Biogeosciences Discussions

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Comment on bg-2021-98

Anonymous Referee #1

Referee comment on "Cells of matter and life – towards understanding the structuring of particles and plankton patchiness in the Arctic fjords" by Emilia Trudnowska et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-98-RC1, 2021

Review for Trudnowska et al. Biogeosciences

General Comments:

The authors present a study in an Arctic fjord that classifies different types of plankton patches and attempts to understand the drivers of these shape changes and the plankton size composition of the patches. While the study topic is certainly valuable, and some of the attempted analyses are new, most of the main findings do not appear to add much to our understanding of the causes of patchiness, and often it is unclear how the data you collected are supporting your conclusions. At no point do the authors actually show the pathway of the towed vehicle, so it is possible that interpolation has an effect on what patch types are detected. For the plots of the patches vs. oceanographic variables, it is unclear how you assign a particular value to a patch that might cross a range of temperatures and salinities, for example. And certain patch types are more likely to have this happen (i.e., ones that are vertical). The authors need to re-evaluate how they are explaining their methods and revisit the figures they chose because I cannot tell exactly what was done, and the data are often presented in a confusing or redundant manner (see figure comments).

The writing is somewhat disorganized, as many paragraphs have abrupt topic shifts and vague language. The authors should strive to use examples and numbers whenever they make general statements because otherwise it can come across as non scientific. Many parts use fairly informal language compared to most scientific papers, and there is an over-use of first person. The disorganized writing makes it very difficult to follow a train of thought, which makes the discussion less valuable.

The authors need to completely re-evaluate the visuals they use and pick the ones that most clearly demonstrate their main points. We cannot just take their word for

it, as many of the figures I do not see showing the data they use to drive the main points of the paper. The data may be valuable, but the presentation is so difficult to follow that this is not close to being publication ready.

Specific Comments:

L11 – I do not know what you mean by "multi-fraction forms" – do you mean multiple size classes? Aren't all plankton patches going to be composed of different size classes?

L12 – It is an overstatement to say your work is "completely novel insight", as many studies have looked at patch structure on multiple scales. This may be the first attempt to categorize them based on specific range of shapes, but that isn't novel insight in my view.

L14 – A common issue throughout is that the authors are using "role" to mean "abundance," as in if the abundance of a particular size class is increasing, you are saying it has an "increasing role." It is better to stick to what you measured (abundance) rather than commenting on the role of a particular size class, which implies you are measuring something about its place or function within the food web.

L15 – There is no logical connection between size class changes and Atlantic waters, and it is unclear what you mean in terms of "temporal scale" here.

L18 – It is better to show us how knowledge has been extended rather than state it. I still do not see what has been found besides distinguishing different patch type categories.

L19-21 – Many, many people have concluded that plankton are not passive particles, so this is not a new finding. You do not mention anything about the sampling equipment in the abstract, but you are using a LOPC, which is giving you snapshots of the distribution of plankton (and only size information – no taxonomic distinction). How would that even tell you if the plankton are moving passively or actively (unless you follow a patch through time)?

L26-27 – It is inaccurate to say that plankton patchiness is "hardly recognized and documented" – many studies have documented patchiness for various size classes.

L31 – I do not think Woodson et al. 2007 is an appropriate reference for sampling methods detecting different size classes because that paper was mostly about copepod behavior in experimental setups.

L36 – Do not say something is “extremely interesting” – better to show the reader why it is interesting rather than state it.

L47-49 – This is not true. There are many papers about the mechanisms favoring patch generation (e.g., Stacey et al. 2007) in different physical contexts.

L51 – Currie et al. 1998 specifically looked at the internal structures of the patches in 1D, and also examined the patch size. There are also numerous studies that have used acoustics and nets to look at patch structure and composition.

L65 – what does it mean to “answer the call for the insight studies” – very informal language overall and excessive use of first person.

L81 – What do you mean by these sites being treated as “natural laboratories” in the context of this study?

L100 – Hard to tell what exactly is being done in the methods. What do you mean when you say “individual patches were selected from each other by the hierarchical clustering…”? You need to be clear about exactly what you are doing.

L106 – Bez 2000 would be a good paper to reference because it talks about how these patchiness metrics can be used or misused. The Lloyd’s patchiness index is not the same as the ratio of variance to mean.

L108 – you have not indicated what kind of correlation coefficient was used.

