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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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This study uses published results from temperate and tropical meta-analyses that calculate mean responses of soil carbon change to different land-use transitions from field measurements of paired plots to better constrain estimates of belowground response to land-use change at a global scale simulated by a dynamic global vegetation model. To my knowledge, this is the first time global syntheses of data from published meta-analyses have been used to compare to results from models. The research takes advantage of a large effort to synthesize global temperate and tropical data on soil C to estimate the response of soil C stocks to major land use transitions.

Overall, the writing could be improved to more clearly describe the modeling approach

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and to distinguish it from past efforts. Some sections have minimal text (for example, description of the observational data and the meta-analysis approach), and while the attempt to be concise is appreciated, more information would make it easier for readers to understand and attempt to replicate the approach.

The discussion dives directly into details of the model but would benefit from an overall summary highlighting the main findings of the paper and being organized around the take home messages of the research. An effort to frame the discussion in a bigger context will help identify novel insights to a broader audience who may not be familiar with the modeling approach but is still very interested in the findings. For example, consider starting the discussion with section 4.1.4 (which has a great discussion of scale between the models and the field observations) then going into the details of the crop harvest and fire, then discussion of the challenges (current section 4.2.1).

The use of the term "meta-data" in the title and throughout the paper to represent results from a meta-analysis (a specific statistical test that calculates differences (effect size or response ratio) between data points) is confusing and inaccurate (and distracting) as this term has a different formal definition ("data that describes other data"). To avoid unnecessary confusion, please use an alternate term, such as "field data," "observations", "observational data" or "results from meta-analyses." The term meta-data in the paper is used to refer to meta-analyses (published studies using the specific statistical approach), to the results of these analyses and to general syntheses of published data, further adding to confusion, as these are not the same.

In a few places, it is unclear how data used in the model simulations is then related to the land cover types and information associated with the observations of soil carbon change. For example, how are the different plant functional types, especially the different forest PFT, related to the 4 idealized land use classes? Given that the observational data used in this paper is heavily biased towards tropical sites (from Don et al. 2011 vs Poeplau and Don 2015), it is expected that the land cover description of the sites in the published literature do not match the PFTs at the global scale in the

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DGVM. In addition, where do the plant productivity measurements used in the model come from and how do these relate to the types of vegetation and their growth rates from the observational soil carbon studies?

How do the model simulations address uncertainties in field soil C measurements? For example, the values given in section 3.1 are averages with some associated error. What is the size of this error, how does this variability affect the carbon response functions, and how then do these influence modeled results?

P. 1, l. 23: Soil C changes with LUC are not only influenced by differences in inputs, but also outputs, and alteration to processes that store C in soils. The last paragraph of section 4.1.1 in the discussion briefly starts to address other factors that can influence soil C decomposition that are not included in the model. Some further discussion on how the focus on plant litter chemistry and climatic variables as controls on C cycling that is the basis for the biogeochemical component of the model and the absence of other mechanistic controls on soil C turnover and how they may influence differences between simulation results and observational data would enhance the paper.

P. 4, l.13-20: This paragraph discusses grid cells with only one vegetation type and also proportions of grid cells undergoing different land use transitions from different vegetation types. Please clarify which approach was taken in the paper and distinguish between old approaches (for example, additive soil C pools with LUC) and the new one proposed in this study.

P. 5, l. 3: What are the four idealized land use cases? These could be identified here or earlier in the description of the observational data and the meta-analyses.

Minor comments

P. 1, l. 5-11: Consider the following sentence reorganization: "Our simulated results show model agreement with observational data on the direction of changes in soil carbon for some land-use changes, although the models generally estimated smaller

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magnitudes of change. The conversion of crop to forest resulted in a simulated soil carbon gain of 10% compared to a gain of 42% in the data, whereas the forest to crop change resulted in a simulated loss of-15% compared to -40%. The model and field data disagreed for the conversion of crop to grassland. The simulations estimated a small soil carbon loss (-4%), while field data indicate a 38% gain in soil C with the same land-use transition. These model deviations from the observations are substantially reduced by explicitly accounting for crop harvesting and removing burning in grasslands from the model."

P. 1, l. 17: suggest deleting: "(hereafter meta-data)" as this is an incorrect use of this term

P. 1, l. 18: add references to the meta-analyses here

P. 2, l. 7: Rewrite: "Despite the dependence of the soil carbon response to local conditions of soils, climate and management practices, regional and global syntheses of published data can be useful to aggregate local-scale measurements on soil carbon changes and estimate mean responses to different LUCs using a meta-analysis approach."

P. 2, l. 8 and 10: Here meta-data should be replaced by meta-analyses.

P. 2, l. 10 and P. 3, l. 7: what is meant by "harmonize"a temperate ? Can you use another term?

P. 2, l. 15: Marin-Spiotta and Sharma (2013)'s work did not use a meta-analysis approach

P. 3, l. 5: replace "the meta-data" with "results from the meta-analyses"

P. 3, l. 6: The "quality criteria" sentence structure is awkward. Consider: "These meta-analyses were conducted on paired plots of similar soil type and texture, to reduce uncertainties from hetereogeneous soil properties unrelated to the land-use transition."

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P. 3, l. 30: Replace windbreak (check definition) with windstorm.

P. 4, l. 3-5: Consider rewording: "The decomposition rate of litter is controlled by its chemical composition, as determined by its solubility (acid, water, ethanol and non-soluble hydrolysable pools) and the presence of a slow decomposing humus pool." It is unclear from the text whether the humus pool is part of the plant litter or a soil organic matter pool? Does the model include above and belowground litter pools?

P. 4, l. 26: replace "ran" with "run"

P. 10, l. 6: above refers to what?

Figures and Tables

Figures 1 and 2 are hard to read. Consider that the green, orange and brown colors will be difficult to distinguish for readers with color-blindness, which affects almost 10% of males in many European and English-speaking countries. The grey background also reduces the contrast between the lines, and the lines are too small and hard to see.

Figure 3. See earlier comment about choice of colors.

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