

## ***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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Received and published: 8 December 2018

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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Christian Rohr: Comment on Brázdil, R. et al: Extreme droughts and human responses to them: the Czech Lands in the pre-instrumental period (Climate of the past – Discussions) This is a very important and rich contribution to historical droughts in Central Europe based on the long tradition of research on weather and climate in the Czech Lands by Rudolf Brázdil and his group. The article is on a very high methodological

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level by combining a large number of documentary evidence with the most important drought indices (SPI, SPEI, Z-index). The authors testify an excellent overview of the state of the art (see also the large bibliography). In the discussion chapter, they differentiate very well when combining droughts with grain prices (which could be influenced by various factors). RESPONSE: We would like to thank C. Rohr for a careful review and generally positive evaluation of our manuscript and the number of constructive comments/suggestions, which we address below (our responses and changes compared to the original manuscript are in red colour).

Chapter 4 contains a very useful overview of the strongest droughts based on documentary evidence. However, it does not always come clear, whether these reports are fully reliable, because they are contemporary (or even written by eyewitnesses) or not. Some of the sources in the bibliography, but some are not (e.g. AS6: Hieronymus Haura). It will be useful for historians in particular to add a short information concerning contemporary or not in the text. RESPONSE: To avoid doubts about use of primary sources, we changed the first sentence in Sect. 2.1 Documentary data of droughts as follows: “A variety of primary documentary sources may be used for the identification of droughts in the pre-instrumental period in the Czech Lands, i.e. before AD 1804, ...” In the whole paper we are working particularly with primary sources, but their quotation is different (see lines 29–31, page 6 in the original manuscript). If such data were already critically elaborated and published, then we quote corresponding publication (see References), what seems to us to be more convenient for readers to find corresponding reports than to search in original manuscripts located in archives, libraries, in private collections etc. If such written documents still exist only in form of manuscripts (not published), then we cite locations of such original sources (see AS1–AS18 in Archival sources). Concerning of AS6, it is quoted in archival sources as a clearly primary source, because Hieronymus Haura was born on 30 November 1704 and died on 7 March 1750, i.e. he was a direct eyewitness of the drought in summer 1746, for which his report was quoted (see page 14, lines 7-14 in the original manuscript). In the use of information from secondary sources, it was mentioned, as for example, on page 8,

lines 18-19: “A secondary source (Noháč, 1911) reports drought in 1728, together with the previous year, ...” or on page 11, lines 43-44: “Secondary sources report drought and grain failure at Postoloprty before 14 August (Veselá, 1893) and a great drought at Krupka (Bervic and Kocourková, 1978).”

Chapter 4.2.2.3: I am not really sure, if we can deduce an autumn drought from this relatively poor documentary evidence. As far as we know, summer 1548 was very dry. In this way, low water in late autumn may also result from this period combined with an at least relatively dry autumn, so that people could cross the riverbed of the Elbe River in early December. RESPONSE: Presumptions for the occurrence of severe drought episode in any part of the year are usually created by patterns in the preceding months, in which they are not yet directly reflected (e.g. smaller portion of snow precipitation, higher temperatures increasing evapotranspiration as well as soil dryness, etc.). As for summer 1548, primary Czech sources mention great drought only in one report to 17 August and heat in some days and further report from AS2 (see below), which is only general (“severe drought”). It means that this scarce data did not allow us to conclude clearly that “summer 1548 was very dry” as the referee mentions. Moreover, combining temperature and precipitation reconstructions, this summer did not appear in drought indices as “extreme dry”. Extremely low water levels in early December at the Elbe (looking also on the “memory” of the catchment) clearly indicate that in that autumn also precipitation totals were very low. By the way, we have there confirmation of autumn drought from other sources as mentioned in the corresponding paragraph: “This tallies with a report from Jan Jeníšek, a landowner, who mentioned very little water in the fish-cultivation pond near Svrčovec around 8 November, citing severe summer drought as the reason. He noted good fields for 15 November, but drought (AS2). Due to extremely dry conditions there were only few pheasants in the vineyards around Most (Nožička, 1962).” From these reasons we believe that this data confirm a selection of autumn 1548 as extremely dry from the calculation of corresponding drought indices.

