Recommendation: Reconsider after major revisions

Scope of this review: one major concern (attribution/causality) and a few minor comments focused on clarity, methodological transparency, and consistency of interpretation.

Response: First, we sincerely thank the reviewer for their valuable time and effort in reviewing our manuscript. The comments and suggestions provided are very helpful and have significantly improved the quality of the manuscript. The response to the reviewer's comments is shown in blue.

Summary

The manuscript assembles multiple observational and reanalysis products to describe Medicane Daniel and its co-occurrence with a warm-core eddy (WCE) and a moderate marine heatwave (MHW). The analysis is potentially useful as a case study, but the current framing advances causal interpretations that are not yet supported by discriminating evidence. The revision should primarily address whether upper-ocean anomalies played a determining role in the intensification, or whether the results support a more limited conclusion of oceanic modulation under favorable atmospheric forcing.

Major comments:

Attribution of intensification to the WCE/MHW is not yet demonstrated "Along the path of …..making Daniel a deadly storm"

The results demonstrate spatial and temporal co-occurrence of (i) elevated upper-ocean thermal indicators (SST anomaly, OHC) and (ii) the period of storm intensification. However, the manuscript does not establish that the intensification point was exceptional relative to other environments sampled along the storm track.

I suggest, For each 6-hr track point, compute SST anomaly, OHC anomaly, surface enthalpy anomaly and then show a percentile rank of the intensification point. Right now we only see aboslute values not relative rarity.

Response: We sincerely thank the reviewer for this insightful suggestion. To address this, we have now extended our analysis by computing the SST and OHC anomaly at each 6-hourly track position, with particular emphasis on the maximum cyclone intensity (Max-CI) Location. We modified Figure 1 (Given below as Figure R1), in which we have added daily high-pass (500 km filtered to highlight mesoscale features) SST and OHC anomalies and along-track evolution during medicane Daniel (8-10 September 2023) using a 2-degree search radius using the Cressman technique (roughly representing the medicane core). This approach allows us to quantify the relative extremity of oceanic conditions encountered during intensification.

The results show that the intensification point coincides with high values of SST and

OHC anomalies, indicating that the medicane Daniel intensified over thermodynamically favorable conditions that were among the most anomalous along its tracks. This strengthens the interpretation that the co-occurrence is not merely coincidental but reflects an alignment between intensification and increased availability of oceanic heat content. We believe this addition significantly improves the robustness of the analysis.

