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Assessment of object-based indices to identify convective organization

The manuscript is well-structured, providing a comprehensive review of past convective indices and offering a quantitative comparative analysis of nine object-based indices based on a set of criteria. The authors introduce a promising index that they suggest is a 'well-behaving index' according to the defined criteria. Nevertheless, this reviewer has a few major concerns that must be addressed for publication. I encourage the authors to view these comments as an opportunity for improvement.

One significant concern is the absence of a proper review and utilization of other existing trackers for convective system identification. Given the manuscript's focus on comparing nine object-based indices, it is both reasonable and, to some extent, ethical to incorporate at least two (if not more) MCS tracking algorithms. This addition would enhance the robustness of the results. Furthermore, a recent MCS-tracking intercomparison study by Prein et al. 2023 (https://essopenarchive.org/doi/full/10.22541/essoar.169841723.36785590) has documented relevant differences in results related to MCS characteristics and statistics across different tracking algorithms.

In addition to the generated dataset, it is suggested that the authors incorporate at least one more tracker in the analysis to ensure multiple algorithms contribute to convective system identification data. One suitable option is TAMS (Núñez Ocasio et al. 2020a; Núñez Ocasio et al. 2020b; https://tams.readthedocs.io/en/latest/), an objective MCS tracking algorithm. TAMS is open-source, publicly available, and Python-based, making it a viable candidate for comparison with TOOCAN.

Both TOOCAN and TAMS share underlying similarities in identification and tracking, yet they differ sufficiently for a comprehensive comparative analysis. Similar to TOOCAN, TAMS utilizes Tb, allowing authors to download satellite Tb for the warm pool region domain in case TOOCAN systems cannot be separated from the Tb data. Additionally, like TOOCAN, TAMS allows saving the mask for the identified convective objects.

For further reference, authors are encouraged to refer to Prein et al. 2023 for information on other trackers that could be considered, such as MOAAP and PyFLEXTRKR. It is advised to provide a proper review of MCS trackers as convective system identification algorithms, including MOAAP, PyFLEXTRKR, and TAMS (in addition to TOOCAN), which are all current open-source MCS trackers available.

Because of the intrinsic relationship between deep convective organization and how an MCS is defined or identified (the first step of a tracking algorithm), this manuscript would benefit from the inclusion of a discussion regarding how the new index is sensitive to the MCS tracking algorithm being used and vice versa. How does the sensitivity of the new ‘well-behaving index’ compare to the sensitivity of other indices to multiple MCS trackers?

Another concern is that the manuscript has some technical English errors that should be addressed. Mainly, these are grammatical aspects that can hinder the interpretation of the discussion. This reviewer has pointed out some of them below in the introduction but there are

more throughout the paper. Authors are encouraged to thoroughly revise the manuscript with the guidance of an internal technical writing reviewer before resubmitting.

Specific comments:

Line 16: Instead of “is the main”, “is primarily”

Line 16: Thus,

Line 17: “we talk about”, is too colloquial, please rephrase.

Line 18: “On *the* climate”

The introduction would benefit from a review of what is convection and convective organization. Although it does not have a rigorous definition, certainly, past papers must have addressed convective organization that is relevant to include here to introduce such indices.

Lines 59-65: This methodology is not clear. Why tune the generated dataset to TOOCAN? Doesn’t seem to be a fair comparison then. Please address.

Lines 110-115: This is confusing, are the authors referring to the numbers in Table 1? They are all way above or way below 0.5. As the author pointed out, it is incoherent. Is there a clearer way to represent these numbers?

For Condition 7: What happens if a study has a continuous domain? Like uninterrupted global datasets? Will the results change?

The quantitative statistical analysis provided by distributions is well structured and complete.

The final summary for each index is very informative and provides a succinct summary of the results. The summary reveals relevant information regarding these emerging indices and the relevance in choosing the right indices for the right scientific question.

Can the authors provide some additional discussion on which of the indices compared the most with OIDRA?