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The ISA-MIP Historical Eruption SO_2 Emissions Assessment (HErSEA): an intercomparison for interactive stratospheric aerosol models

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Major historical volcanic eruptions have injected huge amounts of sulphur dioxide into the stratosphere with observations showing an enhancement of the stratospheric aerosol layer for several years (ASAP, 2006). Such long-lasting increases in stratospheric aerosol loading cool the Earth's surface by scattering incoming solar radiation and warm the stratosphere via absorption of near infra-red solar and long-wave terrestrial radiation with complex effects on climate (e.g. Robock, 2000).

Two recent modelling studies of Mount Pinatubo (Dhomse et al., 2014; Sheng et al. 2015) have highlighted that observations suggest the sulphur loading of the volcanically enhanced stratospheric aerosol may have been considerably lower than suggested by measurements of the injected SO_2.

This poster describes a new model intercomparison activity "ISA-MIP" for interactive stratospheric aerosol models within the framework of the SPARC initiative on Stratospheric Sulphur and its Role in Climate (SSiRC). The new "Historical Eruption SO_2 emissions Assessment" (HErSEA) will intercompare model simulations of the three largest volcanic perturbations to the stratosphere in the last 50 years, 1963 Mt Agung, 1982 El Chichon and 1991 Mt Pinatubo. The aim is to assess how effectively the emitted SO_2 translates into perturbations to stratospheric aerosol properties and simulated radiative forcings in different composition-climate models with interactive stratospheric aerosol (ISA).

Each modelling group will run a mini-ensemble of transient AMIP-type runs for the 3 eruptions with a control no-eruption run followed by upper and lower bound injection amount estimates and 3 different injection height settings for two shallow (e.g. 19-21km amd 23-25km) and one deep (e.g. 19-25km) injection. First order analysis will intercompare stratospheric aerosol metrics such as 2D-monthly AOD(550nm, 1020nm) and timeseries of tropical and NH/SH mid-visible extinction at three different models levels (15, 20 and 25km). To allow the global variation in size distribution to also be intercompared, models will also diagnose 3D-monthly effective radius and integrated concentrations of particles with radius larger than 10nm, 150nm and 500nm.

The mini-ensemble is designed to be straighforward to assess several historical major eruptions and will be a precursor to the larger perturbed parameter ensemble study of the Pinatubo eruption (PoEMS) which will more rigorously assess sources of uncertainty in volcanic forcings simulated by the different models.