EGUsphere, referee comment RC1
https://doi.org/10.5194/egusphere-2022-1008-RC1, 2022

Comment on egusphere-2022-1008

Anonymous Referee #1

Referee comment on "The contrasted phytoplankton dynamics across a frontal system in the southwestern Mediterranean Sea" by Roxane Tzortzis et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1008-RC1, 2022

General Comments

In the manuscript “The contrasted phytoplankton dynamics across a frontal system in the southwestern Mediterranean Sea”, Tzortzis et al. compare the phytoplankton communities at two different water masses separated by a frontal region.

The work is original. The sampling design to analyze the two water masses separated by a front, and the phytoplanktonic community that characterizes them, is very interesting. Especially having a tool like the CytoBuoy. However, the manuscript needs improvement in many aspects before it can be considered for publication.

In general, it is a disorganized text. The story does not flow, the paragraphs do not focus on clear topics, there are very long and confusing sentences, there are methodological descriptions in the results and results in the discussion... All sections should be carefully reviewed and improved.

Especially the introduction and discussion. The study area is barely described or named, why it is so relevant to focus on that particular front (besides the scope of the satellite)? Moreover, in the first paragraph of the introduction, the authors mention the context of climate change. How will climate change affect the presence and intensity of the fronts? And in turn, how a possible change in the intensity and frequency of the fronts will affect the associated phytoplankton communities? As a reader, I feel like I am being shown an interesting image, but in black and white instead of full color.

Specific Comments

Introduction

The authors describe in ~15 lines the relevance of phytoplankton and ocean fronts. In my opinion, more information is needed. Knowing the abundance and diversity of phytoplankton is important, but its role in the carbon cycle should also be highlighted, which changes depending on whether the community is dominated by small or large species. Moreover, an oceanic front is not defined, the authors describe briefly the physical-biological interaction. I also miss an intro to the study region.

After that brief introduction, the difficulty of an in situ study is described, and without continuing the story fluently, they begin to talk about an oceanographic campaign/project. I think the information is relevant, although the more technical details should be indicated in the methodology.

Finally, the last paragraph is confusing. There is a lot of information, but not all makes sense, and it is kind of disorganized. The last paragraph of the introduction should clearly define the objectives of the study and how the authors would answer them.

- Ln 16: Phytoplankton are essential for marine ecosystems, but not really for the functioning of the oceans… Oceans can function without life.
- Ln 16-17: Revise the sentence. The CO_2 assimilated by phytoplankton can be exported to deep waters when they die or are partially eaten, being decomposed at depth; that's the biological pump. But not when they are eaten by higher trophic layers.
- Ln 20-22: Add references.
- Ln 22-23: Revise the sentence. It seems that the idea the authors are trying to convey is that the temporal scale of growth/evolution of the phytoplankton community is due to a fine-scale coupling. It seems that the fronts are the ideal environment for phytoplankton when it is not necessarily true.
- Ln 27: Here there is a change of topic, please, start a new paragraph.
- Ln 24-27: Revise sentence. First, the sentence is too long.

In my opinion, the use of "could" makes the facts described less solid. It is established that fine-scale frontal structures induce vertical velocity. Is there any study where no vertical velocity is associated with these structures?

Vertical velocities do not modulate light availability. Vertical velocities move the phytoplankton cells along the water column and depending on the "resulting" depth they will have more or less light.

- Ln 33-35: I do not understand this sentence. Are you saying that little is known about the phytoplankton diel cycle? Not only there are laboratory experiments, but also models, in particular individual-based models, that study this fact. For example, several studies by Geider et al.
- Ln 44-48: Please, rephrase these sentences with a clearer and simpler message.
- Ln 46-48: Could the authors provide some details about the nutrient concentration of both water masses?
- Ln 49-50: This sentence looks like part of the results section. I understand that you are referring to Tzortzis et al. (2021), but it is not clear.
- Ln 51: This study, or Tzortzis et al. (2021)? I imagine is Tzortzis et al. (2021), then this first sentence and probably the open questions should be in the previous paragraph.

Materials and methods

- Ln 70-73: I don't think this information is relevant.
- Ln 73-76: These facts should be in the introduction.
- Ln 77: Please, consider indicating that the measures have a high spatial and temporal resolution.
- Ln 77: I am not sure if you can use in situ sensors when they are on board. It is kind of repetitive.
- Ln 77-70: Here you are describing in situ measurements, that are described in the next subsection.
- Ln 80-82: Repetitive information (introduction).
- Ln 76 and 83: Please, describe the sampling strategy details in a single paragraph.
- Ln 84 and 85: Please, mention the source of the remote sensing datasets.
- Ln 91-94: What are the temporal and spatial resolution of the temperature and salinity measurements?
- Ln 94-115: One paragraph. Moreover, revise the information provided, there is some repetitiveness regarding the optical signals.
- Ln 104: 1.5 cm3 is the water volume analyzed? Please, consider expressing the volume in mL, in my experience, it is a more common unit used in this kind of study.
- Ln 112: Again, please consider using cell per mL.
- Ln 115-116: Totally out of place.
- Ln 118-124: Please, make it clear that this size-structured population model was applied to every phytoplankton population/group identified previously using the CytoBuoy.
- Ln 126: To use the model, the light scatter signal (FWS) recorded for each cell by the flow cytometer must be converted to size (diameter) using a power law relationship (Sosik et al., 2003), and then to biovolume (v).

I imagine that to convert size into volume you are considering that all the species are spherical. Then, please consider indicating this fact and that you are converting the FWS signal to Equivalent Spherical Diameter.

