

Interactive comment on “The climate of Granada (southern Spain) during the first third of the 18th century (1706–1730) according to documentary sources” by Fernando S. Rodrigo et al.

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Reply to Referee#1

Thank you very much for your comments and suggestions. They will be taken into account in the revised version of the manuscript. In relation to your specific comment 2, I think that a brief comment is necessary. The proposed methodology does not try to provide the year-to-year variability, but the general characteristics of the studied period. In fact, the paper by Rodrigo (2008) is entitled “A new method to reconstruct low frequency climatic variability from documentary sources: application to winter rainfall series in Andalusia (southern Spain) from 1501 to 2000”. If we apply the method to a

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longer time period, using 25 or 31 years moving periods, we obtain the running means of the series, not values year-to-year. However, if instrumental series begins at the end of documentary series (for instance, if documentary data end at 1800, and instrumental data begin at 1801), it is possible to obtain these annual values. The procedure is explained in Rodrigo et al (2012). Past annual values $x(t-r)$ may be obtained by means of a backward iterative process starting with instrumental values $x(t+r+1)$ and using running means ($u(t)$ for the documentary period, $u(t+1)$ for the instrumental period), with $n=2r+1$,

$$x(t-r) = x(t+r+1) - n(u(t+1) - u(t))$$

Unfortunately, continuous instrumental series in Granada do not appear until mid-19th century, and, in consequence, it is not possible to apply here this extension of the method.

It is true that this is a weakness of the analysis. However, this methodology has advantages in comparison with the standard indices methodology. First, ordinal indices may be skewed by the subjectivity of the authors in original sources, and/or by the interpretation of the researcher of the descriptions in the sources. In addition, ordinal indices are often based on the impact of the events on the socioeconomic infrastructures (for example, destruction of bridges during a river flood, loss of harvests, etc), and these impacts may change in different historical periods. The risk here is to consider as heavy extremes certain events that show the vulnerability of the system more than the extreme character of climate variables. The method followed is not based on the severity of the phenomena, and, in consequence, at least to a certain degree, avoid these problems. In second place, does not need an overlapping period with instrumental data, which is necessary to calibrate and validate indices. There is a third problem of statistical character: the calibration of indices normally is made using a regression procedure between proxy data (indices) and instrumental data during the overlapping period. From a statistical point of view, the consequence is the loss of variance of the reconstructed series, a problem that normally is solved using an 'inflation factor' to

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correct the reconstructed series (this is a typical problem in the management of proxy data, you can see how it was applied to documentary data in Rodrigo and Barriendos (2008)). With this method, in principle, it is not necessary to introduce this mathematical artefact (see Tables 4 and 5 of the manuscript, particularly the columns 's' showing the standard deviation of the reconstructed series and instrumental series). Statistical comparisons are made using the 95% confidence level intervals for mean value and standard deviation (l_u and l_s in Table 5, respectively).

These explanations were not included in the manuscript to avoid an excessively detailed treatment of the methodology, which is explained in the references quoted:

Rodrigo, F.S.: A new method to reconstruct low-frequency climatic variability from documentary sources: application to winter rainfall series in Andalusia (southern Spain) from 1501 to 2000, *Clim. Change*, 87, 471-487, 2008.

Rodrigo, F.S., Gómez-Navarro, J.J., and Montávez-Gómez, J.P.: Climate variability in Andalusia (southern Spain) during the period 1701-1850 based on documentary sources: evaluation and comparison with climate model simulations. *Climate of the Past* 8: 117-133. <https://doi.org/10.5194/cp-8-117-2012>, 2012.

A reconstruction from historical documents based on ordinal indices may be found in

Rodrigo, F.S., and Barriendos, M.: Reconstruction of seasonal and annual rainfall variability in the Iberian peninsula (16th-20th centuries) from documentary data. *Global and Planetary Change* 63: 243-257, doi: 10.1016/j.gloplacha.2007.09.004, 2008.

Thank you again for your comments,

F.S. Rodrigo

Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2018-170>, 2018.

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