Feedback from the reviewers is written in italic face, while our responses are written in normal font in green.

**Reviewer 3**

*The authors present a new mechanistic model (SOILcrab) to assess the potential to decrease parameter equifinality by including isotope data of tow soil fractions as constraints on parameter values during model optimization. They found that adding $\Delta^{14}C$ data as a calibration constraint, can correct simulation of the turnover rate of SOC and only substantially reducing equifinality for the parameter regulating desorption rate of OC from minerals. However, adding $\delta^{13}C$ data had little effect to improve simulations of the turnover rate of SOC or limit parameter equifinality. These findings are interesting and can improve the predictions of soil carbon dynamics under environmental change scenario.*

*Major concern:*

*This model was only applied in a deciduous forest site with different soil profile, it is unclear what's the performance of this model when it is applied to a large spatial scale.*

We thank the reviewer for taking the time to read our manuscript and provide feedback. As we responded to another reviewer (see above for reviewer 2), the aim of the model for the presented manuscript was not to develop a model that is readily applicable to a wide range of environments under different conditions, but rather to construct a model with a structure similar to other recently-developed microbially-driven SOC models to show how equifinality influences model results. Therefore, it is beyond the scope of the discussion section to address this issue, and leave this for future research as we apply the model (or an adapted version) to other environments.