L117 – the package is “ggplot2” and it has a function called ggplot() – you should cite the package since the graphs were made with it.

L134-135 – This is not that surprising if large phytoplankton and marine snow aggreagates are present, as they can be ~1cm large or more and often fluoresce (see Timmermann et al. 2014)

L174 – But aren’t you using the concentrations to determine if they are within or outside

patches? Why is this relevant? Just to say that some patches were more concentrated than others? There are no significance tests, so the reader cannot tell if these differences are meaningful or not.

L180 – What do you mean their location was not repetitive?

L247-250 – You also calculated Lloyd's patchiness index and mean crowding, but do not mention these in the results. If they add nothing to the study, then you don't need the extra graphs.

L288-290 – This does not make sense. Can you remind us how you are determining this? Does this mean that the patch category explains the given plankton concentrations?

L295 – This is really confusing. I don't understand what you are talking about, so you need to use examples or numbers to supplement the text.

L305 – This is a misleading statement. For smaller plankton, they are typically reproduced in a given area because their swimming ability is poor. Maybe only really large plankton are capable of "getting" to a place.

L312 – You need to define what and "overlaid effect" is because it is not clear from the text.

L316 – Do you mean physical or biological mechanisms? There can be ecological mechanisms, so I don't think it is appropriate to have "mechanistic vs. ecological" since they are not mutually exclusive.

L317 – What are the "new gates" that are being opened up? There is too much unclear and informal language for a scientific paper.

L320-338 – This paragraph has many topic shifts and is very disorganized, so it is tough to follow the main points. L323- one example of many – this can be much more simply stated: larger scale patches are dominated by physical processes.

L355-360 – Chlorophyll is not the same as phytoplankton because of photoquenching and time of day can affect chlorophyll even though phytoplankton abundance is not changing.

L376 – Do you mean their abundance? This isn't really a "role" unless you are defining it in a different way (in which case you need to state what you mean by "role").

L385 – You have 2 years of data, so you can't really say much about climate change. This is beyond the scope of your study. It would be best to stick to what you can actually demonstrate with your data.

L405-417 – Many parts of this paragraph do not make sense. There are many abrupt topic shifts that make it hard to read any flow to the discussion.

L422 – I do not agree that patchiness is "well-resolved." Many in situ technologies have only been deployed in particular environments and specific times of the year. Our descriptions of patchiness are getting better but still quite limited.

L426 – This is not true – we do know about the internal structures of patches in some instances. There is lots of thin layer research about the structure of patches, and acoustics has shown how patches can change in response to oceanography.

L439 – You previously said we don't know anything about the structure of patches…

L442 – How do you know these results are specific to waters near glacial fronts? Also, don't you think others have reported on the patch shapes you have described? They just might not have used the same terms you are using. It would be good for you to give some credit to researchers that have found something similar in terms of patch shapes.

Figures:

Figure 2- There are no indication of the units for the different size classes. It would be useful to put the track of the tow-yo on at least one of the plots, so the reader can see what was interpolated.

Figure 3 – Color of the boxes and the x axis are redundant – you don't need color for this

figure.

Figure 4 – you should not use the name of an R function in the figure caption. You need to state in mathematical terms what the shapes are enclosing. The patterns are quite messy, and it is really hard to tell what the figure is showing overall. Is this really the best way to show differences in the patches among years and size classes?

Figure 5 – I am not convinced you can determine all of these types with a tow-yo sampling pattern. It is possible that some patch shapes will be less likely to be detected given the sampling pattern? Could this also be dependent on the background abundance of a given particle size? This is why you need to show the path of the sampler in at least 1 figure so this can be evaluated.

Figure 6 – Again your fill and x axis are redundant. Color is not needed, and all of these graphs essentially show the same thing.

Figure 7 – Density usually just implies where the patch was. So how do you account for patch types that are likely to crossing multiple environments. I would think this would be much more likely with certain patch shapes, so how do you realistically standardize this kind of plot. Also, does this account for the time spent by the tow-yo in the different values of the x variable? I cannot tell how this was done (or if it was done) in the methods.

Figure 8 – the size of the dots are changing, but there is no legend to indicate what this means. How can some white squares be significant, but many of the blue dots are not?

Figure 9 – unclear what this is showing – no legend to show what the size of the dots mean. Why would this not be more clearly expressed in a table?