

**Object:** Referee report for Ocean Science Copernicus publications

**Paper:** Response of the sea surface temperature to heatwaves during the France 2022 meteorological summer

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#### General comments

The authors present a study of SST response to anomalously warm meteorological summer of 2022 in France. In particular, the SST response study is performed in three regions, the English Channel, the Bay of Biscay and the North Western Mediterranean Sea, by analysing NRT SST data compared to historical climatology based on L4 ESA CCI SST product. Also, they analyse additional essential variables to complete the whole area overview during summer 2022, by considering Surface solar radiation, windspeed and cloud cover.

The topic addressed is of importance and interest, given the known urgency to understand marine extreme events, to deepen the comprehension of atmosphere and ocean interactions during such events, together with the fact that summer 2022 has been showing record-breaking temperatures both on land and on sea, and is just at present starting to get back to climatological values.

In my opinion the work presented does have interesting outcomes and comments, being also one of the first works which addresses the extreme event of summer 2022, but at the present version lacks in defining clearly its main objective, also presenting results in such a way which makes it difficult to follow smoothly. I should suggest a major revision prior to publication, finding that improvements in presentation have to be considered to make the manuscript more robust, hence more impactful. I hereafter give major comments, followed by line-by-line suggestions to ease revision.

- You talk about summer 2022 heat wave, some times as a whole event, some other times as several separated events with specific dates, and some other times as separate events for each month of June, July and August. I would suggest that you try clarifying how you separate or put together the anomalous event. This would be very useful for the reader's overall understanding.
- The overall objective of your work is not completely clear: Are you willing to demonstrate the need of an operational NRT SST product, or are you mainly interested in investigating the role of ocean response to atmospheric extreme event? This is not clear since your presentation seems to address a bit of both but not really focusing on one or the other.
- Some of the numeric results presented need to be additionally explained or properly references to Figures and Tables to aid readability and understanding (see line by line comments)
- A long part of Discussion and Conclusion section is more properly read as introductory. I suggest to carefully revise this section.
- English must be carefully revised, for typos and full sentences meaning. I report some corrections in line by line comments, but they are not exhaustive.

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#### Line by line comments

##### Abstract

(1-3) These initial sentences should be more precise. From the beginning of which measurements? The Seasonal average of 22.7°C is intended as surface air temperature, or what? Multiple record-breaking heat waves over which period?

(9-10) I would not introduce the core of your study saying that “the contribution of other atmospheric variables is not negligible”. This sounds like an a-priori consideration. I believe, instead, that the choices of variables to investigate have a clear motivation and should be better introduced and made more attractive in the Abstract.

### Introduction

(Figures 1 & 2) The images should be larger, could aid having titles referring to the months. How did you compute the 1991-2020 climatology to which you define anomalies? Since the main rationale of your work is exactly the anomaly in surface air temperature, consider if to switch order of Figures 1 & 2, or if to add a single Figure before these showing the mean spatial anomaly over whole summer, or if a time series.

### Study sites

(25-32) You longly talk about OHC and the reader it brought to think he/she will see some analysis on OHC, which instead is not present. I suggest you shorten OHC description, or you add an analysis of the field in summer 2022

(45-48) As presented this part sounds as if you are describing already some results, because you go specific on dates and causality of events with no reference. I suggest you keep introduction to be more descriptive, eventually recalling in results more specific relations of causation

(64) Since you introduce the SST acronym at line 37, you should not repeat sea surface temperature as a long name after that (it happens in several other points in the manuscript)

(Figure 3) [not necessary, but suggested] I find that putting a single Figure only to show the regions studied is a quite unhappy choice. To economise I should suggest to plot a field of interest for the presentation (e.g. average SST anomaly, at your preference) and overplot the chosen basins. Also, I wouldn't talk about a subdivision since you are not considering the whole European Mediterranean subdivided in regions, instead you are choosing specific areas of interest.

### Data/Methods

Change title in “Data and Methods”

(75) I believe that your Appendix B could be very much interesting to be included in motivation of taking the atmospheric variables that you analyse. I believe that introducing the upper-ocean energy balance by reporting solely Equation B1 is quite abrupt. Instead discussing more about it here or in introduction section would give a more robust background to your study choices. It is important at this level to know which atmospheric variables have been used throughout your work.

(76-78) not very interesting nor informative. Also, here you state that you use monthly data to compute the 1991-2020 climatology, then at (112) you say you use daily averages for climatology for the period 1982-2011. You should be clearer and consistent in the presentation.

(subsection 3.2.1) This section is very detailed. If the purpose of your work is to demonstrate the ability of NRT SST to capture response giving all this information could be justified. At the present version of the manuscript it sounds too detailed.

(subsection 3.2.2) it is misleading to entitle the section “SST analysis”, as this sounds like you will give some results of your analysis already. You should opt for entitling it as “ESA CCI SST product” or “Satellite derived SST”. Indeed, you have section 3.2.3 devoted to describe climatology computation, here you should introduce the product only

(122) replace “calculating” with “calculated”. Replace “long-term value one” with “long-term one”

## Results

(125) remove “use by the”

(125-128) This description is badly written. You talk about ideal case without saying what this means (that is complete data coverage). Please revise accordingly. Also, what do you mean with the basins missing data in percentage? Over the whole period considered? Please specify.

(136) take off “that affected these basins”. Summer 2022 anomalies have not interested only your chosen basins.

(Figure 4) Revise date labels regarding August and make them consistent with the others (08-10 instead of 08-09 and so on). Put titles regarding the basins on each panel. Could be informative to report the percentage of missing data somewhere in panels.

(140) Revise how you write dates. For example, “between the 6th of July and...” should be “between July 6<sup>th</sup>...”, similarly onwards.

(144) where are these anomalies shown?

(147) where is this given? Not evident to reader. Need to properly refer to figures.

(152) you report that temperatures are constantly above climatology by referring to Table, where only average values are given. State better

(Table 4 & Table A1). Table 4 does not exist, but only Table 1. I believe that confusion is made while describing content of tables. In text you say that Table 4 refers to July 31<sup>st</sup> -August 13<sup>th</sup> event, but caption of Table in text says differently. Revise accordingly. Consider to put them both in main text, to aid comparison and enable following values reported in text better.

(158) where do you show the trend?? You are showing average values in Figure 5.

(Figures 5 & 6) It could be useful to recall the regions selected overplotted on fields shown. Also, consider in showing only one of the two periods to not sound repetitive.

(165-171) where are these results shown in figures? Are you talking about Figure 6 23<sup>rd</sup> – 30<sup>th</sup> July event or August event? It is not easy to follow as a reader.

(Section 4.3) in my opinion contains very interesting comments. Consider to enlarge this description, deepening further the phenomenon and recalling it clearly in conclusive remarks.

(174) typo: \*persistence

(179) specify that the anomaly you are talking about is of cloud cover

## Discussion/Conclusions

Change title in “Discussion and Conclusion”

(198) typo: \*studies

(202) limited? I think you meant the opposite

(204-206) What do you mean in terms of comparing other related studies to yours? It is not clear.

(200-206 & 213-244) The majority of concepts reported here sound more introductory than conclusive comments. I suggest to deeply revise Introduction & Discussions and Conclusion sections wisely.

(246) Not clear what you mean when you say “to prevent the detection of anomalously warm SST”