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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An assessment of CALIOP polar stratospheric cloud composition classification" *by* M. C. Pitts et al.

Anonymous Referee #2

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<General Comments>

This study by Pitts et al. reports on the assessment of the CALIOP PSC classification algorithm, which was described by their P09 and P11 papers in detail, using the coincident MLS Version 3.3 HNO3 data and GEOS-5 temperature analysis. They used thermodynamic equilibrium models to assess the accuracy of the classification of STS, Mix-1, 2, 2-enhanced, and ice PSCs from CALIOP data by purely optical properties. They also extended the period of study to recent data for both poles from 2006 to 2011. In this study, they pointed out several new findings for the weakness of the current classification algorithm, such as "speckle of STS points" and possible misclassification of ice PSC as Mix 2-enhanced PSC in the case of severe denitrification. I felt that the paper is well-organized and well-written. However, I have some comments that the au-

thors had better describe more before publication, which are described below in detail.

<Major Comments>

1) In the previous paper P09, they introduced the four CALIOP PSC types; STS, Mix 1, Mix 2, and Ice. In paper P11, they added two more types, and classified into six CALIOP PSC types; STS, Mix 1, Mix 2, Mix 2-enhanced, Ice, and Wave ice. This categorization was made purely by optical properties of CALIOP data sets. In this study, they fundamentally followed the six category classification scheme as P11, and added two independent data sets; MLS HNO3 data and GEOS-5 temperature data. The classification of STS, Ice, and Wave ice are very clear, and easy to be understood. However, I felt that the classification between Mix 1, Mix 2, and Mix2-enhanced are not very clear, and rather arbitrary. These classes are all mixture of liquid and NAT PSCs. The only difference is the number density of particles. I felt that more detailed explanation is needed why they categorized into three groups, based on the nature of formation mechanism of NAT PSCs and/or on the nature of external mixture of NAT/STS PSCs.

2) In this study, the authors mentioned two major weak points in the current algorithm for the classification of PSCs. One is the “speckle STS points”. The other is the misclassification of ice PSC as Mix 2-enhanced PSC in the case of severe denitrification. They mentioned that they are going to investigate methods to correct these deficiencies for their next generation algorithm. For the former effect, they mentioned about the cause of the misclassification (noise of the data), and explained a candidate to eliminate the speckle such as by applying a spatial filter. However, for the latter effect (denitrification), authors never mentioned about a possible method to eliminate the misclassification. Are they going to use the co-located MLS HNO3 data and/or GEOS-5 temperature data for the next generation algorithm? When I looked at the ice PSC branches shown in Fig. 11a and 11b, I felt that inclined boundary would be more appropriate between Mix 2-enhanced and Ice PSCs. I expect that the authors would add more discussion on how to eliminate the denitrification effect in their next generation algorithm.

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3) Although the authors does not mention about it at all in this paper, there is another wavelength (1064 nm) in CALIOP lidar. If they can combine these two wavelength information, they may be able to derive some information on PSC particle size, which would be a very informative information for the categorization of PSC types. Is there any possibility to use 1064 nm channel data for the classification of PSCs in the next generation algorithm?

<Minor Comments>

1) Figure 5a: They claimed “The main STS data cluster does not lie at slightly lower temperatures than the reference equilibrium curve, a finding consistent with Lambert et al. (2012)”. An explanation of possible cause of this offset would be helpful.

2) Figure 5e: Why the authors do not show “Wave-ice PSC” case in Figure 5f? If it is because there is no difference between ice and wave-ice PSCs, please mention about it.

3) Is there any possibility to further separate PSC category of “NAT PSC” from Mix 1, Mix 2, and Mix 2 enhanced categories? If you separate PSC points by two groups which are closer to STS and NAT equilibrium curves, within HNO3-(T-Tic) plots in Figure 5, you may be able pull out pure NAT PSC category?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24643, 2012.