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Quantifying the impact of moderate volcanic eruptions on the stratosphere

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We have investigated the impact of two recent moderate volcanic eruptions upon the sulphur dioxide and sulphate loading in the stratosphere, with the use of the CESM numerical global model. Through the use of the WACCM/CARMA module in CESM, which provides with a comprehensive modelling of the sulphur cycle, and at a $\sim 2^{\circ}$ spatial resolution, we have investigated the impacts of the eruptions of the Kelud (13 February 2014, 7°S, 112°E) and Calbuco (22 April 2015, 41°S, 72°W) volcanoes on the lower stratosphere. The input SO_2 quantities and altitudes of injection were estimated from satellite observations, and correspond in both cases to several hundreds of kT of SO_2 injected directly at upper troposphere/lower stratosphere heights, over a few kilometres of altitude span.

Our results have been compared with satellite measurements, from IASI for SO_2, and the CALIOP space-borne lidar for aerosols. We also provide cross-comparisons with in-situ measurements performed above La Réunion Island (21°S, 55°E), first comparing our simulation results to the data obtained through the launch of a balloon-borne light optical aerosol counter (LOAC), and also by cross-comparison with in-situ lidar measurements.

To investigate the role of dynamical barriers around those volcanic events, our simulations have been run using two different sets of meteorological forcing data (namely MERRA vs. ERA-Interim), which can differ in that respect, especially regarding the vertical advection at tropical latitudes. Our overall aim is to assess the impact of such moderate eruptions over the lower stratosphere, on the one hand chemically, and on the other hand in terms of radiative effects.