Response to reviewer #2

I am truly grateful for the contribution of Reviewer #2 to enhancing the quality of the article. The comments are addressed in detail below (responses marked with "**R:**").

- **General comments**

First, is that the author should better present, from the beginning, the methodology used (the Pseudo-Global Warming approach) together with the limitations of this approach. The description in the Methods section is rather succinct, and the presentation of what the limitations of this approach could be comes rather late in my opinion (it is mentioned in the introduction but the implications are not clear).

R: I appreciate the reviewer's suggestion regarding the presentation of the Pseudo-Global Warming (PGW) methodology and its limitations. The initial intent was to discuss the limitations of the PGW approach after presenting the MHW results, so as to directly link the findings with the underlying assumptions and constraints of the methodology. However, following the reviewer's recommendation, I will include a dedicated subsection (i.e., 2.2 Pseudo-Global Warming (PGW) methodology) in the Methodology section that clearly presents the PGW approach and outlines its main limitations. This restructuring will allow for a clearer and earlier understanding of the methodological framework, while maintaining the connection between the results and their implications through targeted references in the results section.

"2.2 Pseudo-Global Warming (PGW) methodology

As described and illustrated in Denamiel et al. (2025) and Figure 1, for the RCP 8.5 simulation, the Pseudo-Global Warming (PGW) approach (Schär et al., 1996; Denamiel et al., 2020a) is used to adjust the historical forcing dataset by incorporating climatological changes from the LMDZ4-NEMOMED8 RCSM (Hourdin et al., 2006; Beuvier et al., 2010). Specifically, atmospheric variables such as air temperature, relative humidity, and wind components from ERA-Interim are modified using differences between the 2070–2100 and 1987–2017 periods under RCP 8.5 (ΔT, ΔRH, ΔU, ΔV, respectively). These changes generate 6-hourly three-dimensional atmospheric forcing for all 366 days of the year, which are then applied to the WRF 15-km model in the PGW simulation. Similarly, oceanic variables, including temperature, salinity, and currents, are adjusted using the climatological differences to produce daily three-dimensional oceanic forcing for ROMS 3-km (ΔT ocean, ΔS ocean, ΔU ocean, ΔV ocean, respectively). This process ensures that each simulated year inherits the synoptic conditions of the historical reanalysis while embedding the projected climatological shifts.

However, the pseudo-global warming (PGW) approach has several limitations, including simplified atmosphere-ocean dynamics, the assumption of stationarity, perturbations in initial and boundary conditions, resolution constraints, and neglected feedback mechanisms.
The PGW method used in the AdriSC climate model to predict marine heatwaves (MHWs) in the Adriatic Sea incorporates both thermodynamic changes—such as temperature, salinity, and humidity—and dynamic adjustments (i.e., wind and ocean currents). Consequently, the

inaccuracies in representing circulation patterns critical for heatwave development, as highlighted by Xue et al. (2023), are somewhat mitigated. However, the PGW approach assumes that the relationship between large-scale climate drivers and regional weather patterns remains constant over time (i.e., the same climatological changes are applied every year; Brogli et al., 2023). This assumption can lead to potential misrepresentations of future MHW characteristics. As Xue et al. (2023) point out, the effectiveness of the PGW method also depends on how perturbations (i.e., climatological changes) are applied to initial and boundary conditions. Inconsistent or inappropriate perturbations can result in significant variations in simulated outcomes, affecting the reliability of heatwave projections. Additionally, Heim et al. (2023) note that PGW is constrained by the resolution of the driving data and the capabilities of the regional model, which can impact the accurate representation of localized heatwave events. In this study, the initial and boundary conditions are derived from a coupled atmosphere-ocean Med-CORDEX regional climate model with a resolution of approximately 15 km, which is likely sufficient to capture the main dynamical properties of the Mediterranean Sea. However, the very short spin-up period (two months) for the AdriSC RCP 8.5 simulation is likely to influence the results, particularly in the first two to three years of the simulation.
Finally, by focusing on imposed large-scale changes, the PGW approach may overlook regional feedback processes, such as land-atmosphere interactions, which can influence heatwave intensity and frequency (Heim et al., 2023). A key limitation of the AdriSC climate model is that it employs a one-way coupling between the atmosphere and the ocean—i.e., the sea surface temperature from the ocean model is not fed back into the atmospheric model."

My second comment is that there should be also a description of the differences between the historical and RCP8.5 runs, in terms of extrema, variability, intensity and trends. Without this we cannot put in context the differences observed between both runs presented in the paper.

R: Thank you for this constructive suggestion. The differences between the historical and RCP 8.5 simulations in terms of sea surface temperature extrema, variability, intensity, and trends have been thoroughly analyzed in previous studies (Tojčić et al., 2023, 2024). However, I understand the importance of summarizing these key aspects directly within the current manuscript to provide a more complete context for the comparison of marine heatwave characteristics.

To address this, a dedicated paragraph in Section 2 will be added to summarize the main findings from Tojčić et al. (2023, 2024), and a new figure (Fig. 3) will be included to illustrate the trends and variance of sea surface temperature across the Adriatic Sea for both the historical and RCP 8.5 simulations, as follows:

"For the AdriSC historical and RCP 8.5 simulations, Tojčić et al. (2023, 2024) conducted a comprehensive analysis of sea surface temperature trends, variance, and extremes, showing that all identified trends are statistically significant. Notably, as illustrated in Figure 3, the rate of surface ocean warming is 40 % higher during the historical period than under the far-future RCP 8.5 scenario. Nonetheless, Tojčić et al. (2024) demonstrated that in the far-future period, the Adriatic Sea is projected to experience at least 20 additional days of extreme heat per month compared to historical conditions. This increase is primarily driven by surface temperature anomalies (i.e., differences between RCP 8.5 and historical conditions) exceeding 3 °C, especially

in coastal regions. Regarding sea surface temperature variance (Fig. 3b, d), an average increase of 15 % is observed across the entire Adriatic Sea, with localized increases of up to 25 % along the south-eastern coastal regions. These changes further highlight the relevance of the methodology adopted to extract and analyse MHWs. For the comparison between historical and RCP 8.5 conditions, the consistent climatological baseline enables the accurate identification of MHWs, while the additive adjustment applied to the RCP 8.5 scenario helps isolate the heatwave signal from background warming. For the analysis of the influence of ocean dynamics on MHWs, the removal of the large sea surface temperature trends is necessary to properly characterise the link between dynamical features and extreme events.''

