

In this revision, Yue and co-authors improved the manuscript a lot, among others by sensibly incorporating answers to the points of criticism from the reviewers. In particular I have been focusing on their answers to my own reviewer comments.

In general the (my) reviewer comments have been very nicely addressed in the revised manuscript. In few cases answers have been given only in the final author comments in the interactive discussion. Since, however, these answers were of rather technical nature, which would rather tend to obscure than to clarify the manuscript, I find this approach justified.

With one exception (below) my comments to the revised manuscript are either praise or of technical nature.

General comments:

The separation of this paper from the accompanying paper is - at least from the point of view of this paper - well implemented.

The inclusion of the ensemble of runs with different priority to the different cohorts very nicely highlight the influence on the assumptions done by the authors and let the reader judge the solidness of the results.

The results presented in the previous version of the manuscript suggested to me, that there was significant non-linear interactions between land turnover and wood harvest. By including the S2b experiment series the authors have demonstrated that such non-linear interactions only play a marginal role and thus the order of process inclusion is rather unimportant.

Specific comments:

L.75-77: Sentence is hard to read. Perhaps leave out "depending on different models and assumptions" which I assume is clear from the context.

L.94: I am no native speaker, but I am rather sure that "explicit representing" is not grammatically correct. Either "explicitly representing" or "explicit representation of" would work.

L.95, 181 (and elsewhere): I do not really like the expression "time length" but acknowledge, it is not easy to find a good alternative. Maybe anyhow give it a try?

L. 154: Wrong reference style: "... in Piao et al. (2009a)" instead of "... in (Piao et al., 2009a)".

L. 155: Guess "are" should be "were".

L. 206-207 vs. l. 211-212: In the first sentence it is stated that shifting cultivation and wood harvest are (primarily) targeting different cohorts, in the second it is stated that these two processes are treated identically. Please clarify.

L. 214: No comma after "ones".

L. ~318: For completeness, also FFire should be explained.

L. 362-366: Something is wrong with the first part of the sentence.

L. 370: The "- globally" disturbs the reading. Perhaps "in general" (without dash) would fit better? This would also suggest that the uncertainty not only has a geographical but also a temporal component (change of cultivation practices over time at a fixed location).

L. 381: "MTC" is not defined in this paper. I guess for the purposes here, "PFT" would be the right substitution though a more thorough discussion is in the

accompanying paper.

L. 433: "magnitude of areas" is strange, just use "areas".

L. 441: Due to the insertion of the sentence about the S2b experiments, it is no longer obvious which "two simulations" are meant.

L. 447: ", dominated by tropical regions" can be left out since this is a part of the gross transition definition introduced by the construction of the LUH1 data set.

L. 533-534: Figure references are confusing and partly wrong. As far as I can see, in the first bracket, "5d" should be "4d", a "(Fig. 5c)" is missing after "harvest" and "... loss (Fig. 5c, 6d)" should be "... loss (Fig. 5d)".

L. 547-548: Consider reformulation of "the several beginning decades of the 20th century".

L. 584: "Table 4" not "Table 3".

L. 615: Guess "as" should be left out.

L. 653-659: Somehow the numbers stated suggest that the authors claim that $510 < 505$ which - I guess - is not what they mean. This may happen either because it is not stated for when the data set of Avitabile et al. (2016) is valid (insufficient definition of "contemporary") or because they actually compare to the values from their S3 experiment which they don't state instead of the S0 results stated. Should be clarified.

L. 661-679+Fig. S10: Major point:

1) Still I find that this is a lot of pseudo-quantitative work on a very speculative basis which is better left out.

2) Looking closer at Fig. S10 I can't make the numbers match: In South & Southeast Asia the figure suggest an underestimate of ~70 Pg(C) but in the global this seems only to be ~50 Pg(C) despite also several other regions show larger underestimates, while only tropical Africa overestimates (by only a few Pg(C)). The sum of the reconstructed biomass stock for the different regions also doesn't seem to match the global number. Summing from the regional panels of the figure, I get the reported global biomass to ~465 Pg(C), compared to <400 Pg(C) in the global panel. This - on the other hand - could explain the apparent discrepancy of the underestimations which would fit quite well using 465 Pg(C) as the global value. It is unclear to me if resolving these discrepancies would change the numbers in lines 677-678.

3) How does the biomass reconstruction used for Fig. S10 relate to the values of Avitabile et al. (2016)? As far as I can see, they only can be brought to match if there has been a tremendous increase in carbon stocks over the 20th century (505 Pg(C) above ground (~2010) vs. 465 Pg(C) total (1901)). Please comment on this if you decide to keep the paragraph.

Indeed, I see an increase of about 150 Pg(C) during this period in "my own" model (the CMIP5 version of MPI-ESM), but even this seems insufficient to bring the numbers presented here and in Avitabile et al. (2016) together. The increase seen in MPI-ESM is driven solely from an increase in soil carbon (~250 Pg(C)) and is counteracted by a reduction in the living carbon stocks (~90 Pg(C), due mainly to net decreased forest area). Litter stocks are roughly unchanged.

L. 697: "differed" -> "different"

L. 702-703: The insert "as in the case where they're represented with a single patch within the model" should be marked as insert either by commas, dashes or brackets.

L. 702: "they're" -> "they are"

L. 985-987: Using Bmax for both "maximum biomass" and "equilibrium biomass"?!

Tables 2 and 3: Probably just due to the draft format, but the alignment of columns and numbers is not very reader-friendly.

Fig. 2: At least within the same figure, it would be nice if sub-panel names and titles are consistently placed either inside or outside the panel.

Fig. 3 vs. Fig. 2, 4, 5, S3 and S8: It is also not very reader-friendly that the ordering of the sub-panels of the figures is different between the figures (column-wise vs. row-wise).

Fig. 2S, y-axis: Here an "Mkm2" survived.