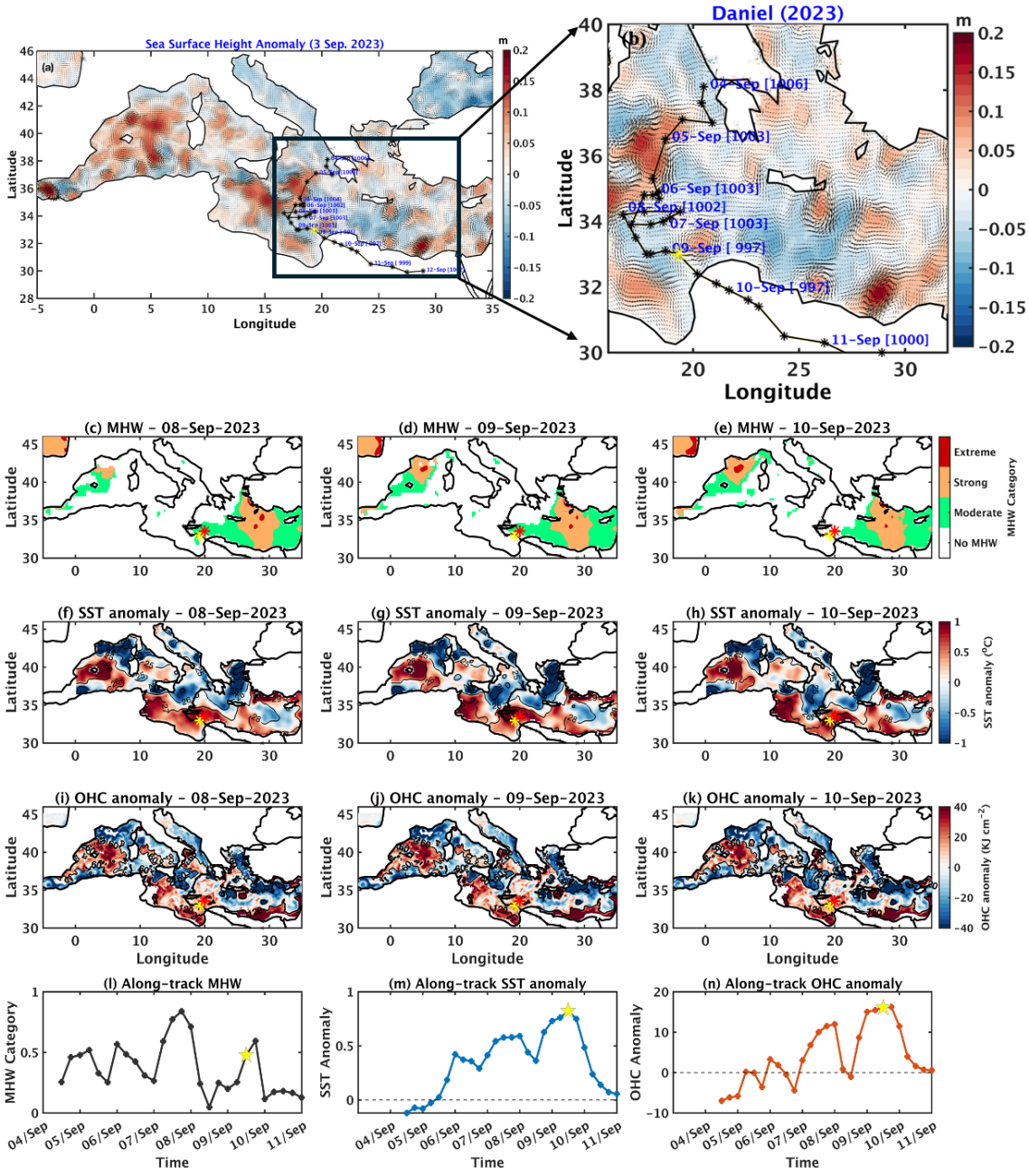

Figure R1: (a, b) Sea level anomaly (shading) with geostrophic currents (arrows). The medicane track is overlaid on (c-e) marine heatwave (MHW) and (f-h) sea surface

temperature (SST) anomalies (500 km radius high-pass filter), and on (i-k) ocean heat content (OHC) anomalies (500 km radius high-pass filter). In panels f-k, absolute values are indicated by contours. Panels (l-n) show along-track values of MHW, SST, and OHC anomalies. The yellow stars (pentagons) in panels a-k (l-n) mark the location of maximum cyclone intensity (Max-CI), while the red pentagons mark the Max-CI location defined by the minimum mean sea-level pressure. The red star marker in panels l-n indicates the position of the warm-core eddy. Dates for each panel are shown along the track.

Minor comments:

Page 1, lines 27–28:
Keywords include "deadliest Medicane," which is subjective and non-scientific in tone. Consider removing or rephrasing to a neutral descriptor.
Response: Thank you for this helpful suggestion. We modified it as 'Medicane Daniel'.

Page 1, lines 31–32 (Key Points):
The statement implies a causal enhancement of precipitation by WCE/OHC/MHW that is not demonstrated by the analysis. This is an interpretation issue and should be softened to reflect co-occurrence or possible modulation.

Response: Thank you for this important comment. We agree that the original phrasing may imply a direct causal relationship, which is not fully demonstrated by the present analysis. Our results show that the presence of WCE, MHW, and high OHC coincide with the intensification phase of Cyclone Daniel (as shown in Figure 1) and with enhanced precipitation (Figure 2).

Page 2, lines ~45–50:
"Warm Core Eddy" and "warm-core eddy" are used inconsistently; please standardize capitalization and hyphenation throughout.
Response: Thank you, we made it consistent throughout the manuscript.

Page 2, lines ~52–55:
"Marine Heat Wave" and "Marine Heatwave" are used interchangeably; please adopt a single convention (e.g., *marine heatwave* following Hobday et al.).
Response: Thank you for your suggestion. We made it consistent throughout the manuscript.

Page 2, line ~60:
Abbreviation "CCE" appears before being formally defined in the text.
Response: Thank you. CCE referred to a cold-core eddy. We have mentioned it in the text as well.

Page 3, lines ~95–100:
The term "air–sea interaction" is used broadly; consider clarifying whether this refers specifically to surface heat fluxes, momentum fluxes, or upper-ocean thermodynamic response.
Response: Thank you for this helpful suggestion. In the revised manuscript, we have specified that it refers to key processes including surface heat fluxes, momentum fluxes, and upper-ocean thermodynamic responses that influence cyclone development and intensification. We modified it as 'To improve the prediction of Mediterranean cyclones and mitigate associated risks, a deeper understanding of air-sea interaction processes, specifically surface heat fluxes, momentum fluxes, and upper-ocean thermodynamic responses, and the role of pre-existing oceanic conditions in cyclone genesis and intensification is essential.'

