Biogeosciences Discussions

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Comment on bg-2021-98

Anonymous Referee #2

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-RC2, 2021

Trudnowska et al. present a study of the distribution of particles using high-resolution datasets from two arctic fjords. They analyze how the distribution of particle patches changes over environmental gradients and time. This is an exciting dataset that has the potential to provide new insight into fine-scale patches, how they vary, and what causes the variation. I also found the attempt to quantify the shape of patches intriguing. While I feel this study has great potential, I have some serious concerns with the current manuscript.

Major comments:

- While I agree with the authors that heterogeneity in particle distributions is poorly understood, especially on the scales quantified by this dataset, in general I found the manuscript was poorly motivated. The introduction should be reworked to better formulate the primary questions, provide the broader context, and articulate why we need to understand the fine-scale distribution of patches. A description of why these sites were selected for this study would also be helpful.
- While the authors presented a nice summary of the data, the manuscript lacked an in depth analysis and discussion of potential mechanisms driving the observed distributions. It appears that there were recurring patches along the transect, what determined the location of these patches? An analysis of density differences (rather than temperature and salinity separately), light profiles (even just estimates based on surface PAR and in situ chlorophyll), and nutrient concentrations (was this collected?) could have provided critical mechanistic insight.
- I really liked the size-spectra calculations as a way to assess the patches, but it was not clear to me how these were made - how did the authors deal with differences over depth? I would have loved to have seen a size-spectra analysis per particle patch! That would have been a truly novel insight that I have not seen previously. Analyzing the patches as a unit rather than analyzing each separately by particle size would have been a lot easier to follow.
- The study aimed to compare the two fjords but only presented minimal data from

Isfjord. It would have been helpful to have had a complementary figure to Figure 2 for this site. In addition, the authors recently published a paper on the dataset from Isfjord, but it was not clear how the results from that paper integrated into this study - what was new in this study that was not done in the previous study?

Minor comments:

- There are many terms which are used in the introduction but poorly defined and not integrated into rest of the manuscript e.g. 'clouds of matter', 'cells of matter and life'
- The methods section lacked critical details:
  - How was the background separated from the patches?
  - How was Llyod's index calculated, please provide the formula
  - What were the background variables that were collected?
- Several of the figures were confusing - e.g. Figure 6, 7, and 9 (why not show the RDA?). In Figure 2, why were only 3 years shown when 6 years are mentioned in the methods.