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Climate of the Past Discussions

Interactive comment on "Effects on the Czech Lands of the 1815 eruption of Mount Tambora: responses, impacts and comparison with the Lakagígar eruption of 1783" *by* R. Brázdil et al.

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We would like to thank Anonymous Referee 1 for very valuable comments contributing to the improvement of the paper.

Specific comments The authors should reconsider the importance/necessity of the comparison with the Lakagígar eruption. Both eruptions are completely different (latitude, date, vicinity to Czech lands. . .) so the authors should clearly explain why it is interesting this comparison between them. Moreover, it is important that the authors explain clearly the different features of the two eruptions. In this point, I think that another option is focusing the paper only in the Tambora eruption. RE: The paper is newly oriented only on the Tambora eruption. Everything related to Lakagígar eruption was

deleted and parts related to Tambora were changed accordingly.

The discussion section is not clearly linked with the result sections; this is more evident in sections 5.2 and 5.3 RE: Because of excluding parts of the manuscript related to the Lakagígar eruptions, we changed discussion and we hope to be more close to the results presented.

One of the main conclusions of the paper is that the Tambora eruption impacted less in the climate and more in the society that the Lakagígar one. But I miss a discussion about why this happened. RE: Because of deleting effects of the Lakagígar eruption, these effects of both eruptions are not directly compared. Climatic and human impacts of the Tambora eruption then follow from corrected results as well as corrected discussion.

Introduction The unidentified eruption of 1809 is cited in the introduction. But nothing about this eruption is explained in the rest of the text. This eruption can affect the short-term analysis presented in the paper because "the mean temperature for each month was calculated using temperature data from five years prior to the eruption", some discussion about that could be interesting. RE: We add some related sentences into the last paragraph of Section 5.1: "In the light of papers by Cole-Dai et al. (2009) and Guevara-Murua et al. (2014), the cold summers early in the second decade of the 19th century may also have been influenced by an unknown volcanic eruption in 1808/1809. In this context, Brönnimann (2015) demonstrated cool April–September 2010 patterns compared to mean surface air temperatures in 1801–1830 and argued that this eruption could have set the stage for sustained ocean cooling (compare Stenchikov et al., 2009). However, 1811 was already warmer in the Czech Lands from spring to autumn, and lower temperatures started in 1812 (see Fig. 2)."

About the impact of Lakagígar out of Europe could be interesting to cite Trigo et al (2010). Also could be useful in the discussion about the foggy events. Ordering the archival sources the S1 must be cited the first in the text then S2. RE: Because of

reduction of the manuscript only on the Tambora eruption, Trigo et al. (2010) was not included into References.

Methods No methods are described for the use of the documentary data (no instrumental). RE: Accepted, the new paragraph related to the use of documentary (instrumental) data was added as follows: “In this paper, descriptions of weather and related phenomena in the Czech Lands post-Tambora, i.e. May 1815–December 1817 are derived from documentary data. All such the data extracted were critically evaluated, including analysis of source credibility, place and time attribution of records, content analysis, interpretation of records with respect to recent meteorological terminology and cross-checking of records against various different places in the Czech Lands. The creation of a database was the next step, in which information about place, time and event, characterised by key-words, full reports and data sources, has been recorded to provide a basis for further use (see Section 4.2). Kreybich’s records from Žitenice (S1–S3) and Hausner’s observations from Buchlovice (S4) were then further employed for calculation of monthly numbers of precipitation days in 1815–1817 (see Fig. 6). The climatic effects of the volcanic eruption based on instrumental observations are expressed in the short-term and long-term contexts. In the short-term, the approach followed is that taken by several other papers addressing the effects of eruptions on temperature series (e.g. Sear et al., 1987; Robock and Mao, 1995; Kelly et al., 1996; Písek and Brázdil, 2006; Fischer et al., 2007). Temperature patterns related to the eruption are described over a ten-year period to avoid the possible influence of a strong trend. The month of the eruption is taken as month zero. The mean temperature for each month was calculated using temperature data from five years prior to the eruption. Each monthly mean temperature for five years before and after the eruption was then expressed as a departure from the calculated mean value. The same approach was applied to series of precipitation totals. For the long-term context, the eruption year and two subsequent years were characterised by their order and magnitude in the whole series shown in increasing (temperatures) or decreasing (precipitation) order.”

