Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2019-146-RC2, 2019

Geoscientific Model Development Discussions

Interactive comment on "Global Transition Rules for Translating Land-use Change (LUH2) To Land-cover Change for CMIP6 using GLM2" *by* Lei Ma et al.

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Received and published: 23 August 2019

The paper provides a useful assessment of how the choice of implementation of land-use data can affect the simulation of tree cover and carbon emissions. A more detailed description of the model used is needed to allow better interpretation of the results. A clearer justification of the choice of optimal transition rule is needed. Key uncertainties in the model simulation need to be discussed, in order to assess whether the results show the optimal transition rule for all models or simply for GLM2. I have also suggested a few minor corrections.

Major Corrections:

- P5, L21: Please provide more detail about the Miami model and the simulation of carbon stocks.
  - What inputs does the Miami model use? Does it use climate data? What is the MSTMIP climatology?
  - Is the Miami model a process-based model or a statistical model?
  - What time period is being simulated? What period does the MSTMIP climatology cover? Does the model use CO2 concentration from the year 850, or is CO2 concentration simply not a factor the model can consider?
- Discussion: The paper should comment on the significance of uncertainty in the map of potential carbon stocks, for example if the global total potential carbon stock were only 557 Pg C, do you think a different transition rule would be optimal?
  - Related to the above point, is whether different rules are best for different ESM, because they will simulate different potential carbon stocks. Please comment.
- P5, L26 and discussion: Why was 2 kg C/m2 chosen to define a forest? Is using 2.2 kg C/m2 equally justifiable and if so, might this lead to a different transitional rule being optimal?
- P10, L27 and figure 4: Disagreement with the average satellite-based forest cover does not mean that the model is not consistent with (i.e. within the range of) the ensemble of satellite-based forest cover. Please can you at least mention this possibility. You could account for this uncertainty, perhaps by adding an uncertainty bar to figure 4 showing the errors relative to the TCCF and GLC2000 datasets.

- Figures 5, 6 and 9: Please add results from rule 4 to figures 5, 6 and 9. I don't know why you have stopped considering rule 4.
- Discussion: More justification is needed for you choice of optimal rule. I agree that, all else being equal, using rule 1 is best because it is consistent with HYDE 3.2. It's fair to exclude rule 4 because it produces too much tree cover (table 4) and compared to the other rules it has twice the carbon stock error in the tropics (figure 8). However, in the discussion you need to more clearly state why rule 4 is excluded. I don't know why rule 3 has been excluded, please can you justify this choice?
- Discussion: Will the choice of rule matter less in future simulations? Is there less range-land expansion in future?

Minor Corrections:

P2, L18-22: This sentence needs to be made clearer. I also think that you are underselling the importance of LUH2, it is not only used in land-use specific model simulations, it is a key input to the DECK and historical simulations as well as for future projections (scenarioMIP). Additionally, you could mention that it is used to simulate the biophysical effects of land-use change as well as the biogeochemical effects.

P3, L11-15: This sentence needs to be made clearer.

P8, L1: What is the "wood fraction?"

P13, L4: Please remove reference to the "Miami-LU model" and replace with "Miami model" or "GLM2," as appropriate.

Caption of Table 5: Should refer to table 3 not table 4?

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