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Reply on RC2

Marc Lemus-Canovas and Joan Albert Lopez-Bustins

Author 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-AC2>, 2021

Thank you for the opportunity to review the manuscript "Assessing internal changes in the future structure of Dry-Hot compound events. The case of the Pyrenees". The manuscript analyses a relevant topic and of wide interest in the scientific community related to compound events. In this work, the authors present a novel compound analysis of concurrent extreme dry spells and extreme hot temperature events in spring (MAM) and summer (JJA) on the Pyrenees, for the present and future scenarios. The proposed definition of the Dry-Hot events considers the length of extreme dry spells and the maximum and extreme maximum temperatures during the dry spells. The results point that present increases in compound Dry-Hot events are mainly attributed to increasing extreme temperatures, while future increases of the compound event will be likely associated to increases in both dry spells duration and extreme temperatures. Overall, the manuscript is well-conceived and organized, and the findings would be worth of publishing in NHESS. Nevertheless, I have some comments and suggestions detailed below that the authors may consider clarifying in the manuscript.

"We gratefully acknowledge the reviewer's comments and the revision of our manuscript. The article has been revised in accordance with the referee's comments and suggestions, which are addressed below. Our responses appear in italic and quotation marks"

Specific comments

Introduction

- Line 29: The authors may consider to use 'compound manner' instead of 'composite manner' to avoid confusion.

"Done"

- Line 43: I recommend including a short introduction in one sentence to the definition proposed by Manning et al (2019) before this line.

"Done"

Data and methods

- Line 76: I suggest the authors to provide some references about this: 'We focused on spring and summer, as spring can constitute the precursor of summer wildfires, and is a season prone to crop yield losses, etc.'

"Done"

- Line 87: I suggest the authors to better explain why using the cell closest to the centroid of each region.

"Corrected. See L97-98"

- Line 139-142:
 - I suggest the authors to better detail the estimation of the 90th percentile for D and EM events.

"We have rephrased L159-160 to make clearer the event definition. In addition, we have changed the 90th percentile by 95th percentile to gain sensibility when detecting extreme dry spells and heat extremes."

- Could Figure 2 be illustrated with a particular observational year?

"The authors considered that this scheme it is enough illustrative and allows the reader easily understand the meaning of each variable (D, M and EM)"

- Would it be interesting to analyze the length of the EM events? (i.e. the number of consecutive extreme dry and hot days, in the addition of the value of $T_x > 90^{\text{th}}$ during D events)

"The authors acknowledge the reviewer suggestion. However, the approach suggested for the reviewer could be biased due to the duration of D events. If in 1981 there are longer dry spells than in 2010, extreme temperature spells will be greater in the former case."

Results

- Line 192: I suggest the authors to detail the calculation of the T_x anomalies, maybe in section 2.

"We added a short explanation in how we compute these anomalies. See L170-172."

- Line 199: I think the authors meant Figure 3, like in the parenthesis in the end of the sentence.

"We have restructured the text of this part because we detected an error in Fig. 3 and Fig 4, which were not calculated annually, but for the whole study period. For this reason, there were dry spell lengths over 100 days in Fig. 3 (when summer and spring separately only have 90 days approximately)."

- Line 255: I suggest the authors to justify the use of a 7 year-moving average, maybe in section 2.

"We have changed 7-yr by 5-yr, a more usual interval in this kind of applications."

- Line 273-316:
 - I suggest the authors to describe in the section 2 the methods employed in the joint probability analysis of D and EM events.

"We have added more relevant information in the caption of Fig. 12, but the authors don't consider necessary to add more information to the section 2 because no additional methods are used to perform the Fig. 12, 13, 14."

- The physical interpretation of the mean value of the bivariate distribution in Figure 10 is the likelihood of average D occurring given that average EM occurs?

"This is the area of maximum point density (D and EM). More information was added to its caption to do this figure more comprehensive. Now it is Fig. 12."

- Maybe Figure 11 could be moved to Supplementary.

"We have changed Fig. 11 (now, Fig. 13), by the HIPY region bivariate distribution figure"

- Line 283-284: "Nonetheless, in the case of summer for this same scenario, a small increase in the duration component was observed." I suggest adding to this sentence that the increase is higher from the first period to the second (2011-2040 to 2041-2070) than from the second to the third (2041-2070 to 2071-2100).

"There were structural changes in this part of this manuscript due to the application of a new method of bias correction MBCn, which implies a slightly different result."

- Figure 10: Some information such as the regression line and the R-squared is not interpreted in the manuscript text.

"Done. See L369 or L385"

- Line 301-316: I suggest specifying in parenthesis the Mediterranean and continental regions mentioned in the text, for example: Mediterranean regions (NMED and SMED).

"Done"

Discussion

Line 327-329: 'A significant finding of our study indicates that there will be a significant increase in the future compound risk in relation both to the magnitude dimension (extreme temperature) and the duration dimension (duration of extreme dry event).' I suggest rephrasing indicating the regions, seasons and scenarios to which this finding applies.

"We have rephrased these lines following the reviewer's suggestions. See L413-416."

Technical corrections

- In general, figure captions can be improved, e.g.:
 - Figure 4 – Indicate period as in Figure 3.

"Done"

- Figure 6 – Explain better the horizontal interval in D points.

"Figure 6 was removed from the analysis due to the restructuration of section 4"

- Figure 10 – Explain the black dashed line, the black numbers over the isolines and the top equations.

"Done"

- Figure 11: Same as Figure 10, not 11.

"Solved"

- Line 80: AND in capital letters

"Done"

- Section 5 title: 'future' to 'Future'

"Done"