

Interactive comment on “Rankings of extreme and widespread dry and wet events in the Iberian Peninsula between 1901–2016” by Margarida L. R. Liberato et al.

Referee comments by Anonymous Referee #2

The main goal of this study is to characterize and rank the most extreme, widespread drought (wet) events in the Iberian Peninsula between 1901–2016. The method used is based on the multiscalar Standardized Precipitation Evapotranspiration Index (SPEI) from CRU. Besides, different time scales (6, 12, 18 and 24 months) were considered in ranking. The topic is quite interesting, but there is a lack of further discussion of the results. It is also necessary to include some validation of the most severe drought events identified in the study area.

Reply: We acknowledge the reviewer for the support and constructive comments, which may contribute to improving the revised manuscript. We agree with the reviewer that a discussion section may be included to stress some of the identified caveats, advantages and disadvantages of this methodology. We will also develop the analysis by including some comparison with auxiliary information on the most severe (wet and dry) events identified in the study area. Our detailed responses can be found below.

General Comments:

Abstract: The authors could bring more highlights about the results in the abstract.

REPLY: We agree with the reviewer and the abstract will be improved accordingly.

Introduction:

Line 57: It is not correct to say that drought indices have been developed in recent years. The PDSI, for example, was created more than 50 years ago. Please modify the sentence.

REPLY: We agree with the reviewer and the manuscript will be changed accordingly.

Lines 106-109: Perhaps these sentences can be removed. I do not think it is necessary to describe the topics of the article.

REPLY: We agree with the reviewer, these sentences can be removed.

The authors could add more details in the introduction about the reason for using SPEI instead other indices, pointing out the main advantages and disadvantages.

REPLY: We agree with the reviewer and we will include more on this information, namely mentioning works performed with SPEI and other indices on IP (Gouveia et al., 2017, Pascoa et al. 2017a, 2017b, Ribeiro et al., 2018). However, we would like to highlight that for this manuscript we could either apply SPEI or other indices; this work does not aim at comparing or assess extremes (wet and dry) using different indices. This is a relevant topic, but it is not the scope here.

“Several authors have performed drought characterization and assessment of impacts, namely on vegetation dynamics (Gouveia et al., 2016, Liberato et al., 2018) and on crops production and yield (Pascoa et al. 2017a, 2017b, Ribeiro et al., 2018). The SPEI and SPI were used in order to identify drought severity and intensity and both indices are able to identify the severest and longest events. Although the recent issues raised due to the uncertainties on AED computation (<https://doi.org/10.1002/joc.6719>, <https://doi.org/10.1002/joc.6126>), some works highlighted the ability of SPEI to identify tendencies towards to dryer conditions on Iberian Peninsula (Vicente-serrano et al., 2014, Spinoni et al., 2015, Coll et al., 2016, Páscoa et al. 2017).”

- Coll J., E. Aguilar, and L. Ashcroft, “Drought variability and change across the Iberian Peninsula,” *Theoretical and Applied Climatology*, vol. 130, no. 3-4, pp. 901–916, 2016.
- Páscoa P, Gouveia CM, Russo A, Trigo RM (2017a) Drought Trends in the Iberian Peninsula over the Last 112 Years. *Advances in Meteorology Volume 2017*, Article ID 4653126, 13 pages <https://doi.org/10.1155/2017/4653126>
- Páscoa P., C. M. Gouveia, A. Russo, R. M. Trigo (2017b) The role of drought on wheat yield interannual variability in the Iberian Peninsula from 1929 to 2012. *Int J Biometeorol*, 61:439-451 DOI: 10.1007/s00484-016-1224-x
- Ribeiro, A. F. S., Russo, A., Gouveia, C.M., Páscoa, P. (2018). Modelling drought-related yield losses in Iberia using remote sensing and multiscalar indices, *Theor Appl Climatol*, doi:10.1007/s00704-018-2478-5
- Spinoni J., G. Naumann, J. Vogt, and P. Barbosa, “European drought climatologies and trends based on a multi-indicator approach,” *Global and Planetary Change*, vol. 127, pp. 50–57, 2015.
- Vicente-Serrano S. M., J.-I. Lopez-Moreno, S. Begueria et al., “Evidence of increasing drought severity caused by temperature rise in southern Europe,” *Environmental*

Extensive extreme droughts during the period 1901-2016: How the major negative societal impacts related to severe droughts was measured? Please, add some examples in the manuscript.

REPLY: We agree with the reviewer that major negative societal impacts are one of the motivations for better understanding extreme, widespread events (dry or wet). As stated above we will include additional information on the most severe (wet and dry) events identified in the study area, including some information on negative societal impacts.

However, we would like to stress here that this paper is not studying the impacts of droughts. We are mostly presenting a methodology which allows to categorize, to rank, to hierarchize, to compare different extreme events (both dry and wet), including the affected area and the magnitude. Individual, recent, extreme wet/drought events are well known in the Iberian Peninsula and have been studied by some of the authors in recent years. We can mention for example the outstanding 2004-2005 drought in the Iberian Peninsula (Garcia-Herrera et al. 2007) or the record Winter drought of 2011-12 in the Iberian Peninsula (Trigo et al. 2013). We can also mention the 2009-2010 extreme winter precipitation in the Iberian Peninsula (Vicente-Serrano et al. 2011). All these extreme events have been previously studied. To develop a methodology to assess these extreme events through the impact perspective is another interesting research question, but it is out of the scope of this paper.

Please consider including some information on the possible causes (climate) of the most severe drought events in the study area.

REPLY: We thought the main objectives and motivations underpinning this manuscript were clear from the beginning. From the reviewers' comments we verify that the scope of this manuscript is not clearly stated. Therefore, we will include changes that will clarify and explain better the motivation and objectives of the paper. We will also highlight the relevance and novelty of this study, which is presenting a methodology for building rankings of extreme and widespread dry and wet events, for several timescales, whatever indices datasets are used (in this case we used SPEI).

To accommodate the reviewer's concerns, we will also include in the discussion a review on the possible causes (including climate) associated with the occurrence of the most severe drought and wet events in the Iberian Peninsula. However, highlighting that attribution of few extreme events is a hot research topic which is out of the scope here.

In addition, it is necessary to quantify the droughts impacts on agricultural production and reservoirs, as a validation of the ranking of drought.

REPLY: We understand the reviewer's point. In fact, several works have already presented the impacts of droughts on vegetation dynamics and crops production and yields (Gouveia et al., 2009, 2012; Páscoa et al., 2017; Ribeiro et al., 2018, 2019) over Iberia. However, we must stress that the assessment of the impacts of dry and wet events is not the scope of this manuscript. This can be seen as a caveat from the point of view of risk management. Therefore, we will be pointing to the ranked impacts of wet and dry episodes and highlight that the impacts were not included in the construction of the methodology.

Figure 1 - What information is presented by the color scale in figure 1? Please specify if it is a physical variable (elevation, etc.)

REPLY: Thank you for highlighting this. We will include a color scale, elevation and units.

Thank you!