

Earth Syst. Sci. Data Discuss., referee comment RC2  
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## Comment on **essd-2022-343**

Peter Minnett (Referee)

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Referee comment on "Southern Europe and western Asian marine heatwaves (SEWA-MHWs): a dataset based on macroevents" by Giulia Bonino et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-343-RC2>, 2022

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The paper reports good work to define marine heatwaves (MHWs) relative to a changing background field of increasing temperatures caused by global warming. The analyses reveal patterns of MHWs in the study area that have distinct, repeatable characteristics. Some of the MHWs are described and discussed, at least to some degree. The product of the analyses is available as a database.

The analysis is sound, and the results appear to be credible. The authors are to be commended for a good piece of work and an interesting paper. The paper is generally well written but would benefit from a few major improvements and many minor ones, given below.

It's as useful for authors to remember the purpose of writing a paper is to convey information and knowledge to their readership. This requires helping the readers to understand the intentions of the authors, and this is not well served by putting up obstacles. It would help here if the figures were positioned close to where they are introduced and discussed in the text. It is tedious and soon becomes irritating to have to scroll forward through several pages to find the figures being discussed, examine them, and then try to find where one left off reading. I found the inclusion of URLs in the text, even though they are in parentheses, to be very disruptive. Would it be better to have the URLs as footnotes? Specialized terms must be well defined and there are several here that are used without an explanation of their meaning. The general quality of the figures is high except for some miniscule, illegible labels, for example in Figure 7. So, help your readers rather than hinder them.

### Major comments

The paper would benefit from the addition of a new figure showing the study area with the

latitudes and longitudes of the boundaries of the region clearly given. The areas referred to in the text should be clearly identified as not all readers will be familiar with the names of the internal seas of the study area.

A fuller discussion of the CCI SST data that are the input to these analyses is needed. In particular, what are the limitations implicit the CCI SST time series that might result from the availability of L2 data, especially in the early period of the analyses? Which satellites contributed measurements to the time series? How was diurnal heating treated in the generation of the CCI SST fields? And is this a weakness in the SEWA-MHW database given the results of Marullo et al., (2016), who showed neglecting diurnal heating in the Mediterranean Sea has significant consequences? How does the inevitable loss of spatial resolution in going from L2 to L4 in the generation of the CCI SST fields, including filling the gaps in the coverage cause by clouds, influence the contents of your database?

A flow diagram of the data processing to generate the SEWA-MHW would be very useful to the reader, especially if it clearly explains the specific terms, such as "macroevents", "labels", and "clusters", used in the text.

The choice of critical parameters for the generation of your database is quite well justified in the text, but is there a way of ensuring they are optimized to produce correct outcomes? For example, in Figure 5, can you be confident that the green area in the southern Adriatic Sea in the 19/10/1983 chart is distinct from the larger, adjacent lilac area in the Ionian Sea? Similarly, is the red area close to the Turkish coast in the Aegean Sea, that also occurs in the chart of a week later, also distinct? And what about the lilac area near Cyprus that persists over four weeks – is this really part of the larger lilac area that has several disconnected parts? The identification of these is presumably a direct consequence of the algorithms and parameters you selected, but I suspect the algorithms do not consider the physics that cause the MHWs. I appreciate this is not an easy issue to address, but I am sure I will not be alone in wondering whether the extensive lilac areas represent a single macroevent, even though it is fractured, and whether it is different from the green and red areas.

The fact that 4 of the 6 clusters in Figure 8 are close to coasts or in enclosed seas begs the question whether there is a connection to land heat waves. The paper would be strengthened by a discussion of whether or not there is some correspondence to heat waves on the adjacent land.

Finally, I think a good opportunity has been lost by not including relevant meteorological parameters. These could have been taken from ERA5 (Hersbach, H., et al., 2020). These variables would have made the SEWA-MHW database much more attractive to potential users.

References:

Hersbach, H., et al. (2020). The ERA5 global reanalysis. *Quarterly Journal of the Royal Meteorological Society*. 10.1002/qj.3803

Marullo, S., et al. (2016). The diurnal cycle of sea-surface temperature and estimation of the heat budget of the Mediterranean Sea. *Journal of Geophysical Research: Oceans* 121. 10.1002/2016jc012192

### **Minor comments.**

Many of the points I identify below are simply the result of carelessness, and would have been readily identified by a spell checker and a grammar checker in a word processing package such as Microsoft Word. I cannot guarantee I have identified all the errors so please run your revised paper through a spell and grammar checker. Other errors, such as citing non-existent figures and the mistake in the date in the caption of Figure 5, would not be caught, so a careful, critical reading of the manuscript is still needed.

Pay attention to how you write "sea" with or without a capital S. When you refer to the name of a particular sea, it is a proper noun and therefore Sea is capitalized. Your choice of Sea or sea appears to be arbitrary.

Some of my comments are intended to improve the language, but if you disagree with them you need not make these changes.

Line 3: macro is a prefix and therefore macroevents is one word. Elsewhere you hyphenate it; the hyphen should be removed. When it is capitalized, only the M should be a capital letter.

Line 11: reconsider the use of the word "pixel". In most remote sensing papers and discussions pixel is the highest resolution measurement and is the native resolution of the radiometer that has taken the measurement. This is the sense in which Merchant et al. (2019) use the term pixel in their paper describing the production of the CCI SST. I suggest you follow their example, and for the data from the CCI SST that you use, refer to it as a grid point or a grid cell and not a pixel.