Chapter 5.2 is a very important part of the discussion chapter. Maybe you could also

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add one or two sentences (p. 13, l. 20 sqq.) on the ambivalent consequences of droughts towards fruit production. Whereas fruit trees (apples etc.) were obviously affected by caterpillars or the like, wine was growing even better sometimes, as you show for 1503, 1536, 1540 etc. However, I would also appreciate if you could add some information if there were any learning processes to prevent similar shortages after droughts, e.g. by installing or enlarging granaries (or mention that the sources do not tell us much about prevention). RESPONSE: Accepted and corrected. We changed a corresponding sentence related to “the ambivalent consequences of droughts towards fruit production” as follows: “While fruit trees were often attacked by outbreaks of caterpillars and certain other pests, often eating their leaves or invading fruit bodies (e.g. in 1680 or 1794), rendering them small, maggoty, and prone to fall prematurely, wine production was good and of a high quality as documented, for example, in 1536, 1540 and 1686.” Concerning of “some information if there were any learning processes to prevent similar shortages after droughts”, two additional paragraphs were added at the end of Sect. 5.2 (in from of Sect. 5.2.1) as follows (new cited papers were included in References): “Despite the considerable impacts of droughts, it is difficult to find references that report measures driven by droughts that might have alleviated the shortages arising out of them. Such actions were certainly taken in response to other hydrometeorological extremes (e.g. floods, torrential rains, hailstorms), or more generally in reaction to harvest failure, particularly of grain; tax alleviation and other forms of compensation were available to farmers affected by such extremes (e.g. Brázdil et al., 2012b). For example, Empress Maria Theresa did, in an edict issued on 26 July 1748, i.e. two years after the extreme summer drought of 1746 (see Table 1 and Sect. 4.2.2.2), recommend the creation of “contribution” granaries in all domains, from which serfs could borrow grain. These played an important role during the famine (“hunger-years”) of 1770–1772 in the Czech Lands (see Brázdil et al., 2001; Pfister and Brázdil, 2006). Emperor Joseph II issued an edict on 9 June 1788 that such granaries had to be established on all estates (Kocman, 1954). Probably in direct response to the extremely dry spring of 1790 (see Table 1), the Land Gubernium in Bohemia issued

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a decree on 5 July 1790 forbidding serfs to get rid of cattle due to shortages of feed (Kalousek, 1910). Allowing cattle to browse in woodland was sometimes prohibited to reduce the impact of droughts in forests (e.g. during the dry spring of 1781 in the forests of Plzeň town – Ministr, 1962) or trees could be supplied with additional water from series of ponds, as documented before the 19th century for the Sadová estate (Horák, 1965). Because of the occurrence of frequent fires during dry episodes and problems with extinguishing them, certain relevant measures were taken. For example, the councillors of Vimperk resolved on 7 May 1651 that “[...] because [the weather] is now so dry, everyone should be cautious with the fires in their homes.” (StarÅ¡i, 1978, p. 53). On 21 August 1751, Empress Maria Theresa declared a fire rule, which defined concrete measures against conflagrations. It was followed by further fire rules for Moravia and Silesia from Emperor Joseph II that came into force on 24 January 1787 (Adamová and Lojek, 2010). The tragic impacts of fires upon the affected people were only partly mitigated by help from neighbours, grain and financial collections, tax alleviation, and relief from corvée, among other things (Marvan et al., 1989).”

Please see some minor corrections of typos in the bibliography mostly concerning titles in Latin and German. In addition, as also mentioned by the second reviewer (an English native speaker), the text needs some more corrections on language and style by a native speaker (e.g. missing articles, construction of some sentences). RESPONSE: Many thanks. All proposed corrections of typos in the bibliography concerning titles in Latin and German were corrected according to the pdf file attached by the referee. The English style corrections proposed by a native referee (D. Nash) were included too. Moreover, the whole article has been checked and corrected by a native speaker Tony Long.

In general, this is an important contribution, which should be accepted with minor revision, i.e. there are mostly some technical improvements (language, typos) and some clarifications needed, as mentioned in my comments. RESPONSE: Thanks for a final evaluation. We hope that in the previous points we responded to request on technical

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improvements as well as for some clarifications.

Please also note the supplement to this comment: <https://www.clim-past-discuss.net/cp-2018-135/cp-2018-135-RC3-supplement.pdf> RESPONSE: Thanks, we included all your corrections.

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2018-135>, 2018.

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