Biogeosciences Discuss.,
doi:10.5194/bg-2016-161-AC1, 2016


Biogeosciences Discussions
Open Access
EGU



# *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.

**Sylvia S. Nyawira et al.**

sylvia.nyawira@mpimet.mpg.de

Received and published: 24 August 2016

[twoside]article

lipsum [sc]mathpazo amssymb, amsmath graphicx [T1]fontenc microtype [final]pdfpages [hmarginratio=1:1,top=32mm,columnsep=20pt,left=26mm]geometry multicol [hang, small,labelfont=bf,up,textfont=it,up]caption subcaption [subfigure]subrefformat=simple,labelformat=simple,listofformat=subsimplebooktabs float hyperref lettrine paralist abstract titlesec

fancyhdr

**Response to B. Guenet of the paper entitled "Soil carbon response to land-use**



Printer-friendly version

Discussion paper

**change: Evaluation of a global vegetation model using observational meta-analyses"**

Ref.: bg-2016-161

Below are the reviewers suggestions (***bold italic font***) and our responses to each point (normal font). In some of our responses, we have cited text from the revised manuscript (*italic font*).

***The study by Nyawira et al., it is nice attempt to evaluate a large-scale model using meta-data. This study focus of LUC effect on SOC dynamic but the methodology presented here might probably use in another context (compare long term and short term effect of atmospheric CO2 increase on NPP for instance).***

Thank you for your comments. We are happy that you find our method useful for other applications.

***The paper is generally well written but the methods section needs to be a bit more de- tailed to be useful to any modeller interested in applying the method. In particular, how the idealized simulations were sampled for non-equilibrium cases.***

We have expanded the simulation setups section (section 2.3) and the model-data comparison approach section (section 2.4) to make the method easily understandable to readers interested in doing similar analysis.

***Another missing point is how tillage is represented in the model and in particular***





Printer-friendly version

Discussion paper

***its effect on SOC.***

The model does not represent other crop management practices such as tillage. We discuss this and the implications of tillage for SOC in section 4.2.1.

***The take home message I found in the paper is that using observed GPP and with harvest representation the model fits better with the data. These results are not very surprising except if different approaches has been tested but not presented. Nevertheless, the main interest of the paper to my opinion is methodological. Therefore I suggest to add the scripts used in supplementary material to facilitate the use of the method by other.***
***Finally I suggest accepting the paper with minor revisions.***

The scripts and the data used for our analysis are archived by the institute and are available upon request, in accordance with the guidelines of good scientific practice of the Max Planck Society. We have added this information in the acknowledgement.

***Minor comments: P4 l4: I don't understand this part. If you did idealized simulation using one vegetation type per grid, why give those details about grid cells with more than one vegetation type?***

In this paragraph we describe why we use idealized simulations and also why realistic LUC simulations with a mix of vegetation types cannot be used for evaluating DGVMs. We have re-written the paragraph to make this point clear.
*"We perform idealized LUCs in which only one vegetation type covers the entire globe and which is subsequently transformed to another type. The idealized simulations approach prevents interference of soil C changes that occur due to different types of LUCs occurring simultaneously in a grid cell or due to sequences of LUC over time. Such interferences occur in realistic LUC simulations. Here, most grid cells in the globe contain a mixture of different vegetation types and at a given year different LUCs*

*may occur. For example, part of the forest in a grid cell may be converted to crop and at the same time part of the grass be converted to crop. Many DGVMs do not separate the soil C for the different PFTs and have one soil C pool for all the PFTs. Those that separate the soil C, e.g. JSBACH, typically add the soil C of the old PFT to the new PFT after LUC. Therefore, soil C change resulting from a specific LUC cannot be obtained using such realistic simulations. The idealized simulations approach used in this study ensures that starting with equilibrium soil C from one land use then changing to another land use, the resulting soil C change can be associated with the specific LUC.“*

***P4 l16: If this is the case here the word "usually" is not necessary.***

We have removed the sentence.

***P4 l29: When LUC is performed it is not very clear how the new vegetation type is split into the different PFTs?***

We have expanded the description of the initial PFT distribution (paragraph 2 of section 2.3) as well as the changes in PFT distribution with LUC (paragraph 4 of section 2.3).
*” To perform the LUCs in Table 1, starting from the obtained equilibrium state for each land cover, we use JSBACH land use transition matrices as described in Reick et al. (2013). We modify the transition matrix to perform the respective LUC transition in all the grid cells in the entire globe at the first simulation year with no other LUC transitions during the rest of the simulation time. The distribution of PFTs for the target land cover map is taken from the idealized land cover maps described before, with the exception that the LUC transition to pasture assumes an equal distribution of C3 and C4 pastures (following the default JSBACH assumptions). These simulations represent the standard model version results.”*

***P5 l6: The product of degradation of this new pool goes back to litter (to simulate***

***composting for instance) or is this OM totally exported?***

The harvest pool decays solely into the atmosphere within one year. Additional organic matter that may be transported back to the field in form of manure is captured implicitly by the biomass left in the field after harvest. We have added this in the text.

***P6 l4: It is quite a big assumption to fix this $\beta$ value since it is likely controlled by several factors (Matthieu et al., 2015). A sensitivity analysis to this parameter might be useful in the supplementary materials.***

We have removed the section on scaling soil carbon in the manuscript.

***Fig. 2: In the title: it is not "equilibrium" anymore right?***

We have changed the figure caption.

***Tab. 4: It seems that to force the model with observed GPP and to better reproduce harvest improved the model-data agreement, what about doing both?***

This is a good suggestion. However, we did not perform this simulation due to technical issues related to how we trigger the harvest events based on phenology in the model. Harvest in the regions with a well defined growing season (e.g., temperate regions) is done at the end of the growing season. In the observation driven simulation, the prescribed LAI seasonality had drops during the growing season that would lead to constant harvesting during the growing season, which would introduce an artificial bias between the model-driven and the observation-driven simulations. However, since the observation-driven and jsbach-driven simulations results for the different LUCs were similar this simulation would not change the conclusions in the paper.

***Tab. 5: Comparison with data might be useful in particular to see the error asso-***

***ciated to autotrophic respiration in the model.***

The NPP values shown in Table 5 are model inputs and not outputs. The obs_drvn simulation values represent the NPP obtained from GPP using ratios. We have added a discussion in the supplementary to discuss uncertainties associated with scaling the GPP to NPP.