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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A climatology of polar stratospheric cloud composition between 2002 and 2012 based on MIPAS/Envisat observations" *by* Reinhold Spang et al.

Anonymous Referee #3

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The paper report an extensive presentation of PSC climatology over both poles. PSC have been classified into seven classes: those formed by the three canonical PSC particle types (NAT, STS, ICE) as well as external mixtures of them, and unspecified clouds. The classification algorithm is discussed clearly but briefly, as more detailed descriptions are already present in the literature. Results of PSC classification are then compared with the satellite borne CALIOP lidar classification, used as a benchmark, in term of PSC occurrence vs altitude and time of the year, for a particular year, over Antarctica. The comparison result is quite satisfactory and put trust in the results of the MIPAS classification that are discussed further on. PCS climatology is then described in term of pdf of PSC occurrences vs temperature, and studied in terms of their

geographical distribution, altitudes, and temporal evolution. This is extensively done for the whole PSC dataset spanning several years, over Antarctica, while the author have sometimes restricted themselves to study a single year over the Arctic, due to the larger variability, and hence scarce representativeness of quantities averaged over the whole dataset. Observational climatologies are also compared with PSC occurrences estimated by a simple temperature-threshold based approach on ERA-i meteorological fields. The paper present a unique dataset of paramount importance, is clearly written and well detailed and referenced, surely deserves publication. However the author should correct some inaccuracies in the text, and may consider some suggestion for improving its readability; as instance, the paper is quite lengthy and the authors may consider (this is not a mandatory request) to shift some material in a supplement. These, and other minor issues, are detailed hereafter:

(43) "PSC... and are formed of particles that are classified into three types..." as the particles are of three types, but coexist, giving rise to PSC classes more than three.

(56) maybe her is "typology" instead of (or in addition to) "concentration"

(60) Here, for completeness, the authors may also wish to quote the extensive dehydration that PSCs can induce in Antarctica.

(80) "...faster..." unclear. Faster than what?

(169) "... with altitude, and with altitude..."

(191) "600000 modelled spectra with varying PSC types:" here it is unclear to me whether this forward model account for external mixtures of the three PSC particles. It seems otherwise, also in view of the following discussion, but maybe this this should be made clearer here.

(372) Typo.

(439) Typo.

(442) Typo.

(440-450) The comparison shows good agreement, but I had some difficulty following the reasoning that tries to explain the only evident discrepancies between the two datasets: NAT and ICE in the low altitudes at the beginning of the season. While the absence of ICE at low levels in MIPAS may be due to the vertical truncation of its data, and while the detection of NAT around 12 km is commented for both datasets, the increased presence of NAT in the MIPAS measures between 12 and 15 km seems to me not well addressed. The authors could similarly comment on that small discrepancy.

(542) Unfortunately in fig. 8 the years 2007 and 2008 are displayed with shades of green too close for me to be able to distinguish them.

(543 and following) Here, and elsewhere, the authors focus their attention on a particular Arctic winter, rather than reporting the climatology of mean values. I do not agree with this choice, given that the particular winter is, as highlighted in the text, exceptional, and therefore not very representative. It is also true that, given the high arctic variability, even the average values are not very significant, but this can be highlighted, thus commenting on the low representativeness of the average conditions, while reporting the climatology over the whole dataset and transferring the discussion on the specific winter 2011 in a supplement.

(612) Here the author may also quote that, to a lesser extent, also the denitrification and dehydration play a role in the downward propagation of PSC occurrence.

(631) See comment for (543 and following).

(685-689) This interesting difference between Arctic and Antarctic seem to be explained by an artifact, but I did not get the explanation in full. Is this difference arising because high, thin arctic clouds are warmer that the corresponding Antarctic ones, at the same altitude and with the same optical thickness? If so, the authors may consider to rephrase the paragraph to make such statement clearer.

(690-700) Interesting feature. Have the authors tried to apply their classification algorithm in non-polar, volcanically contaminated stratospheric regions and see whether there too, the algorithm recognizes presence of NAT?

(701-762) The author may consider to shift the whole paragraph in a supplement, and to quote only the main result in the manuscript.

(711) “”. . . overall MIPAS PSC. . .” all? Antarctic?

(795) “. . . would certainly. . .” I would use “. . . could. . .” as you don’t know unless you try. . .

(803) this statement seem in conflict with an earlier one at (753). Maybe one of the two should be rephrased.

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