REPLY TO THE REVIEWER COMMENTS

(Reviewers' comments are in blue, replies on black, changes to the manuscript in green)

REVIEWER #1

Angela-Maria Burgdorf compiled an inventory of documentary evidence relating to climate history spanning the globe dating back to the fifteenth century of materials. In addition to her paper, she has also compiled a very impressive excel sheet, which can be found in the supplementary materials, with 686 data sets that she has analyzed for this paper.

Thank you for the careful revision and very constructive review of this paper. I appreciate the positive feedback and the helpful comments and suggestions. I have taken them up and revised the manuscript accordingly.

General remarks

Burgdorf's research presented here is impressive and provides an important and much needed first step of integrating the archives of society, i.e. documentary evidence in its many shapes and forms (diaries, ship log books, newspaper articles, clerical documents, chronicles, etc.) with the archives of nature, proxy data from tree rings, ice cores, etc. For the international community, this integration of data from the archives of society is very important as it is currently underrepresented and as historical records often include very precise information that can help the dating of extreme weather events or volcanic eruptions for instance. Furthermore what is also important is the global focus of this inventory, as very often the focus is on Europe, for which very good data exists, but it is crucial to also learn about the resources in other parts of the world and to use these. Her paper provides an inventory of those records that derive from mostly English-language sources that cover a period of at least two decades prior to 1880.

On page 5, line 21, the author mentions that "the period of 1400-1880 is defined as the period of interest." Here I would ask the author to elaborate on why she is specifically interested in this period. What makes this period so special? Why is it important to study and highlight this period? Why did the author pick 1400 as a start point and 1880 as the endpoint? As a historian, I have an idea why this time frame was chosen, but for the interdisciplinary audience that the journal aims at, I would like these to be spelled out further.

That is a good point and I happily add a sentence elaborating why this particular period was chosen:

"The period of 1400-1880 is defined as the period of interest since it marks a novel era in Western (European) history. The early modern period, following the Middle Ages, witnessed a break from medieval scholasticism and a surge of interest in Classical ideologies and values. The profound intellectual, social, and political transformations went hand in hand with continuous scientific evolution (e.g., the invention of the printing press in Europe in the 1450s) and European overseas expansion. This period is also characterized by novel approaches to observing and recording environment processes including the weather. As an effect, a great wealth of documentary material, both unpublished manuscripts, and early printed evidence exist in archives and libraries (Pfister et al., 2018). Moreover, an increasing number of (early) instrumental measurements essential for calibration are available from the seventeenth century onwards. However, with the continuous refinement of instrumental measurements practices and the establishment of national meteorological networks in the eighteenth and nineteenth century (Brönnimann et al., 2019), documentary evidence related to climate gradually became less relevant in many countries. Particularly after the launch of many national weather services around 1850 and the establishment of international measurement standards (Brönnimann et al., 2019), a marked decline in the research interest in non-instrumental climate records can be observed. Since this transition from non-instrumental to instrumental records did not occur simultaneously across the continents, 1850 would be too early as a cutoff year for some regions. Therefore, 1880 is chosen as the endpoint of this inventory. Another reason why I chose the period 1400-1880 is because many of the inventoried time series are assimilated in a novel climate reconstruction that starts in 1421 and solely includes instrumental measurements after 1880."

I want to compliment the author on the structure of her article, it made a lot of sense to introduce the inventory and relevant data before "testing" the inventory's use with three case studies, the first two case studies analyze volcanic eruptions, the 1693 Mount Serua (Indonesia) and unknown 1695 volcanic eruptions and the 1783 Laki eruption in Iceland. Here the author is able to contrast tropical (first case study) and high latitude eruptions (second case study). In this instance, I would have preferred more background information on the 1693 and 1695 eruptions, whether we know if the latter is tropical or not. (Perhaps the 2019 paper by Roseanne D'Arrigo et al. on "Complexity in Crisis: The volcanic cold pulse of the 1690s and the consequences of Scotland's failure to cope." In the Journal of Volcanology and Geothermal Research might be useful here). Considering at least the 1693 eruption was tropical, I wonder why the author chose to only look at the northern hemisphere in the maps of figure 3 and why not utilize the inventory to its full scale and draw a global picture, as far it is possible with the data available. The findings regarding the 1783 Laki eruption are in good agreement with current scholarship in the field of history. The third case study looked at precipitation anomalies during the global drought of 1877-1878, which was interesting and helpful to illustrate that the inventory is not only able to demonstrate temperature changes but also dryness/wetness. Considering that there are two examples of volcanic eruptions, I wonder if it might be useful to also show two droughts, perhaps a drought phenomenon in the early modern period, either global or regional.

