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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effects of atmospheric waves on the amounts of polar stratospheric clouds" *by* M. Kohma and K. Sato

Anonymous Referee #2

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In this paper, the authors examined the impact of atmospheric waves on Polar Stratospheric Cloud (PSC) appearance using three kinds of satellite data (CALIPSO, Aura MLS and COSMIC data) along with reanalysis data (ERA-Interim data) especially during in the 2008 austral winter and the 2007/2008 boreal winter. They found that the PSC frequency observed by CALIPSO is well captured by the TSAT-based PSC frequency estimated by reanalyzed temperature data along with Aura MLS HNO3 and H2O data, in particular for the latitude range of 55S-70S in the Southern Hemisphere and for 55N-85N in the Northern Hemisphere. Then, they quantitatively examined the effects of planetary waves, synoptic-scale waves and gravity waves on PSC areal extent on the basis of the TSAT-based PSC frequency and found that the PSC area extent is predominantly influenced by planetary waves while the influence of synoptic-scale waves and gravity waves is only limited in some regions. Although such results are

considered to include important new findings and the overall description to be satisfactory, more careful discussions should be still needed. Therefore, I recommend the paper be revised with attention to the following details:

Specific Comments

(1) P.16970, L.16: The phrase "while temperatures in the Arctic is" should be "while temperatures in the Arctic are".

(2) P.16975, L.2: The word "accurate" should be "accurately".

(3) P.16977, L.1-7: For the difference in the propagation speed of the high frequency regions of PSCs (20ms-1) and the zonal-mean zonal wind (35ms-1), the authors should make more discussions for the "wave modulation". The estimated traveling period of the former seems to be 5-6 days, if the anomalous field has a wavenumber-2 structure as seen in Fig.3b-d. Or can be seen the feature that the isolated cold pool (not wavy structure) travels eastward?

(4) P.16978, L.5-9: From Fig.4, the TSTS-based PSC frequency is generally lower than the frequency from the CALIPSO observations. This may be due to the failed estimation of HNO3 and H2O mixing ratios. However, if the CALIPSO observations *underestimate* PSC areal extent, the latter frequency may be higher and result in larger difference of the two than in Fig.4.

(5) P.16979, L.15: "V" should be "PV".

(6) P.16983, L.6-8: Fig. 10b shows positive impact on PSCs at altitudes of 16-25 km in spite of little temperature variance from synoptic-scale waves there. This feature is interesting; hence some discussions on this point are to be helpful.

(7) P.16985, L.20-25: In Fig.14, the TSTS-based PSC frequency overestimates the CALIPSO observations. However, the difference of the two is very small in the Southern Hemisphere (Figs.3 and 8). The authors should discuss such a discrepancy.

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(8) P.16987, L.1-10: In the Northern Hemisphere, enhanced components of synoptic-scale are observed in the period of sudden warming events. In this period, the highly distorted polar vortex gives wide-range wave spectra which include synoptic-scale components as well as planetary-scale ones. This may reflect the results shown in Fig.15d.

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Interactive Comment