

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

Anonymous Referee #3

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Review of M. Kohma and K. Sato, “The effects of atmospheric waves on the amounts of polar stratospheric clouds”

Recommendation: Revision required

General comment:

This paper provides careful analyses about PSC distributions in the austral and boreal winters by paying attention to the spatial scale of temperature structures in association with planetary waves, synoptic-scale waves, and gravity waves. The use of data, CALIPSO, COSMIC and Aura MLS, is quite appropriate, and descriptions derived from these datasets are detailed. The key finding that PSC areal extent is mostly determined by planetary waves is convincing. Personally I feel the paper is rather lengthy,

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but it is not crucial. Overall the manuscript is well written, and I recommend that this is acceptable to ACP after some revisions based on the following comments which the authors might consider to take into account.

Specific comments:

Page 16969, line 12- : in the Antarctic -> in the southern hemisphere; it would be preferable.

Page 16969, line 22- : The description here is rather literary. I am not sure its original, but would it be possible for the authors to mix it up with Fig. 1 in the following article?

<http://www.annalsofgeophysics.eu/index.php/annals/article/viewFile/3407/3453>

Page 16970, line 23: miner -> minor?

Page 16973- 16974: In subsections 2.2 and 2.3 there is information on the temperature data the authors used. First I would like to make sure if the authors used the ERA-Interim data to see the background temperature field. Though authors mentioned the COSMIC GPS occultation data are incorporated in the ERA-Interim analysis, I just wonder if the ERA-Interim data particularly in high latitudes are as nice as to the COSMIC data. The authors mentioned that the bias is less than 0.5 K, but they should refer to appropriate research results.

Page 16975, line 9- : To derive TNAT the authors followed Carslaw et al. (1994). In view of the following discussion in this paper, I suppose there would be big uncertainty in this derivation. I just warn the authors that they should be careful about this derivation, and suggest that the authors should write its uncertainty and limitation.

Page 16976, line 9- : The authors set the grid box as 20 x 5 degrees in longitude and latitude. As the CALIPSO observations are along the track with about 14 orbital circles a day, I just wonder if the CALIPSO observations really cover all the grid boxes defined by the authors. Such a point should be explained.

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Page 16977, line 9- : For this TNAT calculation, temperatures from ERA-Interim are used on the 1.5 x 1.5 degrees grids, and HNO₃ and H₂O mixing ratios from MLS are used as those averaged for 20 x 5 degrees grids. Is my understanding correct? Also how do the authors deal with the vertical variations? The authors should explain this point more clearly.

Page 16978- 16981: Section 4 with Figures 5, 6 and 7 is a good introduction to the three types of waves, but I don't find it is essential and I find it may result in redundancy of this paper. Personally I suggest that this section (including figures) may be shortened or deleted.

Page 16979, line 15: V -> PV?

Page 16982, line 4-: It seems to me that peaks of PSC areal extents in Figure 8b are located a little bit higher than those in Figure 8a. In relation to this, I found that there is no discussion about possible sedimentation of PSCs. How do the authors think about this point?

Page 16982, line 9- : The idea illustrated in Figure 9 is fine, but is it really understandable as a linear accumulation of the three types of wave effects? In the following I will repeat related questions several times, and quote this point as '(*)'.

Page 16982, line 29: They used variance to indicate wave activity, but is it really a good index compared with such as standard deviation? The latter would be nice to think about an estimate of wave amplitude.

Page 16983, line 13- : Figure 11 would be good to infer relative importance for the three types of waves. They mentioned the zonal mean temperature field is not effective to ΔR , but is it really so and is it meaningless to indicate a contribution from (a) in Figure 9 in these figures? This is also related to the comment above (*).

Page 16984, line 2: For better readability there should be some descriptions on Figure 11d around here, then the authors may come back to this figure later.

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Page 16984, line 13- : This is related to the comments above (*), but I just assume if it is really conclusively mentioned.

Page 16984, line 18- : As written in the following for the northern winter case, I suppose it would be a mixture of planetary scale wave effect.

Page 16985, line 16: January -> August?

Page 16987, line 8- : This description is also confusing to me in the sense that I have already mentioned above (*).

Page 16989, line 17- : As to the role of planetary waves, is this an appropriate explanation?

Page 16990, line 1- : As to the difference in PSC areal extents between the northern and southern hemispheres, the authors should supply their idea about it.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 11, 16967, 2011.

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