# The Climatic Impact of the 1257 Samalas Eruption.

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The 1257 Samalas eruption was one of the largest eruptions of the Holocene epoch. With a VEI of 7, the eruption column is estimated to have reached altitudes of 43km and ejected an estimated 119 Tg of SO2 into the stratosphere, ten times that of the 1991 Mt Pinatubo eruption1. Whilst proxy data from tree ring chronologies suggest a Northern Hemisphere Summer cooling on the order of -0.7 to -1.2°C2, previous attempts to model the climatic impact of the eruption have tended to overestimate the eruption’s radiative forcing with a global surface cooling of -4°C3. Proxy and historical data also suggest significant regional heterogeneities in temperature and precipitation anomalies, with the eruption’s climatic impact being invoked to account for a range of historical phenomena during the 13th century4,5. Uncertainties also remain over the timing of the eruption, with dates being suggested from between May 1257 to January 12586,7.

Using the UK Earth System climate model, simulations were run for the eruption starting in either January or July with initial conditions that sampled different states of the Quasi-Biennial Oscillation (QBO) and El Niño Southern Oscillation (ENSO), and the climatic impact investigated. This includes an analysis of global mean and regional stratospheric aerosol optical depth, and surface temperature and precipitation anomalies. A database of proxy and historical data has also been complied and utilised to place additional constraints on eruption impact and model accuracy.

Initial results show that model runs of a July 1257 eruption successfully capture both the Northern Hemisphere summer cooling and regional surface temperature anomalies when compared to proxy and historical data. This strongly favours the eruption having occurred in the summer of 1257 and thus places a convincing constraint on eruption timing. The eruption is shown to perturb both ENSO and QBO state, although the role of prior atmospheric conditions in modulating the eruption impact remains under investigation.

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