Thank you for your inputs. I agree that it would be helpful to include some information on the two eruptions in the 1690s and to clearly state that the first example focusses on the climate response to a tropical eruption, whereas the latter demonstrates the climate response to a high-latitude eruption. The following section is added to the manuscript:

"To point out the value of documentary evidence for climate reconstructions, temperature anomalies for the unusually cold decade of the 1690s are analyzed. This particularly cold decade during the Little Ice Age was presumably forced by a series of volcanic eruptions, including the two significant tropical eruptions of Mount Serua (Indonesia) in 1693 (Arfeuille et al., 2014) and the even more potent unknown eruption in 1695 (Sigl et al., 2015; Toohey and Sigl, 2017). According to Sigl et al. (2015), the post-volcanic cooling in their aftermath gave rise to the 9th coldest decade (1692-1701) in Europe in the past 2000 years. It was of near-hemispheric scale and especially pronounced during the Northern Hemisphere (NH) summer months (Wilson et al., 2016). If this cooling is captured by natural proxies such as ice cores (e.g., Sigl et al., 2015) and tree rings (e.g., Wilson et.al., 2016; D'Arrigo et al., 2020), one can assume that it must also have been documented in archives of societies. Especially relevant in this context are records related to harvest, which would have been impacted by cooling of this scale during the growing season."

The reason this analysis is limited to the Northern Hemisphere is simply due to the fact, that there are no temperature records available for the Southern Hemisphere (see Fig. 1).

Thank you for the suggestion to add an additional drought case study. It would certainly be worthwhile to look at another example for a different region. However, considering that reviewer #2 believes the case studies to be redundant in the first place, I propose to stick with the three examples at hand.

The author shows a good knowledge of the field and relevant publications are cited throughout her paper. The number and quality of the references is appropriate. The author also clearly states her own original contribution in the paper.
The title clearly reflects the content of the paper and the abstract gives a good and complete summary of the paper.
The language and grammar of the paper are very good, fluent, concise, and easy to read.
I believe this paper would be a valuable contribution to Climate of the Past.

Thank you for your feedback, it is much appreciated.

Specific remarks

I found very few typos in the text, one such instance can be found on page 5, line 21, there is a random "… a." at the end of the sentence.

Thanks, that is not intended and the "a" is omitted in the revised manuscript.

I found the expression on page 10, line 1-2, “the focus here is on more recent evidence” too vague, I would ask the author to specify the time period she is interested in here, as there are scholars with vastly different research foci in Climate of the Past’s audience (Holocene vs. the early modern / modern period).

Indeed, this expression is unspecific. I will change the sentence as follows in the revised manuscript:

“While some documentary series extend further into the past, beyond the Late Medieval Period, the focus here is on evidence from the Early and Late Modern Period.”

Page 10: I did not understand why the numbers of these records appear to drop so sharply around 1880. This trend does seem very important, could the author elaborate on this change in data availability during this time? (Is it perhaps because of the author’s focus on data that covers at least two decades before 1880?) It did not become clear to me what role the publications of Rykachev play in this context. I believe this needs a little bit more context for readers not familiar with this author.

Thank you for pointing out these ambiguities. I have added some context and explanations to the revised manuscript:

“The number of documentary series gradually decreases in the second half of the nineteenth and twentieth century for all regions. Partly this is simply because no new series are included after 1860. The reason for this is again the fact that many of the compiled series are used in a global climate reconstruction that after 1880 is solely based on instrumental measurements. More importantly, however, this correlates with the exponential development and expansion of instrumental measurement networks across the globe and a diminishing interest in non-instrumental records as a consequence thereof. The sharp drop in numbers for Europe around 1880 can be traced back to the availability of the ice phenology records from the Russian Empire published by Rykachev (1886). Out of these 119 record time series, 103 are not extended beyond Rykachevs publication from 1886. The large majority of these break-up and freeze-up series refer to rivers geographically located East of the Ural Mountains and are, thus, regarded as European series. They account for 85% of the European series ending between 1878 and 1882 and explain the sharp drop. Fourteen records from West of the Ural Mountains initially published by Rykachev (1886) are extended to the 1900s in the publication of Shostakovich (1909). The latter publication includes fifteen additional series from eastern Russia (regarded as Asian series) that also end in the 1900s. These records contribute to the visible drop in the available numbers of Asian series at the beginning of the twentieth century. A further reason for this drop is the fall of the Qing dynasty, China's last imperial dynasty, in 1911 since many Chinese documentary-based record series are based on the vast collection of institutional records from the imperial dynasties. There is an additional marked drop in the overall number of records in the twentieth century which coincides with the start of the Cold War in 1947. The gradual decline in numbers in the late nineteenth and twentieth century can pose a complication since the overlap with instrumental series (needed for calibration) is often limited.”

On page 15, line 30, I found the expression “nice agreement” too colloquial.

Agreed, this is reworded in the revised manuscript:

“Firstly, we can recognize that the seasonal signals among the documentary records agree rather well, particularly for the growing and the winter season.”