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Hydrology and Earth System Sciences Discussions

Interactive comment on "Streamflow droughts in the Iberian Peninsula between 1945 and 2005: spatial and temporal patterns" *by* J. Lorenzo-Lacruz et al.

J. Lorenzo-Lacruz et al.

jlorenzo@ipe.csic.es

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The authors want to express our gratitude for the interesting comments and observations received from the reviewer, all of them aimed to improve substantially the quality of our work and the clarity of the presented results. Following we include a detailed letter where we respond to every suggestion and concern of the reviewer, explaining all changes introduced in the revised version of the manuscript.

General comments

1. Although it's declaimed (by the authors and others) that SSI was comparable spa-

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tially and temporally as it's the Z-Score of a time series, it does depend on the length of the dataset (subsets of a record with different periods have different means and standard deviations, resulting in different SSI). The origin SPI suffers less from this if the record is long enough (e.g. 30 years), as it's arguably acceptable that 30 yrs is long enough to be "representative". However, stream flows can be dramatically reduced or increased following river regulation. Therefore, the relative lengths of the investigated time series falls in pre-/post-regulation eras might have large impact on the resultant SSI. Suggestion: check the raw time series to ensure that the stream flow records have similar proportion of the records before and after river regulation.

A great proportion of the stramflow series and its SSI calculation are not influenced by damming/regulation since they belong to basins regulated prior to 1945 (58 series) or to basins which are not regulated at all (58 series). Considering the series belonging to basins regulated during the study period (71), we checked that there is a generalized balance between the proportion of data before and after the damming in each basin, since the great development of the Spanish dam network took place during the end of the sixties and the seventies. Thus, in the majority of the cases there are, at least, 20 years of data (240 records) before and after the damming, and we therefore consider that the impacts on the resultant SSI in these basins are small, although not negligible as noted by the reviewer.

2. Information and data in Figure 7 could be more clearly presented in a table.

We replaced the graph by a table, showing mean and maximum duration and magnitude for two periods (as in the graph). However, we added a new set of columns where we summarize the variations in drought characteristics for the two different periods (increase or decrease). We also changed the caption of the figure.

3. Why use the thresholds of -0.84 and -1.65 to define drought and severe drought? Why not -1 and -1.5 by Mckee et al. (1995)?

We selected -0.85 and -1.65 because they correspond to round figures of the 20% of

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probability and the 5% of probability, whereas -1 and -1.5 not. Moreover, threshold selection is still a subjective issue, although we followed the recommendations of the most recent articles related to this thematic within Europe (Tallaksen et al., 1997; Fleig et al., 2006; van Loon et al., 2010). In these works the selected threshold was the 30 Percentile, for pinpoint drought episodes in the European spatial context. Nevertheless, and due to the different nature of the hydrological regimes in the Iberian Peninsula (most of them having very low water levels in the dry season), we selected the 20 Percentile, aiming to avoid an over estimation of the registered drought episodes.

Specific comments

1. P8064 line 17-18: "Among natural hazards drought is the most damaging and affects more people than any other one (Obasi, 1994) . . ." This is quite subjective although referenced. Could be "Drought is one of most . . ."

We totally agree with the reviewer thus we replaced "drought is the most damaging. . ." by "drought is one of the most. . ."

2. P8066, line 13: There is a general. . .

We corrected this sentence following the referee recommendation.

3. P8066, line 24 – 25: Suggest deleting "in relation to the drought response of particular catchments."

We deleted "in relation to drought response of particular catchments".

4. P8067, line 13: "using a long-term dataset"

We replaced "long temporal dataset" by "long-term dataset".

5. P8070, line 9: delete "among" We deleted "among". 6. P8070, line 10-11: "Once F (x) (the cumulative distribution function) is identified, the SSI (in z-scores) can easily be calculated. . ."

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We corrected this sentence following the referee recommendation.

7. P8071, line 16-17: "... level that does... records are..."

We corrected this sentence following the referee recommendation

8. P 8077, line 5 – 7: delete the sentence "In Fig. 6..." as it repeats the Figure legend

Although the reviewer is right, we believe that it is important to briefly explain what the figure means. However we have slightly changed the sentence to make it less redundant.

9. P8079, line 19: what's "concrete catchments"? and P8086, line 12 "concrete months"

We replace "concrete" by "specific" where it needed.

10. P8080, line 27 – P8081, line 5: very long sentence, suggest revising

We rephrased the sentence to make it shorter in this way:

For example, López-Moreno et al., [2009] assessed the effects of a large transboundary dam between Spain and Portugal on hydrological droughts in the Tagus basin (Iberian Peninsula; IP), showing how the nature of droughts had experienced severe changes downstream of the Alcántara dam. These changes are associated to an increase in both the duration and the magnitude of drought episodes as a consequence of the dam management, with implications for the availability of water resources downstream, affecting the Portuguese part of the basin.

11. P8081, line 17: associated with

We replaced "associated to" by "associated with"

12. P8082, line 26: ...generates greater differences...

We replaced "generates deeper differences" by "generates greater differences".

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13. p8083, line 2: “Following completion . . .”, A new paragraph, in line with the next one.

We considered “Following completion. . .” as a new paragraph.

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Fleig, A.K., Tallaksen, L.M., Hisdal, H., Demuth, S., (2006): A global evaluation of streamflow drought characteristics. Hydrology and Earth System Sciences 10, 535-552.

van Loon, A.F., van Lanen, H.A.J., Hisdal H., Tallaksen L.M., Fendeková, M., Oosterwijk, J., Horvát, O. & Machlica, A., (2010): Understanding hydrological winter drought in Europe. IAHS Publ. 340, Wallingford, UK.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8063, 2012.

	1945-1974				1975-2005				Periods comparison			
	Mean duration	Max. duration	Mean magnitude	Max. Magnitude	Mean duration	Max. duration	Mean magnitude	Max. Magnitude	1975-2005 respect to 1945-1974			
	(months)		(accumulated SSI deficit)		(months)		(accumulated SSI deficit)		Mean duration	Max. duration	Mean magnitude	Max. Magnitude
PC1	3,7	15,0	2,0	16,4	9,8	66,0	9,5	113,2	Increase	Increase	Increase	Increase
PC2	4,8	26,0	5,1	34,1	3,6	9,0	2,0	9,1	Decrease	Decrease	Decrease	Decrease
PC3	2,7	8,0	1,8	8,3	4,1	17,0	3,5	18,4	Increase	Increase	Increase	Increase
PC4	2,9	11,0	2,2	12,3	3,3	18,0	2,6	15,5	Increase	Increase	Increase	Increase
PC5	3,0	19,0	2,3	27,4	4,6	21,0	3,8	23,0	Increase	Increase	Increase	Decrease
PC6	2,9	10,0	1,8	8,2	4,2	18,0	3,7	17,4	Increase	Increase	Increase	Increase
PC7	8,4	33,0	6,2	39,1	3,4	25,0	2,7	26,9	Decrease	Decrease	Decrease	Decrease
PC8	4,1	16,0	3,0	14,5	4,7	33,0	3,4	43,1	Increase	Increase	Increase	Increase
PC9	4,7	12,0	3,7	21,0	4,1	15,0	3,1	22,9	Decrease	Increase	Decrease	Increase
PC10	4,3	26,0	3,8	49,0	4,6	21,0	3,3	22,1	Increase	Decrease	Decrease	Decrease

Fig. 1.

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