

Review of “Baltic Sea Surface Temperature Analysis 2022: A Study of Marine Heatwaves and Overall High Seasonal Temperatures” by Lindenthal et al. for the 8th edition of the Copernicus Marine Service Ocean State Report (OSR 8)

- **SUMMARY**

The present work conducts an analysis of the Marine Heatwaves (MHWs) detected in the Baltic Sea during the year 2022. To achieve this, the authors utilize various observational and modeling databases. The paper discusses the obtained results, focusing on the analysis of parameters characterizing the variability of MHWs throughout the year (intensity, frequency, and duration). The study describes the magnitude of MHWs in the Baltic environment and draws other interesting conclusions, such as the emergence of positive trends and the relationship between the vertical propagation of MHWs and the development of cold intermediate layers.

Hence, the preprint holds scientific value and falls within the scope of the Ocean State Report. However, some aspects requiring improvement have been identified for manuscript publication. These changes do not alter the substance of the work, allowing its publication with the implementation of minor revisions. Below is a list of the main reasons supporting this recommendation.

As a scientific reviewer, I am compelled to ensure the scientific quality of the contribution. Thus, despite being aware of the space limitations imposed on OSR submissions, some of the recommendations provided may conflict with these constraints. I leave it to the editor's discretion to decide on the implementation of such changes.

- **GENERAL COMMENTS**

The paper employs a considerable amount of geographical terminology (Bothnian Sea, Bothnian Bay, Baltic Proper, Gulf of Finland and Gulf of Riga). The use of this terminology is enriching and aids in the writing process; however, it should be noted that potential readers may not be familiar with Baltic geography. Therefore, I believe that the inclusion of an initial figure (map) displaying relevant data from the study area would be highly beneficial. This map could encompass the following information: Delimitation of the geographical zones used in the article, the location of observational stations (the markers in Figure 2 are hardly visible), bathymetry, etc.

In the Introduction, I miss a clear statement of the objectives and motivation of this work.

One of the weakest points of the paper is related to the model validation (Section 2.4). While the validation exercise is appropriate, it is done inadequately in the paper. Additionally, the graphs used make it difficult to observe the drawn conclusions (see technical corrections). If the aim is to validate the model results regarding the detection of MHWs, I suggest that what should be validated is the model's estimation of the various parameters characterizing MHWs (i.e., the number of events, maximum intensity, cumulative intensity, and MHW days). This comparison can be easily conducted from the data already calculated in Figure 4 and presented to the reader using scatter plots and linear regressions.

The analysis of the vertical structure of MHWs is of great interest and scientific relevance. While I understand the space constraints inherent in contributions to OSR, I would encourage the authors to try to delve deeper into this analysis, as I believe it would enhance the scientific value of the contribution.

- **SPECIFIC COMMENTS**

L 10→ The temperature anomalies are an intrinsic part of MHWs; I understand what the author means but “thermal anomalies” per se, are not a PREcondition for MHWs, actually they are a condition.

L 35→ “In our BSH data”: Reword the sentence avoiding familiarity with the data used.

L 41-49→ As is the case with the other databases, this paragraph does not explain the purpose of reanalysis data in this work.

L 52→ “The BACC Author Team (2008)”: The word “The” is a definite article that, as far as I understand, does not take part in the name of the group. Thus, in the sentence, it must appear in lowercase, and the bibliographic reference must be “BACC Author Team” ordered under the letter ‘B’.

L 80-81→ “rather continuously from 1989 until the present”: Have MHWs been computed from incomplete datasets in this work? If so, discuss the implications.

L 90→ “1 nm”: In scientific publications, units are expressed in accordance with the International System of Units (SI) or by using derived units as products of powers of these. Consequently, “1 nm” corresponds to one nanometre. I suggest expressing the spatial resolution in kilometres.

L 93→ Section 2.4 employs the detection of MHWs, which is explained later in Section 2.5. Therefore, the description of methods for detecting MHWs must precede the model validation.

L 103-104→ “In general though ... station and model data”: I think this is not well appreciated in the displayed figure. However, it would be interesting if, given that this is a study of MHWs, a direct comparison of the parameters that typically characterize MHWs is made: Number of events, duration, intensity, etc (see General Comments).

L 105-114→ Is it not possible to make a similar analysis for the deeper levels than the one performed in surface?

L 116→ MHWs were previously defined.

L 118-120→ Despite of both packages produce identical results; it is worth mentioning why the effort of using different packages. Is it because of the computational efficiency of Matlab package? If so, why not use Matlab package also for observational data?

L 126-129→ In the work, the methodology for computing MHWs is applied not only to product ref. no. 3 but also to product ref. no. 2 (Figure 1 and 4). Therefore, both products deserve the same treatment here. If there were differences between the climatologies used for both products, Section 2.4 must include a discussion of how these differences can affect the validation.

L 144→ SST anomaly rank is not a clear statistic. Please clarify.

L 154→ See L 10.

L 165→ “While the duration of Regions”: It is not clear what region you refer.

L 175→ “total five”: According to Fi. 4b there were four.

L 178-179 → “This trend of ... is taken into account”: This discussion is confusing. Why it is necessary to include extra data to detect trends? I would include the full observational record in left panels of Figure 4 avoiding this discussion.

L 195 → “no temperature measurements exist in lower layers”: As far as I see, this is the first time the reader knows this lack of data in the text. This must be stated much earlier, in sections 2.2 and 2.4.

L 221-226 → The information related to Holbrook et al. 2019 must be moved to Introduction.

L 232 → According to what I know, an exceedance of 9°C could be one of the highest intensities observed of a MHW in the world. It might be interesting to look for some bibliographic reference to provide some context of this huge magnitude.