

Interactive comment on “Modeling the impact of agricultural land use and management on US carbon budgets” by B. A. Drewniak et al.

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The Drewniak et al. article is a modeling study of the effects of crop residue removal, as pertains to cellulosic biofuels, on soil organic carbon. The paper is well written and clearly presented. It is an interesting application of the CLM-Crop model. I suggest the following minor revisions (though the final suggestion could involve some more analysis of the existing model runs and would help enhance the article):

1. Please cite Melillo et al. (2009) in the Introduction, which explored the effects of land use conversion due to cellulosic biofuels. (Melillo, J. M., Reilly, J. M, Kicklighter, D. W., Gurgel, A. C., Cronin, T. W., Paltsev, S., Felzer, B. S., Wang, X., Sokolov, A. P., and Schlosser, C. A. 2009. Indirect emissions from biofuels: how important? Science. 326:1397-1399.)

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2. The sentence “The use of crop residues for bioethanol production shows promise for meeting U.S. energy needs” in the Introduction needs some further clarification – what is meant by U.S. energy needs exactly?

3. Change the color bar in Figure 1c so the numbers match up to the divisions. “ In most regions, the percent difference between the data set and the model simulation is < 5 %” – from Figure 1c, a large portion of the Central Plains appear to be > 5%, not just boreal regions.

4. I do like the validation efforts, so I am not asking for more because I know how difficult it is to get models to look exactly like the data. However, the use of “r” rather than “r²” in Figure 3 is nonstandard and makes the correlation look better than it is. I really see no correlation between modeled and observed values – is there any better r² value for clay, sand, or silt independently? I might instead comment that the overall range of values is captured by the model, in addition to the model underestimate. How does this figure show the model captures the variability?

5. Sentence in discussion: “Currently, individual agricultural plots typically lose 33–51% of SOC, and that loss increases to nearly 90% when residue is harvested” and in abstract: “After long periods of cultivation, individual plots growing maize and soybean lost up to 65%.”. Where do these figures come from? They are not apparent from Figure 4, so I am unclear if they are referring to individual grids, or individual “plots” – do these represent data rather than the model?

6. I thank the authors for pointing out the negative effects of adding too much fertilizer in the discussion. It can also be pointed out the fertilizer use and production also leads to more N₂O in the atmosphere, a powerful greenhouse gas.

7. Typo: Second to last paragraph, change “should a priority” to “should be a priority”.

8. Ultimately this is a very simple analysis of the effect of residue on soil organic carbon. I would think the model would also track the effect of that additional SOC on

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nitrogen – it would add something to this analysis if the authors could easily pull out net nitrogen mineralization rates, or plant nitrogen uptake, to track more precisely how the decreased residue affects nitrogen limiting conditions, and ultimately, crop yield. I would also think they could pull out some actual numbers on crop yield for these different runs, rather than just make the qualitative statements that more SOC leads to better crop yields. However, I am not sure if these output are actually saved on their current history files.

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