The following figure (now Figure 3) will also be added:

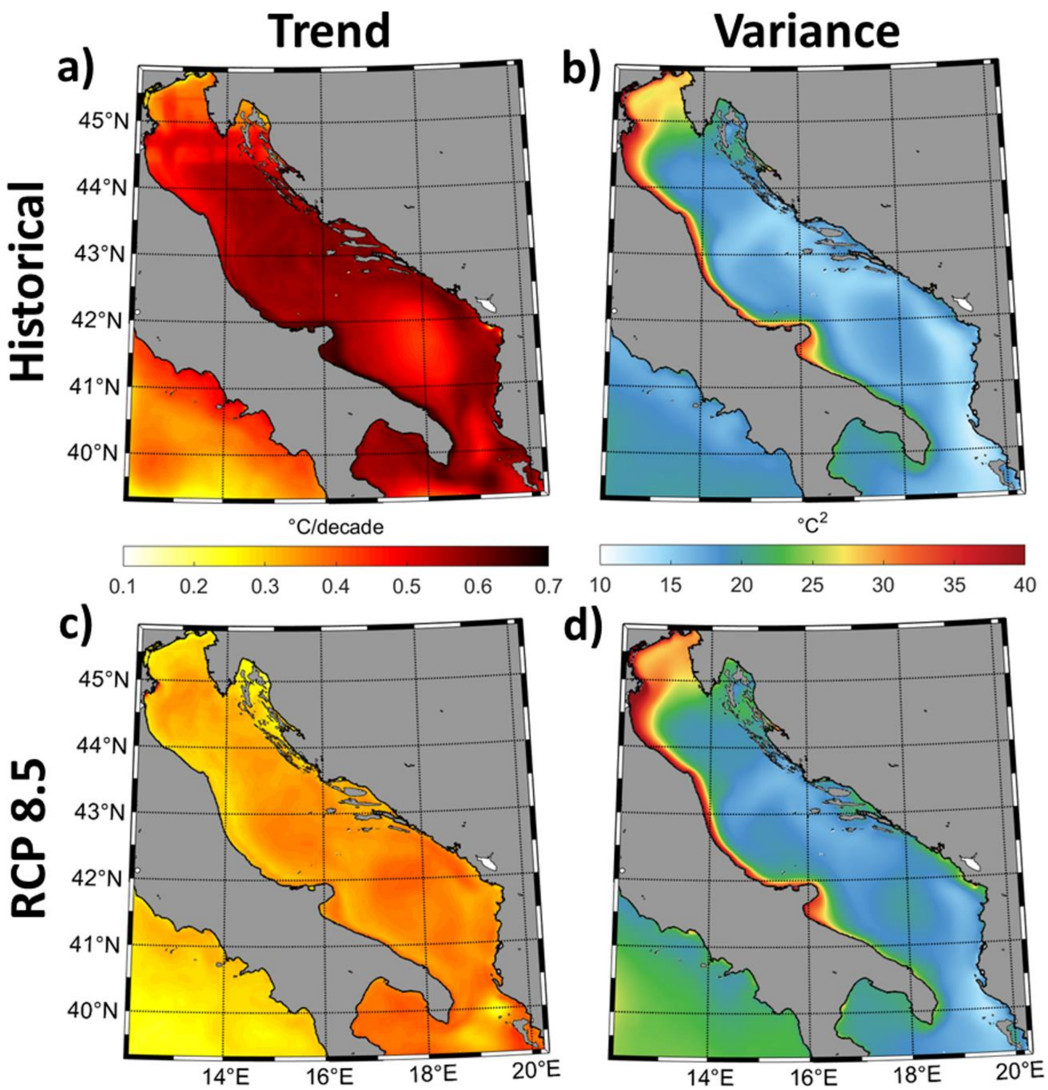

Figure 3. Trend (a, c) and variance (b, d) for the sea-surface temperature over the Adriatic basin derived for the historical (a, b) and RCP 8.5 (c, d) 31-year long periods.

- **Specific comments**

Figure 1. I'd limit the bathymetry colorbar to the depths found in the Adriatic. As it is now, we can clearly see Thyrrhenian bathymetry which is irrelevant, and the Adriatic is rather homogeneous

R: Figure 1 will be updated as follows:

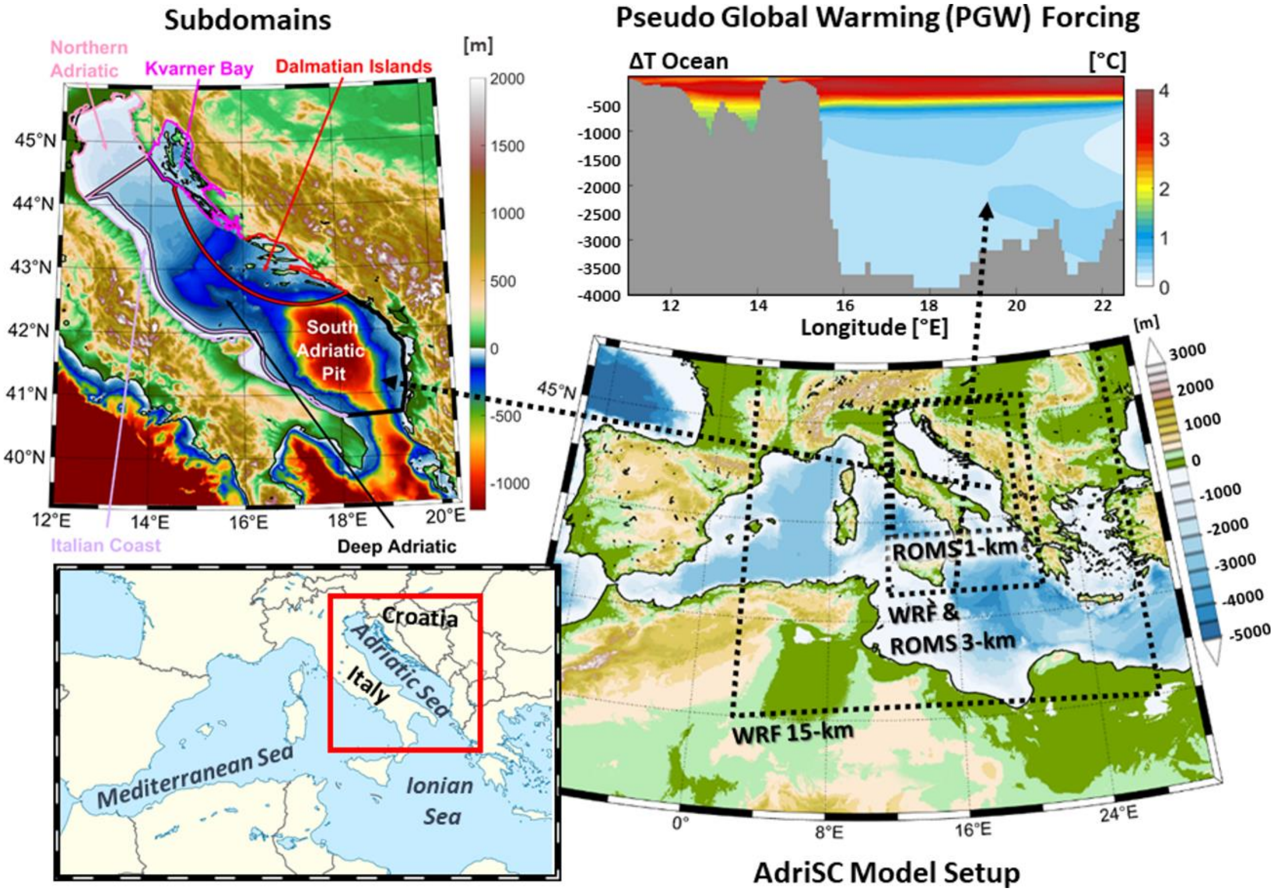

Figure 1. Spatial coverage and horizontal resolution of the different grids used in the AdriSC climate model Setup including the topo-bathymetry of the AdriSC 1-km model with the locations of the 5 subdomains (coloured polygons) used in this study and the Pseudo-Global Warming temperature ocean forcing imposed in the AdriSC 3-km model southern boundary for the extreme warming simulation.

