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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 positive 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 #2

General Comments

I think overall this is a nice climatological overview of the 2015 drought. The comparison with 2003 is also a helpful step in understanding the nature of these droughts (I

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find the differences in their early development especially interesting), and highlights the challenges of predicting their evolution. While the authors do a good job of outlining the various potential mechanisms that may have led to the drought, the discussion largely reflects our current limited understanding of the causal mechanisms of such droughts, and the limitations of assessing causes from an observational-based study.

The weak (if any) link to SST anomalies, the importance of anticyclones, and possible links to various large-scale atmospheric teleconnection patterns, some of which are themselves poorly understood (as well as the potential impact of the overall warming climate) all make understanding the ultimate causes of such droughts a challenge. It would be nice to see a follow-on modeling study that examined some of the potential causes outlined here in a more quantitative way.

Response: We agree with this comment, and as highlighted in our response to Referee #1 we have tried to emphasize also in the manuscript the fact that the Mediterranean SST does have a role in influencing heat waves and droughts over Europe, but the real mechanism behind this relationship is not fully understood. The causality would require a complex model analysis that considers various factors. Nevertheless, we do anticipate designing a sensitivity experiment using a coupled atmosphere-ocean model such as (V. Artale et al.: An atmosphere–ocean regional climate model for the Mediterranean area) by increasing the SST in the Mediterranean region and observing the response of the atmosphere to this increase. This is beyond the scope of the present paper, but we hope that this manuscript will be a starting point for such modelling analyses.

Specific Comments: While (as the authors note) the well-known NAO and SCA patterns appear to play a role in the early and middle stages of the drought, the nature of the blocking pattern that appears to play a key role during August (the warmest month on record) is less clear. In that regard, the authors may find it helpful to take a look at Schubert et. al. (2011) concerning the role of Rossby Waves in summer climate extremes. One of the leading patterns found in that study bears some resemblance to the wave pattern that develops during August 2015.

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Response: We thank the reviewer for this valuable comment and we will add some more information in the revised version of the manuscript regarding the influence of the blocking pattern on the development of the drought event.

On a more technical note, I think that since the focus is on the modern era (reference period only goes back to 1971) it might have been better if the authors had used an atmospheric reanalysis that assimilates upper air observations, rather than the 20th century reanalysis, which only assimilates surface pressure. While monthly means are well reproduced in that reanalysis, the results may be less accurate for sub-monthly values. In any event, it might be worth comparing the results in Fig. 7 with e.g. the results based on the older NCAR/NCAR reanalysis just as a sanity check.

Response: We apologize for the confusion. The reference to the data sets in our manuscript is misleading. We have actually used the NCEP/NCAR Reanalysis 1 (1948 – 2015). We started our analysis using the 20th century reanalysis, but realizing similar concerns to the ones you mention, all the results and figures in the paper have been obtained based on the NCEP/NCAR Reanalysis 1 (1948 – 2015). We missed this change to the references and have modified the revised manuscript to add the proper set of data.

Other details: - please check the cost “5000 billion Euros [EEA, 2010].” – line 5, page 2 - line 18, page 3: “management” should be “managed” - line 22, page 4: “to” should be “the” - what is the reference period for the SST anomalies in Fig 5a? - state the reference period for indices in caption of Fig 8 (1950-2000?) - page 8 lines 25-28, should note that some studies indicate that the role of the Mediterranean Sea was largely passive in 2003 (e.g., Tomassini and Elizalde 2012) - “Siegfried et al. 2014” reference should be “Schubert et al. 2014”. - Figure S5 “As in Figure 9”, but for the period 1950 – 2015. should be “As in Figure 8”.

Response: All the above suggestions/comments will be accounted for in the revised version of the manuscript.

“Warm Season Subseasonal Variability and Climate Extremes in the Northern Hemisphere: The Role of Stationary RossbyWaves,” Schubert, S., H.Wang, and M. Suarez. J. Climate, 24, 4773-4792, 2011

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