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Surface air temperature response to strong volcanic clusters in the Last Glacial Maximum

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Stratospheric aerosol injection from volcanic eruptions results in a complex set of responses driving climate effects across various time and spatial scales. However, the physical mechanisms through which volcanic forcing causes long-term global and regional cooling remain insufficiently examined. In particular, the climate feedbacks and responses to a cluster of strong volcanic eruptions that occurred pre-Holocene are still poorly quantified. We examine the cooling potential of volcanic clusters and assess the short- and long-term memory of regional and global climatic variability using a suite of idealised volcanic forcing experiments with the Hadley Centre Coupled Model, version 3. We compare the responses to Northern Hemisphere high and low latitude volcanic clusters and the impact of different boundary conditions. We find a largely similar surface air temperature response to low and high latitude volcanic clusters. Individual volcanic eruptions lead to a global mean surface air temperature cooling of approximately 0.5°-1.5°C, and this cooling appears to increase after successive eruptions. We also investigate changes in the coupling between northward heat transport, Arctic sea ice, and the Atlantic Meridional Overturning Circulation caused by the volcanic forcing.