Line 125-129. I find it confusing what it is mentioned about the shifting of the RCP8.5 results: is this only for visualisation purposes? Why is this done?

R: Thank you for your comment and the opportunity to clarify. The shifting of RCP 8.5 Marine Heatwave (MHW) intensities by the difference between RCP 8.5 and historical daily mean climatologies is not merely for visualization purposes, but rather a methodological choice commonly used in MHW studies to enable meaningful comparisons across climatological baselines (e.g., Deser et al., 2024).

Without this adjustment, MHW intensities under RCP 8.5 would reflect both the change in baseline temperature and the actual heatwave anomaly, making it difficult to disentangle the effects of background warming from the characteristics of the heatwaves themselves. By applying the shift, the MHW signal relative to its future mean state is isolated, which allows a more direct comparison with historical MHWs.

This approach will be better explained in the manuscript (Section 2) and illustrated with a new figure 2.

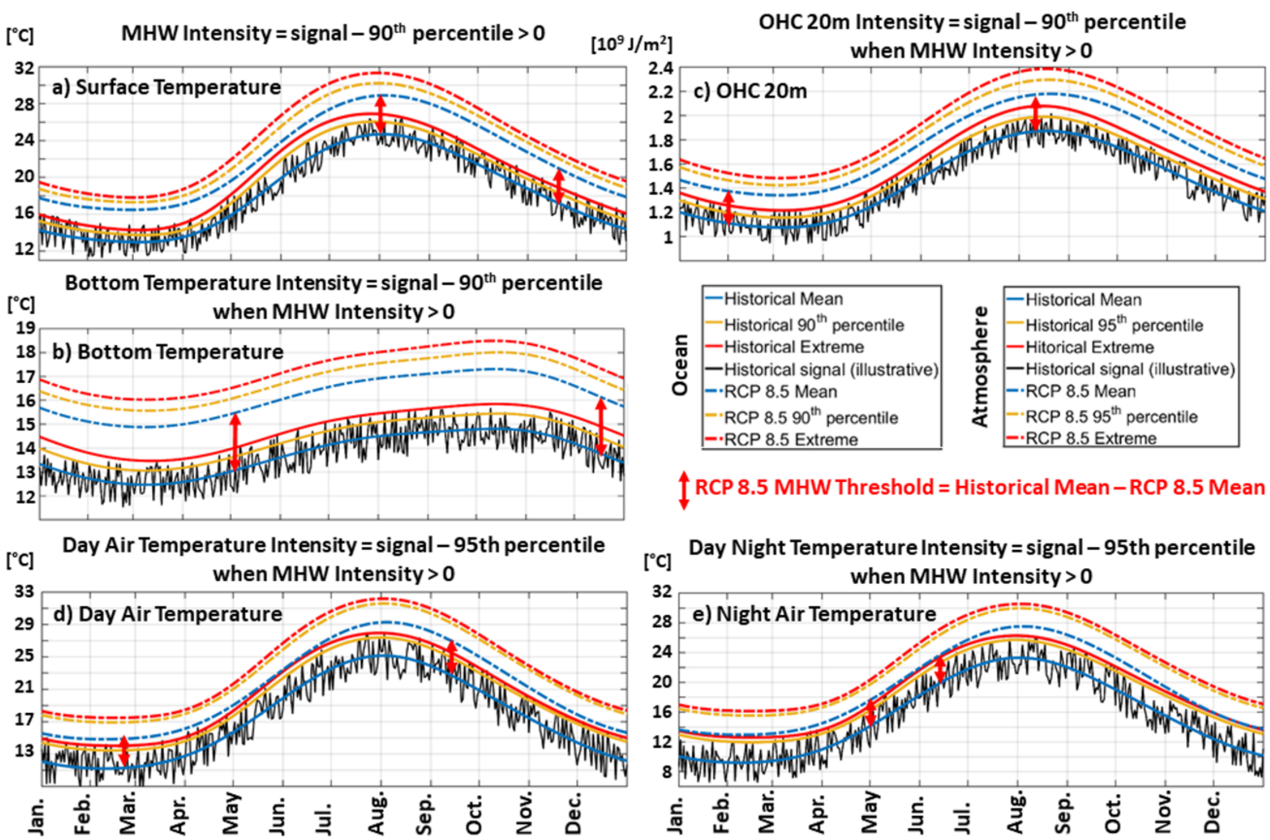

Figure 2. Illustration of the methodology used to extract the daily intensities of the sea-surface temperature (a), sea-bottom temperature (b), Ocean Heat Content (OHC) at 20 m (c), day air temperature (d) and night air temperature (e) during the Marine Heat Waves (MHW) extracted from both the Historical and RCP 8.5 runs.

The following explanation will be added to the text:

"However, to simplify the comparison with the historical results, all the RCP 8.5 intensities presented in this article (except if mentioned explicitly) are shifted by ΔT_{clim}*, the difference between the RCP 8.5 and historical daily mean climatologies (hereafter RCP 8.5 MHW Threshold, as illustrated in Figure 2). This methodological adjustment is widely adopted in marine heatwave (MHW) research to enable meaningful intercomparisons across different climatological baselines (e.g., Deser et al., 2024). The rationale behind this approach is to separate the influence of background warming from the intrinsic properties of MHWs. Without such an adjustment, the intensities under RCP 8.5 would reflect both the elevated baseline temperatures and the heatwave*

anomalies, making it difficult to isolate the climate change signal. By applying a shift equal to the difference between the historical and RCP 8.5 mean climatologies, the analysis focuses on the MHWs relative to their respective mean states, thereby allowing a clearer and more direct comparison of their characteristics across time periods. Additionally, although the RCP 8.5 MHW threshold exhibits pronounced seasonal variability, as shown in Figure 2, it remains effectively constant when considering annual distributions and can therefore be approximated by its 31-year average for year-round analyses."

Line 147: "All the intensities": which intensities

R: To enhance the clarity, the paragraph will be rewritten as follows:

"All the other intensities (as illustrated in Figure 2) are calculated by removing the daily historical 90th percentile for the ocean bottom temperatures as well as the OHCs and the daily historical 95th percentile (i.e., threshold generally used to detect daily atmospheric heatwaves; European State of the Climate, 2023) for the air temperatures during night and day from these results and averaging them over the duration the MHW."

Line 165: "deepest part": I'd suggest to add some bathymetry contours to Fig 2

R: *"deepest part"* will be replaced by *"The Deep Adriatic subdomain (Fig. 1)"* as the area where the highest number of MHW events occur does in fact cover this subdomain.

Line 168: central eastern Adriatic: maybe refer to the pre-defined regions?

R: Excellent point. The text will be modified as follows:

"with the highest and lowest values located within the Dalmatian Islands and Northern Adriatic subdomains, respectively."

