Biogeosciences

Discussions

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Interactive comment on "Soil carbon response to land-use change: Evaluation of a global vegetation model using meta-data" *by* Sylvia S. Nyawira et al.
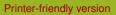
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Nyawira et al. develop a framework to evaluate the response of soil carbon stocks in the DGVM JSBACH to land-use change, using meta-analyses of observations of soil carbon stock change. They find that the baseline model is unable to reproduce the observations for most transition types tested, but that inclusion of crop harvest and exclusion of fires on pasture land notably improves the fit of the model response.

The analysis has been carefully executed and the manuscript is well written. It provides a useful framework for evaluation of soil carbon response to land-use change, which is generally poorly evaluated in DGVMs used to provide land-use emission estimates, despite constituting a substantial part of the overall emission. I am happy to

recommend publication, subject to addressing the following minor comments.

Section 2.2 - In order to understand the differences between the various land-use types considered, more information about the different PFT types is required. In particular, how do C3/C4 grasses, C3/C4 pastures and C3/C4 crops differ from one another? I suggest to add a table listing the differences in any important PFT parameters, or other parameters which may be important to the land-use type (e.g. different soil decomposition rates?).

Pg. 4, line 21 - I wasn't quite sure here if the forest PFTs had been extended to cover areas not presently covered by forest, or not. Can the authors clarify?

Pg. 5, line 12 - 50% seems a high proportion of crop NPP to be allocated below-ground. This will have a substantial influence on the size of the flux lost to harvest and should therefore be discussed in relation to published literature in the discussion section.

Pg. 5, line 27 - I think these are grid-cells where just the relevant transition type has taken place (based on Fig. S2), and not where any LUC has taken place at all? This isn't clear to me from the text. Also, on first reading I thought climate and LUC criterion were being applied simultaneously, and it only later became clear that they were being applied separately.

Pg. 6, line 4 - Should beta have units of length? Also, please define the units of d_0 (presumably cm).

Pg. 6, line 13 - How do you sample simulated soil C changes over the ages? Do you take a simple mean over the age range in the observations, or do you weight the mean by the number of observations in each age range? I would argue the second is much better, if you have the data to do it.

Section 3.2, para. 1 - I think you can be a bit more assertive here in saying that the reason for the results from the crop to grass simulations is fire. That seems to be very

clearly demonstrated at the end of the paragraph, and I'm not sure why the section beginning "we suspect" (line 11) is included.

Pg. 8, line 14 - Should Fig. S2 be cited here?

Pg. 9, line 24 - What is meant specifically by "forest floor"? Surface litter?

Pg. 9, line 27 - Is the larger NPP for forests than pastures in accordance with the literature? Would be good to discuss this briefly with some references.

End of section 4.1.4 - Absolutely agree with this sentiment, but shouldn't we then be aiming for a more stringent test than getting within the very large standard deviation that results from this small-scale heterogeneity?

Pg. 11, line 23 - What exactly is meant by "top soil"?

Section 4.3 - I agree with the general statement regarding absolute estimates, but the way this section is written seems to imply that JSBACH was successful in capturing the observations in this evaluation, which I feel would be stretching it a bit for several of the transition types, especially grass to crop (based on Fig. 2).

Table 4 - I'm not clear on the logic of having this table in addition to Table 3. It would seem more helpful to add the obs_drvn and jsbach_drvn_harv data to Table 3 (appropriately adjusted for 30 cm depth), to allow them to also easily be assessed against the observations.

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