Comment on bg-2022-103
Anonymous Referee #2

Referee comment on "Lagrangian-Eulerian time and length scales of mesoscale ocean chlorophyll from Bio-Argo floats and satellites" by Darren Craig McKee et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-103-RC2, 2022

This manuscript presents extensive work evaluating Eulerian and Lagrangian time and length scales of velocity and chlorophyll, as well as discussion about how they correlate. The proper interpretation of drifting phytoplankton observed in a Eulerian fashion is a long-standing paradigm in ocean ecology. However, estimates of Lagrangian phytoplankton statistics and comparisons with Eulerian counterparts are rare. This study represents a significant contribution towards best understanding how to interpret phytoplankton/chlorophyll measured in both Eulerian and Lagrangian platforms. The authors are very thorough in their analysis and description of the results. Nonetheless, I have a few comments to be addressed prior to recommending publication.

Major comment: There are several data limitations that guide methodological decisions in an analysis of this type (e.g., the broad spatial averaging, chlorophyll averaging in the MLD). While some of the issues arising from these are mentioned briefly throughout the text, I would prefer to see a dedicated discussion section with the limitations and caveats.

Specific comments:

- I find that, while technically correct, talking about Lagrangian-Eulerian “statistics” in the title and throughout the text can be misleading. Why not refer to the specific statistics that are included in the analysis? i.e., Lagrangian-Eulerian time and length scales.
- The notation of upper case L for both Lagrangian and length-scale can be a bit confusing. I suggest using upper and lower case or a different notation to improve readability.
- Equation 5. Terminology becomes confusing here too when calling the nominators Lagrangian, Eulerian and Spatial (chlorophyll) scales. Is there a different name that
could be more appropriate and less confusing? This is essentially a change in chlorophyll, correct?

- Table 1 is also confusing. Why are ACF bins different? Why are time windows for Eulerian and Lagrangian different? Does that have any effect on the comparison? (I think it would if you were calculating other statistics). Where does the 27.8km ACF bin for Eulerian length scale come from? I probably missed it.
- Figure 1d. orange profiles: QPI<5km; blue: all others (i.e., not total)
- Line 180. Please specify the convention for flagging. It is my understanding that BGC-Argo flagging may have changed through the years and between institutions. (I’ve used Sprofs where 3 means bad).
- How does the GlobColour product compare to other products? Why is this one selected over others? (OCCCI, for instance). I suggest including a brief sentence.
- Section 3.3 could be simplified. Two sets of chlorophyll anomalies are estimated: 1. Anomalies with respect to a 31-day smoothing filter, and 2. Anomalies with respect to the climatology. I would suggest stating something like that to start, and then continue with the details.
- The climatology is based on the same 31-day filter + a boxcar function? This is not exactly what comes to my mind when “climatology“ or “repeating annual cycle“ is mentioned.
- I don’t like the use of the satellite-based “subtrahend“ to estimate chlorophyll anomalies from the MLD-averaged chlorophyll from the float. How does the MLD average compare to the satellite? I think some type of bias correction may be needed. You mention that the subtrahend is regressed against float data. Do you mean you corrected a bias? That should be included in a supplement.
- Line 240. Why aren’t Eulerian and Lagrangian segments equal?
- Section 3.4 could be simplified as well. If I understand correctly, you tested two approaches to estimate spatially averaged scales. In lines 272-275 you mention you use one or the other. When and why you use each one should be clearer.
- Line 292. Picks?
- Lines 319-320: “If we take …” this sentence is confusing.
- I probably missed this. Are the results in figures 5 to 9 based on all profiles or only QPI<5km?