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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurements of Global Distributions of Polar Mesospheric Clouds during 2005–2012 by MIPAS/Envisat" *by* Maya García-Comas et al.

Anonymous Referee #2

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Polar mesospheric cloud ice volume density is retrieved from MIPAS spectra. The global distribution of total ice volume density is shown for the first time for several days in both the Northern Hemisphere and Southern Hemisphere. This work is generally in agreement with previous work. The analysis is thorough and appropriate for publication in ACP following some revisions.

Major Comments:

Given the limited amount of data used from MIPAS, it would be useful to better quantify the observed variability in PMC properties throughout the paper. For example, what is the range of "top altitudes" from MIPAS? If there is a high degree of variability, the mean calculated from 12 or 19 days is likely insufficient to converge on the "true" mean.

I would check Figure 5, as I would expect better agreement with SOFIE based on the rest of your analysis. In 2009, for example, the average of 175 MIPAS profiles at 87 km is ∼15ng/mˆ2, compared to ∼2ng/mˆ2 from 165 profiles from SOFIE. If this figure is correct, then I think the large differences and variability compared with SOFIE call into question the entire analysis. It also looks like you may even be seeing ice above 90 km in Figure 5 and are simply setting these values to 0. Also, Figure 4 and Figure 5 do not seem to be in agreement. 2009 and 2010 show a peak in mass density above 87 km that is not represented at all in Figure 4.

Comments:

General: make sure you define each acronym once, the first time it appears.

Line 25: can't temperatures be lower that 150K?

The paragraph beginning at line 35 provides little information except to say that PMCs have been studied. What did these papers show?

Line 55: This paragraph could be reduced to say that similar results were found by Stevens and Hervig [2014] using SBUV.

Line 70: What do you mean by "the responses"? Are you saying that the 27-day solar cycle somehow accounts for long term PMC trends?

Titles of Figure 4 are not consistent with figure caption. It looks like the figure caption is wrong.

In Figure 5, put the red line on top of the shading.

What is the reasoning for showing a single day in Figures 10 and 11? Wouldn't it make more sense to do this analysis using all the data, so you could more easily compare with previous work?

Why do you show latitudes equatorward of 50° in Figure 12? Also, the temperature anomalies do not seem to correspond to the anomalies in ice volume density. Maybe

this is because you are comparing January and July differences in temperature to full season differences in ice volume density. Also, how do your results in Figures 12a and 12b affect your comparison to SOFIE in Figure 5? Would it make sense to only compare am or pm to SOFIE? SOFIE observes sunrise in the NH summer and sunset in the SH summer.

Figure 9 seems to show two distinct populations for the NH and SH. I don't think it makes sense to do a regression analysis of both hemispheres. Looking at the left panel, it seems that there is a strong linear trend in the NH, but in the SH, ice water content seems independent of frost point altitude. Maybe expand your analysis to discuss hemispheric differences and compute the correlation in each hemisphere separately.

Line 217: There is no 70°N in the bottom-left panel of Figure 1

Figure 2: Any thoughts on what drives the zonal variability observed here (i.e., planetary waves such as the 2-day or 5-day wave)? See Siskind, Nielsen, and Merkel

Line 261: What is the standard deviation for MIPAS? You talk about Figure 4 like it is a 4 panel plot, but it only has 2 panels

Line 295: Bardeen et al. [2010] has done this exact analysis.

Line 355: What lidar measurements, and at what latitude?

Line 390: I don't understand how this result is consistent with Figures 7 and 8, which have nothing to do with the bottom altitude.

Line 460: This anti-correlation doesn't seem apparent to me.

Line 513: Didn't you show this in Figure 1 and 3?

Minor Changes: Line 75: change "very little sensitive" to "not very sensitive" Line 84: "icy" to "ice" Line 85: remove comma after "observations" Line 86: remove "the" Line 87: This suggests that the advantages can measure. Change to "advantages that make

it possible to measure..." Line 89: change "including" to "include" Line 90: change "in emission" to "through emission" Line 108: change "which allows to measure" to "allowing it to measure" Line 122: change "along" to "within" Line 123 & 147: Maybe you mean "retrieval" instead of "inversion"? Line 127: change "off-set" to "offset" Line 158: "correct" should be singular since it refers to "version" Line 178: change "in" to "by" Line 184: change "pointed by" to "pointed out by" Line 185: "particle" should be plural Line 202: change "red dash the" to "red dashed line is the" Line 206: change to "for almost all conditions" Line 228: change "From these figures is" to "From these figures it is" Line 229: "occur" should be singular as it refers to "concentration" Line 249: change "altitudes" to "altitudes" Line 265: change to "might also induce a" Line 306: should read "there is very good" Reword sentence beginning on Line 377. Reword sentence beginning on Line 394. Line 447: remove "am" Line 433: change "decreased" in to "a decrease of" Line 493: change "being the lowest altitude" to "with the lowest altitude being" Line 494: add a comma after "(1-2 km)" Line 496: "lidars" should be "lidar" Line 508: change sentence to "Ice water content from MIPAS is also generally..." Line 518: change "in" to "by"

Bardeen, C. G., O. B. Toon, E. J. Jensen, M. E. Hervig, C. E. Randall, S. Benze, D. R. Marsh, and A. Merkel (2010), Numerical simulations of the three-dimensional distribution of polar mesospheric clouds and comparisons with Cloud Imaging and Particle Size (CIPS) experiment and the Solar Occultation For Ice Experiment (SOFIE) observations, J. Geophys. Res., 115, D10204, doi:10.1029/2009JD012451. Merkel, A. W., R. R. Garcia, S. M. Bailey, and J. M. Russell III (2008), Observational studies of planetary waves in PMCs and mesospheric temperature measured by SNOE and SABER, J. Geophys. Res., 113, D14202, doi:10.1029/2007JD009396. Nielsen, K., D. E. Siskind, S. D. Eckermann, K. W. Hoppel, L. Coy, J. P. McCormack, S. Benze, C. E. Randall, and M. E. Hervig (2010), Seasonal variation of the quasi 5 day planetary wave: Causes and consequences for polar mesospheric cloud variability in 2007, J. Geophys. Res., 115, D18111, doi:10.1029/2009JD012676. Siskind, D. E., and J. P. McCormack (2014), Summer mesospheric warmings and the quasi 2 day wave, Geophys. Res. Lett., 41,

717–722, doi:10.1002/2013GL058875.

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