

***Interactive comment on* “Long-range isentropic transport of stratospheric aerosols over Southern Hemisphere following the Calbuco eruption in April 2015” by Nelson Bègue et al.**

Anonymous Referee #1

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This paper focuses on the stratospheric aerosol transport from a recent volcanic eruption, using ground-based observations that are afterwards studied by means of an isentropic model. The stratospheric aerosol transport topic is rather important and interesting, even more so for recent eruptions in the Southern Hemisphere, but before this manuscript can be published on ACP major revisions are needed, both with some addition in the scientific discussion and in the overall quality of the paper, regarding English syntax and grammar and quality of the figures.

Specific points:

- I would suggest adding in the introduction some recent works that have shown how

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significant explosive volcanic eruptions can be for the stratospheric dynamics, by affecting large scale trace species transport and age of air, via radiative perturbations due to volcanic aerosols (Ray et al., 2014). Although the largest emphasis has been given to major tropical eruptions and their induced dynamical effects (Pitari et al., 2016a), extratropical eruptions in the last 15 years may also have had a significant role in lower stratospheric trends of key dynamical quantities (Kremser et al., 2016).

- Page 3, Lines 11-15: Regarding QBO effects on mid-latitude transport of the volcanic plume, I suggest citing Pitari et al. (2016b). In this paper, the e-folding time of the stratospheric sulfate plume caused by four major past tropical eruptions has been studied in a modeling experiment focusing on the QBO role. Their conclusion is in agreement with those in the Trepte and Hitchman (1992) paper.

- Page 10, Lines 16-27: Again, the only studies cited here are the ones from Trepte in 1992-1993. I feel that the addition in the discussion of Pitari et al. (2016b) would enrich the discussion by offering further evidence of the behaviour of the aerosol plume under different QBO regimes.

- Overall, the authors need to discuss much better the differences between Lidar, OMPS and CALIOP in paragraph 3.2.1. In particular, in Fig. 6 and Fig. 7 the differences are far too big between the panels. CALIOP doesn't see anything at all in the June-July period. A proper, good explanation should be given by the authors, I do not think a simple remark on vertical resolution is sufficient.

- Page 13: the authors should provide also the other parameter for the log-normal distribution (σ), to give a better idea of the shape. Also, at 2 m a significant value for the distribution seems to be present in Fig. 8. This value does not fit in the lognormal distribution, and the authors should discuss at least why this value has been ignored, and if it could point out to a coarse mode that is not properly detected because 2 m is the largest class detected.

- Page 13 and Figure 9: First of all, I would suggest limiting the range in Figure 9 to

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the upper troposphere and the stratosphere. The lowest values just create noise and enlarge the x-axes scale. Furthermore, as the authors somewhat point out, a single background profile cannot be used to draw any conclusion. Either the authors find more profiles to average as background, or the figure and the conclusions the authors draw from it should better highlight how limited the comparison is, or removed altogether.

- Page 15, section 4.2: I feel this section could be largely improved. The authors should show what they have done, as described in lines 21-23, in at least one figure.

References:

Kremser, S.; Thomason, L.W.; von Hobe, M.; Hermann, M.; Deshler, T.; Timmreck, C.; Toohey, M.; Stenke, A.; Schwarz, J.P.; Weigel, R.;. Stratospheric aerosol - Observations, processes, and impact on climate. *Rev. Geophys.* 2016.

Pitari, G.; Cionni, I.; Di Genova, G.; Vioni, D.; Gandolfi, I.; Mancini, E. Impact of Stratospheric Volcanic Aerosols on Age-of-Air and Transport of Long-Lived Species. *Atmosphere*, 7, 149, doi:10.3390/atmos7110149, 2016a.

Pitari, G., G. Di Genova, E. Mancini, D. Vioni, I. Gandolfi, and I. Cionni: Stratospheric aerosols from major volcanic eruptions: a composition-climate model study of the aerosol cloud dispersal and e-folding time, *Atmosphere*, 7, 75, doi:10.3390/atmos7060075, 2016b.

Ray, E.A.; Moore, F.L.; Rosenlof, K.L.; Davis, S.M.; Sweeney, C.; Tans, P.; Wang, T.; Elkins, J.W.; Bönisch, H.; Engel, A.; Improving stratospheric transport trend analysis based on SF6 and CO2 measurements. *J. Geophys. Res.* 2014, 119.

The paper itself also requires an extensive check for errors, especially regarding the syntax of some phrases, that are sometimes hard to understand. I suggest the authors to have the paper checked by a native English speaker. Some examples follow:

- Page 5, line 18: I would suggest rephrasing this because it makes no sense. Maybe what the authors meant to say is "The method involved in...". Also the following

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phrases should be rewritten in a way that makes them easier to read.

- Page 5, line 25: it's "called", not "call".
- Page 6, line 9: either a "bigger" or "smaller" is missing.
- Page 7, line 3: please rephrase ("relevant for the monitoring of").
- Page 8, lines 23: "corresponding" .
- Page 9, line 33: "up to" instead of "until".
- Page 10, line 10: "northern" is spelled wrong.
- Page 10, lines 21-24: please rephrase in proper english.

There are many, many more errors and examples of terrible syntax and again I suggest a complete editing by a professional service or by a native English speaker.

Some of the figures need to be rather improved for better readability, their overall quality is very poor. Some specific comments on them follow:

- Fig. 1: It is almost impossible to read the colorbar, and the whole figure seems a bit out of focus. Less numbers, but bigger, are needed. The map is also impossible to read. I suggest splitting the figures in three panels: a) with the map b) the cross section (with all the numbers made more readable) and c) the Brightness Temperature Difference (again, much larger).
- Fig. 2: Part of the bottom of the figure is cut (Time). The caption needs to be much more detailed. Also, always call it "Altitude" over all figures (as in Fig. 1 and 3) and not "Height".
- Fig. 4: This figure has very poor quality. Colorbar numbers are again impossible to read. Enlarge the panels and get rid of all that white space.
- Fig. 5: Why are some of the red points not connected to the others with a red line (Oct 2014 and Feb 2016). What do the error bars represent? The caption needs to

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be improved. Instead of marking with the dashed line the beginning of 2015, I would suggest making with the same line the exact day of the eruption.

- Fig. 6 and 7: There is really no point in having all that white space between panels. The figures could be expanded.

- Fig. 10: The continents are almost not visible at all: The contours should be thicker and more visible.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-544>, 2017.

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