

Dear Editor Steven Bouillon and Reviewers,

Thank you for all comments on our manuscript. Here is a submission of revised manuscript ‘Seasonality of the North Pacific Oligotrophic Gyre area in the past two decades and a modelling perspective for the 21st century’, according to your decision of minor revision.

In this version, we have done the following revision work:

- 1) In the text, following the reviewer’s suggestion, we have clearly stated that our analysis based on surface chlorophyll concentrations data is used to capture the longest-timescale variation of North Pacific Oligotrophic Gyre (NPOG), rather than phytoplankton biomass throughout the water column, to avoid potential misunderstanding.

Line 353-357 in clean version:

To analyse the long-term variability of the NPOG, we used satellite observations of surface chlorophyll concentration from 1998 to 2021. These observations capture only the surface layer and therefore do not reflect the full water-column phytoplankton biomass. Although this limitation could be mitigated by incorporating BGC-Argo measurements, which provide vertical profiles of phytoplankton and other biogeochemical properties, the BGC-Argo record is relatively short and thus cannot fully support long-term analyses.

- 2) We have adapted all of the reviewer's comments in the PDF into the revised version
- 3) We have made a linguistic check through the text.

Siyu Meng, on behalf of all authors

Nov. 20th, 2025

Comments from Reviewer #2:

Dear authors,

Thank you for the significant changes you have made. I realize that you are limited by the data you have. However, it is critical for you and your reader to understand that you are limited to surface phytoplankton concentration only and that the only processes you are looking at are those affecting growth rate (light, nutrients). It was great to see you separated changed from photo-acclimation from those in concentration.

While you cannot observe losses, you can compute accumulation rates, the net effect of growth and loss processes to emphasize how loss processes are as important as growth processes in setting up the observed concentrations (as well as physical effects such as those due to entrainment).

There is significant biomass of phytoplankton below the ML which you cannot see from space, however, it can now be observed with BGC-Argo in most zones of the ocean. Thus I urge you to emphasize you are only dealing with surface concentrations which when integrated within the ML still represent only a fraction of the total phytoplankton biomass (it is likely that the relative proportion of biomass below the ML increases as the ML shallows).

Done.

Please see Line 353-357 in clean version:

To analyse the long-term variability of the NPOG, we used satellite observations of surface chlorophyll concentration from 1998 to 2021. These observations capture only the surface layer and therefore do not reflect the full water-column phytoplankton biomass. Although this limitation could be mitigated by incorporating BGC-Argo measurements, which provide vertical profiles of phytoplankton and other biogeochemical properties, the BGC-Argo record is relatively short and thus cannot fully support long-term analyses.

I am attaching a PDF with example where you may add emphasis on the above. it is your call to what degree you adopt them.

All the comments in the PDF have been adapted in the revised version. Thanks!