

Left- and right-moving supercell dynamics, environments and hazards – today and in future
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General Comments:

The paper is of excellent scientific significance. It shows dynamics, environments and hazards of left- and right-moving supercells over Europe by using simulations of 2 km grid resolution in a current and warmer climate. Left-movers in particular have received little attention in the literature (especially in Europe) to date, even though, as this paper shows, they can produce hazard intensities similar to those caused by right-movers. Also, such a detailed list of various hazards and conditions, broken down by RM and LM, and at least for one idea of the future, makes it possible to understand that left movers are not simply mirror images of right movers, but rather that different conditions can lead to their formation at different positions in the trough-ridge system. In my opinion the scientific quality is already good, so I have only minor comments to include. The way of presenting the results is good in general. Please think at introducing all the variable names you are using in your plots either at some point in the text or in the figure caption.

Specific comments:

Abstract: Maybe you could add “(+3°C)” behind “warmer climate” in line 4

L. 16: To my knowledge, it is more often defined by the deviation of the vertical wind shear vector. Please add this

L. 60: I would reference here the figure of the model domain in the appendix

L. 74: You are writing here about 60km radius. The figures (e.g. Fig. 1) are shown with a radius of 20km. If both numbers are correct and no typo, which radius is used to extract values for the distributions of specific hazards or environmental conditions? Please clarify.

L. 90: You could mention here already one of the outcomes of Tonn et al. (2023) that this D has to be smaller for Europe. You could refer then back to that when discussing Fig.2 that you see also less deviation than Bunkers et al. in their studies for the US.

L. 104-105: Point to discuss, not necessarily to change here: why do you take exactly the 10th or 90th percentile? Since you calculate percentiles grid point wise, also for the median, e.g., the values should be higher in the region of the updraft than in the surrounding, shouldn't they? Do you expect the structure to change if you would choose different percentiles for this analysis or have you checked already others and can answer that? Is it just smoothed for lower percentiles or can also other structures emerge?

Fig. 1 caption: I would recommend to introduce your variable names (e.g. ζ) either in the caption or in the text before already. This holds also for the abbreviations of other variables in the paper, especially LPI was a problem for me since I did not know it before.

Fig. 2: if it is possible without covering other numbers, I would recommend to increase the font size of the axis and numbers here. I also think that captions above the figure itself is not necessary here since it should be and is described in the caption below.

L. 140: see comment regarding Line 90

L. 146: can you really conclude that from the angle difference? (even if I totally agree from your other results, that a different location is the case). Even assuming the same synoptic setting, there would be an angle difference if one cell moves to the right and the other to the left but how large would be this angle difference?

Fig. 3b: refers also to the Fig. 5, 6, 8, 9 & 10 and to the comment to Line 74: are these distributions calculated by taking all grid points within the 60km radius? Are they somehow weighted by their distance to the supercell center or not? Maybe clarifying in the paragraph from Line 73 on where the cookie-cutter method is introduced could help the reader.

Fig. 5: I recommend deleting “Pre-storm environment, 1h prior, full domain” since it can be taken directly from the caption

Fig. 6: same as for Figure 5

Table 1: Are the statements from this table the same if you use median instead of mean? For some of the variables this could be better

Fig. 7: If possible please increase the font size of the colorbar a bit

Fig. 8/9/10: Again general caption above not necessary; please put this information in the figure caption below

L. 206/207: At the moment: 1420 for “moderate occurrence” and 447 for “higher occurrence”. Is this statement because of putting the numbers in relation to the respective area size or is there a typo in the numbers

L. 213: I would add here “relatively” in front of “drier” since for absolute numbers of humidity LM is higher than RM

L. 230 / 349-350: have you quantified that? From just looking at the plots I would agree for NAL, but for IP LM and RM are often very close together and the difference to the +3°C is larger

L. 240: what exactly is this number “+21%” and what is the difference to “14%” in L.235? If 21% is correct here, I would write “more than” instead of “approximately”

Figure 11: Since it is only a schematic, how did you come up with this specific numbers? Probably a good way anyway to show the higher pressure for LM and the order of magnitude for the gradient

General comment on chapter 4: I really like the idea of this chapter, summarizing what was found out in the chapter before and bringing it in a context with all the different literature. My feeling is that it is a bit lengthy and I would appreciate if you would manage to shorten it a bit, however still with bringing it in the larger context.

Technical Corrections:

L66: “,” instead of “;”

L. 183: “second row” must be replaced by “third column”