Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-113-RC2, 2020

Geoscientific Model Development Discussions

Interactive comment on "Potential yield simulated by Global Gridded Crop Models: a process-based emulator to explain their differences" *by* Bruno Ringeval et al.

Anonymous Referee #2

Received and published: 5 December 2020

1. Overview:

Review of "Potential yield simulated by Global Gridded Crop Models: a process-based emulator to explain their differences" by Bruno Ringeval et al. Bruno Ringeval et al. build an emulator SMM with generic equations describing the processes to reproduce the simulation of aboveground biomass and potential yield of maize. They showed that with few carefully calibrated parameters, the SMM can capture the spatial distribution of aboveground biomass and potential yields, and the variations between different GGCMs. This SMM can thus provide a useful tool to compare different GGCMs. For this manuscript, the texts are well written, the methods are clearly described, and the

logic are easy to follow, thus I only have some minor comments.

2. Comments:

1) A GMD paper must "include the title (concise but informative, including model name and version number if a model description paper)" in the title (https://www.geoscientific-model-development.net/submission.html#manuscriptcomposition), so I suggest the authors to follow this instruction.

2) Ln 222: . . ., varying in space as "a" function. . .

3) Ln 278: . . . It is likely "that" some GGCMs. . .

4) Ln 285: the authors admit that their RUE values are smaller than the commonly reported values, but why not increase the range of RUE tested? In the results, they show that for SMM of some models (e.g. pDSSAT), the RUE can reach the higher end of the tested values. If RUE is allowed to be larger than 3.0g DM MJ-1, will the best RUE and the results change?

5) Ln355: please clarify what are the two sub-groups, and what is a third variable?

6) Fig. 3: the listed values should be (RUE, C, RMSE) rather than (C, RUE, RMSE)?
7) Ln 555-570: The RUE in SMM are much lower than GGCMs. Three SMMs have a best RUE to be 1.5. Comparing with the RUE (for the total biomass) at the lower end of the commonly reported values of 3.1 g DM MJ-1, the RUE of SMMs is two-fold smaller. The authors imply that the RUE corresponds to the aboveground biomass, such that it should be smaller than the RUE for total biomass. However, they show that the root:total ratios varying from 0.4 to 0.2 in GEPIC, which seems cannot explain the two-fold differences in RUE from SMM and GGCMs. The second argument is about the LAImax. But from Fig. 2, it seems that the best maxnleaf of the SMM for GEPIC is 9.5, which should translate to a LAImax in this SMM to be 1.8, again two-fold smaller than the original GEPIC (3.5 as the authors wrote), which contradicts to the authors' claim that LAImax is 5 and such that the LAImax can compensate lower RUE.

Overall, this first version of SMM is a simple emulator that only targets at the potential biomass and yields and does not account for the water and nutrient stresses. Accounting for these stresses requires to describe quite a few new processes with more parameters, which will exponentially increase the demand for computing resources for the parameterization. I am keen to see how the next development of such a SMM will emerge in the near future.

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