

Interactive comment on “Representing anthropogenic gross land use change, wood harvest and forest age dynamics in a global vegetation model ORCHIDEE-MICT (r4259)” by Chao Yue et al.

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The manuscript by Yue and colleagues presents model development in ORCHIDEE-MICT, incorporating a forest age structure and gross land use transitions, including shifting cultivation. Both aspects were subject to several papers in the recent years and it would be helpful if the authors set their implementation and their findings more (and more accurately) in context of the already published literature.

In particular:

C1

1. Regarding the effects of net vs. gross transitions, there has been a recent multi-model study by Arneth et al. (2017) that showed the importance of tree harvesting and land clearing from shifting cultivation. In this paper seven models were used to determine the influence of wood harvest and shifting cultivation. It might be helpful to relate to the findings of Arneth et al. (2017).

2. The described approach to model gross transitions as matrices looks very similar to the implementation of gross transitions in the DGVM JSBACH, as described by Reick et al. (2013), which has not been mentioned at all in the manuscript so far (please also see the comment on the lines 87-93 below). It would be helpful to include some comparisons of the way Yue et al. represent gross transitions and the way it is presented in Reick et al. (2013). The same might hold for the mentioned paper describing LPX-Bern (Stocker et al., 2014). There are two further models listed in the 2015 update on the global carbon budget that include gross transitions (Table 5; Le Quere et al., 2015): CLM4.5 (Oleson et al., 2013) and Visit (Kato et al., 2013), which might also be worth looking at.

3. There are several DGVMs that have some kind of age structure, e.g. LPJ-Guess with its gap dynamics (Smith et al., 2014) and LM3V (Shevliakova et al., 2009). The latter is particularly interesting for the manuscript of Yue et al. because of the combination of simulated secondary regrowth and land use and land management, including shifting cultivation.

4. I do not understand which of the implementations regarding age structure stem from ORCHIDEE-CAN and which are newly developed in this study (l. 190-221), and I think it would be helpful if the authors could revisit this paragraph for clarity. Particularly, I do not understand how cohorts are ageing in ORCHIDEE-MICT. Since this might be a critical aspect for the described carbon dynamics it would be helpful if the authors could put some more emphasis in describing the ageing of the forest, maybe an additional Figure could help.

C2

Other comments

lines 87-93: This paragraph is unfortunately not correct. Gross transitions are implemented in the DGVM JSBACH (see Reick et al., 2013), not in an emulator. Also, Wilkenskjeld et al. (2014) did not use an emulator but the carbon cycle sub-module of JSBACH, for efficient comparisons of net and gross transitions. Furthermore, JSBACH with gross transitions has already been used in the MPIESM simulations for CMIP5 and in TRENDYv4 simulations used in the global carbon budget in 2015 (Le Quere et al., 2015). In this budget, two further models beside JSBACH did include gross transitions (see "shifting cultivation", Table 5, Le Quere et al., 2015). The reason why no model included gross transitions in the 2016 update of the global carbon budget was because the LUH2v2h data set was not ready: "The more comprehensive harmonised land-use data set (Hurtt et al., 2011), which also includes fractional data on primary vegetation and secondary vegetation, as well as all underlying transitions between land-use states, has not been made available yet for this year. Hence, the reduced ensemble of DGVMs that can simulate the LUC flux from the HYDE data set only." (Le Quere et al., 2016).

line 115: "sub-grid sub-grid"

line 113: "plant function types" -> plant functional types

line 137: "forgings" -> forcings

lines 215-217: this assumption might not be correct for natural grasslands and pastures (see e.g. Nyawira et al. 2016 and references therein).

line 285: "The cohort age subject to LUC of is one..." -> remove the of

line 328: According to their webpage (http://gsweb1vh2.umd.edu/luh_data/LUHa.v1/readme.t) LUH1 also makes a distinction of harvest from mature and young forest. Do you use this information in your model, too? Furthermore, LUH contains "harvest from non-forested land", is this information used?

C3

line 341: "first go first for" -> first go for

line 347: should this maybe be secondary?

line 359: "to ensure the their" -> to ensure that their?

line 386: but it respire in the grid cell where it is harvested?

line 403: I do not understand this sentence

line 427: remove the "and"?

line 430: replace "on" with "by"?

line 445: held constant or held as constants

line 447: a hypothetical scenario

line 448: I do not understand the sentence "Forest harvest of the same intensity..."

lines 556-561: But why is the NPP in simulations with age dynamics smaller? Is the forest in these simulations not yet as productive than intermediate-age forest?

line 702: Do you mean Hurtt et al. 2006? Else the reference is missing.

lines 710-715: It might be helpful to mention here again that LUH does include biomass harvest but that this is not used in your model.

line 748 this is section 6

line 753 and this section 7

line 1015: Fig. 9 does not include a "panel b"

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