Atmos. Chem. Phys. Discuss., 4, S3863–S3867, 2004
www.atmos-chem-phys.org/acpd/4/S3863/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Differences in Arctic and Antarctic PSC occurrenceas observed by lidar in Ny-Ålesund (79° N, 12° E) and McMurdo(78° S, 167° E)" *by* M. Müller et al.

M. Müller et al.

Received and published: 18 March 2005

We thank Reviewer #2 for his/her valuable comments and useful suggestions.

Regarding the general opinion of the Reviewer, we would like to point out that we do not intend to "...infer the prediction of future Arctic PSC presence from present Antarctica PSC occurrence". In contrast, it is our aim to emphasize that such a prediction is not appropriate. We are concerned that the first version of the manuscript apparently allowed to be misunderstood in this point, and we hope that similar misconception is avoided with the revised version. Also, the structure of the paper has been revised for more clarity, e.g. additional headings are provided in the discussion part and the

repetitive reflection of the McMurdo liquid PSCs has been cancelled.

Please find below our detailed answers to the general and line-by-line comments.

General comments:

1) We agree with the reviewers' statement that from the provided PSC type statistics it is not possible to infer the future Arctic PSC occurrence. Yet as mentioned above, this was never our objective. Rather, we intend to draw the readers' attention to the hemispheric differences in the occurrence of solid and liquid PSCs. Especially the high amount of liquid PSCs in the Ny-Ålesund (Arctic) dataset, and the rather scarce occurrence of ice PSCs together with the persistent occurrence of NAT PSCs in the McMurdo (Antarctic) dataset are notable facts that do not necessarily agree with the common PSC picture. By documenting the differences, we aim to raise a warning flag to such studies of possible future Arctic ozone loss that apply PSC properties as a simple function of temperature. In the revised version of the manuscript, we tried to adjust the verbalisation to avoid misunderstanding of our objective.

2) We state similar conditions of the two stations with respect to the polar vortex by the fact that the analysed datasets are comparable in terms of synoptic and mesoscale PSC occurrence percentage. The vertical variability of the observed PSCs is supposed to reflect the scale of the temperature field causing their formation, with large scale vertical variability found for synoptic scale PSCs and small scale vertical variability caused by mesoscale effects (Adriani et al., 2004). The climatological studies by Adriani et al. (2004) and Massoli et al. (manuscript submitted to J. Geophys. Res., 2005) show similar percentages for the PSCs at McMurdo and Ny-Ålesund, with 60% and 55% of the PSCs showing large scale variability representing synoptic scale clouds, respectively, while small scale vertical variability linked to mesoscale clouds is found in 40% of the PSC observations in McMurdo and in 45% in Ny-Ålesund. We therefore assume that it is adequate to compare the two datasets. An according statement is added to the revised version.

ACPD

4, S3863–S3867, 2004

3) Since the focus of the paper is set on the hemispheric differences between solid and liquid PSC occurrence, it seems less important to distinguish between solid NAT clouds with different particle size and concentration. Therefore in the revised version, type Ia enhanced PSCs are not treated as a distinct category, but are included in the type Ia category, all of them being referred as NAT clouds in the text.

4) As suggested, to remain consistent throughout the paper we now use the percentage of detected PSCs with respect to the number of PSC observation days to account for PSC occurrence. Figure 3 was changed accordingly.

5) We added a paragraph with a more detailed description of our method to count PSC events at the beginning of the statistical analysis chapter. The possible presence of more than one cloud type in the same profile is now explained in the text, while according visualization is expected to be covered by the sandwich structure cloud in Figure 8.

6) The scope of this paper is not a comprehensive statistical analysis, as those have been made for the McMurdo and Ny-Ålesund datasets by Adriani et al. (2004) and Massoli et al. (manuscript submitted to J. Geophys. Res., 2005), respectively, where the temporal-spatial distribution of different PSC types and their vertical extent, climatological studies have been published / submitted. Here, we focus on the interhemispheric comparison of the solid and liquid PSC occurrence.

7) We are aware that there is a huge amount of PSC observations from groups other than German or Italian. Most other ground-based or balloon-borne observations, however, are linked to campaign periods and have more occasional character due to their limited time intervals, while we rather refer to long-term lidar observations and climatologies. Anyhow, we have added more references where suitable.

Line by line comments:

We have implemented most of the suggested expressions. In the following, we com-

ACPD

4, S3863–S3867, 2004

ment only on those parts we left unchanged:

p6841, line 1: "ice clouds occur every winter only in the inner part of the vortex, but not at the edge." In this general introduction we do not want to specify the location of cloud types within the polar vortex, but to point out the difference in ice PSC conditions between northern and southern hemisphere. For this reason, we prefer to maintain the sentence, that is “While these ice clouds occur every winter in the southern hemisphere, they are still exceptional in the Arctic Ĕ”

p6841, line 18: "Figures 1 and 2 could be put into a unique figure, in order to compare easily both stations." Since there are already 11 lines in each subplot, we prefer to keep the Arctic and Antarctic temperature profiles separately as the plots would get overcrowded and the lines undistinguishable.

p6844, line 4-8: In the revised manuscript, the comparability of the two datasets and the method for counting PSC events are described in more detail.

p6844, line 21-22: The sentence has been changed to: “The picture gets more diverse when analysing the occurrence frequency of the different PSC types.”

Figure 6: "Could the author give a reference on their TSTS calculation?" As mentioned in the introduction, we refer to Stein et al. (1999) and references therein to assume that TSTS is 3.5 K lower than TNAT.

References:

Adriani, A., P. Massoli, G. Di Donfrancesco, F. Cairo, M. L. Moriconi, and M. Snels: Climatology of polar stratospheric clouds based on lidar observations from 1993 to 2001 over McMurdo Station, Antarctica. J. Geophys. Res., 109, doi:10.1029/2004JD004800, 2004.

Massoli, P., M. Müller, R. Neuber: Climatology of Arctic PSCs as measured by lidar in Ny-Ålesund, Spitsbergen [78° N, 12° E]. J. Geophys. Res., submitted, 2005.

ACPD

4, S3863–S3867, 2004

Stein, B., et al.: Optical classification, existence temperatures, and coexistence of different polar stratospheric cloud types. J. Geophys. Res., 104 , 23983-23993, 1999.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6837, 2004.