A Climatological Perspective on Cyclones and Surface Impacts in the Eastern Mediterranean Using Potential Vorticity-Based Classification

Response to reviewers' comments

We thank the two expert reviewers for their additional constructive feedback. We have addressed all their suggestions in detail below and made the corresponding changes to the manuscript. The main change since the last submission involves Figure 8. It now presents wind speed anomalies instead of wind speed anomalies normalized by standard deviation in respond to reviewer #2 and the editor.

In the following, we respond to each of the reviewers' comments point-by-point.

Reviewer #1:

Reviewer Summary/Narrative

I am fully satisfied with the revisions implemented by the authors and recommend publication of the work in WCD. I only include a few technical comments regarding Section 3.4.

Reviewer Comment:

In lines 328-330 I suggest removing the following : « While the mean provides a view of most cases, it may obscure information about extremes, their number and location. Moreover, relying solely on the mean values does not indicate whether these values stem from a few intense events or if the precipitation distribution is more evenly spread across the cases. Therefore, » The value of undertaking a grid-point assessment is already well explained in the paragraphs below this text.

Response:

We appreciate the reviewer's comment. We decided to retain this short explanation because it motivates the analysis of the precipitation distributions across the EMC cases, independently of the subsequent grid-point-based assessment. The purpose of this text is to clarify that the spatial composite mean alone may mask the variability between events and the contribution of extreme cases within each cluster. The following paragraph then introduces the complementary grid-point analysis, which addresses localised extremes at finer spatial and temporal scales.

Reviewer Comment:

You could mention that the results for the grid-point analysis of cluster 5 are consistent with its summer-autumn seasonality.

Response:

Done

Reviewer Comment: Caption Fig 6b. « Bars represent the number of grid points exceeding each precipitation threshold and below the level of the following threshold. » Is my addition correct ? This would avoid counting the same extreme grid-point event multiple times.

Response:

Done

Reviewer #2:

Reviewer Summary/Narrative

I would like to thank the authors for their thoughtfulness and thoroughness while replying to the reviewers' comments. The effort put into these changes strengthened the science and flow of this manuscript. I appreciate the increased clarity of the SOM description and improved consistency of diction throughout the manuscript. Additionally, I appreciated the increased discussion of moisture, forcing for ascent, and precipitation. My only larger concern is about the calculation of the 10-m wind speed plots and whether they can/should be normalized. See my questions in the next section below. I recommend this manuscript be accepted subject to technical revisions. See specific comments below.

Specific Minor Comments and Line-by-line Edits

L115: remove "fractions"
Response: Done.

L142-145: This text can be removed. This is excellent justification for a reviewer comment, but an example is not needed in the manuscript text and breaks up the flow of the section.

Response: Done.

L149: Choose a different phrase for "reference vector" since that wording is not used earlier in this section. Perhaps something like "…)) by matching the EMC's PV structure to the most similar SOM cluster PV structures."
Response: Done.

L158-166: Replace "cyclones" with "EMCs" and ensure consistency throughout the manuscript.
Response: This is a general definition not specific to the EM.

L166: Add (N=#) for how many explosive EMCs.
Response: Done.

L178: Replace “rainy season” to be consistent with Reviewer 1’s comments and the rest of the manuscript.
Response: Done.

Figure 1 caption: Replace “the fitlm function in MATLAB” with “a linear regression model.” The exact coding function details are not necessary unless it is a function that is not commonly used or has specific quirks.
Response: Done.

L193: Replace “south-west-to-north-east-tilted” with “positively” to be consistent with other synoptic studies. Replace other instances throughout the manuscript as well.
Response: This terminology was changed in response to a comment from the other reviewer, and we therefore decided to keep it consistent throughout the manuscript.

L208: Replace “cyclones” with “EMCs” and ensure consistency throughout the manuscript.
Response: Done.

L208: List the number of explosive EMCs or please add that earlier in the manuscript.
Response: Done.

L209: Elaborate concisely and describe what “these types” are
Response: Done.

Figure 2: The magenta dots and blue diamonds are quite difficult to see. Is it possible to change their color and/or make them different shapes? I am specifically having difficulty with the magenta dots overlapping with he magenta PVU contours in Cluster 3.
Response: Following the reviewer’s suggestion, I tested several alternative marker colors and shapes to improve visibility. However, stronger marker contrasts tended to draw visual attention away from the PV structures, which are the primary focus of this figure.

Figure 2 caption: Replace all instances of “cyclone” with “EMC” and this black dots are

“stippling” not “hatching”
Response: Done.

