Reply on RC2
Chiho Sukigara et al.

Author comment on "Observing intermittent biological productivity and vertical carbon transports during the spring transition with BGC Argo floats in the western North Pacific" by Chiho Sukigara et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-9-AC2, 2022

To Reviewer #2

Thank you for your comments concerning our manuscript. We have studied all of your comment carefully and answered your comments. (Reviewer's comments are in italic.)

Sukigara and co-authors investigate the effect of passing storms on the production of organic matter and its fate once exported into the mesopelagic, using 2 BGC-Argo floats deployed in the western North Pacific. I reviewed the first version of this manuscript (first submission to BG few months ago) and I think most of the issues I highlighted in my last review have not been addressed. I appreciate the effort done to better describe atmospheric (wind and heat fluxes) and hydrologic conditions but I am not convinced by the heat content analysis. Figure 4f shows differences between delta heat content and heat flux of several orders of magnitude. How can you assume a 1D system? In section 3.1 (lines 274-275), it seems that you conclude that only case 4 is 1D but then, in the discussion, you state that case 1 and 2 are also 1D. You argue that "changes of heat content occurred mainly below the 200-dbar level" but figure 4f only shows 0-400m integrated values. Besides, temperature and salinity profiles also present large differences in case 3. By the way, why salinity profiles are not shown for the other cases?

We calculate the contribution of each layer to the change in heat content and add it as needed. We add salinity profiles as needed.

My previous comments about Redfield and C:Chla ratio still stand. Deviation from Redfield ratio or changes in C:Chla can be due to a lot of different processes. And you actually use these two ratios to explain different mechanisms between your 4 cases. I think it is hard to be conclusive with these ratios. This is why you are using extensively the words "may", "might", "likely" which make the discussion very speculative.

We describe how the C:N and C:Chla ratios changed in this study, rather than comparing them to Redfield ratio and previous reported values. We will also reduce ambiguous descriptions such as “may”, “might”, “likely”.

The results section is very descriptive with very few new results. I think this section could
be better structured, potentially according to your 4 cases (as you have done for the discussion), focusing on new results. Sentences like “The DO concentration in the water column was high in the euphotic zone and gradually decreased with depth” are not necessary.

We reduce the description of general changes in results.

lines 33-35: The phrasing is not correct. Plus, "to observe"

We rewrite this sentence.

lines 82-85: Reformulate with 2 sentences.

We rewrite this sentence.

line 134: You should mention that you assume a constant euphotic depth throughout the timeseries. Or estimate it based on satellite PAR and/or Chla (see for example Morel at al. 2007).

We explain that we measured the euphotic depth only once. And we write the explanation that we adapted this euphotic depth to the overall observation period in the revised manuscript.

lines 171-174: What about Non-Photochemical Quenching? Did you apply a correction for NPQ?

We did not correct for Non-Photochemical Quenching because our floats observed at night. We rewrite this section according to Reviewer1's comment.

equation 4: Describe the terms of the equation. What is Cp and rho?

We add the explanation of Cp and rho.

lines 259-262: The two sentences are redundant.

We rectify these sentences.

line 266: "Because the density changed significantly before the end of events 3 and 4". Which part of the density profile, how deep?

line 267: “the end date was determined from the change in the density profile”. How much density change? Which threshold did you use?

We rewrite how to determine the end of event 3 and 4.

line 274: Only case 4?

Yes.

line 305: “We examine below the physical oceanographic conditions”. Below is section 3.2 about biogeochemical parameters, not physical conditions??

We rewrite this sentence.

lines 312-312: Pretty obvious. Go straight to the main results.
We delete this sentence.

*line 334:* “the depth of the euphotic zone (~200 m)”. You mentioned 70m earlier in the text.

We remove ‘the euphotic zone’.

*line 339:* “Chl a concentrations increased slightly in the euphotic zone after the mixed layer deepened”. Not exactly true. The increase occurs after deep mixing stopped.

We rewrite this sentence.

*lines 347-349:* Pretty obvious.

We delete this sentence.

*line 369:* You mentioned the POC to Chla ratio earlier in the text. Here and later in the text, you used the notation C/Chla. In the Behrenfeld paper, C is phytoplankton carbon not POC. It is a bit confusing. Make sure to distinguish between POC/Chla and C/Chla.

Since this study calculate POC/Chla ratio, we unify the notation. Also, we add an explanation for the difference between our POC/Chla and Behrenfeld C/Chla ratios.

*lines 378-379:* I don’t understand this sentence.

The figure shown was incorrect. The correct figure is 6ij. We rewrite this sentence.

*line 401:* exceeded 19m? or 190m? You could plot a horizontal line for the MLD.

We rewrite the MLD as 19 m. In Fig. 9b, we add the MLD.

*line 428:* All other cases? Be more specific.

We rewrite that it was coincidental that the Chla and POC concentrations seemed to increase with production there.

*line 440-442:* The Redfield ratio is not the TRUE value.

We remove the comparison to Redfield, and rewrite it as shown a low C/N ratio.

*line 471:* “(Fig. 14)”. Which panel?

We rewrite to “(Fig.14c)”.

*line 480:* POC/Chla

We rewrite this word.

*figure 2:* line 869, remove “red”

We remove “red”.

*figure 4f:* You should mention that it is daily integrated heat flux.

We add the explanation.
figure 5: dashed lines

We rewrite to “dashed lines”.

figure 8: no g panel

We rewrite to ‘(f)’.

figure 10: This figure is not useful. You should consider moving some figures to the supplementary information. "A fixed time (the start of profiling) was used to generate the figure." I don’t understand this sentence.

We delete figure 10.