

Clim. Past Discuss., author comment AC2
<https://doi.org/10.5194/cp-2021-147-AC2>, 2022
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Reply on RC1

Heli Huhtamaa et al.

Author comment on "Recession or resilience? Long-range socioeconomic consequences of the 17th century volcanic eruptions in northern Fennoscandia" by Heli Huhtamaa et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-147-AC2>, 2022

Dear Joe Manning,

Thank you very much for your helpful suggestions and encouraging comments on our manuscript. We will respond to your review below by adding our responses in *italics* with running numbering.

Heli Huhtamaa, also behalf of all co-authors

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This is an important paper that presents human and natural data that assesses the impact of three 17th century eruptions: Huaynaputina in 1600 (southern Peru), the double eruption of Koma-ga-take (Japan) and Mt Parker (Philippines) in 1640/41 and a hitherto unidentified eruption in 1695 (UE 1695). Volcanic eruptions can provide discrete windows onto a particular society, its vulnerabilities, and its responses to precipitation and temperature shocks in short time scales. The impact of eruptions must always be assessed against the background climate state, natural variability, and the structure of the particular society. Therefore highly resolved historical data must be integrated with climate proxy data. This article does just this, and presents novel historical (tax records) and climate data (tree rings) from Ostrobothnia (Finland).

Although the region supported a very small population (ca. 91-150 persons), it is the basic method here, assigning historical causation with respect to short term climate shocks in a socio-economic system with high spatial variability, that matters. The Abstract concisely conveys the paper's arguments and data used, the paper is well written and the arguments are very clear.

-- #1 -- *Thank you very much for these kind words. Considering the population number (ca. 91 150 persons, – not from 91 to 150 persons), we replied about this matter already on 15 December 2021.*

Since both the location and the timing of an eruption matters a great deal perhaps something more can be said here. The use of the term "Recession" in the Title and in the paper could perhaps be changed. I am not sure that "recession" used in an economic sense is the right one here, especially in a region with a very small population. The basic point, rather, is that certain parts of the population and certain regions were more

vulnerable to the shocks than others were.

-- #2 -- We agree that the term "recession" can be somehow problematic. We have now added the word "household" preceding the term "recession" in the manuscript (p. 6; l. 145). However, considering the population number, the number is 1000 times larger than the reviewer initially thought. In fact, the data we present in the manuscript includes every peasant farmstead in the whole province of Ostrobothnia. Thus, based on the evidence presented (for example) in Figure 4b on the percentage of farmsteads that were unable to pay their tax debts, perhaps the term household "recession" can be justified here? Nevertheless, we know that the incorrect use of the word "recession" might originate from the fact that none of us authors is native English speaker. Thus, we will leave the decision on whether the term should be changed in the title to the editor – who is a native speaker.

With respect to the shocks to grain production, I wonder if something could be said about grain storage. One might expect that the ability of households to store grain for a year or two could mitigate a short-term shock.

-- #3 -- This is very important comment. However, unfortunately, the written sources from 17th century Finland do not really capture detailed information on the peasants' household-level grain storage capacities. However, we will include a brief discussion on the potential of peasant grain storage capacity, as well discussion on the grain storages held by the parish/crown/merchants, in the manuscript.

On land abandonment, are there other factors that can be treated?, e.g. a lack of heirs might also result in state seizure of property.

-- #4 -- Previous research suggests the lack of heirs was not an issue in the 17th century Ostrobothnia. Instead, previous research suggests that the situation was quite the opposite. We will include short discussion about this matter on the revised manuscript.

Figure 7 might be rethought, a more robust coupled natural-human system model with feedbacks might convey other aspects discussed in this fine study, although I take the point that here, the impact of an eruption on society is mediated by many other factors that must be considered in detail, and only examples that have highly resolved historical and climate data integrated into the analysis allow us the ability to assess how large eruptions impact societies, which, in turn, will allow policy makers to better plan for future eruptions (and potentially the impact of geoengineering).

-- #5 -- Thank you for these insights. Indeed, we fully agree with the reviewer: more robust models might be more helpful to address similar issues regardless of the place or time. Yet, on the other hand, such detailed case studies need to be produced before one can create more general models. At the same time, none of the large eruptions of the last millennium has had the "same" effects on climate, neither in terms of amplitude nor in spatial terms, probably as a result of differing initial conditions or varying states of modes of natural climate variability. Thus, we decided to keep figure 7 as it is. Hopefully, further studies can identify an array of different socio-environmental components that could be described/assessed in more detail in the future. With such insights from different regions and time periods, we are more equipped to draw the suggested more robust model – which can be utilized also within the field of policy making.