L222: “accounts for” doesn’t seem to convey what is trying to be communicated here. Perhaps replace with “occurs most frequently in the months…”
Response: Done.

L226: insert “EMC” before “PV patterns”
Response: Done.

Figure 3 caption: remove “up”
Response: Done**.**

L233, L236: add “hr” units for the time duration – thank you for including this in the Manuscript!
Response: Done**.**

L235: Describe geographically where they are stationary in the domain.
Response: Done**.**

L237: “Intense” in what aspect? Wind and pressure?
Response: We decided to remove this sentence, as it did not add substantial information and could be confusing. The intention was to indicate that both the cyclone pressure is not as deep as in Cluster 1 and that the deepening rates are lower.

L240, L244: add duration in parentheses to be consistent with the earlier part of the section. Throughout this entire section you could also add the deepening rate in parentheses as well.
Response: Done. The duration is added in parentheses to maintain consistency with the earlier part of the section. We decided not to add the deepening rates throughout the text, as this would overload the section with parentheses and additional information, reducing readability.

L262: Remove “in the northern part of the domain” because “south of Turkey” is a more descriptive location.
Response: Done.

L264: Geographically describe the “southern areas” and you could include the values in parentheses after saying “less intense” to support this statement.
Response: Done. We added a more specific geographical description of the “southern areas.” We decided not to include the values in parentheses since they represent a range and adding them here would require adding similar values throughout the section, which could reduce readability. The relevant values are also visible in the figure.

L272-275: Excellent additions!!

L283: Replace “the results reveal” with “Figure 5 reveals” and remove the figure reference at the end of the sentence.
Response: Done.

L289: “situation” is not a very scientific term, recommend replacing
Response: Done.

L292-293: Insert parentheses around Ravel-Rubin and Wernli 2015 citation
Response: Done.

L293: insert comma after “Mediterranean”
Response: Done.

L295-296: Explicitly state where geographically instead of “southern and eastern parts of the domain”
Response: Done.

L297-298: Great addition!

L301: “the results” … specify what results
Response: Done.

L304: “southern part of the domain” … specify geographically,
also why is this colored
Response: Done.

white in Figure 5 when there is no white in the colorbar?
Response: white is zero.

L310: What about moisture in addition the PV?
Response: Moisture-related aspects have not yet been analyzed in sufficient depth to draw concrete conclusions.

L317: Replace “south-west-to-north-east-tilted” with “positively” to be consistent with other synoptic studies. Replace other instances throughout the manuscript as well.
Response: This terminology was changed in response to a comment from the other reviewer, and we therefore decided to keep it consistent throughout the manuscript.

Figure 6: Replace bottom axis of rightmost figure with “ERA5 Precipitation per EMC (mm/24hr)” for clarity. Also, I think you cold remove the “b” points from the figure since they are not really discussed in the manuscript.
Response: We did not apply this change because the precipitation values are shown per

grid point, not per EMC.
We decided to keep the “b” points in the figure and added a short discussion about them in the manuscript.

L382: The addition of the surface winds is really great! I think adding in a transition sentence at the start of section 3.6 would improve the flow of the manuscript.
Response: Done.

L396: Specify which “coast”
Response: Done.

L398: Insert “of 10-m wind speed” after “patterns”
Response: Done.

Figure 8: add label for colorbar even if dimensionless. What time of the EMC life cycle is this composite? Negative values should still be added to the colorbar (even if white). What does the distribution look like for the climatological wind speeds? Is the distribution normal? Otherwise, you cannot do this. Why not just do an average anomaly? If you want to see what the average anomalies are significant, then perhaps just do bootstrapping and add stippling. The legend for the wind vector should be moved outside of the plot to not cover the high wind data.
Response: Following the suggestions of both the reviewer and the editor, the figure was revised to show average wind speed anomalies instead of standardized anomalies. Accordingly, the colorbar, significance representation, and related discussion were updated. In addition, the wind vector legend was moved outside the plot to avoid obscuring regions with strong winds.

L407: Replace “We here” with “In this section, we …”
Response: Done.

Figure 9: replace “cyclones” with “EMCs”
Response: Done.

L426: Is the 1 standard deviation change “extreme” for these storms? Also, perhaps add “…wind anomalies out of all EMCs.”
Response: Following previous reviewer comments, we no longer refer to the anomalies in terms of standard deviations, and therefore we did not assess whether they can be considered “extreme” in that context.

L460-462: Nice addition.

Figure 10 caption: “PVU surface (shading) and SLP (dashed lines)”
Response: Done.