Page 4, lines ~135–140:
The description of SWOT capabilities could be clarified to distinguish improved spatial resolution of SSHA from direct observation of air–sea coupling processes.
Response: Thank you. We added a new paragraph as 'Unlike traditional altimeters, SWOT's wide-swath coverage enables improved detection of mesoscale and sub-mesoscale eddies, frontal gradients, and filaments that regulate ocean heat distribution and air-sea exchanges. These features are often underrepresented in low-resolution datasets, limiting their ability to capture localized processes such as eddy-cyclone interactions and cyclone-induced mixing. By resolving these fine-scale physical structures, SWOT also provides a framework for interpreting biogeochemical responses. While coarse datasets show bulk chlorophyll changes, SWOT helps identify localized regions of enhanced mixing and upwelling that drive nutrient supply and biological variability. This allows for a clearer linkage between physical forcing and biogeochemical response. Overall, SWOT overcomes key limitations of conventional altimetry by preserving high-frequency spatial gradients, enabling a more accurate representation of the ocean state during extreme events such as Medicane Daniel.'

Page 6, lines ~248–249:

The definition of MHW intensity categories introduces the symbol \theta without explicitly defining it at first use.
Response: Thank you for pointing this out. We have now defined the θ in the revised manuscript at its first occurrence, along with the corresponding equation, to improve clarity.

We modified the entire section as "MHW intensity was classified following Hobday et al. (2018) into four categories based on the metric θ, where θ represents the normalized SST anomaly relative to the climatological threshold. It is defined as:

$$\theta = \frac{SST - SST_{climatology}}{SST_{90Th_{percentile}} - SST_{climatology}} \quad \text{.....(5)}$$

Where SST is the daily sea surface temperature, $SST_{climatology}$ is the climatological mean SST, and $SST_{90Th_{percentile}}$ is the seasonally varying 90th percentile threshold.

Based on this metric, MHW intensity is categorized as follows: moderate ($1 \leq \theta \leq 2$), strong ($2 \leq \theta \leq 3$), severe ($3 \leq \theta \leq 4$), and extreme ($\theta \geq 4$)."

Page 7, line ~262:
Temperature is referred to without clearly stating whether it is expressed in °C or K in the context of energy calculations.
Response: It is mentioned that the temperature is in °C. For the computation of TCHP only, we converted it to Kelvin.

Page 8, Figure 5 caption:
The caption includes interpretive language (e.g., "indicates," "confirms") that would be better placed in the main text; captions should focus on describing what is shown.
Response: We revised the caption to focus on a clear and objective description of the figure content.

Page 8, Figure 5 panels (h–k):
Green and purple arrows are not clearly identified as schematic; this should be explicitly stated in the caption to avoid implying direct diagnostics.
Response: According to your suggestion, we have mentioned it in the figure caption.

Page 9, lines ~436–440:
The interpretation of subsurface "secondary circulation" below ~200 m is speculative; language such as "may indicate" is appropriate but should be consistently maintained throughout the paragraph.
Response: Thank you for pointing this out. We have made it consistent throughout the paragraph.

Page 9, line ~441:
"DCM" is used without being defined at first appearance.
Response: Thank you for pointing this out. Here, DCM refers to the Deep Chlorophyll Maximum, and we have mentioned it in the revised manuscript.

Page 10, lines ~512–514:
The phrase "determine the intensity and destructiveness of these storms" overstates the conclusions; consider revising to reflect combined influence or modulation.
Response: Thank you for this important suggestion. We have revised the text to: "The findings suggest that, similar to tropical cyclones in other ocean basins, medicanes may be significantly influenced by the interplay of oceanic heat content, eddies, and atmospheric dynamics. These factors could be responsible for the intensification of the cyclone and the destruction caused by the medicane."

Line 395-396:

Clarify the Ekman pumping formulation and separate it from storm-driven turbulent mixing; provide sufficient methodological detail to reproduce the Ekman pumping estimate: input wind product, curl computation method (grid/metrics/smoothing), the source of relative vorticity (if used), and sign conventions. Also, be mindful of the 2nd and subsequent key points in page 1 and 2.

Response: We already mentioned the formulation in Section 3.2.3; the sign convention is also stated in the methodology. According to your suggestion, we substantially improved the section as 'Ekman pumping was computed using the wind stress components $\tau=(\tau_x, \tau_y)$ from ERA5, namely Eastward Wind Stress (EWSS) and Northward Wind Stress (NSSS), which is available for 0.25° × 0.25° and hourly/daily temporal resolution. To compute the wind stress curl ……
introduced by Stern (1965) to account for the effect of the ocean currents on upwelling, is calculated using equation 8'

Throughout the manuscript:
Some colorbars in multi-panel figures use small font sizes and inconsistent unit formatting (e.g., mg m^{-3}); please standardize for readability.

Response: Thank you for pointing this out. We have increased and standardized the font size in the figures to improve readability. We hope the revised figures are now clearer, consistent, and easier to read.s