Line 16: rephrase "from the open ocean to coastal regions" as this implies that the MHWs somehow propagate or migrate from the open ocean into coastal regions.

Line 18: replace "is completely" with "may be completely".

Line 33: "global scale" should be "global scales".

Line 58: "in literature" should be "in the literature".

Line 126: "In location" should be "with location".

Line 129: there is no Figure 1c, top panel.

Line 136: "continuous events" should be "single continuous event".

Line 142: what are the indices that you refer to as start index, end index and index peak? I presume they are related to position of a data point in the time series at a given place. However, while that may make the analysis more straightforward it does not really convey any scientifically useful information to the reader. Perhaps "date" or "day of year" would be better, as that would tell the reader what you are storing.

Line 150: the Strait of Gibraltar is not in your study area. Do you mean the Alboran Sea?

Caption to Figure 1b: the Hobday line is blue not black.

It is quite difficult to discern the differences between STL and Hobday in Figure 1b. It would be useful to have a third panel showing a time series of the differences.

Line 155: replace "over the studied basins" with "in the study area".

Line 157: where does 4 km come from? As you stated earlier, the CCI SST field has a spatial resolution of 0.05 degrees in latitude and longitude; this is about 5.5 by 4.5 km in your study area. The 0.05 degree is the same resolution as OSTIA, and Donlon et al. refer to it as a ~6 km grid spacing. Is it really a pixel-based data set?

Section 3.2 title: what is a "macro event"? Please define this early in this section.

Line 158: please explain "binary map". Is it yes or no for a marine heat wave? Correct 4 km. Do you really mean global ocean?

Caption of Figure 2c: what is a "trend cycle"?

Caption of Figure 3a: "number of events" is not very clear. Do you mean the average number of annual events?

Line 166: please explain "structure element matrix". Is "inspected" the word you really want? The remainder of this paragraph is far from clear, and it should be rewritten.

Line 171: "an unique" should be "a unique".

Caption of Figure 4: "category" should be capitalized for each panel as you have done in the titles above each panel.

Line 172: rather than "filtering out" would "removing" be better? Why is km in italics?  $64 \text{ km}^2$  is based on a  $4 \times 4 \text{ km}$  pixel and that is not the case. Here and elsewhere, there should be a space between a number and its units.

Line 176: I suggest changing October,5th to 5th of October. Also, October 19th on the next line.

Line 177: Looking at the figure, I am not sure that the heat wave "almost occupies all of the eastern Mediterranean Sea". If this were the case, there would be very little white in the area. I suggest you use "extending over much of the eastern Mediterranean Sea".

Line 185: "well know" should be "well known".

Line 190: here and for the other phases, I suggest you remove ": it" so that it reads "Phase 1 lasted from..."

Line 191: there is no Figure 3c.

Figure 5: the color bars at the right-hand side convey no useful information and should be removed.

Caption of Figure 5: is it really 2021?

Line 192: I suggest you change "middle July" to either "the middle of July" or "mid-July". Also, elsewhere in this list.

You might consider putting the information in this numbered list in a simple table as that would be more digestible for the reader.

Line 202: replace "by NOAA-AVHRR" with "derived from NOAA-AVHRR measurements". Insert a space before Marullo.

Line 203: why is sea surface temperature written in full when you have already used the abbreviation SST in multiple places in this paper?

Figure 6b: what does "event map" mean?

Caption for Figure 6a: what does "active points" mean?

Line 218: remove the second "we".

Line 220: would "differences" be better than "dissimilarities"?

Line 223: km<sup>2</sup> squared should have superscript 2. Replace "around" with "about".

Line 225: "others" should be "other".

Line 231: please give a short description of cosine distance as some of your readers will not be familiar with this term.

Line 240: the segment beginning "Moreover" is not very clear and a better discussion is needed, including what we are supposed to understand from the colored shapes in Figure 7b.

As mentioned above in this review, the labels on this plot are much, much too small.

Caption of Figure 7: silhouette and agglomerative should not have capital letters for Figure 7a just as they do not have for Figure 7b. Spaces are needed either side of the =.

Line 245: remove s from MHWs and from events. Do not capitalize Macroevents.

Line 247: A space is needed before intensity.

Line 251: cluster 2 should be capitalized as it is a proper noun. Check elsewhere.

Line 252: why do you mention the Aegean Sea as an exception to the western Mediterranean Sea? I do not think the Aegean Sea is part of the western Mediterranean Sea.

Line 254: remove Island after Cyprus.

Caption of Figure 8: remove "obtained" from in front of clusters. Replace "which belong to" with "of".

Line 265: I think the summer season could just be summer.

Line 266: similarly, the winter season might just as well be winter. I think "counts" would be better replaced with "produced".

Line 267: insert "incomplete" after "last" and remove the s from decades. Remove "with respect to the past". Replace "is instead" by "this is". Replace "in" with "by".

Line 271: you have not discussed the efficiency of the computer code to derive these results, so I suggest you replace "efficient" with "effective".

Line 272: should the Black Sea also be mentioned given its appearance in Cluster 5?

The sentence beginning "The macro events" is not clear.

Line 276: insert "by" before "analyzing".

Line 277: use SST instead of sea surface temperature.

Line 278: again, I query 4x4 kilometers.

Line 279: insert "points" after "grid"?

Line 289: again, replace "efficient" with "effective".

Line 292: remove "in literature".

Line 300: replace "up to reach a" with "to provide".

References. Please capitalize all journal titles including those on lines 340, 363, 375, 381, 383, and 398. There may be others. The reference beginning on line 395 is incomplete.