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Comment on nhess-2021-5

Anonymous Referee #3

Referee comment on "Assessing internal changes in the future structure of dry-hot compound events: the case of the Pyrenees" by Marc Lemus-Canovas and Joan Albert Lopez-Bustins, Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-5-RC3>, 2021

The authors assessed the future changes of Dry-Hot compound events in Pyrenees. Based on the definition of the duration (D) and magnitude (M) of the dry-hot event, they analyzed the climatology of the two properties. D and M from climate model simulations were corrected and then used for future projection in the study area. Overall, this study falls within the scope of this journal. It could be improved by clarifying D/M definitions and bias correction methods/results. Several comments are as follows.

Major comments:

(1) The definition of D, M, and EM is not quite clear. For example, the definition of the 90th percentile for both the D and M needs to be clarified.

(2) For the bias correction, the D and M are corrected directly. Some comments or comparisons with the multivariate bias correction of climate variables (and then derive the D and M) could add merit to this study.

(3) Presentations and discussions of patterns in several figures need to be more clear (e.g., Figure 6 and 12)

Other comments

Please correct typos in many places of the manuscript (e.g., line 34).

Lines 139-140 (and Table 1): how do you define the "90th percentile" for both D and EM? Is this threshold based on the temperature of MAM and JJA? Please clarify.

In Table 1: There are multiple days with temperatures higher than 90th percentile. How do you define the EM (average or maximum)? Please make this clear.

Lines 157-162: This bias correction procedure is performed on the D and M. One can also adjust the climate variables and then compute the D and M. In this case, the multivariate bias correction is of particular interest to correct the dependence between the contributing variables of compound events (Cannon, A. J., 2018, *Clim. Dynam*; Zscheischler J. 2019 *Earth System Dynamics Discussions*). Some discussion or comparison on this would enhance this study.

Figure 6: For the corrected M and EM, the bias seems to be 0 for all seasons and regions. This means that the bias correction procedure has corrected almost all the systematic biases. Is this the case in Figure 6? Please explain or clarify the almost perfect performance of the correction.

Figure 12: "The drivers of the three future periods of the compound event" The analysis of the driver is interesting. However, the estimation of the driver seems to be quite vague. How do you determine the driver? Please explain it clearly.