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Biogeosciences Discussions

Interactive comment on "Phytoplankton growth and physiological responses to a plume front in the northern South China Sea" *by* Qian P. Li et al.

Anonymous Referee #2

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The story about the enhanced micro-phytoplankton growth by elevated nutrients is not new. But it's lucky, in the northern South China Sea, we have large river discharge carried with high nutrient concentration (33.3 μM N+N in S1) and extremely high N/P ratio (151:1), the upwelling (with N/P close to the Redfield ratio) also contributes to the nutrient dynamics in the northern SCS shelf. It's a perfect place to examine both the effects of increasing nutrient concentrations and altering N/P ratios. I like the statement "the mixing of bottom water would stimulate the growth of surface phytoplankton on both sides of the front by altering the surface N/P ratio closer to the Redfield stoichiometry". It's like a shelf-tuning mechanism of marine ecosystem to cope with the anthropogenic influences by increasing N inputs. The authors conducted the comprehensive and heavy-work experiments to examine the phytoplankton dynamics during

the mixing processes between non-plume waters and plume waters and bottom waters (representing upwelling). For the front, the mixing is of both nutrients and phytoplankton; but for the sea-side, the mixing is only of nutrients; it's reasonable because of the distances. And the manuscript is well written.

The discussion is insufficient to address all the issues. It's not surprise to see enhanced phytoplankton growth by elevated nutrients. But what about the N/P ratio? The increasing Chla production and net growth rate with mixed ratio in Fig. 7 in day 1 is not the response of S4 phytoplankton to PW addition, but essentially the response of mixed communities of S2 and S4 to different levels of nutrients concentrations and N/P ratios (Fig. 1). The differences in net growth rate may be related to the changes of N/P ratio. The discussion about the optimal N/P ratios for phytoplankton in plume waters is essential (Geider & Roche 2002). If we compare Fig. 8 with Fig. 9 and Fig. 6 for the same stations, such as S6 and S7, we can find different changes in size structure of Chla in day 1. Nano-phytoplankton showed greater responses to FPW than to BW/FBW and to nutrient addition. It may imply influences of N/P ratio on different species.

I find the incubations were made in May and June. But the manuscript has the April hydrographical data. It confuses me. What's the additional value of April data to this paper? And there are some questions about your graphs:

Fig. 1. You may zoom out a little bit, so we can see S3 and S7 clearly. You have the salinity contour in the graph. Is it a composite of three cruises or just the June cruise? You use different symbols for S1, S3, S5 and S2, S4, S6, S7, respectively. Do you mean S1, S3, S5 were in May, S2, S4, S6, S7 were in June? Were S5 and S6 in the same position? What is S8 in the map? You don't have S8 in Table 1.

Fig. 2. The title is "A Temperature vs. Salinity diagram during May-June 2016". But you have April data in it.

Fig. 4. The same question, is it a composite of three cruises or just the June cruise?

Other comments:

P2-21, “affect the large area of” is “affect a large area”

P2-25, “a P-limitation of phytoplankton” is “a P-limitation of phytoplankton growth”

P5-16, What’s “black filter”, do you mean “neutral filter”?

P5-21, “These waters were used to dilute the local surface waters at S6, S7 and S8” in what percentage?

P5-26, can you specify the “biological impact”?

P6-1, The percentage of 100% for S2, literally means no S4 waters, but you said it’s a mixing experiment. It’s good to have a comparison. But it’s confusing. Maybe to say S2 instead of 100%.

P7-4, “warming effect” is usually used when we are referring to an impact of global change, here I think it’s just a seasonal change of temperature.

P7-20, “This water”, I can see two water masses in the previous sentence. So, which one did you refer to?

P9-3, “controlled by” is “contributed by”

P9-14-17, I can see a smaller value of nano-phytoplankton chla in 75% than that in 50%. Does pico-phytoplankton chla in 75% statistically lower than that in 50%?

P9-27 & P10-1, “At station S6, the raw plume water (PW) was also added to the surface water for incubation to account for the advective chlorophyll input 1 by the river plume.” This necessary information should be in the method section.

P10-8, you can do the maths for N/P ratios since you have the numbers in the table.

P10-6, in the section 3.4, the discussion about the nutrient limitation status and grazing activity should be moved to the discussion section.

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	Shore-side	Front	Sea-side	Closer to Redfield N/P ratio?
+4.8 µM NaNO3 +0.3 µM NaH2PO4	S1, S2	S3, S4	S5, S6, S7	Yes
+PW		S4, mixed with nutrients and phytoplankton of S2	S6, mixed with nutrients and phytoplankton of S2	Front: yes for S2 phytoplankton, no for S4 phytoplankton; Sea-side: yes for S2 phytoplankton, yes or no for S4 phytoplankton depending on mixed ratio
+FPW			S6, S7, S8, mixed with nutrients of S2	Yes for S6
+BW	S2, grazing effects?	S4, grazing effects?	S6, S7, grazing effects?	Yes
+FBW	S2, no grazing effects?	S4, no grazing effects?	S6, S7, no grazing effects?	Yes

Fig. 1. Summary of incubation experiments