

Reviewer 1

We would like to thank the reviewer for the hard work invested in reviewing our paper and the overall very positive view on it (manuscript os-2021-124). We have gone over all of the issues raised and revised the manuscript accordingly. These comments provided much assistance with reshaping and clarifying the manuscript. We hereby present point-by-point answers to the issues raised by the reviewers. Our answers are in blue.

Moderate revisions

General comment

This paper aims to describe the impact of cyclonic and anticyclonic eddies on the primary productivity, bacterial productivity and plankton biomass in the southeastern Mediterranean Sea. The paper is well written, in some passages a little too long, but still easy to follow. The Figures are generally clear but some of them can be improved as suggested in the specific comments. The biological and biogeochemical aspects are very detailed, with extensive discussions well placed in the context of previous literature. On the other hand, the physical part is not so accurate. It is quickly described only in the Results Section and are not included in the Discussion Section and not even linked to the results of the biogeochemical parameters. The manuscript should also include a short final paragraph summarising the main conclusions and new findings of this work.

Reply: We thank the reviewer for his/her comments and suggestions. We have specifically clarified the physical part where needed, added some relevant discussion and improved the resolution of some figures.

We believe that adding a final paragraph with the main conclusions/ new findings may be repetitive and length the manuscript even more so than it is now without a real scientific-based necessity.

Specific comments:

Title: This paper provides a snapshot of two structures, one cyclonic the other anticyclonic, sampled in the late summer of 2018. The current title is too pretentious, suggesting an

analysis that is more comprehensive and extended in time. I suggest adding at the beginning of the title "On the influence..." or at the end of the title "...in late summer 2018".

Reply: We revised the title as suggested by both reviewers. The title now reads: *“Influence of cyclonic and anti-cyclonic eddies on plankton in the southeastern Mediterranean Sea during late summertime”*.

Results: The AMEDA algorithm finds Argo float traces (grey lines in Figure 1) within both the cyclone and the anticyclone examined in this paper. These data could be useful to describe the temporal evolution of thermohaline characteristics in these structures before and concurrently to the analysed period, to confirm the presence of upwelling and downwelling within them and/or the flux of cold waters upwelled south of Cyprus into the cyclone #11988.

Reply: We have added this information in the revised manuscript: *“...Later, when the DYNED atlas was extended to include 2018, it was identified as cyclonic eddy #11988 that was created more than a year earlier, mid-September 2017 (Figure S2). It was split from cyclone #11310 located south of Cyprus and migrated to the easternmost SEMS. Profiles of Argo floats (#6903221 and #6903222) localized within cyclone #11310 showed that it brought denser, colder and saltier water upwelled on the southern Cyprus coast (Figure S2A)... ”* (Lines 295-300).

Line 290: Please add a short description of the SST maps in Figure S2, highlighting the upwelling along the southern Cyprus coast and the following spreading of cold waters in the SEMS.

