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Stratospheric aerosol forcing for climate modeling: 1850-1978

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We present here a stratospheric aerosol dataset produced using the available aerosol optical depth observations from the pre-satellite period.
The scarce atmospheric observations are supplemented by additional information from an aerosol microphysical model, initialized by ice-core derived sulfur emissions. The model is used to derive extinctions at all altitudes, latitudes and times when sulfur injections are known for specific volcanic eruptions. The simulated extinction coefficients are then scaled to match the observed optical depths.

In order to produce the complete optical properties at all wavelengths (and the aerosol surface area and volume densities) needed by climate models, we assume a lognormal size distribution of the aerosols. Correlations between the extinctions in the visible and the effective radius and distribution width parameters are taken from the better constrained SAGE II period. The aerosol number densities are then fitted to match the derived extinctions in the 1850-1978 period.

From these aerosol size distributions, we then calculate extinction coefficients, single scattering albedos and asymmetry factors at all wavelengths using the Mie theory. The aerosol surface area densities and volume densities are also provided.