Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC3
https://doi.org/10.5194/gmd-2021-244-RC3, 2021
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Comment on gmd-2021-244

Anonymous Referee #2

Referee comment on "Modeling perennial bioenergy crops in the E3SM land model (ELMv2)" by Eva Sinha et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-244-RC3, 2021

The authors attempted to improve the representation of perennial bioenergy crops in ELM and identified the sensitive parameters to evaluate the performance of the newly developed module - ELM-crop. I have some concerns. First, there are not many improvements that have been made in the ELM-crop. The authored adopted a lot of processes and parameters from ELMv1 or CLM4.5, described in section 2. I am not sure what is the major contribution that the authors have made to develop the ELM-crop module. Second, since the authors were modeling crops, fertilization should be considered. How does the ELM-crop deal with fertilization (nitrogen input, plant uptake, nitrogen emissions, and leaching/runoff)? I did not see any detailed description on this, nor about the input data sets. Third, the authors only calibrate the newly developed model at one site. How does the model perform at other sites? Fourth, although the authors spent a lot of energy on parameter optimization, I do not think they were necessary enough to improve the ELM-crop module that they developed. Moreover, the comparison of daily GPP shown in Fig. 1 looks far from good for Miscanthus.

Detailed comments:

Line 17: Here, does “agriculture” include pasture? Or do you mean “cropland only”?

Line 46: Provide the full name of “ISAM”. Also, in lines 49 and 52 for “ORCHIDEE” and “JULES”.

Lines 54-55: This sentence seems out of place. The authors should introduce the importance of parametrization optimization when they describe all improvements made in previous land models. Then, they can conclude this. I think it is necessary to add this description.

Lines 71-76: This paragraph fails to convey the objectives of this study. It is necessary to describe what the authors have done in order like (1) the improvements of perennial crops in ELM; (2) the calibration scheme; (3) validation if the authors have done; and (4) the key implication or the regional application of the newly developed module at the regional scale.

Lines 78-79: The authors should add one or two sentences to describe this. Also, at least one sentence for explaining the major difference between ELMv1 and CLM4.5.

Lines 85-86: ELMv1 has not (or partially?) considered nutrient input, allocation, and limitation, right? Did you improve all these processes in the newly developed version?

Section 2.2: I am confused. I think carbon and nitrogen allocation in perennial crops are different from the annual crops, but in this section, it seems that the authors just adopt these processes from the annual crops in ELM. So, what is the authors' contribution?

Section 2.3: What do you mean "a single time step after occurrence of the leaf senescence."? Any range for the number "**70%** of the available C and N contributes…"?

Line 135 and 146: Give the full of QoIs in the first place.

Section 3.1: It is necessary to describe your input data sets such as meteorological conditions, nitrogen fertilization, soil property, etc. To my knowledge, the authors should drive the ELM-crop with all inputs from the selected site at the University of Illinois Urbana-Champaign (UIUC), right? In line 173, the authors mentioned the eddy covariance flux towers. I think it is necessary to give the names of these flux towers. One more question about the calibration: The authors only described the calibration. Do they have any other site-level data for model validation?

Fig. 3a: The peaks of modeled GPP shifted compared to the observation for Miscanthus. Can you explain?