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Biogeosciences Discussions

# *Interactive comment on* "Estimating global gross primary productivity using chlorophyll fluorescence and a data assimilation system with the BETHY-SCOPE model" *by* Alexander J. Norton et al.

**Anonymous Referee #1**

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Norton et al. "Estimating global gross primary productivity using chlorophyll fluorescence and a data assimilation system with the BETHY-SCOPE model".

GENERAL

This paper is a revised version of previous submission in 2018 with the same title. As a reviewer for both papers, I found the authors made helpful improvements but with new problems. In the earlier comments, I raised two main questions: First, the GPP is not effectively improved with SIF assimilation. Second, the GPP-SIF relations are not well



explained. Compared to the earlier version, this revision improves the second aspect but still fails to show a reasonable improvement in GPP.

The authors include more details about how GPP and SIF are connected in the model. In general, these two variables have some offsetting phases, because they share the same radiation energy. Such relationship explains why the posterior parameters reduce the high biases in SIF (Fig. 4) and consequently promote GPP (Fig. 10). However, compared to the 2018 paper, SIF is higher in the 2019 paper and is closer to observations (Fig. 4). Then why the GPP is much higher in this paper (167 Pg C yr-1) compared to earlier version (137 Pg C yr-1), instead of lower value? It shows that the SIF-GPP assimilation system may be arbitrary or casual about parameter adjustment.

The simulated GPP is much higher than present-day estimates from other studies/models. Results in Fig. 11 show that the 'improved' GPP is way too higher than the values from FLUXCOM and TRENDY. The authors claimed that GPP from FLUXCOM and TRENDY may be biased in tropics due to the limits in observations (Page 22). However, for mid-high latitudes (35-60ËŽN) in Northern Hemisphere where most of FLUXNET sites locate, the SIF-derived GPP values almost double the FLUXCOM. As a result, I think the assimilation system may have systematic biases, either from parameters (e.g., Fm', ÏĮp) or physical processes (e.g., the Equations 1-3), that degrade the values of this framework. In a word, the improvement of SIF does not effectively improve GPP.

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