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Biogeosciences Discussions

Interactive comment on "Ages and transit times as important diagnostics of model performance for predicting carbon dynamics in terrestrial vegetation models" *by* Verónika Ceballos-Núñez et al.

Anonymous Referee #4

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The article develops an interesting approach to distribute structural and labile carbon into age distributions with the resulting transit time of carbon in the vegetation. They tested three different allocation models and used measured carbon values from Harvard Forest to parameterize each model and atmospheric isotopic carbon to compare against the isotopic signatures calculated from each structural component. Age and transit time distributions were different for the different allocation models, showing older age distribution in the model with more storage compartments, as well as with the wood components.

1. At the end of the introduction it is stated that the models are diagnosed according to four metrics, but only metrics 1 and 2 (carbon fluxes and bomb spike) are based on observations, and even those are not necessarily for each component, so the diagnosis is really just an analysis of how the different model results compare or what they imply rather than an actual metric based on observed values. There needs to be better distinction between what is actually observed vs what is modeled throughout the paper.

2. So, one justification for this research is that age and transit times can be measured with isotopic tracers, but that was not done in this study. There should be some examples in the literature of these types of measurements or some attempt to use them to verify the results of this study. It would be nice if there were some way to prove that adding more compartments improves the age distribution and transit times. However, compared to the total atmospheric isotopic signatures, the multi-compartment schemes actually do worse, which the authors attribute to perhaps the lack of phenology.

3. The models used here are purely parameterized models without any processes at all, so how would this approach actually apply to models that were process-based? Bayesian optimization of parameters has been done before, but it is impressive that this approach was taken here. Any speculation about how this age and transit distribution approach could be applied and tested in some of the major ecosystem models?

4. Non structural carbon would seem to be the same thing as labile carbon, so maybe indicate that first time the term is used.

5. The allocation models here really refer to models with different quality storage pools. The allocation itself seems to be simply constant rates – but I would consider allocation model to imply different methods of determining allocation, i.e. literature-based rates, cost-benefit analysis, etc. I would prefer more clarity on how the constant rates differ between the pools, and how they are determined.

6. P. 7, and of first paragraph: How do the functions used to calculate age and transit time distributions relate to the formulas in the introduction? Last Paragraph: What is

meant by lower-diagonal with respect to the figure?

7. P. 9, Figure 3: Are the observations data the dots and vertical lines? Seems like a large range for the error bars – why so large, and what are they based on? Table 2: What is the criteria for positive or negative correlations (i.e. how large and R2 value?)

8. Figure 4 is not mentioned in the text. More detail on the source of the isotopic carbon data would be useful. How are the "bomb spikes" used to determine radiocarbon values?

9. P. 11: Not sure whatis meant by "Notice that distributions with the highest peak (occurred) closer to 0 years, and with younger mean and median ages had the youngest C".

10. P. 16, second paragraph: What parameters are the ones that compose the beta vector and B matrix? Not all the appendix figures (A4 to A9) are mentioned in the text. At bottom of page, what are implications of the different age values – i.e. how do the 1.71/2.14 and 45 yr relate to the 7.2?

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