Figure 3. Add (left) and (right) to the description of panel (e) in the caption. The colors used in panels (a) and (b) are rather random. I would suggest to use shades of the same colours for each decade (e.g. shades of blue for the first decade, shades of orange for second decade and shades of purple for the last one. I would avoid red and green on the same figure). What are the dotted lines in panel (e)? (one is straight and the other seems to follow the histograms). The colours of the histograms represent the same thing as the numbers on the x-axis? and what about the height of the histograms? Because I do not understand why the yellow histograms for the monthly panel are higher than the RCP8.5 histograms but are still yellow.

R: The comments of the reviewer are addressed point by point below with the new figures:

Left and right will be added to the description while the colormap will be changed following the suggestion of the reviewer in both figures 2 & 3 (original draft) that will be figures 4 & 5 in the new version of the article in order to preserve the consistency on the way to present the results.

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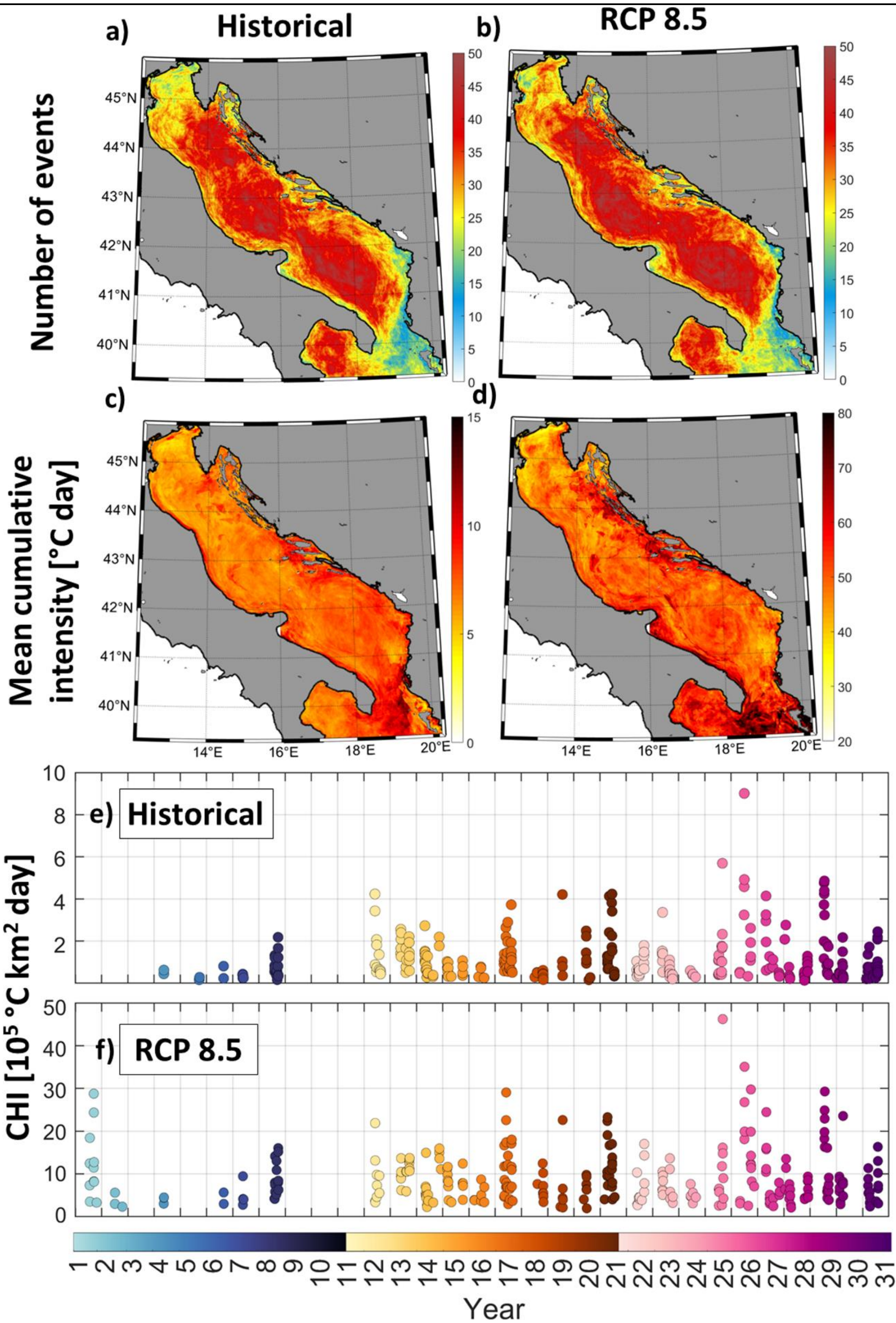

Figure 4. Spatial distributions of the total number of marine heatwave (MHW) events (a, b) and their associated mean cumulative intensity (c, d) across the Adriatic Sea for the historical period (a, c) and the RCP 8.5 scenario (b, d). Panels e and f show the Time series of Cumulative Heat Intensity (CHI) over the 31-year historical and RCP 8.5 periods (e, f).

