

## ***Interactive comment on “Historical droughts in Mediterranean regions during the last 500 years: a data/model approach” by S. Brewer et al.***

**S. Brewer et al.**

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Reviewer 2

**Chronology.** We acknowledge that there is debate about the timing of the LIA period, and so have expanded the description of this period. However, given this debate, we believe that is easier to define the period by name, having stated that, for the purposes of this paper, it corresponds to approximately 1650-1850 AD.

**Fuzzy logic.** We have added more detail to the description of the Hagamans distance, to describe why it has been used. As it deals with numbers that are defined by a membership function, rather than a single value, this is correctly described as fuzzy logic.

**Clusters.** We agree that if the model data had been clustered, then no agreement

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should be expected. However, this has not been done. We have instead clustered the reconstructed PDSI values, and then assigned the model year to the cluster in which the equivalent data year is located. Given the set of similar data patterns (each cluster), we wish to see how closely the corresponding model patterns fit, and we find that, with the exception of cluster 5, the ECHO-G model run reproduces the ‘mean’ pattern with some skill. Secondly, we wish to examine whether the temporal occurrence of these patterns is similar in the data and model by using the graphs showing the frequency of occurrence (col D of figure 6). We have added some text to the start of this section to attempt to clarify this.

Clusters vs NAO. 1) The use of winter SLP patterns. The PDSI in this region is controlled largely by the conditions of the previous winter, mainly precipitation. As one of the goals of the study was to understand the observed patterns of PDSI in an extra-regional context, we chose a priori to use the winter SLP as a representative of synoptic scale circulation patterns.

2) Whilst we are not experts on the use of superposed epoch analysis, we believe that it would give similar results, as the SPE approach is used to analyse data belonging to particular categories (time periods, seasons, etc). Using cluster analysis simply replaces the choice of the categories with a set of clusters representing similar spatial patterns, and the use of the cluster centroids is the equivalent to using the median value obtained for a given category in SPE analysis. We would further argue that the cluster-based approach allows greater flexibility in the later comparison as we use the extent of each cluster to better assess the model-data fit. Comparisons may be then made through time by examining the frequency of occurrence of the different clusters or by the time series of Hagaman distances, showing how the model-data fit varies over time (not shown).

3) The comparison between the SLP pattern and the reconstructed PDSI fields is carried out by selecting, for each cluster, the three model years that most closely resemble the median PDSI data field for that cluster. We have not used a three year average

around selected individual years. The aim is to obtain the simulated PDSI pattern that most closely corresponds to the reconstructed PDSI pattern that is representative of that cluster. Once obtained, the SLP patterns of these three years are averaged to give a single pattern that can be used to interpret the observed PDSI.

Analysis of individual years. With the exception of the use of individual model year to help in the interpretation of the reconstructed patterns, there is no reference to individual model years. The comparisons referred to here are simply a comparison of the occurrence of certain specific years described in the work of Luterbacher with the cluster obtained in our analysis.

#### Minor points

- 1) This phrase has been removed
- 2) The 6ka discussion has been removed. We have kept the reference to the PMIP project as a) it is the best established of the paleo-comparison projects; b) has been the origin of the methods used here; c) allows us to demonstrate the interest of studying on the last millenium.
- 3) We agree that this phrase is not clear, and adds nothing to the paper. We have removed it.
- 4) References have been added.
- 5) We agree that the use of yearly data may obscure any different or contrasting seasonal response. However, as the index used is calculated from monthly data, we believe that seasonal differences will be taken into account.
- 6) The text has been changed.

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Interactive comment on Clim. Past Discuss., 2, 771, 2006.

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