

## ***Interactive comment on “Extreme droughts and human responses to them: the Czech Lands in the pre-instrumental period” by Rudolf Brázdil et al.***

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Interactive comment on “Extreme droughts and human responses to them: the Czech Lands in the pre-instrumental period” by Rudolf Brázdil et al.

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General comments Thank you for the opportunity to review this manuscript, which presents a detailed analysis of extreme droughts in the Czech Lands during the 12th-18th centuries. It is extremely well-written, founded on a rich empirical basis, and demonstrates clear and systematic analysis. It makes some interesting conclusions that will be of considerable relevance for other analysis of historical droughts. I was particularly struck by the observations on p.12 regarding the identification (or other-

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wise) of spatially limited droughts, which could only be made from such a rich dataset. I have no hesitation in recommending it for publication, subject to a few recommendations. RESPONSE: We would like to thank D. Nash for the generally positive evaluation of our manuscript and the number of constructive comments/suggestions, which we address below.

Specific comments 1. The introduction to the paper is generally good, and sets a sound context for the study. However, it could stress the novelty of the investigation more forcefully. There are relatively few parts of the world where there is a sufficiently rich documentary dataset to conduct this type of study. This should come through more forcefully in p.2 lines 29-40. RESPONSE: Accepted, following sentences were added into the quoted paragraph as follows: “Although a number of studies of droughts based on documentary evidence already exist for the Czech Lands (the recent Czech Republic) (Munzar, 2004; Brázdil et al., 2013; Brázdil and Trnka, 2015; Munzar and Ondráček, 2016), the current investigation concentrates on the comprehensive study of extreme droughts in the pre-instrumental period from the 12th to the 18th centuries. The somewhat episodic character of drought information before AD 1500 dictates that the primary focus is confined to extreme droughts during the 16th to the 18th centuries. This type of study is made possible by the wealth of historical documentary evidence, reaching back several centuries that exists in the Czech Lands. This body of evidence has now been researched, collected and collated for nearly three decades. A particularly novel feature of this study is also that it constitutes an “objective” selection of extreme droughts based on long-term series of drought indices reconstructed from such documentary data.”

2. I found the text in sub-section 4.1.1 of Sect. 4.1 rather confusing. The overall heading for section 4.1 is ‘Extreme droughts in the Czech Lands during the pre-instrumental period’ but the text in section 4.1.1 (p.5 line 29-30) indicates that ‘it is difficult to identify cases that could clearly be classified as extreme’. So are these droughts before AD 1500 extreme? If not, then why is the paragraph a subset of section 4.1? I suggest the

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authors either drop the subheadings to 4.1.1 and 4.1.2 and group the text together, or move lines 21-30 to immediately after the heading to section 4 (i.e. before 4.1) as an introduction to the whole section. RESPONSE: Accepted and corrected. We deleted the subheadings of sections 4.1.1 and 4.1.2 and grouped it together.

3. Sections 4.2.1 and 4.2.2, while rich with detail, take up 4.5 pages of the 15.5 pages of text in the manuscript. I wouldn't suggest losing these sections, but (depending on the policy of *Climate of the Past*) they could be more usefully moved to the end of the document as an appendix. RESPONSE: Sorry, but we totally disagree with this proposal. Presentation of outstanding droughts in Section 4.2 we see as an inseparable part of our results. Finding and interpretation of documentary data represents very important part of research work in historical climatology. Moreover, we see publication of these results as important for further researchers trying to compare their droughts found in a broader territorial scale. If we remove Sections 4.2.1 and 4.2.2 into an appendix what will remain from our Sect. 4 Results? It would be a total degradation of the whole article. We do not know any policy of *Climate of the Past* supporting this proposal of the referee.

4. It would help the reader (and help link the descriptions of droughts in sections 4.2.1 and 4.2.2 to the rest of the manuscript) if the text in section 5.2 could cross-reference to specific drought years as examples. So, the mention of famine in p.13 line 42 could note years when famine was identified in parentheses. I'm not suggesting that all droughts need to be cross-referenced, but mentions of noteworthy examples would bring the sections of the manuscript together. RESPONSE: Accepted and corrected. We changed a last sentence of the first paragraph ("Reported below are only those drought impacts and responses that are known from Czech documentary evidence (with cross-referenced examples of specific extreme dry years mentioned in Sect. 4.2).") and complemented corresponding years of extreme droughts in many places of the manuscript in Sect. 5.2.

5. Tables 1 and 3 could be made more clear for the reader. I would recommend

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replacing ‘a, b, c’ in the column headings of Tables 1 and 3 with ‘SPI, SPEI and Zindex’, such that the reader does not need to cross-refer with the table caption. RESPONSE: Accepted and corrected. It was a practical reason to use ‘a, b, c’ instead of ‘SPI, SPEI and Z-index’ to accommodate all data into both tables in any reasonable form. Now we changed their headings as requested.

