4.027 Mass-independent isotopic fractionation and transport in volcanic sulfates.

Early Career Scientist

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Abstract:

Atmospheric sulfates play an important role in the Earth's radiative balance [IPPC report, 2013]. Volcanoes are among the main natural sources of sulfur in the atmosphere. Once injected in the atmosphere, volcanic sulfur is oxidized and converted to sulfate particles. There are still significant uncertainties pertaining to the atmospheric sulfur oxidation in different regions. Mass-independent isotopic fractionations (MIF) of sulfur oxidized species can be used as quantitative markers of oxidation pathways in the atmosphere and to constrain the sulfur cycle. The majority of the oxygen-MIF anomalies observed in sulfur species originate from the ozone anomaly transferred during oxidation, while the majority of the sulfur-MIF anomalies come from the photochemistry of atmospheric sulfur species.
The isotopic composition of sulfate in volcanic deposits has been measured in different regions of the world. We present here the analysis of the isotopic data using a photochemical box-model (CiTTyCAT) that contains a detailed description of tropospheric chemistry. The box-model can be further coupled to a Lagrangian model (FLEXPART) to simulate the transport of chemically evolving air masses. We have added a detailed sulfur chemistry scheme which includes its heterogeneous chemistry in the aqueous phase. Moreover, we have implemented and linked to it an isotope sulfur oxygen scheme, which allows to model the time evolution of the oxygen-MIF in volcanic sulfates during the oxidation of volcanic sulfur. The MIF anomalies modeled in volcanic sulfate are finally compared to the isotopic measurements made on sulfates collected in different regions.