Dear authors,

Thank you for sharing your interesting work. We would like to point you to our study dating back to 2017 (Wu et al., 2017) because we think it provides a good comparison to your results. In Wu et al. (2017), we focused on the Sarychev eruption in 2009 using AIRS SO_2 observations and a Lagrangian particle dispersion model to reconstruct the altitude-resolved SO_2 emission time series. The following figure (Fig. 2 in Wu et al., 2017) shows the SO_2 emission time series of Sarychev during its entire eruption time period.

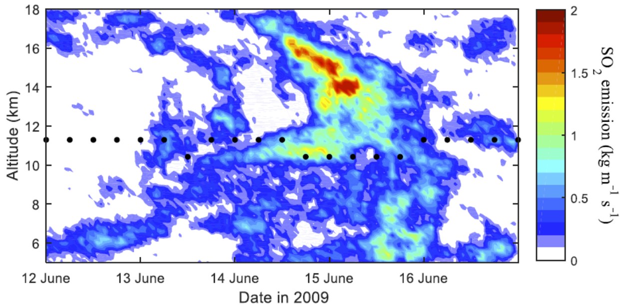


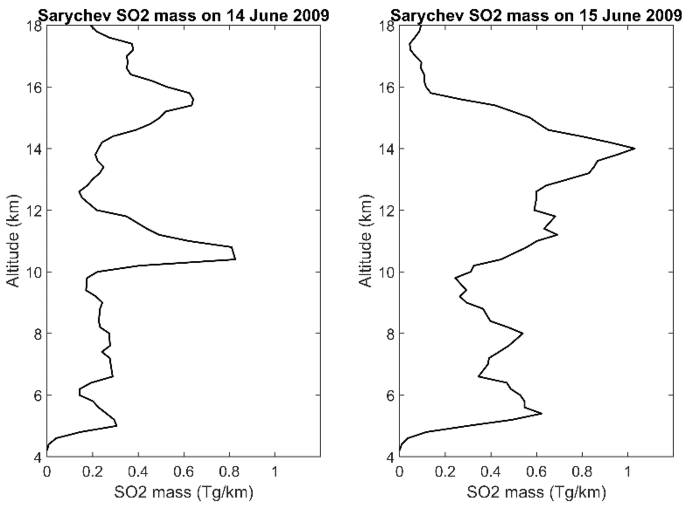
Figure 2. Sarychev SO_2 emission time series derived from AIRS measurements using a backward trajectory approach (see text for details). The emission data are binned every 1 h and 0.2 km. Black dots denote the height of the thermal tropopause.

We verified the reconstructed SO_2 emission time series by using it to initialize forward trajectories and compared the simulated horizontal dispersion with further AIRS SO_2 and MIPAS aerosol observations. In the vertical, the comparison with altitude resolved MIPAS aerosol measurements showed good agreement.

In addition to the Sarychev case, the method was also applied to other volcanic eruption cases (Grímsvötn, Nabro, Puyehue-Cordón Caulle, and Merapi) in Hoffmann et al. (2016) and Wu et al. (2018). With a more computationally expensive inverse approach, we investigated the Nabro eruption in Heng et al. (2016).

Since we used a very similar methodology and applied it to the same eruption case, we would appreciate it if you would spend some time reading our published work, particularly Wu et al. (2017) and Hoffmann et al. (2016), and perhaps compare your results with ours.

For your convenience, I calculated the Sarychev SO_2 mass profile on 14 and 15 June 2009 (by adding up all SO_2 mass on each level for each day) as below:



You may see the two peaks in the vertical direction at 10–12 km and 14–16 km, which seems to agree with your results as shown in your figure (although the date differs). If you are interested in comparing your results with ours, please do not hesitate to ask Dr. Hoffmann (l.hoffmann@fz-juelich.de) or me (wuxue@mail.iap.ac.cn) for our data.

Thanks again for your interesting work.

Sincerely,
Lars, Sabine, and Xue

References:

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Wu, X., Griessbach, S., and Hoffmann, L.: Long-range transport of volcanic aerosol from the 2010 Merapi tropical eruption to Antarctica, Atmos. Chem. Phys., 18, 15859–15877, https://doi.org/10.5194/acp-18-15859-2018, 2018.