EGU2020-5254
https://doi.org/10.5194/egusphere-egu2020-5254
EGU General Assembly 2020

Large variations in volcanic aerosol forcing efficiency due to eruption source parameters and rapid adjustments

Lauren Marshall[1], Christopher Smith[2], Piers Forster[2], Thomas Aubry[3], and Anja Schmidt[3]
[1]Department of Chemistry, University of Cambridge, Cambridge, UK (lrm49@cam.ac.uk)
[2]Priestely International Centre for Climate, University of Leeds, Leeds, UK
[3]Department of Geography, University of Cambridge, Cambridge, UK

The relationship between volcanic stratospheric aerosol optical depth (SAOD) and volcanic forcing is key to quantify the climate impacts of volcanic eruptions. In their fifth assessment report, the Intergovernmental Panel on Climate Change uses a single scaling factor between volcanic SAOD and effective radiative forcing (ERF) based on climate model simulations of the 1991 Mt. Pinatubo eruption, which may not be appropriate for eruptions of different magnitudes. Using a large-ensemble of aerosol-chemistry-climate simulations of eruptions with different SO_2 emissions, latitudes, emission altitudes and seasons, we find that the effective radiative forcing is on average 21% less than the instantaneous radiative forcing, predominantly due to a positive shortwave cloud adjustment. In our model, the volcanic SAOD to ERF relationship is non-unique and depends strongly on eruption latitude and season. We recommend a power law fit in the form of $ERF = -15.1 \times SAOD^{0.88}$ to convert SAOD (in the range of 0.01-0.7) to ERF.