

Biogeosciences Discuss., author comment AC2
<https://doi.org/10.5194/bg-2021-163-AC2>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC2

Daniel M. Ricciuto et al.

Author comment on "The impacts of model structure, parameter uncertainty and experimental design on Earth system model simulations of litter bag decomposition experiments" by Daniel M. Ricciuto et al., Biogeosciences Discuss.,
<https://doi.org/10.5194/bg-2021-163-AC2>, 2022

We thank the reviewer for the thoughtful comments. The review is copied below with responses in **bold** text.

This paper is a modelling study looking at whether two existing soil process representations within the ELM model can capture observations of litter decomposition from a distributed litterbag experiment. The authors devise a modelling framework - a functional unit approach - to easily reproduce the large number of observations as well as our conceptual understanding of decomposition inside litterbags. The authors conclude that the two different representations have a similar capability to reproduce the observations.

The modelling approach is robust and the manuscript is well written, but I find the authors downplay their results in the discussion section. This is largely a comparison with another similar study and how their modelling approach and results differ from that of Bonan et al., 2013. I am not very familiar with that study and cannot provide a point by point comparison, but surely there is more to the paper under review than whether it does or does not produce the same results as a paper from 8 years ago? Specifically, I think it would be interesting to discuss more the implications of the results and future modelling directions. How can we improve our models? What other data should we use? Should we focus more on parameterisation than structure, as the parameter sensitivity suggests? These points are touched briefly in the last couple of paragraphs but could be emphasized more for a stronger paper.

Thank you for the comments. We agree that the manuscript focused too much on the comparison with Bonan et al. and not enough on the implications of the new results presented here. We focus here on how the nutrient dynamics influence the turnover rates, and will re-organize the discussion to highlight these results and put them in the context of 1) previous studies and 2) how additional data and modeling may help to resolve model parameter and structural uncertainties. The discussion will be reorganized to emphasize these points.

A couple of other points that would make the paper easier to read: there are a lot of acronyms, especially related to the site names and litter types; I wonder if these could be replaced with more intuitive names, especially the litter types? E.g. high/low lignin or high/low CN? Also, the introduction could be improved by some headings to guide the

reader.

Thank you for the suggestions. We would like to keep the litter names for consistency with previous studies, but will indicate the C/N ratios next to the litter name. We will edit the text to use more descriptive site names.

Minor comments

Table 1 - It would help to add lat/lon information as not everyone is familiar with the exact location of US states.

We will add the lat/lon information to the site table.

L 146 Are the temperature, moisture etc modifiers common to the two models?

We will add the equations for the temperature and moisture scalars to the supplementary information.

L 150 What is the respiration a fraction of?

During the decomposition step involving a pool transition (e.g. from litter pool 1 to soil organic matter pool 1), a fraction of the carbon respire to the atmosphere. The remaining carbon transitions to the new pool. We will revise the text for clarity.

L 178 How long was the spinup period and how was steady state determined?

The spinup involves 200 years of accelerated decomposition (Thornton and Rosenbloom, 2005), followed by 600 years of additional spinup. Following this spinup, we check that the net ecosystem exchange (NEE) should be less than 1 gC m⁻² yr⁻¹ on average. We will provide these details in the text.

L 186 How was this adjustment done?

For each month, we add or subtract a bias factor so that the 3-hourly GSWP3 monthly mean temperature matches the site-observed, and multiply the monthly precipitation data by a factor so that the monthly sum matches the site-observed value.

L 546 'model' repeated

Thank you, we will correct this error.

L 558 Missing bracket

Thank you, we will fix this.