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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Overshooting of clean tropospheric air in the tropical lower stratosphere as seen by the CALIPSO lidar" *by* J. P. Vernier et al.

Anonymous Referee #1

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The interaction between the upper troposphere (UT) and the lower stratosphere (LS) is not well known because of few observations. The authors show that deep convections clean stratospheric aerosols by statistical analysis of the space-borne lidar measurement, CALIOP, indirectly. That is, the authors show CALIOP signals in LS are weaker when the occurrence frequency of deep convections is greater, and the rising speed of the weaker signals is 3 km/year and it is consistent with that of the Brewer-Dobson circulation. Though the authors do not show the direct proof of the cleansing due to weak lidar returns, their results are interesting; I recommend the acceptance of the manuscript after some corrections.

Major comments:

1. The lower CALIOP lidar returns (SR) denotes the lower number of aerosol particles (=cleaner air) and/or the smaller aerosol particles. The authors should show the lower SR does not denote the smaller aerosol particles. This is because, if deep convections dehydrate LS, size of water-soluble aerosol particles in LS would be smaller and SR would be lower by the convections. This scenario is inconsistent with the paper. The authors should explain the definition of "clean" and the relation between "clean" and SR.

2. The authors should show the mechanism that deep convections cleanse aerosol particles in LS because the authors do not show deep convections cleanse them directly. For example, the theoretical simple estimation of the cleansing time is needed to validate their discussion.

Minor comments:

1. The authors should explain all figures in detail in the text; e.g., I cannot find when and which figure the authors describe at P168, L24, and P170 L11.

2. P170−171: The authors should explain the method to retrieve the mean zonal cloud top. I believe the cloud top of deep convections should be averaged. The authors should also explain whether there is a relation between the cloud top height and cleansing. I think there isn't because the cloud top heights in Fig. 4 are almost the same. If so, the occurrence frequency of deep convections is more important for cleansing and it supports the paper.

3. Overshooting is not defined as an area of rainfall and a radar reflectivity factor like the paragraph from P171, L15. Those are an empirical threshold of TRMM-PR. The authors should use "a deep convection" instead of "overshoot" in the text or they should add a comment of the exact definition of overshooting in the text. Or the authors should estimate overshooting by use of CALIOP/CloudSat and ECMWF/AIRS data.

4. P172, L11: The authors should estimate a size of aerosol particles by use of a color ratio or the other methods. The data of an optical particle counter does not represent a size distribution of the global aerosol particles.

5. P172, L7 (Figure 6): "<0.1" and up to "0.6" are not clear in the figure. The authors should enlarge the figure and draw it with a different color bar.

6. P174, L19: How do the authors estimate the values?

7. I believe the section 4.3 is not necessary. Some of them should be included in the introduction.

8. The authors should summarize eruptions in a table, such as the eruption date, the name of mountain, latitude and longitude, and the country. The eruption dates arrowed in Fig. 1 are also helpful to understand.

9. Figure 1: The authors should write the retrieval method of the potential temperature. Why did the two volcanic plumes become one in 2006?

10. Figure 2: I believe the dotted line is not necessary because there is no description about it in the text.

11. Figure 4: What is the color? Figures are too small. It should be ">5%", not "=5%."

12. Figure 5 (upper): There are two peaks of Nb but there is one peak of SR in 2007. The authors should write the reason briefly.

13. Figure 8: The authors should describe the rectangle in the figure in detail.

14. The authors MUST check all references. FOR EXAMPLE, years of many references are incorrect, Schoeberl et al (2008) is not listed in the Reference, and Bourassa et al (2010) isn't in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 163, 2011.