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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of Polar Stratospheric Clouds with Space-BorneLidar: CALIPSO and the 2006 Antarctic Season" *by* M. C. Pitts et al.

Anonymous Referee #3

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General:

This is the first paper describing the detection of polar stratospheric clouds (PSCs) by the spaceborne lidar CALIOP. The discussed dataset is exceptional since for the first time the evolution of PSCs during nearly a whole Antarctic winter period has been observed by lidar with unprecedented horizontal and vertical resolution.

The manuscript is structured and written very well. Only the chapter about PSC composition studies may be skipped since a follow-up paper is planned with this content. The manuscript anyway contains sufficiently new information and after some minor changes (see below), I strongly recommend it for publication in ACP.

Specific:

p.7939, l.23: 'significantly larger range in background noise.'

Does 'larger range' imply that the mean of the background noise is higher or is the variability of the noise higher while the mean is the same? Please clarify.

p.7940, l.1: 'we applied additional spatial averaging to all data below 20.2 km to closely match the resolution of the data above 20.2 km.'

Could you explain how the averaging is performed? Especially, how you achieved a horizontal resolution of 1.67 km from a resolution of 1.0 km?

p.7940, l.4: 'in Fig. 3b.'

The text and the Figure caption implies that between Fig. 3a and 3b only the data below 20.2 km is changed. However, also the picture above 20.2 km is different.

p7940, l.18: 'that has single profile resolution of 540-m vertical and 5-km horizontal.'

It would be instructive if this final result could be shown e.g. as Fig. 3c.

p7941, l.16: 'The spread of the background aerosol data is representative of the magnitude of the noise in the measurements (sigma=0.32)'

How has this sigma value been determined? (All data above 198 K?)

From Figure 4 one can see that the noise of the background seems to increase with decreasing temperature (e.g. from 220 K to 200 K). What is the reason for this? Could you discuss if there is any need to account for this increase in the PSC detection scheme when entering the PSC-temperature domain?

p7943, l.2: 'There is a peak in the cold (blue) distribution corresponding to the background aerosol at cold temperatures and a pronounced positive tail corresponding to the PSCs.'

Is there an explanation why the maxima of the distributions in the right part of Fig. 5

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are less than 1. Is this also the case for the 13 June high-temperature data?

p7951, l.9: 'The accuracy of the TNAT area calculations are dependent on the accuracy of the GEOS-4 temperature and MLS gas species mixing ratio data, but it is unlikely these uncertainties are large enough to explain the observed discrepancy.'

One should discuss here two items related to the use of MLS HNO3 data:

1. MLS HNO3 is only the gas-phase fraction of HNO3 and, thus, does not account for the HNO3 taken up by the PSCs. The authors use the expression 'denitrification', but from the dataset itself it cannot be decided whether the missing HNO3 is still present in the particles or removed from the stratosphere entirely.

2. In version 1.5 of MLS HNO3 there is a high bias of about 30%. Has this been corrected for? If not, this would lead to some overestimation of the PSC area.

Chapter 4.4 'PSC Composition Studies'

In my opinion this chapter could be skipped since it does not go into detail and a paper on PSC composition retrieval is anyway planned. Perhaps the authors can move a few parts into the conclusions.

Technical:

Figs. 12-18: daily time series, x-axis

It would be easier for the reader if at least the months could be indicated.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 7933, 2007.