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Discussions

Interactive comment on "30-year lidar observations of the stratospheric aerosol layer state over Tomsk (Western Siberia, Russia)" *by* Vladimir V. Zuev et al.

Anonymous Referee #1

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GENERAL COMMENTS

This paper uses an extensive lidar dataset to characterize multiple eruptions over a northern mid-latitude site. The Russian site is quite far from other lidar sites so is unique is that respect. The analysis is straight forward and described well. I recommend that the paper be published with minor corrections. The content of the paper is well written although the English grammar should be edited.

SPECIFIC COMMENTS

Abstract: no comments.

1 Introduction: no comments

2 Lidar instruments and methods I would like to see a short description of the lidar photon-counting data acquisition electronics. Is it from a commercial vendor or built just for the lidar? Is signal induced noise, and counting saturation taken into account?

I would like to see more about the normalization. Is only a single altitude used? Is it 30 km? Many of the Scattering Ratio profiles shown in the paper haven't decreased to 1.0 at 30 km, so higher altitude data must have been used. Is there an objective way to do this?

Choosing H1 (lower attitude of the SAL) as 15 km seems reasonable, but other lidar groups have used the actual tropopause or tropopause + 1 km. Choosing this altitude can be complicated since there can be multiple tropopauses sometimes. It can also be complicated when there has been an eruption since the upper troposphere can have much more aerosol. But perhaps you can comment on how much of a difference it would make to lower the H1 altitude during background conditions.

3 Results of the SAL lidar observations over Tomsk

3.1 Time series of the integrated stratospheric backscatter coefficient (1986–2015) In Table 1 the maximum plume height is listed. How are these measured? The initial plume heights are not very accurate if done by naked-eye observations. Are these measured later with lidars?

There has been an ongoing discussion in the community about whether there is an annual cycle in SAL. Your Figure 2 shows a winter/summer ratio of about 1.35. Figure 3 is similar. This would be influenced by the choice of the H1 altitude. It would be interesting to calculate a ratio and error bar as your best estimate of an annual cycle.

In Figure 2 what do the error bars represent, one sigma of the spread of the data?

3.2 Detection of plumes from northern volcanoes in the stratosphere over Tomsk in 2008–2010

3.2.1 Okmok and Kasatochi

In Figure 5 there is a peak on September 4, 2000 at 27-30 km. Is that real? The altitude axis might be clearer with 1 km tic marks instead of 1.5 km.

3.2.2 Redoubt and Sarychev Peak No comments.

3.2.3 Eyjafjallajökull No comments.

3.3 Detection of volcanic plumes in the stratosphere over Tomsk in 2011

3.3.1 Merapi No comments.

3.3.2 Grimsvötn and Nabro No comments.

3.4 Polar stratospheric clouds No comments.

3.5 The latest SAL perturbations over Tomsk (2012–2015) No comments.

4 Discussion and conclusion "The Happy Camp Complex fire consumed more than 134 acres ($\sim$543 km2)...". Acres are much smaller than km2, something is wrong with the areas.

Figures 6 (a), 6 (b), 9, and 11. I am amazed that all four trajectories almost exactly cross over the volcanoes after so many days. Did you find an optimum altitude or something that gave you the best trajectory? Were the trajectories sensitive to the initial conditions?