Climate
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Discussions

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Interactive comment on "Rogation ceremonies: key to understand past drought variability in northeastern Spain since 1650" *by* Ernesto Tejedor et al.

Anonymous Referee #1

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The paper aims to characterise the variability of droughts in NE Spain since 1650 using records from rogation ceremonies from 13 cities. This type of records have been used in the literature as proxy for droughts in the last years with success, as can be seen in the literature and is well reflected in the references of the manuscript. Most of those previous studies are focused on certain locations, but there have also been previous exercises analyzing jointly these records. The main novelty here is the use of cluster analysis to identify spatial patterns within NE using these rogation ceremonies. I have several major methodological problems in the type of treatment used in the manuscript that prevent me from acceptance. 1- For every location the authors generate and index which ranges from 0 to 3 depending on the frequency and type of rogations. According

to the manuscript, the index is computed as a weighted average of the reports found for a given year between December and August. The weight depends on the type of rogation held, according to a given protocol. In my view this must be interpreted with caution due to different reasons. First the same value can be reached with different extremes. Thus, a value of 2 (moderate drought) can be obtain with one single record of level 2 or with two records: one rogation ceremony of level one and another one of level 3 (1x1 + 1x3)/2=2. The climatic difference is really relevant, since in the second case the drought should have been much more extreme than in the first one. This index is semi quantitative because the levels are assigned after analyzing the ritual and due to the lack of overlap with the instrumental record, it is just an assessment expressed in a quantitative scale. Finally, the index is not linear, in the sense that a drought of level 3 should not necessarily be three times more intense than a drought of level 1. All these cautions should be taken into account when applying to the index built in the manuscript. The authors claim (I 249 for example), that they have obtained a continuous quantitative index, but these cautions are not mentioned in the text. 2-Next, a cluster analysis is performed to identify spatial patterns. According to the manuscript, there are three patterns: Mediterranean, Mountain and Ebro Valley. I think that this division does not make sense from the climatological viewpoint due to several reasons: - Lerida (other times called Lleida) and Cervera are two locations separated around 50 km, they are both included in the Ebro valley, at a similar distance from the sea and with no relevant mountains in between (see figure 1). On top, the pluviograms are very similar, check the Iberian climatologiacal Atlas, for instance (http://www.aemet.es/documentos/es/conocermas/recursos_en_linea/publicaciones_y_estudios/publicaciones/Atlas-climatologico/Atlas.pdf). However, Lerida is included within the Mountain cluster and Cervera within the Mediterranean one. This is difficult to understand. - Teruel, in the middle of the Iberian range, is included within the Mountain cluster, which is mostly composed by locations close to the Pyrenees. Teruel is around 400 km from the closest location in the cluster. Its precipitation regimen is poorly associated with those in the Pyrenees. Additionally, as can be seen in figure3, Teruel index is only

significantly correlated with Barbastro and non significantly with the rest. - Gerona (or Girona, depending on the text or figure) shows similar problems with the rest of the Mountain cluster with 3 nonsignificant correlations and two very poor correlations (up to 0.22). Anyone familiar with the climate of Spain (as the authors) should be aware of these issues, that are also evident in figure 5. Consequently, I think that of physical meaning of the cluster is very poor and the patterns might be an statistical artifact. This is not strange, since the usual clustering techniques use Euclidean distances to define clusters and they are appropriate for quantitative variables. Unfortunately, the methods section does not provide information on the distance used to measure the stations proximity. In my view, the authors should repeat the clustering process but applying a technique appropriate to their data (semiquantitative and nonlinear indices with a short range 0-3) and should interpret the results much more carefully. To add credibility to the exercise, I suggest that they compute the SPI or SPEI indices for the 13 locations during the instrumental period and check and compare the results with those obtained with the historical indices. This would provide a certain idea of the consistency of the results. Minor comments Language should be rechecked since there are several grammar errors The authors should unify terminology (Lleida/Lerida; Girona/Gerona) The references to gray literature in Spanish should be eliminated or minimized.

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