Clim. Past Discuss.,
https://doi.org/10.5194/cp-2019-77-AC2, 2019

Climate of the Past Discussions

Interactive comment on "The extreme drought of 1842 in Europe as described by both documentary data and instrumental measurements" *by* Rudolf Brázdil et al.

Rudolf Brázdil et al.

brazdil@sci.muni.cz

Received and published: 24 August 2019

Interactive comment on "The extreme drought of1842 in Europe as described by both documentary data and instrumental measurements" by Rudolf Brázdil et al.

Anonymous Referee #2

Received and published: 22 July 2019

The extreme drought of 1842 in Europe as described by both documentary data and instrumental measurements. This is overall a nice paper that sheds light on an important European drought event. The paper is well written and presented and does a good

job of illustrating the power of bringing together both qualitative and quantitative data to understand an important historical event. That said, I have some comments that need to be addressed by the authors. RESPONSE: We would like to thank the referee for generally positive evaluation of this manuscript. We are trying to respond below to all critical comments to contribute for further improvement of the paper.

The most significant comment I have is around the structure of the paper. It seems that results are presented throughout the paper including in the introduction which highlights some of the documentary impacts of the 1842 drought, and in the discussion where new results are presented to the reader. In particular I would interpret section 5.1 and 5.2 as results. I will leave it to the editor to decide this but I would prefer to see these integrated into results as the paper is using documentary and instrumental data. If the authors would prefer to have the proxy tree ring data as part of the discussion then I can understand that. The role of the discussion section should be to discuss the results and place them in a broader spatial/temporal context and to discuss any limitation, assumptions etc that were part of the analysis. The latter in particular could be fleshed out a bit more than is presently the case. Taken together with other comments below I feel that the outcome should be accept with minor revision as little new analysis would be required. RESPONSE: Concerning of the Introduction, the referee has probably in mind the paragraph on page 2, lines 15–29. In our feeling it is not presentation of the results, but some explanation and motivation which led us to study this particular drought event. From this reason we would like to preserve it how it is. Concerning of Sections 5.1 and 5.2, results of our research are clearly presented in Section 4, why here we put our results into context of finding from many other independent studies. So, in Section 5.1 we are confronting our results with findings from other papers based on instrumental and documentary meteorological data, i.e. here are not included any our direct results. Similar situation concerns also Section 5.2, where our results were put into context of dendroclimatological analyses and other phenological results, taken again from many other papers than is our recent study. From these reasons we believe that both sections 5.1 and 5.2 are not presenting results of our recent research and

from this reason they clearly belong to the discussion part.

Other comments Acronyms are used in the abstract, while some like NAO are widely known others like CEZI, SPI, SPEI, Z-index may not be, please spell these out for the reader. RESPONSE: Accepted and corrected.

It would be useful to have a map of Europe showing from where instrumental and documentary sources are derived from. This would help convey the continental nature of this event and its impacts. RESPONSE: Accepted, Section 2.2 was complemented by location of meteorological series used in graphic presentation. The maps indicating localisation of quoted documentary data have been prepared and are included in Supplementary material.

In describing the Pauling et al data please give a references for the gridded analysis from 1901-2000. RESPONSE: Accepted. On page 5, line 33, following reference was added: "Mitchell and Jones (2005)" Reference: Mitchell, T.D. and Jones, P.D.: An improved method of constructing a database of monthly climate observations and associated high-resolution grids, Int. J. Climatol., 25, 693–712, doi: 10.1002/joc.1181, 2005.

Does the Pauling et al data include precipitation from the individual series that you present later from across Europe and if so does this introduce a circularity into using these as independent pieces of information to assess the magnitude of the drought? RESPONSE: Pauling et al. (2006) used several long instrumental precipitation series from Paris (Slonosky, 2002), Kew (Wales-Smith, 1971), Bern (Gimmi et al., 2005), England and Wales (Wigley et al., 1984), Padova (Camuffo, 1984) and Estonia (Tarand, 1993) as predictors (among numerous other data types). It means that randomly selected series in Figs. 4 and 5 like Paris and Edinburg were used also in Pauling et al. (2006) in their spatiotemporal reconstruction of precipitation in Europe as presented in Fig. 2. However, we are using Pauling reconstruction (Fig. 2) and long precipitation series from several European stations (Figs. 4 and 5) just to demonstrate two different

aspects of 1842 drought: 1) its spatial distribution, and 2) its annual course of precipitation. We do not combine data used for these two aspects to derive any new (and potentially dependent) product. We do believe that our results and interpretations are not influenced by the fact that some analyses uses partly overlapping data.

