effect can be significant and must be accounted for when attributing soil carbon change to different environmental drivers (Georgiou et al. 2015).”

We note that this comment was addressed by a new co-author who is now included in the study.