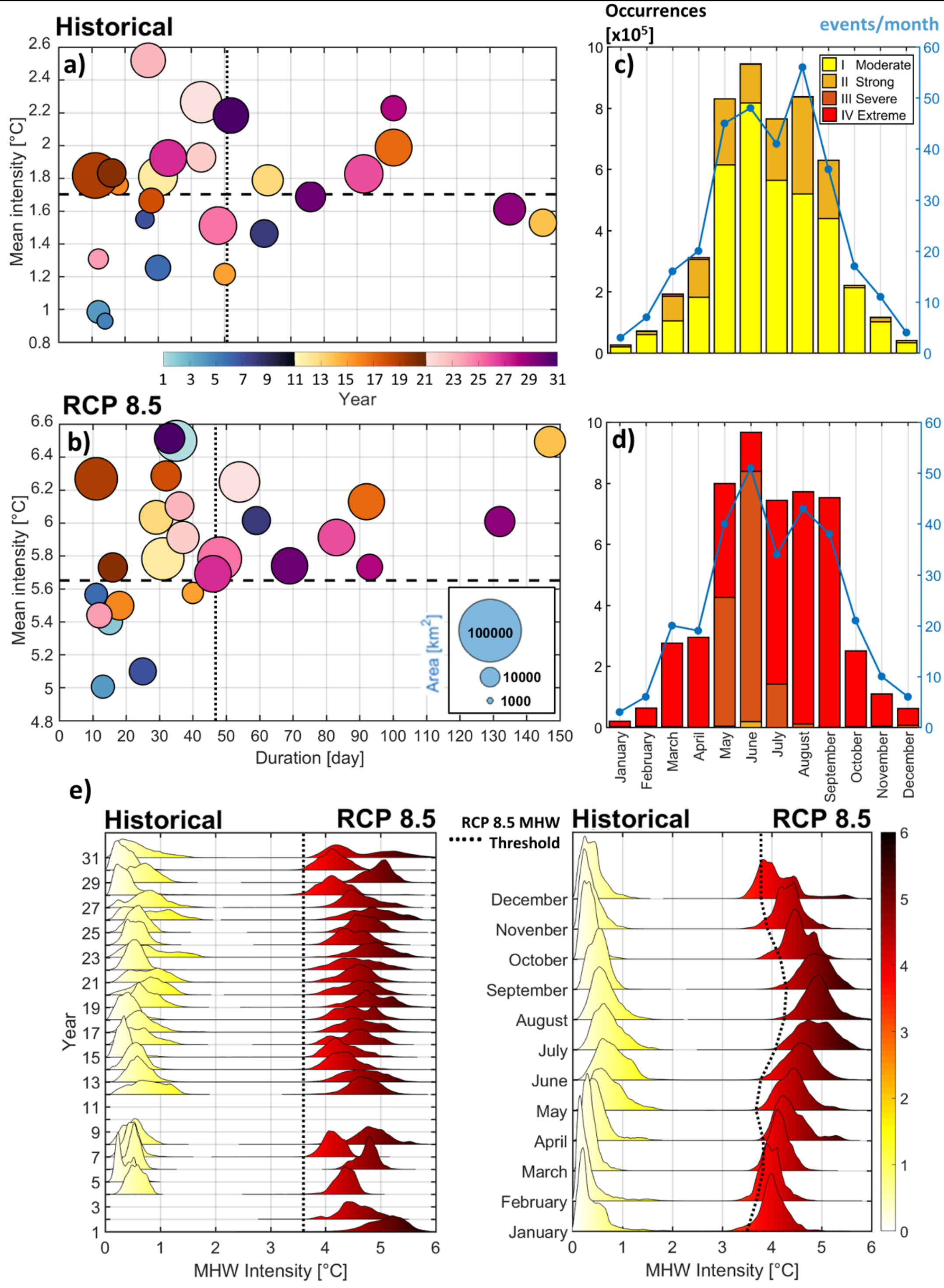

Figure 5. Scatter plots of the yearly maximum value of the MHW mean intensity versus the maximum yearly value of the duration of the MHW with the size of the circles depending on the maximum yearly value of the area covered by the MHW during the historical (a) and RCP 8.5 (b) 31-year long periods. Monthly distributions of both the MHW categories---with each occurrence representing one cell of the model---presented as histograms and the number of MHW events during the historical (c) and RCP 8.5 (d) 31-year long periods. Yearly (left) and monthly (right) probability density distributions of the MHW mean intensity during the historical and RCP 8.5 31-year long periods (e).

The dotted lines had a legend in the original figures but I admit that (1) the description of what they represent in the methodology was not properly detailed and (2) the legend might have been a bit small. The methodology section will be modified to address this deficiency (see text above which also explains why one line is straight and the other is curved) while the legend font will be increased in order for the information to be more visible.

Actually for the histograms, the colors represent the MHW categories as defined by Hobday et al. (2016) and explained in the methodology (with the traditional colors used to represent these categories). The x-axis represents the different months (as per the legend) and the y-axis represent the number of occurrences. This is a traditional way to represent a lot of information for the MHWs (e.g., Pastor and Khodayar, 2023). The fact that the historical histograms can be (as they are not for every month) higher than the RCP 8.5 histograms just reveals that more occurrences happen for this month while the categories show that the intensity of the MHWs is far greater in the RCP 8.5 scenario (brown and red colors corresponding to categories III & IV) than for the historical conditions (yellow and orange colors corresponding to categories I & II).

Line 188. Here you mention for the first time that there are no MHWs for years 9-11 in both runs. This comes as a surprising fact, moreover since this happens in both runs, which makes it look suspicious that the PGW approach is not able to separate from the variability from the base/historical run. This is discussed in the Discussion section, but I think a brief comment (indicating this is fully described in the Discussion section) should be added here.

R: The following paragraph will be added to the text: *"As explained in Denamiel et al. (2025), the large-scale atmospheric and oceanographic patterns that force the boundaries of the AdriSC WRF 15-km and ROMS 3-km grids under historical conditions are also present in the RCP 8.5 simulation. Consequently, the 3-year gap in MHW occurrence observed under both historical and RCP 8.5 conditions is likely linked to an extraordinary atmospheric or oceanographic event, which will be further discussed in Section 4."*

Line 200. Is the word skewed the correct one here? For me skewed indicates there is a bias/error in the data, and not just that it show a trend towards a specific value (which is what is mentioned here).

R: In statistics, "skewed" refers to a lack of symmetry in a probability distribution. A skewed distribution is asymmetrical, meaning the left and right sides are not mirror images of each other. It contrasts with a symmetrical distribution like a normal distribution, which has a perfectly symmetrical bell shape. Hence, in this context, the fact that the distributions are (right) skewed towards a certain value XX only means that the tail (the part extending beyond the peak) is on the right side of the distribution towards XX and that the mean is greater than the median.

To be more precise the word "right" will be added in front of skewed in the text.

Line 222. Are MHWs less frequent in RCP8.5 because they are longer? (i.e. there is less time with no MHW so less possibilities for a new MHW to develop).

R: This is an interesting comment. In fact, as suggested by reviewer #1, I have redone the analysis of the MHWs with the detrended sea surface temperature to better capture the impact of the ocean dynamics on the MHW characteristics. Following this new analysis, more MHWs are picked up in the RCP 8.5 simulation than under historical conditions because the historical trends are 40 % higher than the RCP 8.5 trends (as shown in the new figure of trends and variance).

A new subsection and figure will be added in the discussion to present the detrended results and compare them with the previous (non-detrended results).

*"**4.2 Added value of the Pseudo-Global Warming method***

In the preceding sections, MHWs were identified using an updated reference period for the RCP 8.5 scenario (Smith et al., 2025), which represents a standard approach when employing the Pseudo-Global Warming (PGW) methodology. In this subsection, MHWs are instead extracted using a detrended baseline following Smith et al. (2025), in order to better isolate and evaluate the influence of oceanic dynamics on the characteristics of MHWs.

4.2.1 MHW characteristics under the detrended baseline

The MHWs identified using the detrended baseline framework are first characterized by the number of events per year, along with the distributions of their mean intensity, duration, and spatial extent over the 31-year historical and RCP 8.5 simulations (Fig. 11a–d). Importantly, for consistency in comparison, the RCP 8.5 mean intensities are not adjusted to account for the difference between the RCP 8.5 and historical temperature climatologies.

In contrast to the previous results, the intensities of MHWs under historical and RCP 8.5 conditions are comparable, with median mean intensities of 0.59 °C and 0.63 °C, and 75th percentiles of 0.80 °C and 0.87 °C, respectively. Their spatial extent is also similar, with median areas of approximately 13,800 km² and 13,600 km², and 75th percentiles of about 20,400 km² and 21,400 km², respectively. However, as in the previous results, their duration remains consistent, with median values of 8 days and 75th percentiles of 12–13 days.

