

Review of the manuscript sp-2025-6 “Establishing a Monitoring Approach for Marine Heatwaves in the Black and Mediterranean Seas” by Lima et al.
(December 2025)

This manuscript provides a comprehensive description and analysis of MHWs from surface to 40m depth in the Mediterranean and Black Seas. MHWs propagate in depth making the development and implementation of the proposed indicators relevant. While MHWs in the Mediterranean have been studied in the last years, results in the Black Sea are novel.

The manuscript is very well-written. The study and results are relevant for the scientific community, as well as for society given the needs of adaptation to face the multiple climate-change impacts. However, some information is missing and clarifications are needed. I would recommend the publication of the manuscript after revisions, in particular, clarifications and justifications required for methodology. Please, find the comments below.

General scope

- **Novelty of the study.** The authors should better highlight the novelty for the Mediterranean Sea. Indeed, SST and OHC within 0-40m have been already addressed in Dayan et al., 2023. In addition, recent studies have analysed subsurface MHWs in the Mediterranean (Juza et al., 2022; Dayan et al., 2023; Martinez et al., 2023; Pirro et al., 2024) addressing deeper layers for some of them. Maybe, the use of multiple products could be better highlighted as novelty. Finally, comparisons or similarities between the two basins could be addressed in terms of drivers, mechanisms, impacts if relevant.
- **MHW in subsurface.** The authors could better highlight the importance of monitoring subsurface MHW. Developing such related indicators are essential to face socio-economic and environmental challenges in the context of accelerated climate change.

Methodology

- **Indicators.** The authors propose OHC within the upper layer 0-40m. They should explain why in the introduction (not in the last sentence of the manuscript). Why this layer, specifically? Why OHC rather than temperature at 40m? Why not deeper? What about OHC within the mixed layer? I would need some justifications in the introduction and in the discussion. Given the seasonal variability of the mixed layer and stratification, would seasonal metrics be relevant? Could the authors provide seasonal indicators and have (at least) a discussion about this aspect?
- **Climatology.** Explanations about the reference period 1993-2022 for climatology are needed. It seems to me that the last recommendation at

international and OSR levels is the use of the longest period available. Do not the datasets start earlier than 1993? In any case, please, justify your choice.

- **Metrics.** MHW mean and maximum intensities are more usually provided above the mean climatology rather than above the threshold. It would facilitate the intercomparisons with others studies. Concerning the spread, could you better explain this metric in the methodology?
- **Model validation.** Providing percentages of error would facilitate the quantification in model assessment. Also, could you explain why you process model assessment. To justify their use in OHC-MHW metrics and/or in uncertainties?

Results and discussion

- **Key findings.** The subsections are a bit long. It would be strongly appreciated to add concise outcomes/conclusions at the end of each of them.
- **Gulf of Lion.** It is a place of deep convection (sometimes bottom sea convection), so it would be an interesting region to add in section 3.3.2.
- **Methodology sensitivity.** It could be discussed (choice of the climatology, datasets, seasonal vs annual metrics etc).
- **Conclusions.** Environmental and socio-economic impacts of the main findings are missing. Also, based on the results, some recommendations in terms of observing systems would be really appreciated. It is essential to improve our knowledge and forecasting systems in order to better support the adaptation of our societies.

Figures

- **Figure 1.** I would replace “Number” by “Frequency”, and “Intensity” by “Maximum intensity”. Units should be in the legend or subtitles of the figure.
- **Figures 4 and 5.** These figures have a very low quality. They should be improved.

Suggestions for additional references (subsurface MHWs)

- Zhang, Y., Du, Y., Feng, M., & Hobday, A. J. (2023). Vertical structures of marine heatwaves. *Nat. Commun*, 14(1), 6483. doi: 10.1038/s41467-023-42219
- Juza, M., Fernández-Mora, À., & Tintoré, J. (2022). Sub-Regional Marine Heat Waves in the Mediterranean Sea From Observations: Long-Term Surface Changes, Sub-Surface and Coastal Responses. *Front. Mar. Sci.*, 9, 785771. doi:10.3389/fmars.2022.785771
- Pirro, A., Martellucci, R., Gallo, A., Kubin, E., Mauri, E., Juza, M., et al. (2024). Subsurface warming derived from Argo floats during the 2022 Mediterranean marine heat wave. of the Copernicus Ocean State Report (OSR8), edited by: von Schuckmann, K., Moreira, L., Grégoire, M., Marcos, M., Staneva, J., Brasseur, P., Garric, G., Lionello, P., Karstensen, J., and Neukermans, G., Copernicus Publications, State Planet. doi:10.5194/sp-4-osr8-18-2024