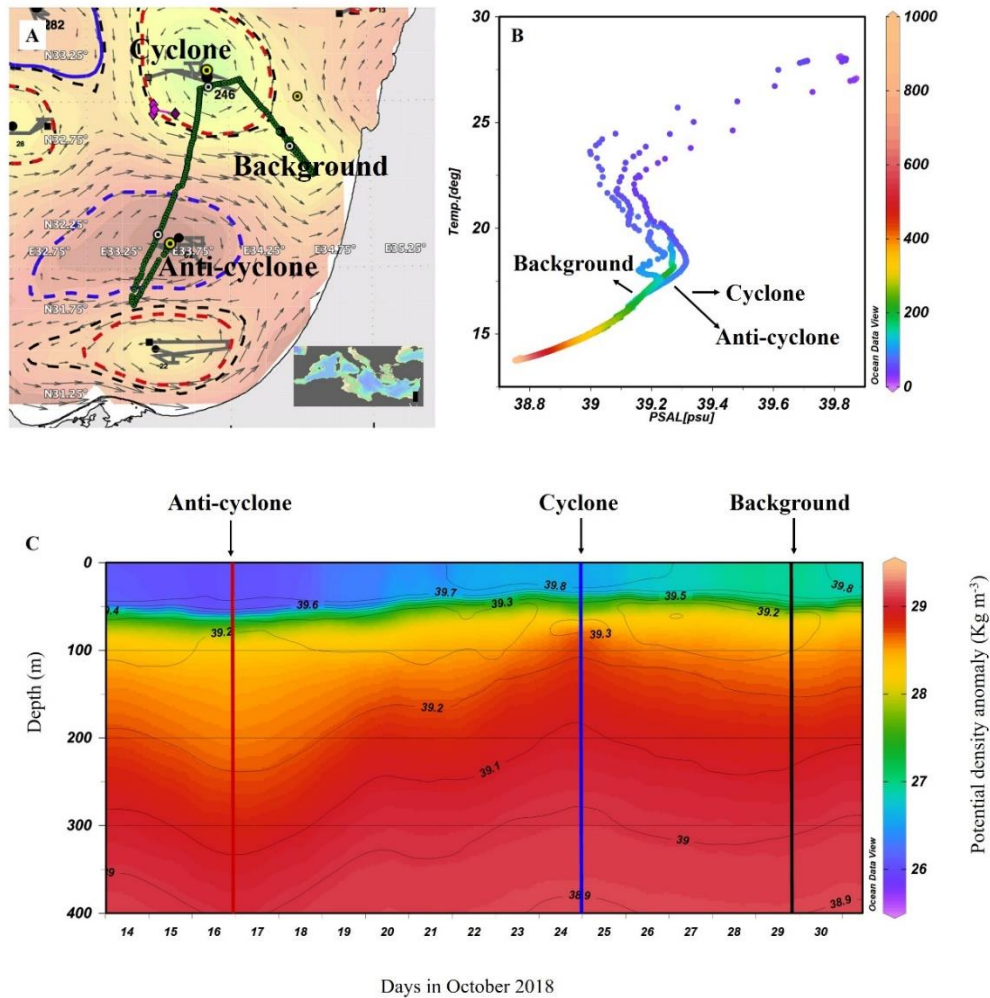
Reply: We now describe in more details that the upwelling at the southern Cyprus coast and its associated cold water spread as a cold-core cyclone: *“...cyclone #11310 showed that it brought denser, colder and saltier water upwelled on the southern Cyprus coast (Figure S2A). At the time it was sampled it is characterized as a cold-core cyclone, colder than its surrounding waters (Figure S2B)...”* (Lines 298-301).

Line 297: The cyclone #11310 is not shown in Figure S2.

Reply: Cyclone #11310 (25-Nov-2016 to 29-Sept-2017) dates prior to cyclone #11988 (first detection 15-Sept-2018) and therefore is not seen in Figure S2 that shows SST for 11/08/2018 (A), and 12/10/2018 (B). We removed the reference to Figure S2 in the revised manuscript.

Line 310: Remove the isopycnals from Figure 1d and overlap the corresponding isohalines on the density contour. This will make the properties described in lines 315-317 much more evident to the reader.

Reply: Agree – the figure was revised as suggested:



Figures 1b, c: Increase the quality of Figures and their sizes (insets are very hard to read). My suggestion is to replace these figures with Figure S3 (e.g. with profiles coloured by depth) and move them in the supplementary materials.

Reply: We agree with the reviewer and revised the figures and corresponding text accordingly. Where, we moved the vertical profiles of temperature and salinity to the supporting information (new Figure S3) and added to Figure 1 the T-S profile colored by depth as suggested. We also improved the resolution and quality of the figures. Please see Figure 1 in the comment above and Figure S3 below.

