A simulation of the 2009 Sarychev eruption using CESM1(WACCM), and comparison with in-situ data and satellite measurements

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The Sarychev eruption of 2009 was simulated at LPC2E using the CESM1(WACCM) model and its CARMA module in order to assess the impact of its SO2 injection on the stratospheric aerosol burden. Thanks to the sulfur cycle included in the chemistry scheme and a sectional aerosol module, some precise data could be yielded on the formation of sulfate aerosol in the wake of the eruption. We find good agreement between simulated aerosol properties and in-situ optical particle counter measurements, both in terms of counts and size distributions. We also compared our simulated aerosol optical depths (AOD) to satellite measurements by OSIRIS. By specifically accounting for biases in the satellite data, a fair concordance was found between the two. Finally, we show that simulating an injection of HCl alongside SO2 prolongs the lifetime of SO2, thereby slowing down the sulfate aerosol formation process. This role of HCl, but most importantly the biases on OSIRIS's measurements could explain that previous studies reported too rapid a response of their models in the formation of sulfate aerosol.