

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2022-11

Anonymous Referee #1

Referee comment on "Improved representation of plant physiology in the JULES-vn5.6 land surface model: photosynthesis, stomatal conductance and thermal acclimation" by Rebecca J. Oliver et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-11-RC1>, 2022

The preprint manuscript gmd-2022-11 "Improved representation of plant physiology in the JULES-vn5.6 land surface model: Photosynthesis, stomatal conductance and thermal acclimation" presents the implementation and parametrisation of three additional photosynthesis and stomatal conductance formulations (Farquhar, Medlyn and "AcKK" in addition to original Collatz formulation) into the JULES LSM. Parametrisations are mostly based on large datasets or pre-existing peer-reviewed work. The four model configurations were analysed on site level with data from 17 EC sites as well as globally using drivers from the WFDEI meteorological dataset. An additional RCP8.5 scenario simulation was also performed and evaluated.

I found this manuscript to be an interesting read and I do not have any major revision requests. The results are (mostly) clearly presented, properly discussed and the conclusions are accurately drawn. While the presented model modifications are not new, they provide new insights in model behaviour and expand the JULES model functionality. Additionally, the new model configurations also provide a possibility for the model to be run in an "ensemble" mode (similar in style to CMIP) that would allow e.g., improved detection of model weaknesses and uncertainties related to processes and variable estimates. One thing that could be discussed is the effect of static PFT's to the simulations and results.

Minor revision requests:

L167 The last reference Mercado et al. – 'et al' is in italics and missing point.

L181 I believe this should be GC3.1 instead of GC.1.

L200-202 So soil water stress is a linear response function (as in Best et al. 2011), but are the parameters fixed throughout the different biomes/soil types? I think it is reasonable to exclude possible β -function modifications (such as sigmoidal response or β^s formulations) from these experiments, but I would like a clarification to the manuscript, i.e., just stating that the parameters are fixed or that they depend on the soil type is ok.

L239 You have here an undefined parameter θ and I think you mean α .

L247 Just a suggestion for the last 'large' division – add normal brackets around both numerator and divider and add '-1' exponent to the latter and write them as a product. If you like the original formulation more just use that.

L310-312 Although, fitting g_1 to g_s is not the most complicated of tasks, at least some more information should be given about this. I think you are using nonlinear regression, but did you estimate the goodness of the fit as in Lin et al. (2015) or use a separate validation set to control for overfitting? Regardless, the dataset seems heterogenous enough to prevent overfitting by itself.

L346 Is the mean seasonal cycle produced over entire measurement period or do you have one average cycle for each year? With former you are essentially smoothing the timeseries and reducing year-to-year variability which makes sense from a "climatic" perspective, but you might miss interannual variability. Although, since you are not calibrating/optimising model parameters this is not really an issue. Additionally, could you add time-intervals (which years of measurements you have used) to Table S1?

L385 You should explain what conservative here means (flux preserving) or give a reference.

L393-396 Just to clarify if I understood this correctly, you generate a separate spin-up for each model configurations and the difference of differences is taking "Collatz" as the baseline configuration for site simulations?

L398 You have a different realization of a process, not a complete lack of one, so I would suggest rephrasing this sentence.

L419 "Jmax:Vcmax" ratio has ":" in the index (or is this deliberate as it appears like this elsewhere in the paper as well).

L468 Because you have RMSE in the panel headings, I was initially reading this as “negative values are improvements” (since RMSE would be smaller). If you want to “fix” this, change the order in EQ 12 to “new – old”.

L481 Figure 2 headings are now telling a different story. Here you state that comparisons are to the original, but in the caption it is between the different configurations (based on headings you are not showing differences between Fq.Jac and AcKK.Med as well as Fq.Med and Clz.Jac.). Please change either image or text to what you want to show.

L612 It is a bit difficult to properly interpret the RMSE values from S8 and S9 so I wanted to ask, how clearly defined are these areas? In many places the differences seem quite minimal (and I don’t think there’s a good way to improve the images).

L706 I believe there was no competition among species or changing PFT zones/percentages (this came to mind with the mention of boreal region here)? This is one thing you might want to mention or speculate on somewhere in the discussion (maybe in or after the last paragraph under this heading).

L712 Missing space after bracket.

L890 You use two types of doi formats (long and short), and I would suggest sticking with just one.

Fig. S2 is not referenced in the manuscript or supplementary material.