6. I found Table 2 very difficult to interpret – could this be made more user-friendly? I assume that I am meant to read it by looking down the columns ‘Order 1-10’ and ‘Order 1-20’ to see which years appear in multiple studies? This isn’t easy across multiple centuries. Could the authors perhaps highlight years that appear in the majority of series (e.g. by putting them in bold or italics) or think of a graphical way to display the data? RESPONSE: We complemented Table 2 including all extreme droughts of order 1–10 and 11–20 for all series used, when cases in the pre-instrumental period are expressed in bold. It allows now to do a detail comparison our selection of extreme droughts with those from other reconstructions. What we see as important message from this table for a reader we included in the corresponding paragraph in Sect. 5.2 as follows: “As might be expected, all the extreme droughts reconstructed for the Bohemian wine-growing region (Možná et al., 2016) are also reflected in selected droughts in the current paper (Table 2). From 13 pre-instrumental droughts based on oak tree-rings in Bohemia (Dobrovolná et al., 2018), agreement with those in the current paper occurs in eight cases. Three remaining tree-ring-based series exhibit agreement with them in a half the cases. If the 20 driest years of all eight series are taken and analysed together, only the year 1616 appears in all of them. The topical discussion of a “megadrought” in 1540 by Büntgen et al. (2015) and Pfister et al. (2015) appears justified, since this event was the most severe in all the documentary-based datasets, except in MAM, where 1540 was the third most severe. While the megadrought does not appear among the 20 most severe cases only in two Czech tree-ring series (Brázdil et al., 2002; Dobrovolná et al., 2018), it corresponds to the 12th order for the territory of the Czech Republic and to the 17th order for central Europe in series derived from OWDA (Cook et al., 2015). The year 1718 appeared among the driest months in five

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series and the years of 1504 and 1603 in four series. Many extreme dry years are detectable either in documentary-based series or tree-ring based series.” We believe that there is not necessary to include further details which can be further derived from Table 2.

7. I found it difficult to compare the three parts of Figure 2. Could the diagram be made larger and more easily readable (e.g. by inserting some vertical lines at each 0/100 year tick mark)? RESPONSE: Accepted, we added vertical lines for each 100-year interval. We would like only show fluctuation of a given drought index with respect to calculated thresholds, i.e. the figure has only an illustrative character. We do not expect that the reader of the article will compare its three parts (corresponding selected extreme droughts are in Table 1). The final size of the figure will be depending on a technical elaboration of the article in case it will be accepted for publication.

Technical corrections p.1 line 37 – ‘: : :in a deficit..’ (delete ‘a’) p.1 line 39 – ‘: : :this may be exacerbated: : ’ (insert ‘be’) p.2 line 27 – ‘: : :in the other areas of the world: : ’ (delete first ‘the’) p.2 line 29 – ‘: : :already exist for the: : ’ (insert ‘for’) p.2 line 32 – ‘However, the somewhat: : ’ (delete ‘However’, capitalise ‘The’) p.2 line 44 – ‘: : :may be used for the: : ’ (insert ‘the’) p.2 line 45-46 – replace ‘: : :mean monthly precipitation series calculated for the territory of the Czech Lands’ with ‘: : :mean monthly calculated precipitation series’. p.3 line 14 – ‘On the other hand, records related: : ’ (delete ‘On the other hand’, capitalise ‘Records’) RESPONSE: Accepted and corrected.

p.3 line 22 – not sure what ‘nad Labem’ means. RESPONSE: A full Czech geographic name is Roudnice nad Labem.

p.4 line 37 – ‘ and the instrumental periods: : ’ (delete ‘the’) p.4 line 39 – ‘On the other hand, the: : ’ (delete ‘On the other hand’, capitalise ‘The’) p.4 line 39 – replace ‘: : :may be taken as a certain disadvantage’ with ‘: : :may be considered as a minor disadvantage’ p.5 line 35 – ‘: : : that the use of: : ’ (delete ‘the’) p.13 line 1 – replace ‘Impacts on social life and human responses: : ’ with ‘Impacts on society and human

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responses: : : ' RESPONSE: Accepted and corrected.

p.13 line 13 – note sure what 'aftermath harvest' means – do you mean 'poor ensuing harvest'? RESPONSE: This is a term which is used for the second haymaking (the first haymaking is usually in June, while in this case "aftermath" is harvested usually at the end of August or in the early September).

p.13 line 13 – ': : : had to be bought: : : ' (insert 'be') p.13 line 21 – replace 'eruptions' with 'outbreaks'? p.13 line 22 – ': : : rendering them small, maggoty: : : ' (delete comma after 'them') p.13 line 25 – replace 'if fire that broke out: : : ' with 'if fire also broke out: : : ' p.14 line 11 – ': : : may be collated: : : ' (insert 'be') RESPONSE: Accepted and corrected.

p.14 line 15 – should section 5.2.1 not be section 5.3? There isn't a section 5.2.2. If so, section 5.3 will need renumbering to 5.4 RESPONSE: No, we would like to preserve this numbering of sections. The reason is that Section 5.2 has more general title (and content) "Impacts on society and human responses to extreme droughts", while "5.2.1 Extreme droughts and grain prices" is devoted only to one particular possible impact, i.e. only to effects of extreme droughts on grain prices.

p.14 line 41 – ': : : led to produce a great: : : ' (delete 'produce') RESPONSE: Accepted and corrected.

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