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Interactive comment on "The European 2015 drought from a climatological perspective" *by* M. Ionita et al.

M. Ionita et al.

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We would like to thank the reviewer for the constructive feedback on our manuscript and we are grateful for the comments on how it can be further improved. Here, we respond to each comment in turn – full details of the implementation will be provided in the revised manuscript.

Interactive comment on "The European 2015 drought from a climatological perspective" by M. Ionita et al.

Anonymous Referee #3

General: An in-depth study of the 2015 European drought would be a valuable addition to the literature. This is clearly a strong group of researchers, but I was very

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underwhelmed by this article. The analysis is almost entirely descriptive and largely consists of maps of precipitation and temperature anomalies, along with accompanying maps of drought indices. All of this information is easily or widely available. Most of the conclusions reached are obvious: the drought was associated with below average precipitation, above average temperature, positive 500Pa height anomalies, and "widespread areas of negative SPI and SPEI" (quote from Abstract). What drought doesn't have these features? The result that is most interesting is the associated sea-surface temperature patterns, but, like the other analyses, this is a largely descriptive exercise. The comparison with 2003 provides some additional substance, but it makes one wonder about the features of other past droughts. Why use just one year for the comparison when an ensemble approach is much more valuable? Similarly, no probabilistic information on how unusual (extreme) the 2015 drought was is provided other than that inferred from the SPI and SPEI values. The article reads like a routine government report rather than cutting-edge research.

Response: As clarified in our response to Reviewer 1, the aim of our study was to have a broader overview of the drivers of the summer 2015 drought both from a climatological point of view (present paper) as well as from a hydrological point of view (http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-366/), following the pattern of previous atmospheric summaries of individual climatic extreme events. Analyzing and managing drought in a pro-active way requires a concerted action of the hydrological and climatic communities. This twin papers are a first attempt to emphasize the need of such actions from different communities. The hydrological portion is fully covered by the twin paper mentioned before. In this way, the two papers are largely descriptive, but are designed as a clear and comprehensive summary of the 2015 event to promote more detailed future studies by compiling available data. There is a long history of extreme event summaries published in the atmospheric science literature, from 1970s-80s to the yearly special issues of the Bulletin of American Meteorological Society – State of the Climate (https://www.ncdc.noaa.gov/bams). These studies have been designed to highlight the unique features of a given event and to spur/urge/promote more

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detailed modeling research. This study follows this tradition, but along with its companion hydrological paper, summarizes the drought event from both, a meteorological and hydrological perspective, focusing on drought indices used operationally and quantifying the larger water cycle effects.

Specific: (1) At a minimum, this article needs to incorporate a more quantitative and probabilistic perspective on the 2015 drought. The SPI and SPEI values are a start but don't fully show how unusual the values are. This could be done at each grid point or regionally over appropriate areas (such as agricultural regions or drainage basins).

Response: To add more quantitative measure to our analysis, we will incorporate ranking maps in the revised manuscript (see Figure S1 at the end of this document), which will show where summer 2015 ranks, in terms of amplitude, compared to the last 65 years. The ranking is done in every grid point.

(2) Building on the lack of probabilistic information, there also is an opportunity to include a paleoclimatic drought perspective. This could easily be done by using data from the Old World Drought Atlas (Cook et al., 2015) and then using that information in a more probabilistic approach.

Response: Including a paleo perspective, while interesting, would be beyond the scope of our paper. Moreover, a comparison between the drought 2015 and the Old World Drought Atlas would not be feasible, due to the different data sets involved. Our drought measures (SPI, SPEI) are based on observed data (e.g. precipitation, temperature) and verified algorithms, while the self-calibrating Palmer Drought Severity Index data from the world drought atlas is based on proxy data (e.g. tree rings). Furthermore, the scPDSI from the Old World Atlas does not cover the year 2015, which would make such a comparison impossible. Finally, and perhaps most critical, is that the regions most affected by drought in 2015 (the eastern part of Poland and Ukraine), are poorly or not at all covered by tree rings sites in the Old World Atlas scPDSI reconstruction (see Figure 1 in Cook et al. 2015), thus making the drought reconstruction over these

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regions not reliable.

(3) In terms of what other droughts have occurred and how they compare to these two, the current analysis suggests that the SST dipole may be an important and presumably causal feature. But it is unclear how often this occurs and how long it persists. Is it necessary but not sufficient? What other SST patterns cause extreme droughts in this area? Some additional analysis of that feature could make this a much more useful piece.

Response: More complex analysis (e.g. Empirical Orthogonal Function Analysis (EOF) and Composite Maps Analysis (CMA)) will be employed to tackle these issues and new results based on these statistical measures will be added to the revised manuscript.

Technical: (1) In the title, “2015 European drought” seems more appropriate than “European 2015 drought”. (2) The information on losses of 5000 billion Euro is given twice in the Introduction. (3) The rainbow color map used in Fig. 7 is not appropriate.

Response: All these technical issues will be accounted for in the revised version of the manuscript.

References: Cook, Edward R., et al. "Old World megadroughts and pluvials during the Common Era." Science Advances 1.10 (2015): e1500561.

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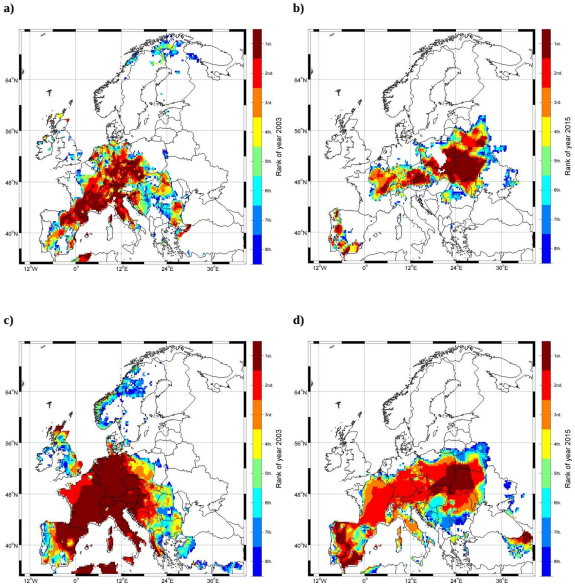

Figure S1. Top 8 ranking of summer (JJA) SPEI3 severity for the (a) 2003 and (b) 2015 drought events. In this figure, 1 means the driest summer since 1950, 2 signifies the second driest, and all ranks greater than 8 are shown in white. Tmax for summer (JJA) are shown in a similar manner for the (c) 2003 and (d) 2015 drought events.

Fig. 1.

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