Biogeosciences Discuss., 11, C1869–C1871, 2014
www.biogeosciences-discuss.net/11/C1869/2014/

Biogeosciences
Discussions
Open Access

Interactive comment on "The implications of microbial and substrate limitation for the fates of carbon in different organic soil horizon types: a mechanistically based model analysis" *by* Y. He et al.

Y. He et al.

he72@purdue.edu

Received and published: 26 May 2014

We appreciate the constructive comments by reviewer 2. We have revised the manuscript based on the discussion and have carefully taken into account all comments.

Response to general comments:
(1) The authors imply that their model is an improvement of Yi et al. (2009), however no evidence is presented to justify that. The authors are critical of site-specific model

parameterizations; however, the authors have chosen to test the sensitivity of the model against site-specific data. The fact that "the model only weakly captures the effect of moisture" needs to be considered when formulating the introduction/discussion.
Reply: We did not state that our model was an improvement over Yi et al. (2009) and we did not do any model comparison. We only adopted the vertical aspects of the soil structure from the model of Yi et al. (2009). Note that we have restructured the introduction and discussion to focus on the contribution of sensitivity analysis on identifying dominating process and guide experimental work. Comparison of this model with other standard soil C models was not addressed in this study, but is the focus of another paper that is currently under review.

Response to specific comments:
(2) There is no justification given for the MIC/SOC ratio being fixed at 2% or the CUE at 0.4.
Reply: These values are not technically "fixed" in the model as the model dynamics determines that CUE and MIC changes over time with temperature and moisture. The CUE and MIC/SOC used here is to set an average state for inverse modeling, so that the parameters vary in a range that produces reasonable output. We also added sentences in section 4.2 to discuss the impact of this on our conclusions (L456-459).
(3) It is not clear from SI figure 1 that a sample size of 2000 produced narrower standard deviations than a sample size of 1000.
Reply: c_SOC and r_EnzLoss showed more notable difference between these two sample sizes. Overall, higher sample size yielded in more consistent result but at a higher computational cost. Our choice of 2000 was chosen as an acceptable compromise of these two issues (we initially evaluated sample sizes between 500 and 8000).
(4) The authors only give information on how the original model performs in relation to soil respiration. There is no evaluation of model performance against the measured soil c stocks.

Reply: Because the focus of this study is sensitivity analysis, we calibrated the model just to obtain a valid range for parameters. Also because we only have soil respiration data for one year, soil C stock should not change much during this time course. The observed soil horizon thickness and soil properties were used to initialize the model.

Technical issues:
(5) Fan et al (2008) and Mack et al (2009) are missing from the reference list. Mathworks, 2012a is missing from the reference list.
Reply: We checked the reference list and assured that the list is complete now.
(6) Table 3 – there are 10 parameters included in this list.
Reply: We corrected this typo in revised manuscript. Note that the 10 parameters were bolded in Table 2 and Table 3 was omitted from the revised manuscript.
(7) p2240, line 10. The word should be which only instead of while only.
Reply: We corrected this in the revised manuscript.
(8) p2247, delete As from line 5.
Reply: We rewrote the sentence in revised manuscript (L452).
(9) Supplement: the unit of the variables should be defined. In equation 14 – MICtoSOC is no defined. In equation 17 – it looks like the font has been corrupted (italics/non-italics) in dSolubleC.
Reply: The units of those variables are defined in Table 2 of the main text. MICtoSOC is defined in the text right above Eqn 14. We corrected other issue mentioned above in the supplementary material.

Interactive comment on Biogeosciences Discuss., 11, 2227, 2014.