SATELLITE CHARACTERIZATION OF GLOBAL STRATOSPHERIC SULFATE AEROSOLS RELEASED BY TONGA VOLCANO

PETER F. BERNATH, *Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA, USA*; CHRIS BOONE, *Department of Chemistry, University of Waterloo, Waterloo, ON, Canada*; ADAM PASTOREK, *Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA, USA*; WILLIAM D CAMERON, *Department of Physics, Old Dominion University, Norfolk, VA, USA*; MIKE LECOURS, *Department of Chemistry, University of Waterloo, Waterloo, ON, Canada*.

Large volcanic eruptions create an enhanced layer of sulfate aerosols in the stratosphere. These sulfuric acid droplets persist for many months, altering the climate and stratospheric chemistry. Sulfate aerosols scatter sunlight back to space, cooling the surface of the Earth and absorb outgoing thermal radiation, heating the stratosphere. The calculation of the climate impact of sulfate aerosols depends on their physical properties such as droplet size and chemical composition. These properties are not well known, and this uncertainty contributes to the errors in climate model predictions. Here we derive the first empirical formula that predicts the composition of stratospheric sulfate aerosols from volcanic eruptions from the air temperature and water vapor pressure. Measurements of atmospheric infrared transmittance of the Hunga Tonga-Hunga Ha'apai sulfate aerosol plume by the Atmospheric Chemistry Experiment (ACE) satellite were analyzed to determine composition (weight percent of sulfuric acid) and median particle radius. These data are supplemented by measurements of the Raikoke and Nabro eruptions. Our analysis allows the properties of volcanic aerosols in the stratosphere to be predicted reliably in atmospheric models.

Reference to publication: Bernath, P.; Boone, C.; Pastorek, A.; Cameron, D.; Lecours, M. Satellite characterization of global stratospheric sulfate aerosols released by Tonga volcano. JQSRT, 299, 108520 (2023)