Final response - minor revisions (Manuscript "EGUSPHERE-2025-376")

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1 Introduction

We would like to thank the reviewer again for providing insightful feedback. In this response, we aim to address all raised concerns. For every comment, you can find (1) the comment, (2) the author's response (both with lines from submitted manuscript), and (3) the author's changes in the revised manuscript. The lines given for **author's changes in the manuscript** refer to the lines in the **revised manuscript**.

2 General comments

- **Comment**: The reviewer appreciates the authors' efforts to improve the manuscript. The previous comments primarily concerned clarifications of the methodology, interpretations, and descriptions. The authors have substantially revised the manuscript, and the reviewer finds that the earlier concerns have been adequately addressed. For this second review, the reviewer again provides comments focused on clarification, as the manuscript has undergone significant modifications since the previous version. The reviewer considers the paper acceptable for publication, provided that the points specified below are adequately addressed.
Author's response: Thank you for your feedback on our revised manuscript and our proposed modifications. We strive to clarify all points raised in your review.

3 Specific comments

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- **L5-7**: L5-7, "Our analysis emphasises that the most important distinction between all detected clouds and strong convective organisation may relate to a larger cloud area, a lower cloud top and core height, and a shorter lifetime.Weak. Weak convective organisation tends to occur with smaller clouds with fewer cores, and a shorter lifetime.": The first sentence is unclear about which characteristics apply to "all detected clouds" versus "strong convective organisation". It is also unclear whether the two sentences are consistent with each other. Please revise to clarify the intended comparison.
Author's response: We agree that these sentences may seem unclear and revise the text.
Author's changes in the manuscript: Lines 5-8: "Our findings highlight how cloud properties may interact with organisation. Hence, strong organisation tends to occur with larger cloud areas, lower cloud tops and core heights, and shorter lifespans compared to the average convective system. In contrast, weak organisation may be associated with smaller clouds, fewer cores, but similarly shorter lifespans."

- **L10**: L10, "over the remote Atlantic Ocean": The phrase is ambiguous. Please specify the geographical extent or latitudes of the area referred to.
Author's response: The sentence should refers to Atlantic Ocean south of 15°S. We revise the text.
Author's changes in the manuscript: Lines 10-11: "From March to May, patches of strong convective organisation emerge along the African coastlines and over the southern Atlantic Ocean."

- **L30**: L30: The most standard reference to “self-aggregation of convection” is Bretherton, C. S., Blossey, P. N., & Khairoutdinov, M. (2005) An energy-balance analysis of deep convective self-aggregation above uniform SST. Journal of the Atmospheric Sciences, 62(12), 4273–4292. The authors should also note the earlier reference to the radiative convective equilibrium simulation than Held et al. (1993) is Nakajima, K., & Matsuno, T. (1988) Numerical experiments concerning the origin of cloud clusters in the tropical atmosphere. Journal of the Meteorological Society of Japan, 66(2), 309–329.
  Author’s response: Thank for your comment, we will revise the text to contain additional, earlier references.
  Author’s changes in the manuscript: Sect. 1, lines 29-34: "While convective organisation is difficult to quantify in observational data, idealised model configured in radiative-convective equilibrium (RCE) could demonstrate a large-scale clustering of convective clouds which is known as self-aggregation of convection (e.g, Nakajima and Matsuno (1988); Held et al. (1993); Wing et al. (2017)). Following Bretherton et al. (2005), it occurs on a timescale between days and weeks and describes the transition of an approximately random distribution of convective cells into convecting and non-convecting regions that grow upscale over time."

- **Figure 1**: Caption of Figure 1, The first line: “we show how the derive a contiguous 3D cloud field from 2D data by a machine learning-based extrapolation” should be “… how to derive … ”
  Author’s response: Thank you for your correction, the text will be changed.
  Author’s changes in the manuscript: Figure 1: "In (a), we show how to derive a contiguous 3D cloud field from 2D data by a machine learning-based extrapolation (Brüning et al., 2024)."

- **L147**: L147, “To reduce noise, we first apply a Gaussian filter with a sigma value of 0.5 to smooth the input data.”: Please describe the spatial scale of the Gaussian filter. What effective scale is used for the analysis?
  Author’s response: Following the definition of the Gaussian image filter, we employ an effective scale that comprises half a standard deviation (sigma = 0.5) for the given input image (across the AOI of 1200 x 1200 x 90 pixels), containing the 3D radar reflectivity field with values between -25 to 20 dBZ.
  Author’s changes in the manuscript: Sect. 2.3, lines 147-149: "To reduce noise, we first apply a smoothing Gaussian image filter with an effective scale of half a standard deviation (sigma = 0.5) on the 3D radar reflectivity field."

- **L181**: L181, “land-sea mask”: Contiguous convective clouds consist of multiple points and may generally include both land and sea grid points. How can the land or sea type of clouds be classified?
  Author’s response: We are aware that clouds may travel across both land and sea grid points along their life-cycle. Although it may not account for these real world conditions, we apply a simplifying approach to reduce the complexity within the dataset. For this purpose, we use the modal location of the grid points (either over land or sea) to classify the whole cloud. We note this classification displays only an approximation. We revise the description in this paragraph to be more clear.
  Author’s changes in the manuscript: Sect. 2.4, lines 183-185: "Each cloud track is classified as either marine (sea) or continental (land) using a binary land-sea mask. For this purpose, we determine the most frequent (modal) surface type across all grid points along the cloud trajectory. While this method does not capture changes in surface type throughout the cloud’s life-cycle, it may provide insights on the effect of the most frequently occurring surface type."

