

Atmospheric Chemistry and Physics

Supporting Information for

**Submicron volcanic ash detected in sulfate aerosol mixtures observed by the
Atmospheric Chemistry Experiment satellite**

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Contents of this file :

Figure S1-S3

Data availability:

ACE-FTS volume mixing ratio and imager retrievals can be accessed at https://database.scisat.ca/level2/ace_v5.3/display_data.php (ACE-FTS Level 2 Data, 2025) (registration required). The ash-sulfate aerosol data used in the study are available at Zenodo via <https://doi.org/10.5281/zenodo.21479502>

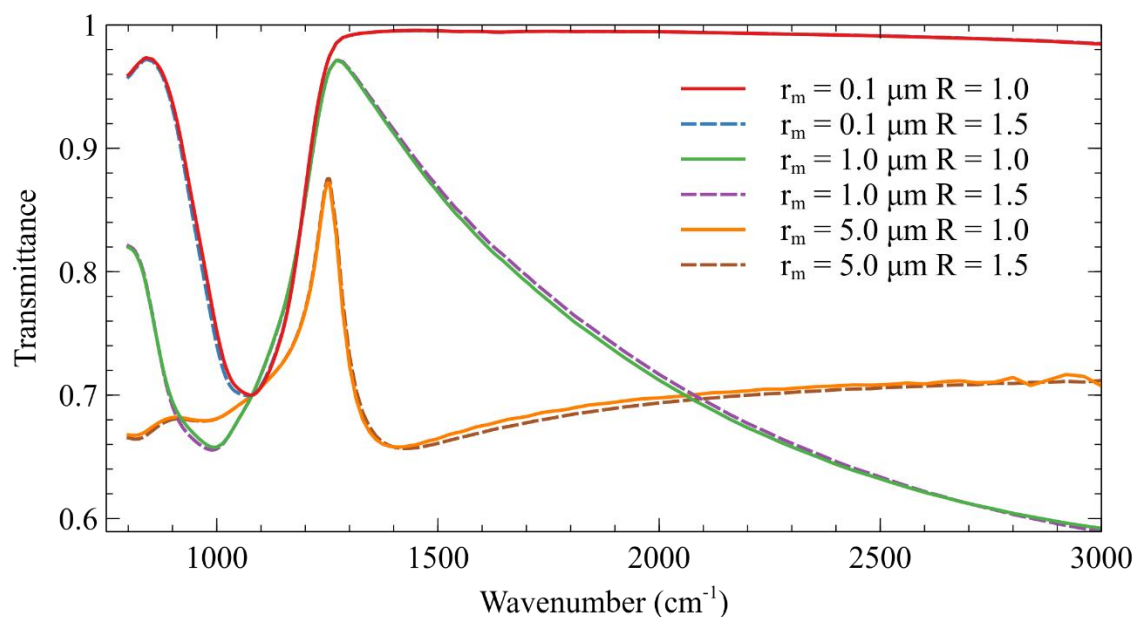


Figure S1. Simulated volcanic ash transmission spectra using the optical constants for the Calbuco eruption from Deguine et al. (2020) with a log-normal particle distribution where $S=1.6$. Extinction coefficients were calculated with miepython (solid lines) and the T-matrix method (dashed lines) from Mishchenko and Travis (1998) with an axial ratio of 1.5. Column densities were chosen such that the transmission at 1100 cm^{-1} was exactly 0.7. Significantly different transmission spectra are observed for significantly different median radii. The effect of axial ratio is minimal.

