



EGUsphere, referee comment RC2
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Comment on egusphere-2022-91

Anonymous Referee #2

Referee comment on "Physiological flexibility of phytoplankton impacts modelled chlorophyll and primary production across the North Pacific Ocean" by Yoshikazu Sasai et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-91-RC2>, 2022

General Comments

The manuscript "Physiological flexibility of phytoplankton impacts modeled biomass and primary production across the North Pacific Ocean" by Y. Sasai and colleagues compares modeled phytoplankton biomass and primary production from a flexible plankton community model accounting for photoacclimation and variable C:N:Chl, with an inflexible plankton community model assuming constant C:N:Chl ratios. These models are coupled to a 3-D eddy-resolving ocean circulation model of the North Pacific. The authors compare the performance of these models by using Chl, nutrient, and primary production observations and find that primary production and chlorophyll were better predicted/modeled by incorporating photoacclimation and variable C:N:Chl ratios.

This manuscript provides valuable results that are important for the future implementation of plankton community models. However, as the manuscript stands, I suggest major revisions to outlay a more clear motivation and revise the methods, results, and discussion sections to allow readers to more easily follow this manuscript.

Specific comments:

- There should be a more clear description of the structural differences between models. Although the description of the models is easy to follow, there is some confusion about what the key differences between models are. For example, throughout the manuscript, the text deviates on whether only the complex model implements photoacclimation or both models do. In Table 1, the differences in potential maximum growth rates can create confusion on whether it is the same model simply having a higher growth rate, or understanding where the main differences between models are coming from.

- The results section can be hard to follow in some parts, and quantitative information backing up the results stated will allow readers to better understand the variation between models and models and observations.

- The aims and objectives of the study are lacking throughout the manuscript, especially when stating what observations are being used. There needs to be a better explanation of why this data was used, and why comparing the last 20 years of the model run with observations from different years instead of exact comparisons?

- Lastly, an explanation of limitations and what still needs to be improved from these models can be useful.

Technical corrections:

Abstract:

L005 - Does InFlexPFT also incorporate photoacclimation?

L008 - Briefly Specify where these observations are coming from.

L009 - What about nutrients? They are mentioned in the earlier line.

L010 - Specify where this subsurface Chl maximum is reproduced, and the Chl concentrations are overestimated.

L014 - You should also state the role of FlexPFT incorporating photoacclimation.

Introduction:

L029-L030 - Provide further details on how they are debated.

L072 - cite some of the few tests that have been conducted.

L075 - FlexPFT is also an NPZD model no?, I would recommend rephrasing this sentence to more clearly depict the differences between the control and flexible C:N:Chl model.

Methods and Materials:

L085 - Very descriptive, but this sentence is a bit hard to follow, I would recommend restructuring to make it more clear.

L101 - state the value of this initial nitrogen N field if possible, otherwise be more specific on what you mean here.

L102-L03 - is there a reason why these values were used? Add citation, reasoning, or state that it is part of model calibration?

L104 - This sentence feels a bit out of place. I would add this to your previous description in L093.

L115 - If Q is a function of I, N, and T, I would add that in Eq1. $Q(I,N,T)$.

L116-L117 - Add citation directing to Eq.4. Fv is repeated in L125.

L124 - Explain how you determine potential maximum affinity for N. Also cite table 1.

L131- cite table 1 after the theta explanation.

L132 - Is there a reasoning behind the activation energy E_a used? If so, cite it. Is it derived from observations?

L135 - I understand why μ_{InFlex} and μ_{Flex} are used, but they are quite lengthy, if possible I would abbreviate them to have shorter names.

L138 - since you already explained the potential maximum uptake rate and the potential maximum affinity for N above, I don't think you need to explain them again here, but do add the last part of this sentence and citations (L139) in L124.

L154 - This part is difficult to follow. Expand further on this paragraph. All these parameters are introduced, but no equation explains where they come from.

L158-L163 More explanation/rationale is needed here on model evaluation and why these observational datasets were selected.

L162-170 - It would be nice to map the observations and add them as a supplementary figure. It will be easier to understand what observations you are using.

Results and Discussion:

L174 - cite the satellite imagery and in-situ observations.

L174-177 - Should this physical evaluation go on the results. Was this part of this project or evaluated elsewhere? If so, state that.

L182 - Throughout the manuscript, the focus is on comparing biomass and primary production between these two models, but now through the results the focus changes to comparing the chlorophyll pattern which is a proxy to biomass, but not biomass.

L185 - The title should state this is a comparison since the paragraph concentrates on the model to satellite imagery comparison.

L187- Are there any biased statistics to see how well the seasonal variations compare and what the deviations are?

L190 - More quantitative information on this model to satellite imagery comparison would be useful to understand the degree of variation.

L200 - Same comment as L185 (state that it is a comparison in the title).

L200 - This section is difficult to follow. I would suggest restructuring and incorporating tables or diagrams summarizing the major findings, and categorizing the different areas you are comparing.

L217 - These last two sentences are a bit hard to follow, I suggest utilizing more

quantitative comparisons between model and observations, to understand the degree of variation.

L169-171 - Is there reasoning why you think both models predict higher growth rates here?

L277-L278 - By what degree more so for FlexPFT?

L327 - Do you mean that the spring bloom occurs across latitudes and longitudes?

L332- L335 - Explain why FlexPFT predicts this.

L345 - Chl:C instead of Chl;C

L346 - I think this paragraph should go earlier.

Conclusions:

L376 - I think you should say you compared Chlorophyll instead of biomass.

Figures:

Figure 1.

- Minor point, but why not average from 2003-to 2019 to make the time comparison the same?

Figure 2.

- State what the white areas represent in panel a.

- Why not use just the 2006 model year for comparison instead of 2000-2019?

Figure 3.

- I would add the text again from Figure 2. Instead of saying "same as for Fig. 2.).

Figure 5.

- Same comment as figure 3. I would restate the information of the figure here.