

## ***Interactive comment on “Ecosystem carbon transit versus turnover times in response to climate warming and rising atmospheric CO<sub>2</sub> concentration” by Xingjie Lu et al.***

### **Anonymous Referee #2**

Received and published: 23 June 2018

In this manuscript, Lu and colleagues use the CABLE model to show: a) how turnover time and transit time diverge under transient global change simulations, and b) decompose the contribution of turnover time between the age structure of ecosystem pools and their contribution to the output flux. This is an exciting and important paper. Previous studies have shown how turnover time contributes to our predictive uncertainty of the future response of the terrestrial biosphere to global change (e.g. Friend et al., 2013). However, this study nicely shows that turnover times themselves can also be an uncertain metric to assess model performance and quantify carbon storage potential in the terrestrial biosphere under non steady-state conditions.

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The manuscript expands on previous work by Rasmussen et al. (2016) who developed formulas for the mean transit time for non-steady-state conditions. It shows how global change drivers such as warming and CO<sub>2</sub> can modify the time that carbon requires to transit through the terrestrial biosphere. The implications are not only for comparing two different modeling metrics, but it helps to understand how global change modifies the time scales of carbon storage in the terrestrial biosphere.

Unfortunately, the manuscript has problems with the English language (typos, grammar), but if these issues are addressed with the help of a native English speaker, the manuscript can be published with minor revisions. I only have a few minor comments to help improve the manuscript:

- Line 22. Increase with respect to what? Do you mean increase in the transient simulations with respect to steady-state? Please clarify.
- Line 29 plus 3 other occurrences. Change Olsen to Olson.
- Figure 2. I don't understand why you plot together the turnover times from Carvalhais et al. (2014) versus the dynamic transit times. They are conceptually different and computed in very different ways. This figure gives the false impression that these metrics should be compared, and that they are roughly equal, which this very same manuscript clearly shows that they are not. I suggest removing this figure to avoid confusion.

## References

Carvalhais, N., Forkel, M., Khomik, M., Bellarby, J., Jung, M., Migliavacca, M., Mu, M., Saatchi, S., Santoro, M., Thurner, M., et al. (2014). Global covariation of carbon turnover times with climate in terrestrial ecosystems. *Nature*, 514(7521):213.

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Friend, A. D., Lucht, W., Rademacher, T. T., Keribin, R., Betts, R., Cadule, P., Ciais, P., Clark, D. B., Dankers, R., Falloon, P. D., Ito, A., Kahana, R., Kleidon, A., Lomas, M. R., Nishina, K., Ostberg, S., Pavlick, R., Peylin, P., Schaphoff, S., Vuichard, N., Warszawski, L., Wiltshire, A., and Woodward, F. I. (2013). Carbon residence time dominates uncertainty in terrestrial vegetation responses to future climate and atmospheric CO<sub>2</sub>. *Proceedings of the National Academy of Sciences*, 111(9):3280–3285.

Rasmussen, M., Hastings, A., Smith, M. J., Agosto, F. B., Chen-Charpentier, B. M., Hoffman, F. M., Jiang, J., Todd-Brown, K. E. O., Wang, Y., Wang, Y.-P., and Luo, Y. (2016). Transit times and mean ages for nonautonomous and autonomous compartmental systems. *Journal of Mathematical Biology*, 73(6):1379–1398.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2018-175>, 2018.

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