

Comments from Reviewer

The manuscript submitted by Rafique et al entitled "Divergent predictions of carbon storage between two global land models: attribution of the causes through traceability analysis" is an interesting work on the behavior of land models. The authors used an analytical approach (traceability framework) to decompose model predictions of ecosystem carbon (C) storage into a set of common parameters. The authors also made good attempt in writing the manuscript, however, there are few concerns (mentioned below) those can help in improving the manuscript. I believe that after considering below mentioned concerns, this manuscript can be suitable for publication in *Earth Syst. Dynam. Discuss* journal.

Major Comments

- (i). The traceability framework used in this study can be discussed in more detail to make it more compelling. This can be done through the better articulation in the objectives section. In the Results section, the text mainly focusing on detailing the differences in models which is good but should not be stretch too much and rather authors should focus on the key differences and the importance of those differences in modeled NPP and carbon storage.
- (ii). The discussion section is reasonably organized and describes a summary of the differences in the models. However, this section needs to focus on the model performance, and why this approach is most useful than previously studied. Also, what are the model uncertainties?
- (iii). The summary section of should focus on key findings and take away message rather than repeating most of the results.

Specific Comments

- (i). *Abstract*: The abstract is well written, however, it can be further improved by more focusing on the take away message. Also, highlight what we learned from this study.
- (ii). *Introduction*: Authors mention that the future CO₂ concentrations depend on the balance of C uptake and C loss from ecosystems. Why is "in simulations" used? The future of CO₂ concentration depends on how the terrestrial carbon cycle will (actually) respond to various external factors, not on how we simulate it. Further, the sentence needs work...Many studies have evaluated and compared the carbon cycle components of ESMs...Also you focus on ESMs here, but the analysis presented in the paper is using land models (not ESMs). This distinction is not clear.
- (iii). *Materials and Methods*: Again, here referring to ESMs, when analysis is focused on land models. If CLM-CASA' and CABLE are forced with different climate drivers? If so, this needs to be made clear. Somewhat glossed over here.

- (iv). *Results:* The statement "In general, biomes with higher carbon storage capacity of models, showed moderate NPP and higher ecosystem residence times" does not seem to accurately describe the relationship between U_{ss} and τ_E . This only seems to describe ENF. Please check it again. The sentence "Three biomes, evergreen broad leaf forest, C4G" is unnecessary and too wordy. "similar diverse"??? This needs to be fixed. Majority of the text is describing figures only. Please shorten the text (as commented above in the **General Comments**) to highlight the main points and their importance.
- (v). *Summary.* See response in above **General Comment** section.
- (vi). *Figures:* Figures can be improved by mentioning in the caption about the black circle and the open square symbols. These things have not been mentioned in the figure 1. Same apply for the Figure 2. Further, in Figure 4, the time period of the weather data should be mentioned.