



## **The relationship between aerosol model uncertainty and radiative forcing uncertainty**

Ken Carslaw, Lindsay Lee, and Carly Reddington

University of Leeds, School of Earth and Environment, Institute for Climate and Atmospheric Science, Leeds, United Kingdom (k.s.carslaw@leeds.ac.uk)

There has been no systematic assessment of how reduction in the uncertainty of global aerosol models will feed through to the uncertainty in the predicted forcing. We use a global model perturbed parameter ensemble to show that tight observational constraint of aerosol concentrations in the model has a relatively small effect on the aerosol-related uncertainty in the calculated aerosol-cloud forcing between pre-industrial and present day periods. One factor is the low sensitivity of present-day aerosol to natural emissions that determine the pre-industrial aerosol state. But the major cause of the weak constraint is that the full uncertainty space of the model generates a large number of model variants that are “equally acceptable” compared to present-day aerosol observations. The narrow range of aerosol concentrations in the observationally constrained model gives the impression of low aerosol model uncertainty, but this hides a range of very different aerosol models. These multiple so-called “equifinal” model variants predict a wide range of forcings. Equifinality in the aerosol model means that tuning of a small number of model processes to achieve model-observation agreement could give a misleading impression of model robustness.