Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2019-1-AC2, 2019

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The impact of drought on the productivity of two rainfed crops in Spain" *by* Marina Peña-Gallardo et al.

Marina Peña-Gallardo et al.

marinapgallardo@ipe.csic.es

Received and published: 7 May 2019

Authors sincerely thank to the three anonymous Referees for their reviews, constructive comments and positive feedback in general. We hope that they find the responses satisfactory.

Anonymous Referee #2

This manuscript examines the spatial and temporal relationships of crop yield to a suite of drought indices in Spain. Two different crop yield datasets are used and seven drought indices are used including the multi-scalar SPEI, SPI, and SPDI and the uni-scalar PDSI, z-index, PHDI, and PMDI. Main findings were that then multi-scalar drought indices were most strongly related to crop yield and that spatial patterns varied

Printer-friendly version

Discussion paper

depending on time of year and drought index time scale. This paper is well written and of interest to the community. Overall, I did not find any major issues with the paper, but a few parts of the methods and analysis do need a bit more clarification. Once these methods are clarified the paper should be accepted for publication.

1. Figures 3-5 show the strongest correlations to crop yield but don't discuss the ending month of the strongest correlations. I realize month is discussed in other figures but I don't think it specifically highlights the ending month of those maximum correlations. Please clarify how the ending month is accounted for. An additional figure showing the spatial distribution of the ending months associated with max correlations could be useful.

In figures 3-5 we only attend to the magnitude of correlations stressing the difference of these among drought indices. The monthly response of yields to drought is summarized in the results obtained from the PCA (Figures 7 and 8). The PCA was performed using the maximum monthly correlations (pp. 212-214) and the comment of the temporal relationship between yields and climate is covered in point 3.3 and more specifically by crop and spatial scale in points 3.3.1 and 3.3.2. In discussion section, we also refer to the seasonality observed in the results and relate it with the phenology of the cultivations (pp. 488 – 495). Thanking the suggestion, authors think that adding supplementary figures showing the same maximum monthly correlations does not offer additional information beyond the one shown in the summary graph from the PCA.

2. Throughout the paper the "impact of drought" on crops is mentioned several times. However, all data for the period is used which includes droughts, wet years, and average years. I would think additional analysis would be needed to justify that wording that looks specifically at drought episodes. I would suggest somehow rephrasing that throughout the manuscript to more of a general "climate" impact of droughts as drought events are never discussed.

Authors appreciate this comment raised by the Referee and would like to offer their

opinion at respect. As Referee points out, it is true that we have not conducted an analysis of either a particular drought event or its impact on yields. Instead, we evaluated the capacity of different drought indices to detect changes on rainfed crop productions. Fluctuations on rainfed crop yields may respond to different causes such as plagues however, water availability is the main constraining factor. We aimed to assess how good or "less-good" each index analysed performs, and ultimately define the most appropriate index for drought monitoring purpose. In this paper, the term 'impact of drought' is referred succinctly in the context of the strong relationship found between the drought indices and the rainfed yields. We appreciate this comment as we think it is important to clarify it, for this reason, we have changed the use of the term 'impact of drought' for 'impact of climate' in those parts of the text where no reference to the strong relationship found between drought indices, and yields is made.

3. It is not completely clear how the monthly drought indices are correlated to ANNUAL crop yield. Months in Figures 7-9 begin in October so is that the October prior to the crop yield year?

Harvesting season ends in late July (in some regions this season extents until the firsts weeks of August), while sowing season starts (in general) in October. We made our climatic series start in October matching the beginning of the growing season. Thus, annual yields are related with climate starting in October from the previous year if it is consider January as the starting month.

Also, can you explain what correlations of drought index to crop yield in say, December, actually means. By December all of the growing season and harvest is finished so what does this physically mean? Or, is this the December prior to the crop yield year? Please clarify some of these issues.

In line with the previous response, December values correspond to the first stages of growth in both crops, when wheat and barley rainfed cultivations are more sensitive to precipitation shortages. This is observed in figures 7/8 and 9 as maximum monthly cor-

relations are recorded in May at 4/5-month time-scales (corresponding to Dec-January climate conditions).

4. Line 147: The “atmospheric humidity demand” is only considered if using a Penman-Monteith or other physical evaporative demand formula. Palmer’s original paper on used temperature and no humidity. I suggest changing just to “atmospheric demand”.

We take note of the suggestion in the manuscript. Thank you so much.

5. Figures 2 and 3: Please clarify in the captions that the box plots are showing the distributions for all districts or provinces.

We have added it to the caption. Thank you.

Fig. 3. Box plots showing the distribution of the strongest correlation coefficients found between drought indices and wheat and barley yields at the agricultural district (a and b) and provincial (c and d) scales, for all districts and provinces analysed. The solid black line shows the median, the white asterisk shows the mean, and the dashed red lines show the $p < 0.05$ significance level.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-1/nhess-2019-1-AC2-supplement.pdf

---

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2019-1, 2019.

Printer-friendly version

Discussion paper