

Biogeosciences Discuss., referee comment RC1
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Review of bg-2021-192

Anonymous Referee #1

Referee comment on "Evaluation of carbonyl sulfide biosphere exchange in the Simple Biosphere Model (SiB4)" by Linda M. J. Kooijmans et al., Biogeosciences Discuss.,
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Linda M.J. Kooijmans and coauthors present an evaluation of the implementation of carbonyl sulphide (COS) fluxes in the terrestrial biosphere model SiB4. One can say without exaggeration that the earlier SiB4 implementation of COS is the reference for all current biosphere models that include COS. Kooijmans et al. present a very thorough evaluation with excellent supplementary information that answered almost all questions that arose while reading the manuscript.

My comments are hence minor.

1. I would disagree with the recommendation 4.1. α is not the only reason that COS fluxes are underestimated at some sites. GPP is also underestimated at DK-Sor and AT-Neu. The seasonal shape of GPP is very different in the model at US-IB2 compared to the estimated GPP from observations. So fitting α seems like a fudge factor. I would not recommend this.

2. I also regret the wording in recommendation 4.2. The minimum stomatal conductance is called g_0 in the manuscript. It is not explained how it is used in the model. Stomatal conductance most often depends on net assimilation in conductance formulations such as Ball-Berry and its variants. Net assimilation is negative during dawn and dusk. Is stomatal conductance then set to g_0 ? This is questionable. If I remember well, Ball et al. (1987) said that g_0 is simply the fitted intercept in the empirical formulation during daytime photosynthesis. It is not the nighttime value. If ever I would recommend to look into such formulations as in Barbour and Buckley (PCE 2007).

3. I was missing the explanation/discussion that the authors used reanalysis data to drive the model and not local observations. But especially the discussion of the underestimation of GPP and COS fluxes at DK-Sor literally screamed for it. Would it be possible to redo say

SiB4_var_Ogee of Figure 2 using local meteo?

4. I would have loved to see the comparison of SiB4 output with the inverted fields of Ma et al. (2021).

5. I think that Figure 1 is redundant given Table 3 and I would remove it.

6. I found the notation V_{\max} pretty unusual. I had to go back several times to Equations 2 and 3 to check the definition. I would recommend to use something like $V_{C,\max25}$, which is pretty standard and tells the important information, i.e. it is for carboxylation and at 25 °C.