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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrological response to different time scales of climatological drought: an evaluation of the standardized precipitation index in amountainous mediterranean basin" *by* S. M. Vicente-Serrano and J. I. López-Moreno

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We thank the positive comments done by the reviewer about the usefulness of this paper for the hydrological management and monitoring of mountainous catchments and the possible use of the results to monitor ungauged basins. We are also very grateful for the suggestions done by the reviewer 2. We think that these provide important new concerns, which have been considered to improve the manuscript.

Following, we address the main concerns indicated by the reviewer:

1- The reviewer indicates that the used data set is very limited, relating to only one catchment and not taking into account soil moisture or groundwater.

We agree with the reviewer about the interest of analysing the response of soil moisture and groundwater evolution to SPI. However, data on both parameters are sparse and only monitored during short periods. Thus, it would not be possible to compare the results with those obtained about river flows and water storages. With regard to the unique use of one catchment, the main purpose of this paper was to check the validity of several statements, which are frequently accepted about the usefulness of the SPI to identify droughts in different subsystems of the hydrological cycle. In order to address this goal, it was correlated SPI series at different time scales (from 1 to 24 months) with river flows and reservoir storages at monthly level. This procedure provided a large amount of information. Thus, it was required a noticeable synthetic capacity and the use of relatively complex graphs (i.e. Figs 4 and 6) to show properly the results. Moreover, this paper did not aim to provide optimal SPI time scales for monitoring hydrological droughts in different basins. In the discussion, we outline the necessity to carry out similar analysis than here in other mountainuos areas, before to use SPI for monitoring droughts. We considered that the introduction of more basins in the study would imply to enlarge unnecessarily the paper, as well as to introduce a greater complexity for interpreting the results. The Upper Aragón river basin represents well the characteristics of a mountainous Mediterranean catchment in both: climate and land-use/ land cover conditions. The selection of the basin was based on the quality of the data available, and on the knowledge about its environmental and hydrological characteristics, analyzed by the authors in previous works (López-Moreno et al., 2002 and 2004; Vicente-Serrano et al., 2004).

2- "..although the interest is in droughts, the whole time series are used to calculate correlation coefficients". Referee answer about the effects of studying the whole time series instead of the dry period only.

We are very grateful with this comment because of this topic was not considered in the first version of the manuscript. We considered this question very interesting and feasible for application in the water resources management. In the revised manuscript,

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we will add the analysis done recently in which is considered independently the role of SPI on dry and humid periods of reservoir storages and river flows. The results found are very interesting. Although the patterns of correlation are quite similar to the analysis done using the complete time series, there are some differences in the time of response regarding to dry and wet periods, which will be presented in a new section of the revised the manuscript.

3- We used Pearson's correlation coefficient to compare climate-water resources relationships. Referee suggests the convenience of using time series models like Box-Jenkin models.

The use of time series models may provide interesting findings. Nevertheless, we consider that according to the objectives of this paper, the correlation analysis satisfies the purposes of this work and the results of this analysis are more comprehensible than Box-Jenkin models since this method is not widely known either used for hydrological analysis.

4- The referee suggests some papers to provide more references about the usefulness of SPI index and strengthen the conclusions of the paper.

References and comments about the papers suggested by the reviewer will be included in the revised manuscript.

5- The distribution of precipitation stations is clearly not random. All stations seem at relatively low altitude. Referee is concern about the possible effect of this on the results. He suggests the use of an interpolation method based on altitude.

Meteorological stations range between 500 and 1300 m a.s.l. High mountain sectors are not covered by the network of the National Meteorological Services (Spain) due to operational difficulties mainly during winter months. Although precipitation follows a positive altitudinal gradient in Pyrenees, it shouldn't affects to the interannual evolution, since we are considering standardised values series. Table 1 shows the correlation of

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the individual series with the obtained regional series. Correlation values are very similar for all the stations suggesting that altitude does not affect the interannual evolution of precipitation. It confirms the consistency of the regional series of SPI for summarizing the regional anomalies of precipitation above or below the average.

Finally, the comments about style and grammar will be taken into account in the revised mansucript.

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