- **L188**: L188, “at least 15 min”: Does this require at least two time steps (i.e., more than 15 minutes), or is a single snapshot (i.e., 15 minutes) sufficient?
  Author’s response: Refers to at least one time step of 15 minutes which is required for the occurrence of cores, and the CTH/CBH/reflectivity thresholds. We rephrase the sentence to be more clear.
  Author’s changes in the manuscript: Sect. 2.5, lines 190ff.: "We filter the cloud trajectories to exclude possibly non-convective tracks from the analysis. For that purpose, we employ three criteria occurring for at least a single timestep of 15 minutes: (a) One or more core regions, (b) radar reflectivity of higher than 0 dBZ at 10 km height, and (c) minimum CTH of 10 km and maximum CBH of less than 5 km."

- **L195**: L195, “Approximately 75% of cloud tracks occur over ocean, with land-based tracks comprising the remaining 25 %”: What is the ratio of land and sea areas within AOI? Does the ratio 75% larger than the area fraction of sea within AOI?
  Author’s response: Thank you for your comment; the ratio of land / sea within the AOI comprises about 35% to 65%, pointing out a shift of about 10 % towards marine convection, compared to the land-sea distribution.

The distribution is shown in detail in Part 1 of this paper sequence - we will revise the manuscript to provide these information and the associated reference.
Author's changes in the manuscript: Sect. 2.5, lines 199-201: "Approximately 75 % of cloud tracks occur over ocean, with land-based tracks comprising the remaining 25 % (Figure 2, b). Compared to the land-sea distribution of grid points across the AOI, we observe a 10 % shift toward ocean for detected clouds (Brüning and Tost, 2025)."

- **Figure 4**: Figure 4: It is difficult to read from the figure whether the contribution over land is larger or smaller than that over the sea. Moreover, it is unclear whether the "all" category represents the sum of the land and sea contributions. Could you please clarify what "all" refers to?
Author's response: We revise the figure to show this contribution more clearly. Here, "all" refers to "clouds over all surface types" (i.e, the whole dataset) - we will change the description.
Author's changes in the manuscript: Changed "All" to "All surface types". For the visualization, we changed the plot to show bars for each class (sea, land, all surface types).

- **L352-368**: L352-368: It is unclear whether the "differences" mentioned in line 352 refer to the values of JJA minus those of MAM. The description in this paragraph does not appear to be consistent with Fig. 9. For example, the statement "ROME displays more complex behavior along the period, with an overall increase around the AOI in JJA" (lines 356–358) seems inconsistent with Fig. 9(c), which clearly shows an increase in ROME across the entire domain.
Author's response: The values show MAM minus JJA, we add the information in the caption of Figure 9 and the text. Moreover, we revise the paragraph to describe the observed changes more clearly.
Author's changes in the manuscript: Please see Sect. 4.3, lines 357-377 for a revised description of Figure 9.

- **L352**: L352: The term "summer" is not an appropriate abbreviation to refer to JJA. "Boreal summer" or simply "JJA" is more suitable.
Author's response: We agree and change the term to "boreal summer"
Author's changes in the manuscript: Sect. 4.3, line 357: "Figure 9 presents the average differences between boreal spring (MAM) and boreal summer (JJA) (MAM minus JJA), interpolated on a 3° × 3° grid and along the latitudes."

- **L369**: L369: Please refer to "Table 4" at the beginning of the paragraph.
Author's response: Thank you for your comment, will be changed.
Author's changes in the manuscript: Please see Sect. 4.3, lines 378ff.: "We evaluate how the relationships between organisation indices and cloud/core properties evolve along the two seasonal subsets by comparing the correlation coefficients between MAM and JJA (Table 4). (...)"

- **L378**: L378, "additional regional factors": What factors would affect the results? The large-scale circulation is an example.
Author's response: We will revise the sentence and add examples - such as the large-scale circulation, interannual variability like ENSO, or the topography, which may have an effect but were not directly considered in our analysis.
Author's changes in the manuscript: Sect. 4.3, lines 387-389: "These weak correlations suggest that relations may be affected by additional factors which were not integrated in our analysis, such as the large-scale circulation, interannual variations (caused by, e.g., El Niño-Southern Oscillation (ENSO)), or local topography."

- **L405**: L405, "more common": The contribution over land is smaller than that over the ocean in all cases. The phrase "more common" is unclear and may be misleading.
Author's response: We agree and change the sentence .
Author's changes in the manuscript: Sect. 4.4.1, lines 416-419: "Comparing the surface types of all cloud tracks and both percentile subsets, we observe a higher proportion of clouds over the ocean than over land for all datasets. However, there are differences within the surface-type distribution for the organisation-based subsets: when comparing all three datasets (all cloud tracks, P90, P10), strong convective organisation occurs about 5–15 % more frequently over the ocean, whereas the proportion of cloud systems with a weak convective organisation is about 10–15 % higher over land (Figure 11, a)."

- **L598**: L598: Please spell out “DBSCAN” and “HDBSCAN” and provide appropriate references for both.
  Author’s response: We will add references and introduce the acronyms.
  Author’s changes in the manuscript: Sect. 5.3, lines 609-612: "To address this, we plan to explore unsupervised clustering techniques such as the Density Based Spatial Clustering of Applications with Noise (DBSCAN) (Ester et al., 1996) or the extended Hierarchical Density-Based Spatial Clustering of Applications with Noise (HDBSCAN) (Campello et al., 2013) as a more data-driven alternative."