Additionally, in contrast with the previous results, within the detrended baseline framework, MHWs are slightly more frequent under RCP 8.5 conditions, with a total of 287 events compared to 280 events under historical conditions. Notably, during the first eight years of the historical and RCP 8.5 simulations, the number of MHW events increases significantly under this framework—reaching 117 and 91 events, respectively—compared to just 26 and 38 events, respectively, in the previous (non-detrended) results. These results clearly highlight the influence of long-term temperature trends on the detection and characterization of marine heatwaves. In particular, the significant increase in the number of events during the early years of both simulations under the detrended baseline framework—compared to the original results—demonstrates that background warming trends in the Adriatic Sea can obscure or delay the identification of MHWs. By removing these trends, it becomes possible to isolate the intrinsic variability and short-term anomalies that define MHW events, thus offering a more consistent basis for defining the impact of the ocean dynamics on the MHWs.

Further characterization of MHWs under historical and RCP 8.5 conditions is carried out using yearly probability density distributions of MHW mean intensity (Fig. 11e) and scatter plots *displaying the yearly maximum values of MHW mean intensity, duration, and spatial extent (Fig. 11f, g). The density plots reveal that, under historical conditions, no MHWs are detected in the first two years of the simulation—compared to the first three years in the previous (non-detrended) results. As in the previous analysis, no MHWs are identified in years 9–10 in either simulation; however, in year 11, one event is now detected under historical conditions (Fig. 11d). Under both historical and far-future extreme warming scenarios, the yearly maximum MHW durations (on average 42 and 40 days, respectively), maximum mean intensities (on average 1.6 °C and 5.6 °C, respectively), and maximum affected areas (mostly below 50,000 km²) remain comparable to those obtained with the non-detrended baseline. The most notable difference between the two approaches lies in the increased detection of more intense and longer MHWs during the first decade of both simulations when using the detrended baseline, highlighting again the impact of baseline trends on the timing and characteristics of MHW detection.*

Overall, the comparison between detrended and non-detrended baselines underscores how baseline selection influences the interpretation of marine heatwave characteristics. While the non-detrended approach captures the compounded effects of long-term warming and short-term variability, the detrended baseline isolates interannual to decadal variability more effectively. This distinction provides complementary insights: the former emphasizes the trajectory of change under climate forcing, while the latter enhances the detection of underlying oceanic dynamics. Together, these methodologies offer a more comprehensive understanding of future MHW behaviour in a rapidly warming Adriatic context."

(Figure next page)

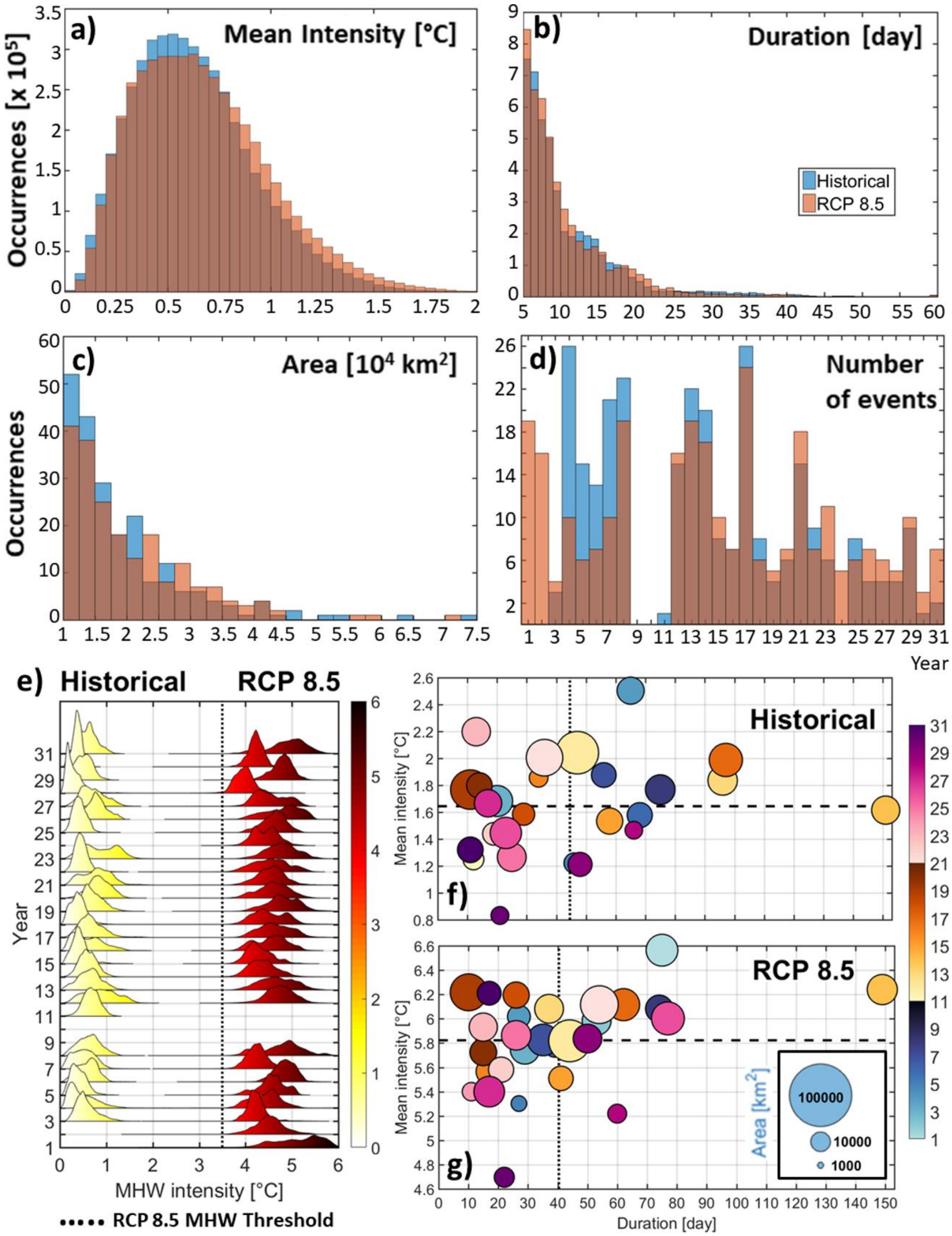

Figure 11. MHW characteristics based on the detrended sea-surface temperature. Distributions of the mean intensity as originally extracted with the heatwaveR package (a), duration (b) and area (c) as well as yearly time series of the number of events defined over the 31 years for the historical and RCP 8.5 conditions. Yearly probability density distributions of the mean intensity during the historical and RCP 8.5 31-year long periods (e). All probability density distributions are normalized to unit area to facilitate direct comparison. Scatter plots of the yearly maximum value of the mean intensity versus the maximum yearly value of the duration with the size of the circles depending on the maximum yearly value of the area during the historical (a) and RCP 8.5 (b) 31-year long periods.

Line 223-225. I do not understand what the author refers to in this sentence. If it is what I think I understand, doesn't a correlation of 0.9 show again that the PGW is not effectively separating events from the historical run from the RCP8.5?

