Response to Authors

Dear Rahul Raj and co-authors,

I thank you for your responses to my last comments on the article "Bayesian integration of flux tower data into process-based simulator for quantifying uncertainty in simulated output". You have answered, to a large extent, to the initial concerns I had about your modifications to answer the comments of the two reviewers. However before publishing this article I would like you to consider and take into account the following remarks (given that some of your modifications are not complete enough or/and not clear).

1) INTRODUCTION

For the justification of using only GPP data and not NEE, you added:
"In principle, NEE data could be used alone to calibrate BIOME-BGC, where NEE is derived as the difference between the GPP and ecosystem respiration (Reco). A calibration of BIOME-BGC using NEE data only means that the difference between GPP and Reco equals the difference ***between the two measured in the field*** *(Mitchell et al., 2011). Hence, the accuracy of simulated GPP can not be achieved using the NEE data alone."*
Such statement is slightly misleading as it seems to indicate that the GPP and RES are measured in the field; while you clearly explain later in the method that the GPP is only the result of a the NRH model. Please consider reformulating this added change to avoid any misleading interpretation.

At the end of the introduction, you state:
« The main novelty of this paper is the presentation of a Bayesian framework for BIOME-BGC parameters estimation. »
This statement is a bit restrictive and you should already mention that the paper also intend to provide some perspectives for other process-based models with respect to parameter calibration.

2) METHOD
Equation 6: typo with two signs "+ -"

3) SECTION 5.2 "BIOME-BGC calibration"

The sentence at the end of the first paragraph is not clear.
« The fact that the temporal correlation in the residuals is not only responsible for the temporal development of GPP indicated that the representation of dynamic processes within the simulator could be improved. »
Please try to be more explicit.

Third paragraph of section 5.2, you state:

« The resulting time series has discontinuities in state variables that can help to analyse the simulator behaviour in more detail. »
I don't understand why the discontinuities in state variables CAN HELP to analyze the simulator behavior; i.e. compared to a case where you would not have these discontinuities (with varying parameter along the simulation as initially suggested by the reviewers and not implemented). Please explain why or consider re-phrasing.

Added text in the third paragraph of section 5.2:
"This approach, however, can not be implemented in the original configuration of BIOME-BGC, ….. Such a modification in BIOME-BGC code is outside the scope of current study,.. »
The justification may sound weak, as modifying the code to include the possibility of varying the parameter values over time seems a "feasible task". You may consider adding that such implementation was not desired to illustrates that without code modification you can still investigate model structural errors (through varying parameter across the season) with your proposed approach 2.

End of third paragraph (added text):
You say : « If some parameters have different optimum values when calibrated against different months of data, then this indicates that the relation between these parameters and the state variables that (should) change during the season, may require improvement in the future. »
Please consider rewriting, as the sentence is not clear. Such sentence could also be more informative or points to the next paragraph that provides more insights on the potential of temporally varying parameters.
Note also that in the next paragraph, we miss an explanation on which parameter changes in experiment 2 are responsible for the reduction of the GPP in April (reduction to match the fluxnet derived data)?

Fith added paragraph :
You say : « We have, thus, provided as a general message that the temporal variation in the input parameters should receive further attention to the modelling communities focusing on simulating forest carbon cycle. »
Again this sentence is relatively vague! You could inform the reader about potential shortcoming of BIOME-BGC that may apply to other models; for instance those linked to LAI, VCMAX temporal evolution and the potentially missing processes that can be deduced from your experiment 2. This would reinforce the "messages or perspectives" for other similar models that the study brings. The objective is not to have varying parameters over time (then we can call them parameters) but to include all processes/equations to improve the temporal variations of state variables.

4) CONCLUSIONS (SECTION 6)

Point 2 about the experiment with/without the nuisance parameter "Phi". This part of the study is relatively novel and still poorly highlighted. In the conclusion you should try to expand a bit on the benefit for other modeling groups to include or not such term ; and thus to provide more general recommendations.

Point 3: the last sentence is relatively vague; it should summarize for process-based ecosystem modelers what you may learn in terms of model deficiencies with an experiment like your experiment-2

I apologize for the long delay in treating your responses.
Best regards,
Philippe