In addition, perhaps I missed it but in the data section an overview of the precipitation gauges used later in the paper is not provided. In addition are there other series and regional precipitation records that might be usefully used to extend the quantitative assessment? RESPONSE: Station/regions represented in Figs. 4 and 5 were selected to keep any acceptable number of graphical examples and express well some territorial coverage over the territory of Europe. They were selected from the set of 33 temperature and 53 precipitation series going before 1842 and extending at least to 1990 (with respect to the 1961–1990 reference period), for which all analyses presented in both figures were provided too (for temperature only those stations with parallel precipitation measurements were considered). We used all data to which we had access and we could freely use them.

Why did you use SPI/SPEI 1 and not longer accumulations given that much of the focus is on agricultural, hydrological and socio-economic drought. Some thoughts on this either in the methods or in the discussion would be welcome. Does the result change if you do? RESPONSE: We used the drought indices and their 1-month versions to show contribution of individual months to the 1842 drought. Additionally we calculated for all stations/regions used also SPI and SPEI values for 3, 6 and 9 months. For stations/regions used in Fig. 5 they are presented as supplementary material to this article and at the end of the corresponding paragraph following sentences were added: "In order to present accumulated effects of drought, SPI and SPEI values for 3, 6 and 9 months were also calculated (see Figs. S2 and S3 in Supplementary material). Compared to Fig. 5, features of drought are well preserved but annual variation of indices is more smoothed a partly moved to the second half of the year demonstrating some persistence of drought patterns."

More detail is needed on how the drought indicators were derived, just saying that 'These series were then worked up' does not allow the work to be repeated. RESPONSE: The SPI, Z-index and SPEI were calculated using the methods provided on the page 6, line 26. However, it has been modified as follows: "These series were then worked up to calculate monthly drought indices: (i) Standardised Precipitation Index for one month – SPI-1 (McKee et al., 1993); (ii) Standardised Precipitation 25 Evapotranspiration Index for one month – SPEI-1 (Vicente-Serrano et al., 2010); and (iii) Z-index (Palmer, 1965) (Fig. 5). In case of SPEI-1 and Z-index, the calculation used the Thornthwaite method to estimate the potential evapotranspiration and data from the 1901–2000 period were used as reference period for all three drought indices. The SPI-1 and SPEI-1 were further complemented by their calculations for 3, 6 and 9 months."

Has the homogeneity of the various instrumental records used been assessed? If so/not this needs to be stated and if necessary returned to in the discussion. This is an early period in the observational history and gauges and their exposure often very different that today. More comment is needed on this. RESPONSE: Where it was possible, homogenised series of individual stations or regions were used, but it was not technically possible to homogenise other available non-homogenous series (due to missing reference series and metadata). Information of this type was added as the new second paragraph with figure of station locations to Section 2.2 as follows: "Using meteorological data from above cited and other sources, only stations including the 1842 year and ending not earlier than in 1990 (to have 1961–1990 reference period) were considered. This concerned finally 33 series of monthly temperatures and 53 series of monthly precipitation totals. But only ten of them extending over the studied part of Europe and having both temperature (T) and precipitation (P) data were used for graphic presentation (Fig. X – Selected European stations and regions used for graphic presentation of temperature, precipitation and drought indices in 1842). These series were from greater part homogeneous and some of them at least quality checked (Paris – T, Stockholm – P, Cracow – T,P)."

In terms of the consideration of hydrological drought why not look at 1842 in the context of the long term mean as you have done with precipitation? Only two adjacent years are used. Is the data not available? It seems it is from what is presented. RESPONSE: Compared to meteorological series, use of hydrologic series seems to be more problematic. Usually they are not homogenised and changes in catchments of corresponding rivers could mean quite significant breaks in homogeneity. From this reason we preferred only information from published papers or known sources (e.g. the Vltava or the Danube) with known quality of records or the use of extracted daily values from Wiener Zeitung for 1841–1843 to have at least some comparison with neighbour years. In other cases, as was for example daily data for the Meuse, only some part of this data was available. Moreover, the hydrologic data were used "only" for documentation of hydrological drought, complementing many documentary data reporting it.

Use of documentary sources is very good and indeed a standard to be aspired to. RESPONSE: Many thanks for this evaluation.

See points above on discussion where I think most work is needed in revising. RESPONSE: Please see our responses above and anticipated changes.

Interactive comment on Clim. Past Discuss., https://doi.org/10.5194/cp-2019-77, 2019.