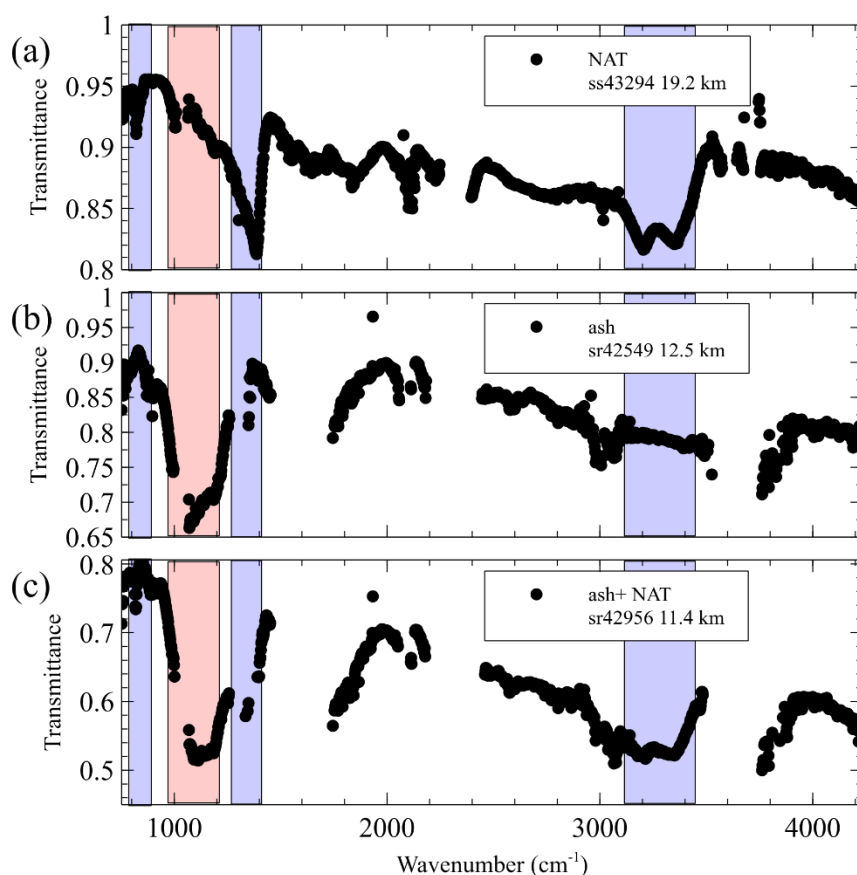


Figure S2. Uncalibrated residual spectra. Panel a) ss43294 19.2 km recorded on 28 August 2011 at 78.02 °S and 178.5 °E representing the spectra of a typical nitric acid trihydrate (NAT) polar stratospheric cloud. Panel b) sr42549 12.5 km recorded on 8 July 2011 at 56.87 °S and 74.6 °W representing the spectra of relatively pure ash from the Puyehue-Cordón Caulle eruption. Panel c) sr42956 11.4 km recorded on 5 August 2011 at 66.89 °S and 73.28 °E representing a mixture of ash and NAT. The diagnostic spectral features for NAT are highlighted in blue and the ash features are highlighted in red.

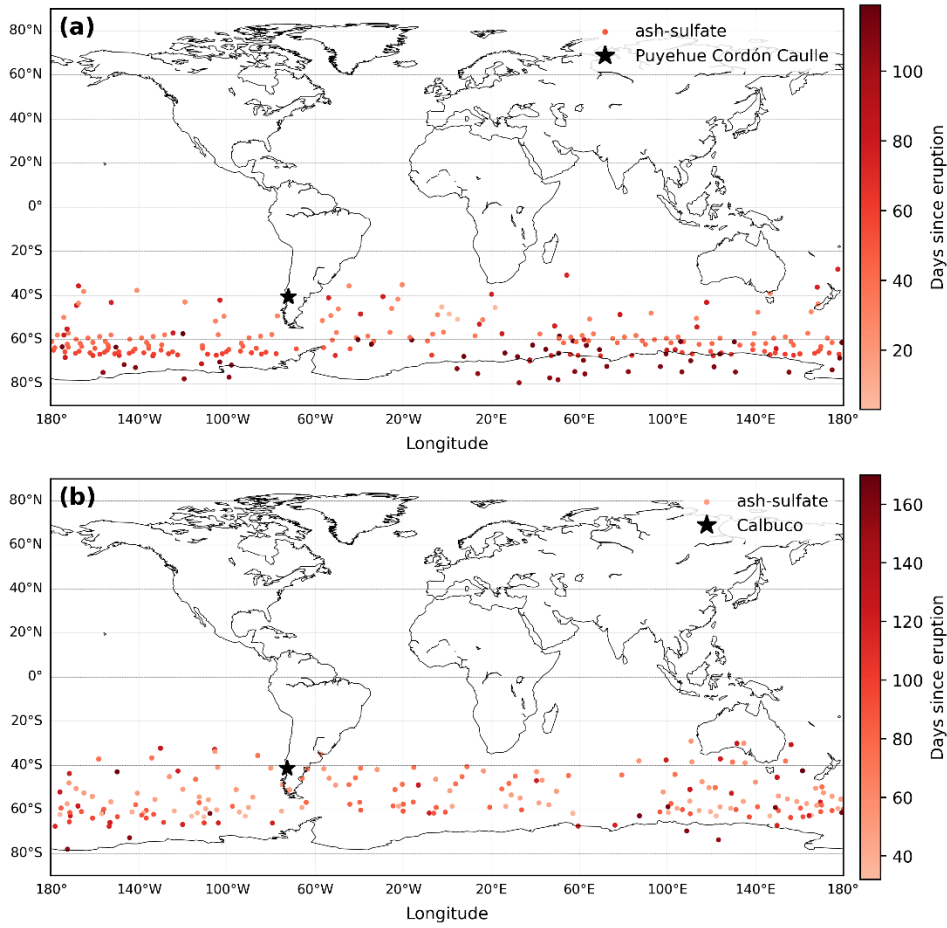


Figure S3. a) Locations of ash-sulfate mixed aerosols following the Puyehue-Cordón Caulle eruption of 2011. B) Locations of ash-sulfate mixed aerosols following the Calbuco eruption of 2015. The geographical location of the respected volcano complex is represented by the black star in each panel.