



EGUsphere, author comment AC3
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Reply on RC3

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., EGU sphere,
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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:

- We acknowledge some of the caveats by using this interpolated dataset and the necessity to address this more carefully. The data we used was a blended product that, even though originating from several microwave sensors, will still have a large amount of error in relation to clear skies observations. Although we did not take this into account in the original version of the manuscript, we are to incorporating a

performance assessment of this data in the revised version in two ways: 1) we intend to show that the approximated error associated with the data provided by CMEMS, as they do not provide any other measure of cloud cover or missing data, and, this approach aims to evaluate the overall quality of the analyzed data in respect to the equivalent non-TC area errors (see fig. R1); 2) we will use both case studies as evaluation cases for un-blended (i.e., non-interpolated) data and compare them to the original blended SST and Chl-a data from CMEMS (see fig. R2). Ideally, the second approach should be applied to all TCs, however, satellite products usually do not have such a long available time period without gaps (either due to cloud coverage, satellite blind spots, or satellite down-time), making a general study complex and requiring several different datasets to cover the entire region for over 20 years. Therefore, the datasets presented in the original manuscript were particularly relevant in this broad context. Nonetheless, we are confident that the addition of results based on the non-interpolated data will only benefit the original analysis.

- We agree with the reviewers' observations that there is a need to clarify how these anomalies are computed. There are indeed two types of anomalies that aim to account for two very different situations: 1) The first type is presented in the methodology section and corresponds to "classic anomalies" obtained when daily absolute values (of both SST and Chl-a) are compared to the corresponding daily climatological values for the region (Fig. 3, original manuscript); these were used to eliminate the seasonal trend in our data. 2) The second type of anomalies, shown in the results section, corresponds to "anomalies induced by the TCs", originating from the difference between the mean situation before the TC and the situation after (Fig. 2, original manuscript), only based on absolute values prior and after the passage of each TC, i.e., without using the climatological reference. Upon this and other reviewers' suggestions, the revised version of the manuscript has suffered a significant improvement on several methodological steps, including the time considered before and after the passage of TCs. In the revised approach we are only using the observed values to compute everything that is needed (search and results), i.e., no "classical anomalies" are considered. This new approach considers the climatological situation of that storm's time period and compares it to the observed situation when the TC occurred in the region, in the form of excess standard deviation and then evaluates the maximum differences before and after the storm. A practical example for Hurricane Nadine is shown for Chl-a (Figure R3).
- We agree with the reviewer that the study case of Hurricane Nadine was not entirely convincing. We tried using essentially the same approach to the analysis of both case studies and presenting them as such, in retrospect this proved not to be so successful for the Nadine study case and the revised manuscript does have these observations into account (see Figure R4).

Answer to suggestions:

- Changed accordingly.
- Since thermodynamic exchanges played a major role in the beginning of the storm, we presumed that dynamic mixing should affect more the later stages. However, without clear data to support the statement we are downgrading it in the revised manuscript.
- Changed accordingly.
- Changed accordingly (original suggestion is in l. 41-42).
- Yes, and this is brought in Chacko (2019), we did not include this fact to keep the paragraph concise, although the revised manuscript will include this and a better link between this paragraph and our own study region.
- Answered in detail before (please see answer to major comment 1).
- Changed accordingly. At the time of writing the 2021 data was not yet available.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.

- Agree. We aim to reduce the first two paragraphs of the methodology section, also following similar suggestions of other reviewers.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- In this instance we were referring to classical anomalies, computed from climatological values. Full answer in major comment 2.
- Changed accordingly.
- Changed accordingly.
- In this case, it would be the newly computed induced anomalies, as they were a result of the subtraction of the daily values with the average mean before the storm. Nonetheless, this section will be changed significantly in the revised manuscript namely to accommodate the novel methodology described above when answering the major questions raised by the reviewer.
- Changed accordingly. Figure not mentioned here.
- Changed accordingly. Figure not mentioned here.
- Changed accordingly.
- Changed accordingly.
- Yes.
- The extra periods were relative to other time periods identified by the algorithm, and were different for SST and Chl-a, while the main ones coincided in time.
- Estimated with the climatological values. However, in the revised manuscript these anomalies will be disregarded.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- We meant that the range of induced anomalies was larger. However, we realized afterwards that this statement is not correct and, therefore, will be rectified in the revised version based on new results.
- It does not affect the analysis of the histogram in any way. It is just a justification for the blue and orange histograms inside each subplot (that are analyzing the same number of cyclones) not presenting the same area under the curve.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- We agree, as this information is in retrospect, redundant, it will be removed.
- Changed accordingly.
- We agree with the reviewer and this issue will be one of the major points addressed in the revision in the manuscript.
- Indeed, we thank the reviewer for the correction.
- We did not test for significance in either of the study cases. However, this section of the manuscript has suffered a major revision and these questions will be taken into consideration for clarity.
- We did not consider Nadine's intensity to be so relevant for this study case since the TC was not very intense and did not change too much during its lifetime in the study region. As mentioned in the previous point, this section is revised, and these points have been taken into consideration for clarity.
- We agree, and one of our aims for the revision is to make these results clearer.
- We agree with the observation (Please see answer to Major comment 1).

- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- Changed accordingly.
- The two first effects were verified in our database, and the third we did not look into since post-tropical transition might occur immediately outside the study region or the best-track data does not include the observations after the tropical nature of the cyclone ceases. Nonetheless, these remarks (l. 297-300) pertained to the bibliography and not to our results.
- Agree.
- We agree, we detailed our new approach to this problem in the detailed comments.

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 (New fig. 6) - Histograms for the situation before (black) and after (grey) for each of the study cases. Top row shows the CMEMS interpolated data and the bottom row the correspondent non-interpolated data.

Figure R3 (Supplement only, not included in the main manuscript) - Daily excess standard deviation over the climatological value of Chl-a for the area affected by Hurricane Nadine (2012).

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-AC3-supplement.zip>