EGUsphere, author comment AC1
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Reply on RC1

Miguel M. Lima et al.

Author comment on "Upper-ocean response to the passage of tropical cyclones in the Azores region" by Miguel M. Lima et al., EGUsphere,
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We would like to thank the reviewer for the constructive comments on our study, they were appreciated and will certainly improve the overall quality of this article. Some points of the manuscript have suffered major revisions to answer the criticisms/suggestions made by the reviewers, including:

- Some steps of the methodology have been revised to take into account the characteristics of each Tropical Cyclone (TC), thus, we have considered the climatological situation for each individual storm and compared it to the condition when the TC occurred. This change allowed us to individually study the responses for each TC more accurately while at the same time separating the SST and Chl-a response completely.
- The uncertainty surrounding the interpolated data was addressed in this revision. For this, we incorporated two types of analysis: 1) we showed the approximated errors associated with the analyzed data and for various time periods surrounding TCs; 2) we used the previously shown two study cases (Nadine and Ophelia) as evaluation cases for non-interpolated data. Overall, the interpolated datasets appear to provide consistent data that delivered good results, either not showing a large uncertainty (particularly for SST) and showing good relations to non-interpolated data (particularly for Chl-a).
- Finally, some small but important changes were made in the results section, with the addition of individual 6-hour observation analysis, which corroborated the analysis made in the original manuscript; and in the Nadine (2012) study case, which was not clear enough in the original version.

Overall, we are confident that these changes contributed to clarify some issues not sufficiently clear in the original manuscript. In this regard, the observations made by the reviewers were greatly appreciated and have certainly helped to improve the quality of the revised manuscript.

Answer to major comments:

- Ekman pumping is an important component of the surface mixing as shown in some of the literature we've presented in the manuscript (e.g., Prince, 1981). The Ekman pumping is often computed using satellite (wind and wind stress), however, it can be complicated to study this effect behind TCs using remote sensing data due to large gaps in daily data as a consequence of frequent cloud cover. To partially overcome this

caveat, we have elected to produce an additional analysis included in the Ophelia study case that expands beyond our study region and explores the wind stress data provided by the NOAA CoastWatch dataset. This dataset is derived from wind measurements obtained from the Advanced Scatterometer (ASCAT) instrument onboard EUMETSAT's MetOp satellites (A and B). ASCAT presents a near all-weather capacity (not affected by clouds), as it operates a frequency in C-band (5.255 GHz), therefore, minimizing the number of missing values in predominately clouded areas such as the case of tropical cyclone paths.

- We thank the reviewer for the very relevant point raised here. The CMEMS interpolated datasets used in this work aims to improve the low level of knowledge over those areas with strong cloud cover, however, it is expected that few data available should be affected by the interpolation. The data providers cannot guarantee absolute success in this process although with high reliability (Krasnopolsky et al., 2016 (doi:10.1155/2016/6156513); Maritorena et al., 2010 (doi:10.1016/j.rse.2010.04.002; Saulquin et al., 2019 (doi:10.1080/1755876X.2018.1552358)). CMEMS does not provide information of percent area that is covered by clouds in their data, but instead, they provide approximated information about errors (Chl-a) and uncertainty (SST) associated with the data (computed from the methods presented in Krasnopolsky et al. (2016) and Saulquin et al. (2019)). Therefore, in the revised manuscript we will incorporate this information (Figure R1) in the analysis and take it into account in the discussion of the results.
- We appreciate the reviewer's comments on this matter and agree that the methodology requires further explanation and clarification. At first, the window considered was the same for all TCs, which in retrospect seems to be not the most adequate for this study. The nature of this methodology forced our algorithms to search before the storm for a mean situation and after the storm for a significant response and then produce a mean ideal window to study all considered TCs. Indeed, as it stands it is not flexible enough to accommodate for differences among these many different storms, with diverse translation speeds and sizes, as pointed out by the reviewer. We have considered to implement a major change in the methodology that is capable of better representing such differences between TCs. Thus, some steps in the methodology have changed to better account the individual characteristics of each TC. In particular, we have considered the climatological situation of that storm's time period and compared it to the observed situation when the TC occurred in the region. This new approach allows the study of different time periods where SST and Chl-a responses differ, as well as different impacts depending on the TC's characteristics.
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It is true that the difference in location was not taken into consideration, and we want to thank the reviewer for this important point. In fact, as discussed in the introduction, there is a noticeable meridional gradient of each variable in this region (warmer SSTs in the south and more biological activity in the north), this matter was further explored and will be taken into consideration in the revised manuscript. The novel methodology, as described in detail when answering the 3rd and 5th major comments, allows to take this latitudinal dependence into account. Thus, we have now analyzed the response in each observation respective to the latitude and longitude of each observation (see fig. R2). Results were only significant (at the 95% statistical level) for the Chl-a respective to the latitude. However, the relation is minimal ($r = 0.135$), and since the other responses were not significant, we decided not to include these results in the main manuscript, but to mention them since they are relevant.

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We agree with the reviewer that the properties of TCs change a great deal during their lifetimes such as seen in the Hurricane Ophelia study case. In this regard, we will have

an additional change to the revised methodology, where it will be divided in full TC and individual 6-hour observations. These two approaches differ in the way they are processed since the full TC eliminates any superposition of pixels (such as seen in the Nadine study case) and allows us to analyze the area after the complete passage of the cyclone over the region; for the second, we will not have this possibility and the superposition needs to be accounted on the discussion, however, this allows the study of the responses based on the observations' characteristics (intensity, translation speed, etc.). Concluding, this change will impact the results since the revised figures will include individual observation (see fig. R3).

Answer to other points:

- It is related to the much lower cyclonic activity observed in our study region in relation to that observed in the rest of the north Atlantic basin, in which it is inserted.

- We agree with the reviewer, and we will make an effort to reduce some of these sentences in the revised methodology.

- Not entirely sure we understood this point, it is however worth saying that figure 7 (in the original manuscript) has suffered some changes to help clarify our results, as per other reviewers' suggestions (see fig. R4).

Figure labels (figures included as supplement):

Figure R1 (New Fig. S2) - Value of associated uncertainty for Chl-a (top row) and SST (bottom row) for three critical moments of this analysis (before, during, and after TCs) and a random sample from the dataset. Do note the larger scale of uncertainty for chl-a.

Figure R2 - Relation of Chl-a (top row) and SST (bottom row) induced anomalies with latitude (left) and longitude (right). The dashed line indicates non-significance at a 95% confidence level.

Figure R3 (New Fig. 5) - Same as previous fig. 5 (original manuscript) but taking into account individual 6-hour TC observations. An additional revision made was to incorporate the response with respect to the time in the season (c) & f)).

Figure R4 (New fig. 8) - Revised Nadine study case. Scatter plots (b) and (c) show the avg. induced response for each subregion (based on super-position of pixels) inside the affected area in (a).

Please also note the supplement to this comment:
https://egusphere.copernicus.org/preprints/2022/egusphere-2022-31/egusphere-2022-31-AC1-supplement.zip