Figure S3:

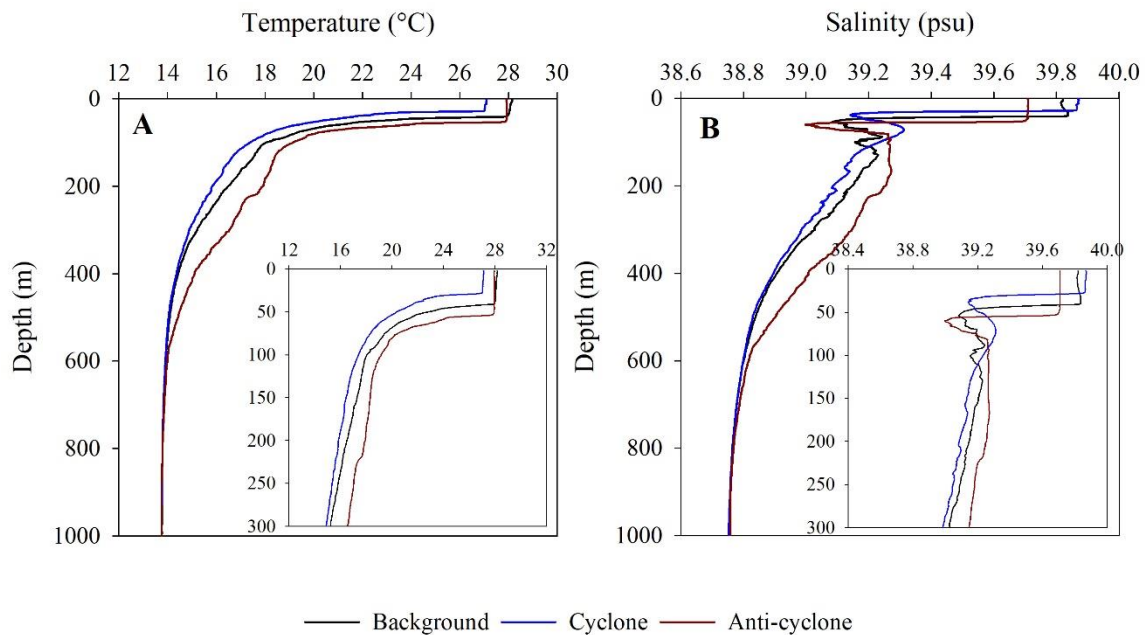
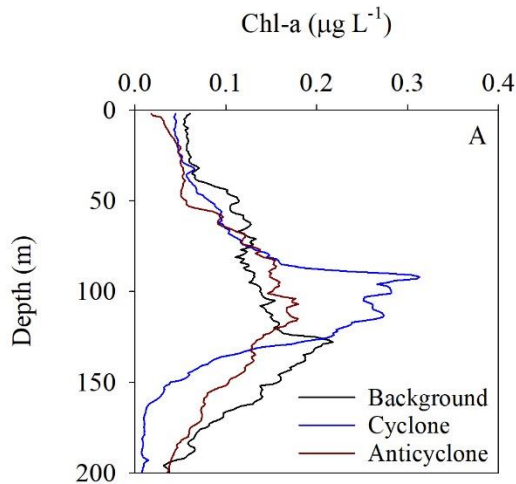


Figure 3a: add symbols to identify the anticyclonic, cyclonic and background conditions.

Reply: The chlorophyll-*a* data is measured continuously every meter on average, similarly to the T-S profiles, by a fluorimeter (calibrated against *ex-lab* pigment extraction). Adding symbols will result in unclear profile design-wise (that is, too many data points). To avoid confusion, we added a specific legend in panel 3A.



Figures 4, 5, S4, S5: Increase the quality of Figures

Reply: We have revised the figures which now has a better resolution and thus quality. Note that the figures uploaded to the OS platform are in in the journal's requested format.

Reviewer 2

The authors are presented a study about influence of cyclonic and anticyclonic eddies on plankton in the southeastern Mediterranean Sea. This work relies upon an extended dataset in two hydrologically different sites in the SEMS deep waters. The presented results are interesting and offers useful background for future investigations of Mediterranean biodiversity and introduction of non-indigeous species as well as in general ecosystem status due to impact of cyclonic and anti-cyclonic eddies on abiotic and biotoic factors. Therefore, this manuscript deserve to be published but the ms needs the following correction before it can be recommended for publication. Detailed comments.

