Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-508-RC2, 2020


Biogeosciences
Discussions

# *Interactive comment on* "Wide Discrepancies in the Magnitude and Direction of Modelled SIF in Response to Light Conditions" *by* Nicholas C. Parazoo et al.

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Received and published: 2 March 2020

This paper compares different process based terrestrial biosphere model (TBMs) that include solar induced chlorophyll fluorescence (SIF) as output. The models are briefly introduced, with emphasis on the different representations of SIF. The model output with respect to SIF and gross primary productivity (GPP) output is inter-compared, and comparisons are made to a time series of field measurements. The models diverged, and the authors relate the differences among the models to the underlying process descriptions: the estimates of APAR, energy partitioning in the leaf and radiative transfer of fluorescence.



The paper provides a good overview of current TBMs capable of simulating SIF. This is of interest to the readers. It has an informative title, abstract and figures. It does not introduce new concepts, but it compares existing model concepts and recommends strategies for improvement. The paper is well written and clear.

I have the following recommendations to consider in the preparation of the final manuscript (all minor):

1. Make the paper (even) more inviting for readers who are unfamiliar with the terminology of SIF. In Line 208 $\text{SIF}_{yield}$ is first used, later in lines 593-602, it is defined, and the difference with $\text{SIF}_{rel}$ is discussed. It may be helpful to introduce $\text{SI}F_{yield}$, $\text{SIF}_{rel}$ and $\Phi_F$ together and earlier, explaining why these three are used for comparison in this paper (in Figs 3 and 4), and what they mean.

2. Lines 623-626. I did not grasp the following reasoning: 'Finally, we note that PhotoSpec scans of leaf-level emissions are averaged and reported here as canopy averages, while model output is reported at the top of the canopy, which accounts for within-canopy radiative transfer, re-absorption of SIF, and shaded canopies, causing lower emissions compared to the canopy average.' Aren't the top-of-canopy measurements also affected by within-canopy radiative transfer etcetera?

3. Continuation of previous point: The difference between the measurements and the simulations is that the measurements are the average of small footprints at multiple viewing angles, whereas the models are nadir values, as explained in the 'apples to apples' section (line 691). I presume the radiative transfer factor $\kappa_{740}$ was derived from SCOPE simulations in nadir. With SCOPE it is possible to estimate $\kappa_{740}$ $(\theta_o)$ for multiple observation angles, and then take the average. Thus it is possible to compare apples to apples. I understand the TBM's do not have this right now, but at least I would have expected that to be part of the discussion, or as part of recommendation 5, which now only mentions instruments with a wider FOV.

4. Line 566, Strictly, x is not the fraction of absorbed light not used in photosynthesis, if

this refers to the variable ‘x’ in the model of Lee et al. and Van der Tol, because when x = 0, this fraction is 0.17 due to constitutive heat dissipation.

5. Line 728-730. ‘The fact that relative SIF is the least sensitive [] reduces the sensitivity to APAR and reveals a strong SIF response to changes in photochemical quenching’. Yes, that seems to be the case, but perhaps a few lines can be added to guide the reader through this argument (see also point 1).

6. Line 811, recommendation 2. Is it the water stress formulation, or the parameter values, i.e. the values for the Ball-Berry parameters?

7. In Line 680, there is a reference to Figure 6, which is not in the manuscript

8. Figure 3C and 3D. What is the temporal resolution of these data? Multiple-day averages? It takes some effort to relate the spikes to the wet and dry periods described in the text.

Technical comments

Line 290, sentence starting ‘The quantum yield’ has an extra ‘to’

Line 365 and elsewhere, I recommend to spell out ‘met forcing’

Line 508, ‘eaves’ should be ‘leaves’

Figures S1 and S4 are reversed

The labels in Figure S7 are too small

The legend in Figure S8 is too small

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