

Biogeosciences Discuss., referee comment RC2  
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## Comment on bg-2021-163

Anonymous Referee #2

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Referee 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-RC2>, 2021

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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.

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.

### Minor comments

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

L 146 Are the temperature, moisture etc modifiers common to the two models? L 150 What is the respiration a fraction of?

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

L 186 How was this adjustment done?

L 546 'model' repeated

L 558 Missing bracket