

## ***Interactive comment on “Understanding the uncertainty in global forest carbon turnover” by Thomas A. M. Pugh et al.***

**Anonymous Referee #2**

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In “Understanding the uncertainty in global forest carbon turnover” Pugh et al use remote-sensing based turnover estimates to evaluate the performance of six TBM. Based on this evaluation the authors propose eight hypothesis which are then discussed.

The study is well structured, the discussion is insightful and the hypotheses are supported by the analyses. It is clear that a lot of thinking went into this analysis which by itself is a sufficient reason to support publication of this manuscript.

In my opinion the discussion lacks one section, i.e., a critical assessment of the concept of biomass turnover and whether it is key benchmark for model evaluation or an observation that should only be used if more process-specific observations become available. Given that several model groups are replacing their turnover parameter by

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an explicit representation of the different mortality events, what is the future of these remote-sensing based turnover estimates?

From a scientific point of view the manuscript could be accepted as it is. Nevertheless, the current manuscript is very dense. The manuscript could become easier to read and digest (and would therefore become more likely to make an impact) by: (1) Rewriting/expanding the equations (especially eq 2). The study does a good job in disentangling the major processes that contribute to the turnover time of biomass carbon but the equations fall short of reflecting this complexity. Either the introduction or section 2.1 could be used to refine and better formalize the definition of turnover. Ideally each of the hypothesis should be reflected in one of the terms shown in the final equation. (2) Rethink fig 1. I don't get the meaning/purpose of figure 1. I think it is related to my point above, i.e., showing the diversity of processes contained in the remote-sensing based turnover observations but it did not help me. Turning this figure into a table may help. After reading the entire manuscript, I think I would have benefited more from a description of each of the terms with an example rather than the bars and arrows. (3) Thinning the results section. In my opinion the model comparison is the least developed part of the manuscript and I even doubt whether it is essential. If the definition gets better developed, it might be possible to derive the hypothesis from the definition and then discuss these hypothesis in the light of scientific literature. This would change the type of study but it could increase the impact of this study. If you decide to keep the model comparison, please, better justify the model experiment (and add revision numbers for each of the models). It would have been much easier to compare the models if a run with a prescribed PFT distribution was used as well. How can you justify the comparison of data with management to simulations without management? How meaningful is this given that management is a major driver of both the growth and the mortality components of turnover? Given the complexity of the processes described by turnover but the simplicity of the observations (i.e. a single number), the model comparison remains superficial in the sense that it is hardly possible to label some of the model behavior as “very unlikely”. In the end this section takes up a lot of space

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for very little information (although I liked Fig 2 a lot. It is an informative way to show both models and data – note that this is the only figure that shows the observations). Maybe the bulk of the comparison could be moved to the supplementary materials?

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