Results Pag. 3 line 33-37 This paragraph would be better in the introduction with a comparison with the Lakagígar eruption. I do not like the structure. I think that some information given in “Post-volcanic weather and impacts on society” are “climatic responses”. I propose a year by year structure but with all the information (instrumental and documentary, climatic and social) for each year. RE: Accepted. The corresponding paragraph was included on the beginning of the second paragraph in Introduction: “A great deal of literature has been devoted to analysis of the climatological and environmental effects of the Tambora eruption. The volcanic eruption of Tambora (Lesser Sunda Islands, Indonesia) in April 1815, is among the most powerful of its kind recorded, classified at an intensity of 7 in terms of Volcanic Explosivity Index (VEI) (a relative measure of volcanic explosiveness, VEI is an open-ended scale that ranges from 0 to 8, where 8 represents the most colossal events in history. It is based on the amount of volcanic material ejected and the altitude it reaches – see Newhall and Senf, 1982).” Concerning of joining of instrumental and documentary data year by year we do not see as too useful with respect to different suite of data. We mentioned it inn introductory paragraph to Session4 as: “This section describes climate, weather and related phenomena in the Czech Lands during the time after the Tambora eruption. Because the character of the data differs quite sharply, a division is maintained between information obtained from quantitative meteorological measurements and more qualitative data arising out of documentary evidence.”

Pag 4. Line 29. When are the haymaking and the grain harvest? RE: Haymaking is in average running before the mid-June and grain harvest in the third decade of July. But in this context we only say that haymaking and the grain harvest have run during the rainy weather, i.e. in bad weather conditions. Because we speak before about summer months, attribution both activities to summer is apparent.

Page 4 line 29-30 “if two days were fine, it then rained for two days.” This phrase it is not clear for me, is it referred to august?. RE: This sentence follows after mentioning of August, i.e. this concerns of August. We hope that change of phrase on “if two days

were fine, it then rained for following two days" is better understandable. It means that any days of fine weather were immediately followed by rainy weather.

Page 4 line 30 "The wine vintage was bad for the third year" I do not understand this phrase, what year is the third? 1815? Is there some climatic explanation for the caterpillars plague in May? RE: Accepted and corrected as: "The wine vintage of 1815 was bad for the third year, after 1813 and 1814 (S4)." Sorry there is not any climatic explanations for caterpilars. We put this sentence with respect to the fact that it had influence on bad harvest of fruits which were important part of nutrition for people.

Pag. 4 line 36-37. "Kreybich reports a flood on the Elbe for 10–14 August with extensive damage to agricultural crops" is it known the specific location? Zitenice? RE: Accepted and corrected as: "In a similar vein, Kreybich in his records at Žitenice reports a flood on the Elbe for 10–14 August with extensive damage to agricultural crops (S1)."

Pag 4. Line 41. The dry autumn of 1815 is also clear identified in figure 4. RE: Accepted, the corresponding sentence was changed as follows: "The wet, cold summer gave way at the end of August to a very dry, cold autumn in 1815, confirmed by sources from Bohemia (S1) and Moravia (S4), and clearly documented by negative precipitation anomaly (Fig. 5) and lower monthly numbers of precipitation days (Fig. 6)."

Pag 5 line 11 "Other Czech documentary sources report 1816 as particularly cold and wet, with bad harvests and rising prices of all products" this phrase need a cite. RE: This sentence introduces several documentary data, which follows afterwards. Making clearer this context, we changed subsequent sentence as follows: "For example, around Nové Město na Moravě . . ."

Pag 6 line 11 "shortages" of what? food? water? RE: Accepted and corrected as: "shortages of food"

Pag. 6 25-29. I see better this paragraph in the introduction and developing a comparison with the Lakagígar eruption. RE: This paragraph was deleted with respect to

restriction of the paper only to the Tambora eruption.

Pag. 7 Many references to thunderstorms during the Lakagígar eruption but also during the Tambora. Can you discuss deeply how this phenomenon could be induced by the eruptions?. RE: Removing the Lakagígar eruption from the article, not any particular thunderstorms are reported, i.e. proposed discussion would be not relevant.

Figures Figure 1: It would be interesting including a legend to explain which locations have instrumental information (temperature and precipitation) and/or documentary information. RE: Corrected as requested.

Figure 2, 3, 4: Does it make sense including the Chez Lands series? This series during this period is calculated from Prague and Brno. Both included in the figures. RE: We see including of the Czech series as useful. In the period analysed it is not only simple average of the two series because of method of calculation used (both series were adjusted with respect to 1961–2000 temperature patterns – see Brázdil et al., 2012a).

Figure 6: Redundant, all the information in this figure is also in figure 10. RE: Figure 10 was deleted.

Technical comments Be coherent with format of the dates 7 April or 28th April. RE: This concerns of formulations "between 11th and 28th April" and "between 17th and 28th April", otherwise we use the first type of writing. We consulted it with a native speaker: if we use only "between 17 and 28 April", it implies that it snowed only once and we don't know when. From this reason we let it in its original form.

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