

Review of Knepp et al., 2nd Revision)

Reviewer: Mike Fromm

The authors have once again made enormous changes and improvements to their manuscript. These are greatly appreciated, and allow me to acknowledge acceptance for publication after consideration of a few very minor suggestions.

Suggestion: reach out to Chris Boone regarding the ACE-FTS occultations presented herein, especially the two in July. Dr. Boone has dropped those from his current manuscript, under review, on Raikoke aerosols. This is largely because of uncertainties he had with the smoke spectra.

Section 6.4.4. The author's conundrum regarding Figure 20 and the generally assumed SO₂-sulfate conversion timeframe of ~30 days has some particularly relevant reinterpretation regarding sulfate abundance much sooner post eruption. Guo et al. (2004; doi:10.1029/2003GC000655) discussed observations of very young sulfates in the Pinatubo cloud. De Vries et al. (2014; doi:10.5194/acp-14-8149-2014) documented

stratospheric sulfates in the active Nabro eruption umbrella cloud and in the days immediately after the 13 June 2011 eruption. In addition, two works have shown substantial Raikoke stratospheric aerosol optical depth well within the first month after eruption (Kloss et al. 2021; Gorkavyi et al.

<https://doi.org/10.5194/amt-14-7545-2021>). And since CALIOP is invoked in Knepp et al., it might be worth reviewing these data to show that the Raikoke SO₂ cloud was imbedded with aerosols each day after the eruption. While some of these observations might be interpreted as ash, the important take-away is that there were indeed Raikoke particles in the stratosphere from the get go. Knepp et al. give a very nice detailed example of Raikoke sulfates on 2 July, which were imbedded in a synoptic-scale SO₂ plume. Here, CALIOP provides a larger context for the SAGE layer, with signals interpreted as sulfate. https://www-calipso.larc.nasa.gov/products/lidar/browse_images/show_v4_detail.php?s=production&v=V4-10&browse_date=2019-07-02&orbit_time=09-10-53&page=1&granule_name=CAL_LID_L1-Standard-V4-10.2019-07-02T09-10-53ZN.hdf