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New microphysical volcanic forcing datasets for the Agung, El Chichon and Pinatubo eruptions

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Major tropical volcanic eruptions inject huge amounts of SO_2 directly into the stratosphere, and create a long-lasting perturbation to the stratospheric aerosol. The abruptly elevated aerosol has strong climate impacts, principally surface cooling via scattering incoming solar radiation. The enhanced tropical stratospheric aerosol can also absorb outgoing long wave radiation causing a warming of the stratosphere and subsequent complex composition-dynamics responses (e.g. Dhomse et al., 2015).
In this presentation we apply the composition-climate model UM-UKCA with interactive stratospheric chemistry and aerosol microphysics (Dhomse et al., 2014) to assess the enhancement to the stratospheric aerosol and associated radiative forcings from the three largest tropical eruptions in the last 60 years: Mt Agung (February 1963), El Chichon (April 1982) and Mt. Pinatubo (June 1991). Accurately characterising the forcing signature from these major eruptions is important for attribution of recent climate change and volcanic effects have been identified as a key requirement for robust attribution of multi-decadal surface temperature trends (e.g. Marotzke and Forster, 2015).
Aligning with the design of the ISA-MIP co-ordinated multi-model "Historical Eruption SO_2 Emissions Assessment" (HErSEA), we have carried out 3-member ensemble of simulations with each of upper, low and mid-point best estimates for SO_2 and injection height for each eruption. We evaluate simulated aerosol properties (e.g. extinction, AOD, effective radius, particle size distribution) against a range of satellite and in-situ observational datasets and assess stratospheric heating against temperature anomalies are compared against reanalysis and other datasets.

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