R: The reviewer is correct and this was originally analyzed in Section 4. As the limitation of the PGW will now be presented in Section 2, the paragraph will be modified as follows:

"Furthermore, over the last 20 years of the simulations when MHWs occur annually, the correlations between median yearly variations in MHW intensity, area and duration under historical and RCP 8.5 conditions reach 0.92, 0.44 and 0.91, respectively. These high correlations between historical and RCP 8.5 MHW intensity, area, and duration are likely a consequence of the PGW approach–which assumes that the relationship between large-scale climate drivers and regional weather patterns remains constant over time–rather than realistic temporal features."

*Figures 5 and 6. Again, there is a dotted line which is not described in the caption, and no units in the y-axis of panels a.b.c (left). What is bottom temperature and OHC *intensity* ?*

R: The new version of the methodology section as well the new Figure 2 will explain correctly (1) what the dotted are representing and (2) what bottom temperature and OHC 20m intensities are (see above modifications). As per the previous figure, the font of the legend of the dotted lines will be increased.

Regarding the absence of units in the distribution plots, I would like to respectfully point out that this convention is also followed in Figure 3 (which will become Figure 5 in the revised version). This choice aligns with common practices in the literature for presenting normalized probability density functions (PDFs), as illustrated, for example, in Pastor and Khodayar (2023). Since these PDFs are normalized to an area of one, including physical units on the vertical axis would not convey additional quantitative meaning.

The following sentence will be added to the legend of the Figures:

"All probability density distributions are normalized to unit area to facilitate direct comparison."

That said, if the reviewer strongly feels that including units would improve clarity, I would be happy to revise the labels for ex-Figures 5 and 6 accordingly. Unfortunately, for ex-Figure 3, the figure's design and formatting constraints make it difficult to incorporate units without compromising readability. I hope this explanation clarifies the reasoning behind the current presentation.

(updated figures continue to next pages)

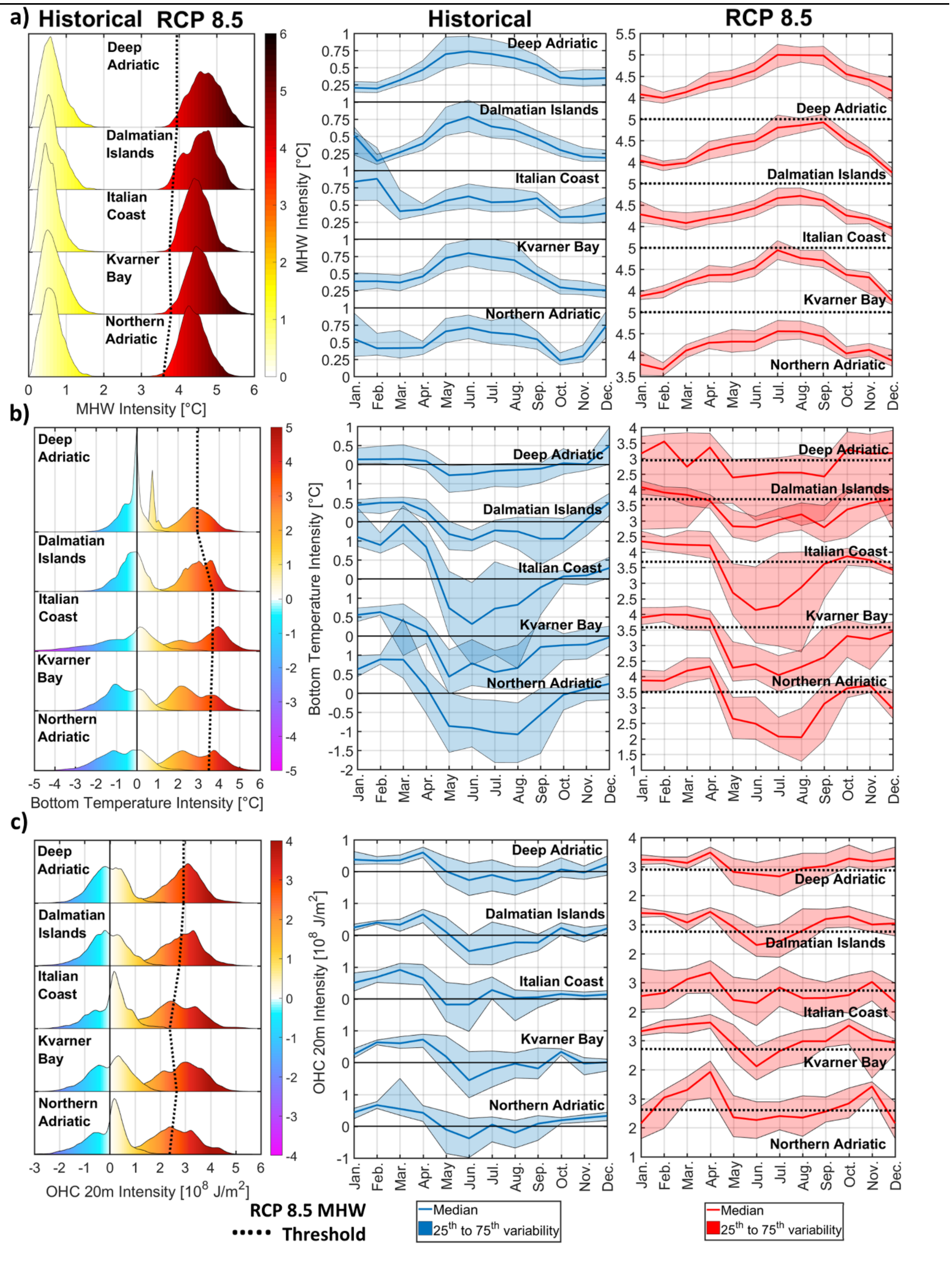

Figure 7. For the 5 selected subdomains (Northern Adriatic, Kvarner Bay, Italian Coast, Dalmatian Islands and Deep Adriatic), distributions (left panels) and monthly climatologies of the median, 25th and 75th percentiles (centre and right panels) of the MHW (a), ocean bottom temperature (b) and OHC at 20 m (c) intensities

defined over the 31 years for the historical and RCP 8.5 conditions. All probability density distributions are normalized to unit area to facilitate direct comparison.

