Review of: A pan-European analysis of large-scale drivers of severe convective outbreaks

This study investigates the large-scale drivers of severe convective outbreaks (SCO) in Europe. SCO events cause significant damage to infrastructure, property, and human health and life, and they occur regularly across Europe. However, while a well-defined model of severe convection exists for the US, other extratropical regions like Europe still lack a comprehensive framework. This paper therefore represents an important step toward improving SCO predictability, and even understanding how these events may evolve under global warming.

The authors detect convective events using a CAPE-shear threshold binary variable (CIX) and cluster them into regions where SCOs occur simultaneously. These regions are then grouped into three categories based on the dominant climatological perturbation driving SCO initiation during the extended summer. Using this framework, the paper examines the large-scale descriptors of convective outbreaks, differences between short-lived and persistent SCOs, and trends in these descriptors.

The paper is well-organized, clearly written, and methodologically sound. I particularly commend the authors for their rigorous use of statistical inference, including the application of False Discovery Rate (FDR) correction for gridded testing—a theoretically necessary but often overlooked practice in climate studies.

Overall, the manuscript requires only minor revisions. I have read the comments from Reviewer #1 and agree with their suggestions, particularly regarding the inclusion of Appendix figures (especially B1) in the main text. Below are my additional remarks:

- Line 70: The use of CIX alone is one of the relatively weaker aspects of the study. As the authors mention comparing CIX-based clustering with lightning data, I recommend including this comparison in the Appendix for transparency.

- Line 78: The authors note that they tested different CAPE and shear thresholds for defining CIX. It would be valuable to demonstrate the robustness of the results to these threshold choices, especially given the lack of validation for CIX as a convection proxy using observations.

- Line 138: The statement "*In each region, we find a maximum of convective precipitation on the day of the SCO*" is technically correct but initially confusing when examining Fig. 3. At first glance, one might expect the precipitation maxima in panels (first two rows) to align strictly with the detected SCO regions. Instead, the key finding is that each region experiences its peak convective precipitation during its respective SCO events. I suggest clarifying this point and briefly discussing overlaps between regions (e.g., W-M/AL SCOs sometimes coincide with convection in BE/CE or SL/AD).

Additional minor corrections:

- Line 193: 900 hPa → 800 hPa

- Line 163 & Fig. 7 caption: Replace “insignificant” with “non-significant” or “not statistically significant” for precision. “Insignificant” can be misleading, especially when used in a text with no reference to the result of a statistical test as at Line 163.