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Revisiting the climate impact of the ~13,000 yr BP Laacher See eruption

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The large VEI= 6 explosive eruption of the Laacher See volcano dated to c. 13,000 yrs BP (Reinig et al., 2020) marks the end of explosive volcanism in the East Eifel volcanic zone (Germany). It has previously been argued that this eruption temporarily impacted Northern Hemisphere climate (Graf and Timmreck, 2001), environments (Baales et al., 2002) and human communities (e.g. Blong et al., 2018). It has also recently been suggested again that the eruption may in fact be implicated in the onset of the Younger Dryas. Recent advances in the modelling of volcanically-induced climatic forcing warrant renewed attention to the eruption's potential influence on Northern Hemisphere climate. Detailed reconstructions of its eruption dynamics have been proposed. The eruption might have lasted several weeks, most likely with a short (~10h) intense initial phase. A bipartite NE- and S- plume deposited tephra to the north-east the volcano towards the Baltic Sea and to the south towards Italy (Riede et al., 2011).
In revisiting the eruption's potential influence on Northern Hemisphere climate, we here present revised model simulations of the radiative impacts of the LSE using a global stratospheric aerosol model and new sulphur dioxide (SO2) emission estimates. The simulations were performed with the general circulation model MAECHAM5-HAM, which is coupled to an aerosol microphysical model. This allows us to simulate the evolution of the volcanic sulfur cloud and the transport of the ash cloud. The position of the observed deposits of the LSE depend on the weather and the wind direction during the eruption, demanding specific weather conditions to simulate similar locations of the observed deposits. Our models provide significantly improved insights into the meteorological situation during the eruption event as well as its impacts on Northern Hemisphere climate, with attendant implications for ecological and cultural impacts.

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