Reply: We would like to thank the reviewer for the hard work invested in reviewing our paper and the overall very positive view on it (manuscript os-2021-124). We have gone over all of the issues raised and revised the manuscript accordingly. These comments provided much assistance with reshaping and clarifying the manuscript. We hereby present point-by-point answers to the issues raised by the reviewers. Our answers are in blue.

Title According to my opinion better option for title is: „Influence of cyclonic and anti-cyclonic eddies on plankton in the southeastern Mediterranean Sea“ by Belkin et al.

Reply: We revised the title as suggested by both reviewers. The title now reads: “*Influence of cyclonic and anti-cyclonic eddies on plankton in the southeastern Mediterranean Sea during late summertime*”.

Remove „PERLE“ from keywords

Reply: The word PERLE was removed as suggested.

Abstract

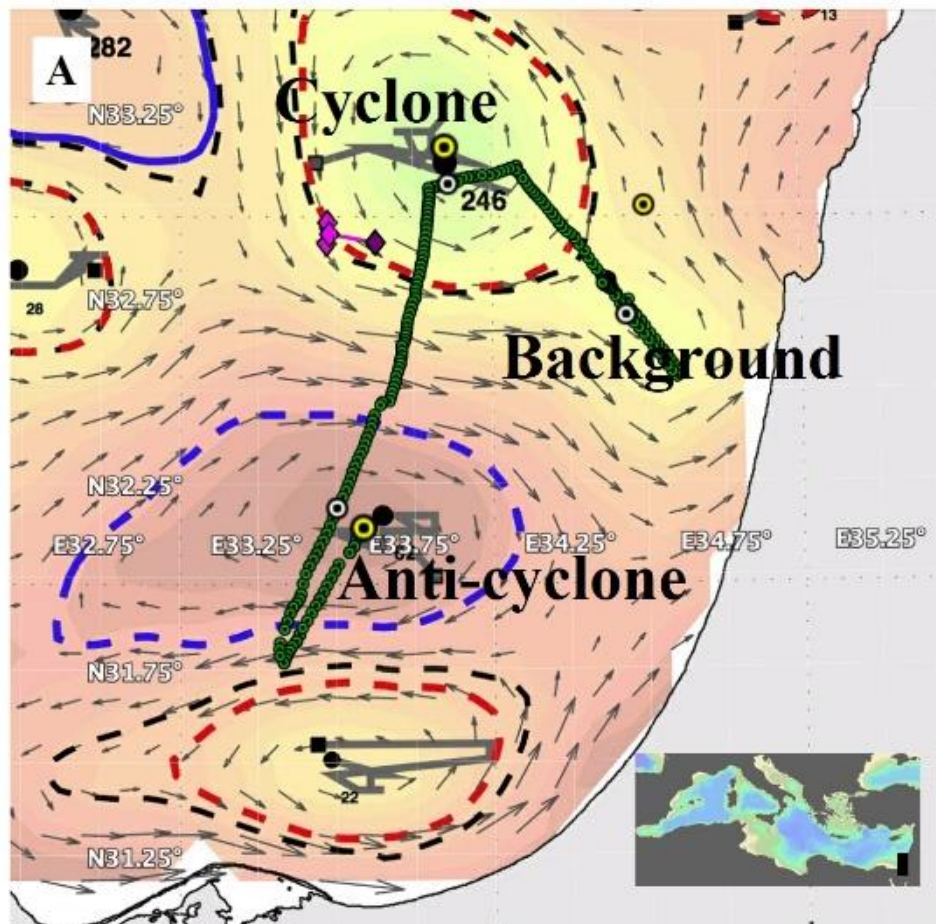
Abstract is too long.

Reply: We have shortened the abstract by ~20%. It is to be noted, that our study is highly multi-disciplinary (as both reviewers mentioned) and includes physical (e.g., CTD, gliders), chemical (nutrients) and biological (biomass, physiology, diversity) information. Therefore, the abstract is indeed a bit long to cover all of these aspects, yet meets the journal's guidelines.

