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Modelling volcanically induced climatic perturbations and their impacts on palaeodemography around 13ka BP in Europe

Laurits Andreassen¹, Felix Riede¹, and Claudia Timmreck²

¹Aarhus University, School of Culture and Society, Archaeology, Aarhus, Denmark (laurits.andreassen@cas.au.dk)

²Max Planck Institute for Meteorology, Hamburg, Germany

Climate and human populations can be said to make up a complex system with many possibilities for one component to impact another. Present day global warming is one example, yet examples are not limited to the Anthropocene but can also be found in the deep past. The Laacher See Eruption (LSE) that occurred around 13,000 BP is one example of how climate, the environment and human palaeodemography interacted. Archaeological findings suggest the LSE potentially had strong and long-lasting impact on contemporary hunter-gatherer societies in some parts of Europe – in some sense the memory of the impact might even be considered infinite and hysteresis-like, since culture might have changed more permanently in the eruption's wake. We investigated the climatic legacy of the LSE using computer-based models. This requires a model suite that deals with both physical, environmental, and demographical variables. For this we combine the MPI Earth System Model with a statistical model that estimates population densities and information on generation times in hunter-gatherer societies. This configuration allows us to estimate the size and duration of the impact the LSE had on climate variables and - via changes in the carrying capacity - palaeodemography. Our findings suggest that the palaeodemography of Late Glacial hunter-gatherer societies showed a memory of the initial environmental perturbation at a temporal scale exceeding that of the transient perturbation itself. The memory found in our models is, however, relatively short-lived, which could reflect the actual memory of the physico-social system, or limitations of our modelling approach. Further evaluation of the model against archaeological sites is needed to suggest what is the case.