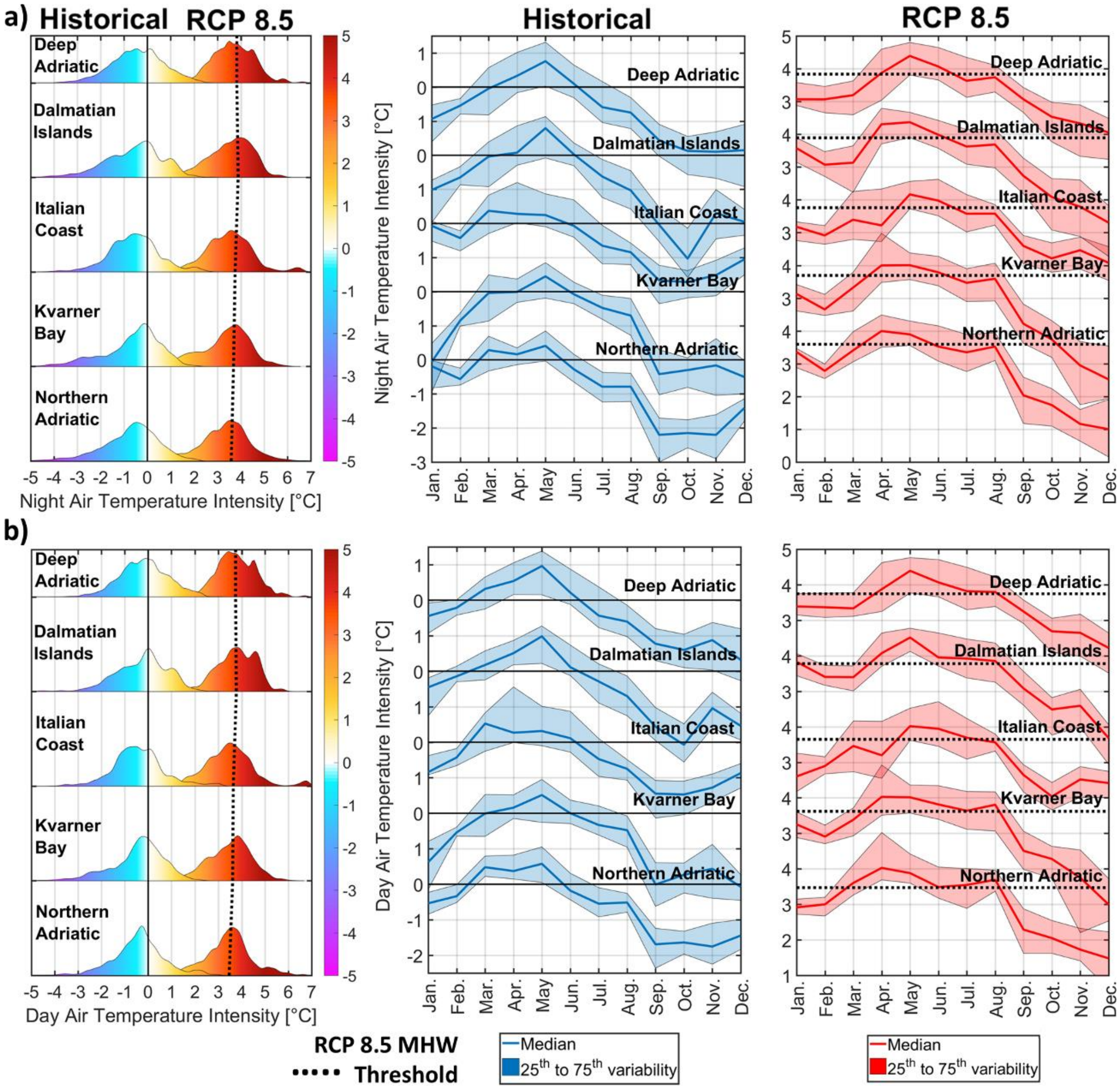

Figure 8. For the 5 selected subdomains (Northern Adriatic, Kvarner Bay, Italian Coast, Dalmatian Islands and Deep Adriatic), annual distributions (left panels) and monthly climatologies of the median, 25th and 75th percentiles (centre and right panels) of the night (a) and day (b) air temperature intensities defined over the 31 years for the historical and RCP 8.5 conditions. All probability density distributions are normalized to unit area to facilitate direct comparison.

Line 270. values of 0.25degC etc "above the climatology" I guess?

R: With the clarification of the methodology in Section 2 (including what will be Figure 2 in the new version of the article), the meaning of "intensity" throughout the article should now be totally transparent.

Figure 7. There is no description in the text of how the "percentage of events primarily driven by air-sea fluxes" is determined.

R: The following sentence will be added in order to explain how the percentages are calculated: *"Importantly, the percentages of events primarily driven by air-sea heat fluxes is calculated under the assumption that the contribution of total air-sea heat fluxes to the change in sea-surface temperature anomaly is considered significant when more than half of the warming/cooling can be attributed to air-sea heat fluxes—i.e.,* $dSST_{Q_{net}} / dSST_A > 0.5$*."*

Line 326. I would not call these other studies "independent observations" since they might use the same datasets. Just "other studies" would be more adequate.

R: The word *"independent"* will be removed and only *"observational studies"* will be kept.

Line 374 and following: how are the percentage of changes in the discharges decided? Why is this not discussed in the Methods section?

R: Thank you for this suggestion. The percentage changes in river discharges are part of the PGW methodology implemented in the AdriSC model and are fully described in Pranić et al. (2021). While I understand the importance of providing clarity on key modeling choices, especially for readers who may not be familiar with the AdriSC modelling suite, I believe it is also essential to build upon previous work without reproducing the entire methodological framework in each new article.

That being said, I acknowledge that the reference to Pranić et al. (2021) was missing in the original description, and I will revise the paragraph to include the following clarification:

"– see Pranić et al. (2021) for more details."

I hope this addition addresses the concern and provides the necessary guidance to readers seeking further information.

Section 4.2.2 Here the author mentions the Easter Mediterranean Transient as a possible cause of the absence of MHW in years 9-11, but no proof or demonstration is given, so this is just a suggestion provided by the author that needs to be verified. Line 427 says no previous work has linked EMT to MHW suppression, but this work doesn't provide the link either. And again, the fact that the MHW absence is also noticed in the RCP8.5 run should be better explained as it reflects in my opinion that the PGW fails to detach from the base variability. There is some mention in line 447 but this should be made clearer before.

R: I fully agree and this is why the following sentence concludes the subsection:

"Consequently, **further targeted research is necessary to establish a definitive connection** *between MHW intensities and frequencies and EMT or other significant oceanographic events like the BiOS."*

And also in the conclusion:

"However, while these results **seem** *to demonstrates the influence of natural variability on MHWs, no correlation was found with the Ionian-Adriatic Bimodal Oscillating System (BiOS), highlighting the need for* **further research to clarify the role of oceanographic events in Adriatic MHW dynamics.***"*

Further, with the addition of the limitations of the PGW method in section 2 and the sentence concerning the MHW gap (see reply to *Line 188* comment), I think the PGW framework will now be better explained.

Finally, while I appreciate the reviewer's perspective, I respectfully disagree that the absence of MHWs in the RCP 8.5 simulation indicates a shortcoming of the PGW methodology. On the contrary, it is precisely due to the controlled framework of the PGW approach that this particular event could be robustly identified and analyzed. By preserving the large-scale oceanographic and atmospheric variability from the historical boundary conditions, the PGW methodology enables a meaningful attribution of such anomalies, which may otherwise be obscured in fully coupled future projections.

Additional References:

Deser, C., Phillips, A.S., Alexander, M.A., Amaya, D.J., Capotondi, A., Jacox, M.G., and Scott, J.D.: Future Changes in the Intensity and Duration of Marine Heat and Cold Waves: Insights from Coupled Model Initial-Condition Large Ensembles, J. Climate, 37, 1877–1902, https://doi.org/10.1175/JCLI-D-23-0278.1, 2024.

Pastor, F. and Khodayar, S.: Marine heat waves: Characterizing a major climate impact in the Mediterranean, Science of The Total Environment, 861, 160621, https://doi.org/10.1016/j.scitotenv.2022.160621, 2023.