Methods

Please, in Figure 1 present wider area of the east mediterranea (with countries) where study sites are.

Reply: We added a map of the whole Mediterranean Sea as a reference location for the study site. We wish to leave the enlarged map showing the easternmost Mediterranean where our stations were at, as we believe it is clearer to the reader that way.



Line 195 to 198, miss reference.

Reply: Reference added to the list.

The main objection is methodology for zooplankton sampling. Meso-zooplankton were sampled using vertical WP2 hauls ($\varnothing$ -57cm, 50- μ m mesh. This mesh size and diameter are not appropriate for mesozooplankton (not representative), only for microzooplankton (see some zooplankton methodology). In the plankton rich environment (cyclonic) due to clogging of the pore of mesh of this size only a fraction of the water volume will actually have passed through the net. Also, in this circumstances, water goes out of the net and many specimens will not be caught in the sample. In addition, diameter of 50- μ m mesh is too small for catch representative samples of mesozooplankton in plankton poor environment (anticyclonic) because they are rare in the oligotrophic conditions. Finally, samples

collected only from the upper 300 m in anticyclonic eddies could also be wrong because it is possible that due to downward of water organisms are deeper. As we can see from the figure 8., many groups of zooplankton have not been recorded in the AC eddies, like for example chaetognaths, which is not possible (for my opinion). So, please, give some explanation (if you maybe can provide any citation) for this method for mesozooplankton or some kind of calculation (approximation).

Reply: We agree with the reviewer; a 50- μm mesh size is more appropriate for microplankton assessment than mesozooplankton. That being said, the southeastern Mediterranean Sea is an extremely oligotrophic region, with very low zooplankton densities, especially in the large-size fraction (Koppellmann et al., 2009). A similar trend was found in a recent cross-Mediterranean study (Feliú et al., 2020). It was therefore stressed that the standard 200- μm is underestimating the mesozooplankton abundance and community structure in this region. In the manuscript, we have not compared the absolute zooplankton concentrations obtained in our study to studies from other regions, but rather compared the concentrations between our sampling sites (i.e., background vs. cyclone vs. anticyclone). Moreover, we have used vertical hauls, restricting the filtered volumes. Furthermore, the nets collected low biomass (a total of 112-1300 mg C m^{-2} or 303-3045 mg dry weight m^{-2} over the whole column of the upper 300m). This biomass of plankton did not result in net clogging. Indeed, the nets came up relatively "clean", and the samples did include two species of large-sized chaetognaths (*Flaccisagitta enflata* and *Pseudosagitta lyra*).

We added the M&M:

"...The southeastern Mediterranean Sea is an extremely oligotrophic region, with very low zooplankton densities, especially in the large-size fraction (Koppellmann et al., 2009). It was therefore stressed that the standard 200- μm is underestimating the mesozooplankton abundance and community structure in this region (Feliú et al., 2020) and therefore we used the 50- μm mesh-size..." (Lines 108-113).

References In the reference list miss Motoda, 1959.

Reply: Reference added.

Please check references carefully.

Reply: We have gone over the references list again and made sure everything is cited properly.

Discussion From lines 685 to 700 are very similar conclusions like from line 814 till end.

Reply: In lines 685-700 we introduce for the first time the hypothesis on cyclones as refugia for native species and anticyclones as vectors for dispersal of thermophilic Red Sea species, based on temperature anomalies. After providing more evidence based on biodiversity differences between eddies, we conclude (lines 814-end) that this hypothesis is supported by our findings, although further studies are needed to reinforce it.

What means > 100 um samples?

Reply: The obtained net samples were sieved via a 100- μ m sieve and therefore represent >100- μ m size fraction. The information is already presented in the M&M: "...*Ethanol-preserved zooplankton samples were sieved using a 100- μ m Nitex sieve, washed with distilled water to remove ethanol residuals, and homogenized by vigorous vortex and pipetting...*" (L242-245).