

Response to the comments from Reviewer #1:

General comments

This manuscript investigates the phytoplankton community species composition response to iron and macronutrient in the western North Pacific in summer by looking at physically driven inputs. Results show that the response of the diatom community was driven by the vertical fluxes of Fe and macronutrients (especially silicate) being supplied from the North Pacific Intermediate Water. Overall, the results are relevant to the field, and this paper should be published; however, some revisions are required. Currently, the figures would need a bit of work to increase the quality. The discussion on phytoplankton genus-specific response lacks a bit of literature and is not contextualised enough.

Thanks very much for all the comments and evaluation of our manuscript. We appreciate your recognition of the relevance of our study to the field and your suggestions to improve the quality of our figures and strengthen the discussion on the phytoplankton responses at the class level. All comments are very useful in improving the manuscript. All the comments below have been incorporated into our revised manuscript according to the reviewers' suggestions. We hope the revised manuscript will satisfactorily meet your expectations and address your concerns.

As suggested in your general comments, we have improved the discussion of the responses of diatoms to iron availability and the resolution of figures. Please review the point-by-point responses to the specific and technical comments of Reviewer#1-7 to Reviewer#1-10.

Specific and Technical comments

Reviewer#1-1

line 52: It is unclear how Si^* was derived in Sarmiento et al. 2004 method the way it is written now. In the paper, they use the following: $Si^* = [Si(OH)_4] - [NO_3^-]$.

Thank you for the suggestion. We have modified the sentence in the revised manuscript as follows:

“Sarmiento et al. (2004) utilized a tracer named Si^ ($Si^* = Si(OH)_4 - NO_3^-$), which was defined by combining silicate with nitrate...”*

Reviewer#1-2

Line 63: verb missing ‘processes ARE controlling’

Thank you for pointing it out. We have amended it in the revised manuscript as follows:

“processes controlling” -> “processes are controlling”.

Reviewer#1-3

Line 66 and 67: repetition of ‘investigated’

Thank you for the suggestion. We have amended it in the revised manuscript as follows:

“investigated” -> “evaluated”.

Reviewer#1-4

Paragraph 3.5 - both parts could be better connected (previous work from Kaneko et al. 2012 and this one), and how this is surprising could be discussed.

Thank you for the suggestion. We combined the two paragraphs to explain the differences between Kaneko et al. (2021) and this study, and added one more sentence to the end of Section 3.5 in the revised manuscript as follows:

“However, as the dominant phytoplankton communities would vary between the subarctic and subtropical Pacific, relationships between the phytoplankton community composition (cf. Chl a in Kaneko et al. (2021)) and dFe or macronutrient fluxes would attract more attention.”

Reviewer#1-5

Line 262-263: which previous studies? Authors could give examples to contextualise the results. After discussing genetic and remote sensing studies, authors could first compare with in situ data (even from other locations) and then contextualise with remote sensing data.

Thank you for the suggestions. We have added the past literature and modified the sentences in the revised manuscript as follows:

“The results of diatom distribution along 155° E in this study are similar to those of previous studies (Hirata et al., 2011; Endo et al., 2018; Li et al., 2023), which can provide more insights on the ecology of the organisms. Diatom abundance, as estimated from the 18S rRNA gene copy numbers, reached the maximum in the SAG and showed similar distribution patterns along 160° E in summer (Endo et al., 2018). Additionally, satellite-based diatom-derived Chl a concentrations reported by Hirata et al. (2011) and Li et al. (2023) also increased with latitude in the western North Pacific. These studies would help contextualize our findings within the regional diatom dynamics.”

Reviewer#1-6

Line 282-285: Martin’ s work was the first to report that, but since then, numerous Fe-addition bottle incubation experiments were performed- As well as bioavailable Fe assays were performed in the S0; this could be added to contextualise this part of the discussion better.

Thank you for the suggestion. We have added the past literature and modified sentences in the revised manuscript as follows:

“Since then, a number of ocean iron fertilization experiments (Coale et al., 1996; Boyd et al., 2000; Tsuda et al., 2003; Boyd et al., 2004; Coale et al., 2004), Fe-addition bottle incubation experiments (Martin et al., 1990; Hutchins and Bruland, 1998; Nishioka et al., 2009) and bioavailable Fe assays (Nodwell and Price, 2001; Hassler and Schoemann, 2009), these studies proved that Fe stimulated the diatom growth.”

Reviewer#1-7

Line 285: Here, the genus-specific requirements towards trace metals and macronutrients could be added; why do diatoms may have higher Fe requirements compared to the other members of the phytoplankton community in the area?

Thank you for the comments. We have added a sentence to the revised manuscript as follows:

“experiment (Tsuda et al., 2003). Compared to other phytoplankton groups, the requirement of Fe and macronutrients in diatom is higher due to their larger cell size (Sunda and Huntsman, 1995). Also, the Fe starvation-induced protein 1 (ISIP1), which evolves in the Fe uptake process, is primarily a specific protein for diatoms (Kazamia et al., 2018).”

Reviewer#1-8

288: As it ends with the seasonality aspect, the authors could hint at other controls that could happen during winter, for instance.

Thank you for reviewer’s suggestion. We added a sentence to the revised version as follows:

“Contrasted to the winter season when winter deep mixing brings nutrients from the subsurface to the surface layer, eddy diffusion is one of the important physical processes that supply the nutrients from the subsurface to the surface in summer (Itoh et al., 2021).”

Reviewer#1-9

It is a bit confusing to have the part 3.7 at the end as the genus-specific response is discussed and the physical drivers were treated before. Maybe authors could consider having in part 1: the physical drivers (incl. fluxes and flux divergence) and then the phytoplankton responses.

Thank you for the suggestion. Below are our explanations on this:

Firstly, we wondered whether the dFe and macronutrient fluxes from subsurface waters to the surface layer could control the phytoplankton abundance. If there is no significant correlation between them, we consider investigating the nutrient return path meaningless.

Since we found significant relationships between them, we started to investigate the location of the return path of dFe and macronutrients from the subsurface to the surface layers via the flux divergence estimates.

Reviewer#1-10

Fig. 6, 7 - the quality is not so good, especially when zooming. Would need more space between the 3 panels to see the titles better.

Thank you for the suggestion. We have taken the following steps to address your concerns:

1. We have recreated Figures 6 and 7 with higher resolutions to ensure better quality;
2. We have added more space between the three panels.

References

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