Biogeosciences Discussions

Biogeosciences Discuss., author comment AC3
https://doi.org/10.5194/bg-2022-172-AC3, 2023

Reply on RC1

Yujie Wang and Christian Frankenberg

Author comment on "Technical note: Leaf light absorption and electron transport assumptions bias photosynthesis modeling" by Yujie Wang and Christian Frankenberg, Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-172-AC3, 2023

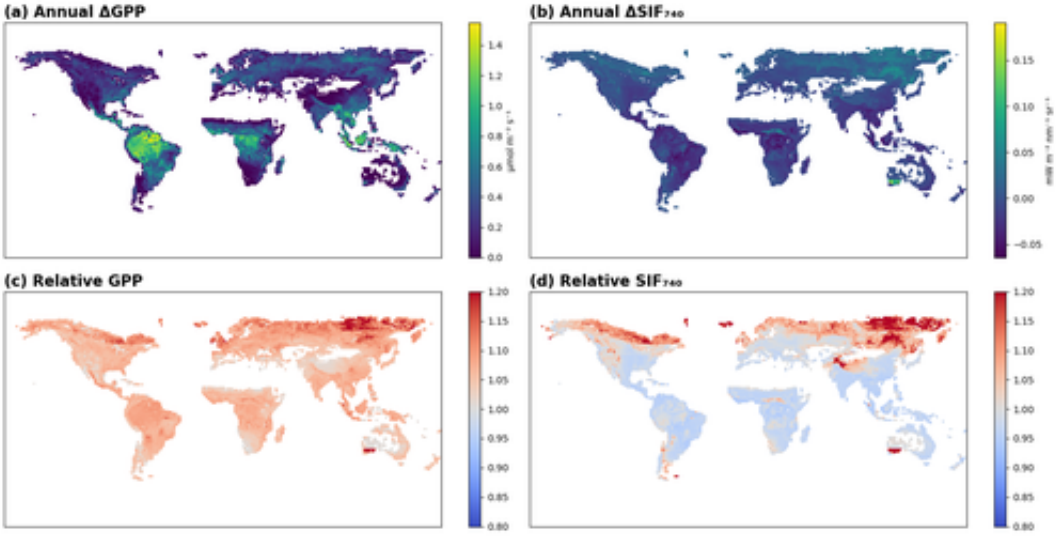
Following our previous response, we have made more changes to the text, including adding two new figures (one for the spartial and temporal patterns of f_APAR * f_PPAR; one for how GPP and SIF may be biased if one neglect the chlorophyll content patterns).

[New Author response]

As mentioned in the last response, we added a new figure to show how global simulations of GPP and SIF may be impacted. We emulated the typical settings of high leaf absorption coefficient of 0.86 compared to using gridded chlorophyll content. We ran the emulation by setting chlorophyll content to 50 ug cm-2, and f_PSII = 0.592 so that f_APAR * f_PPAR * f_PSII = 0.86 * 0.5 = 0.43.

Related changes are listed here:

- **We emulated how global simulations of the gross primary productivity (GPP; integrated gross photosynthetic rate of the canopy) and solar-induced chlorophyll fluorescence are impacted if one uses the average CLM setting of leaf absorption coefficients (0.86). We ran the emulation of constant fAPAR · fPPAR · fPSII = 0.86 · 0.5 using the Land model developed within the Climate Modeling Alliance (CliMA Land) (Wang et al., 2021, 2022). Because of the higher modeled JPAR, gross photosynthetic rate and thus GPP are always overestimated compared to the reference where spatial variations of chlorophyll content are accounted for (Fig. 7a,c). Annually mean GPP is overestimated by up to 1.5 μmol m−2 s−1 in the tropical regions (Fig. 7a). In comparison, SIF at 740 nm (SIF740) is overestimated in the high latitude regions, but slightly underestimated in the low latitude regions (Fig. 7b,d).**


(a) Annual ΔGPP
(b) Annual ΔSIF740
(c) Relative GPP
(d) Relative SIF740