

Below please find our specific responses to the reviewer CC3. The format is the reviewer comments in italics followed by our reply.

CC3:

1. The interpretation of the color ratio depends entirely on Mie scattering calculations carried out with SASKTRAN. These calculations depend on input parameters and assumptions, which need to be explicitly stated. In particular, the results depend on the assumed composition (weight % of sulfuric acid) and the optical constants used. What is the temperature of the optical constants and was there any effort to match the optical constant temperature to the atmospheric temperature? The assumption of 1.6 for the width of the log-normal distribution is noted, but the systematic error on the median radius from this assumption is not estimated. Some discussion of systematic errors introduced by these various assumptions should be included.

Thanks for the suggestions, which is similar to RC1. We will include error estimates in the revised manuscript as Sections 2.2 and 2.3.

2. Two recent papers on the properties of stratospheric sulfate aerosols from Raikoke, Tonga and Nabro volcanic eruptions based on ACE-FTS spectra have been overlooked [1,2]. These papers can help with point 1 above and with particle size comparisons with independent measurements.

References

- 1. Bernath, C. Boone, A. Pastorek, D. Cameron and M. Lecours, Satellite characterization of global stratospheric sulfate aerosols released by Tonga volcano, J. Quant. Spectrosc. Rad. Transfer 299, 108520 (2023). Doi: 10.1016/j.jqsrt.2023.108520*
- 2. D. Boone, P. F. Bernath, K. LaBelle and J. Crouse, Stratospheric Aerosol Composition Observed by the Atmospheric Chemistry Experiment Following the 2019 Raikoke Eruption, J. Geophys. Res.: Atmospheres 127, e2022JD036600 (2022). Doi: 10.1029/2022JD036600*
- 3. D. Cameron, P. Bernath and C. Boone, Sulfur Dioxide from the Atmospheric Chemistry Experiment (ACE) Satellite, J. Quant. Spectrosc. Rad. Transfer 258, 107341 (2020). DOI: 10.1016/j.jqsrt.2020.107341*

Thank you for these references, we will include them.

3. The plume from the Raikoke volcanic eruption traveled both northwards and southwards, not just South [2,3]. “The eruption cloud is initially at 50° N and moves southward so the aerosols are detected at more southerly latitudes at a later time.”

Yes, a portion of the plume moved northward, but in the figures we see a time phasing as it moved southward. Figure 8 from Gorkavyi et al. (2021) clearly shows the spread in both directions. We see how the sentence could be confusing and will correct it.

Reference:

Gorkavyi, N., Krotkov, N., Li, C., Lait, L., Colarco, P., Carn, S., DeLand, M., Newman, P., Schoeberl, M., Taha, G., Torres, O., Vasilkov, A., and Joiner, J.: Tracking aerosols and SO₂ clouds from the Raikoke eruption: 3D view from satellite observations, *Atmos. Meas. Tech.*, 14, 7545–7563, <https://doi.org/10.5194/amt-14-7545-2021>, 2021.