Please, indicate the units of both measurements. Also for the rest of the variables (t, E, g, μ*,…).

- Ln 128: I am not sure if N is the number of cells in all the size classes or at each size class.
- Ln 133: How many size classes were determined and how? Does it follow a log distribution?
- Ln 135: I am not sure what exactly is "this probability". Is it the probability of cells growing in a time interval? Is it a probability or a proportion?
- Ln 141: Instead of however, besides seems more appropriate.
- Ln 141-142: Repetitive information.
- Ln 147: I consider kind of inappropriate the use of a "decrease in cell size", it is a division. A phytoplanktonic cell decreases in size if the growth conditions are not optimal, and that is not an indication that there is a doubling event.
- Ln 150-151: This sentence is confusing. Why do you talk about N(0) when is not used in the equations 5. (Two equations = two labels, please. Similarly, with equations 8)
- Ln 153: A(t) is a tridiagonal transition matrix that contains.
- Ln 159: Could you elaborate on what you mean by optimal parameters, please?
- Ln 160: Standard deviations of the errors?
- Ln 166: There is no information about this equation.
- Ln 167-169: I do not understand this explanation.

Moreover, the definition of "bar l" (I do not know how to write the loss symbol here) confuses me. If it is the daily average population loss rate, how dt is 1 hour? On the other hand, what do you mean exactly by loss? The number of cells moving from one size class to another, or death?

What is the description of T1day NT0?

I have no experience using this kind of model, but any reader should be able to understand the methodology followed in the study without having to read previous studies. So please, review this section carefully and try to make it as clear as possible.

Results

- Ln 176-188: This information should be included in the methodology section. Also, at the end of this explanation, it will be interesting to indicate how to convert the scatter signal to size and volume.

The details about how every species was differentiated, in my opinion, are not necessary, therefore I propose the authors move it to the supplementary, together with Figure 2.

- Ln 210-211: The information about the figures does not fit here. It will be more appropriate to move to the beginning of the next paragraph. On the other hand, please explain the background information. Does it make reference to the proportion (percentage) of cells of each biovolume? If it is a percentage, why it does not vary between 0 and 1?
- Ln 211-216: How was reconstructed the 24-hour irradiance curve should be explained in the methodology.
- Ln 221, 222, 231, and 232: Please, include the standard deviation value together with the mean value.
- Ln 217-233: Please, explain in this section why there is no information about the other 6 groups identified.

Discussion

- Ln 236: Please, add some references.
- Ln 245-246: What do you mean by transiting in all the cell cycle stages? That they are growing and dividing?
- Ln 254: What do you mean by extensive distribution?
- Ln 265: Is it really the only reference for this fact?
- Ln 269-274: Basically the same was said in the introduction.
- Ln 275: Please, revise this sentence.
- Ln 284: The fact that light and irradiance are essential for phytoplankton growth was known before 2001.
- Ln 285: Then is expected a higher nutrient concentration in the old AW? For that reason, there is a higher contribution of larger cells?

Conclusions and perspectives

- Ln305-309: This is not a conclusion.

Technical corrections

- Ln 6: Delete the space between "numerous" and ";".
- Ln 21: Add a comma after (days-weeks).
- Ln 41: Delete parenthesis after altimetry.
- Ln 87: Once the front "is" localized.
- Ln 103: 1164 samples "were" analyzed.
- Ln 122: Maybe light availability is more adequate?
- Ln 129: Please, consider changing investigated by counted.
- Ln 134 and141: … between the time interval t…
- Ln 135-136: … necessary to carry out photosynthesis?
- Ln 157: Is there a typo? The probability of division is not denoted by γ?
- Ln 163-164: You already defined those symbols; it is kind of redundant to do it again.
- Ln 185: [chla]?
- Ln 207: Please, consider using disregarding instead of eliminating.
- Ln 227: Observed biovolume (observed and in situ are kind of repetitive), and predicted biovolume (check also Ln 219).
- Ln 219-220: all species populations in both water masses?
- Ln 222: No comma before the parenthesis.
- Ln 221, 223, 224, 229, 230, 240: l or "bar l"?
- Ln 239-240: The structure of the phytoplankton community.
- Delete the point after the manuscript title and after the abstract.
- Please, use 1 or 2 decimal numbers for all the variables measurements, to keep the format along the manuscript (e.g., Ln 46, 48, 221).
- Please, use the same format for the dates along the manuscript (e.g., Ln 70 and 93).
- Please, revise the use of the word indeed, it is repeated quite often throughout the text.

Figure 1.

- Panel a is very small, impossible to appreciate the information. Moreover, the colormap scale is minuscule and does not indicate the variable (and units) that represents.
- In panel b, it would be interesting to indicate where the sampling events took place.
- In panel c, in my opinion, the clock diagrams are not necessary.
- Legend: The purple box encloses a (b) zoom of the sampling region with overlaid chlorophyll-a concentration (units). _____. The red line represents _____, the dark blue box _____, and the light blue box _____.
- I am not an English native, but I think that the lines and boxes are superimposed to the chl map. The other way around will not allow you to see lines and boxes.

Figure 2.

- As previously indicated, I do not consider this figure of relevance to the main text.

Figure 2.

- Legend: Background colors indicate the two water masses…

Figures 4-6.

- Explain what represents the red line and the background color.
- Correct all the color bars (by figure) to vary all in the same range.

Figure 7.

- A very small figure, with some details difficult to appreciate. Even the legend is difficult to read.

Table 2.

- Indicate also that there is information about the standard deviation.
- Define every variable on its own.
- μ_{ratio} should not be adimensional? The equation and its meaning are already defined in the text.
- Define the acronym PFG.