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Improvement of OMI ozone profile retrievals by simultaneously
fitting Polar Mesospheric Clouds

by Bak et al.

General Comments

This paper describes the results of modeling and simulation studies to characterize biases in the OMI ozone profile retrievals due to contamination by PMC scattering in the polar summertime regions. Clear correlations are seen between negative ozone biases at higher altitudes (as determined by coincident OMI/MLS comparisons) and the presence of PMC's. It is then shown how these biases can be largely eliminated by simultaneously retrieving a PMC optical depth parameter along with the ozone profile.

This study is useful in that it characterizes, and provides a solution for, a clear source of error currently affecting the operational ozone product from OMI. Furthermore, this has larger implications, as the authors point out, because several other similar UV nadir-pointing ozone experiments are likely similarly affected by PMC contamination.

The paper is well written and thorough, and is suitable for publication in AMT. I recommend it be accepted for publication after the authors address the issues raised below. These are not serious criticisms and I do not need to see a corrected version of the manuscript before publication.

Specific Comments

In Section 1, the discussion starting on line 46 of limb-viewing instruments, the SOFIE instrument on AIM should be mentioned as it provides an extensive record of these parameters.

Line 52 – "water vapor content" should be "ice water content". There is no water vapor in PMC's.

In Section 1, the discussion starting on line 57 of nadir-viewing instruments, the CIPS instrument on AIM should be mentioned.

Figure 1 – How did you define both PMC and non-PMC averages for the OMI data alone (the black curve in top panels)? Does this involve averaging neighboring PMC/non-PMC pixels? Over what areas is the averaging done? Also, what is the origin of the kink in the OMI O3 profiles near 1 hPa shown in the bottom panels? This does not look physical at all and it's interesting that it looks almost identical in both hemispheres. It also corresponds exactly to the point at which the PMC effect on ozone starts. Surely this is an artifact of some kind?

Line 240 – Here you are just comparing the PMC-induced error you just derived for OMI, based on comparison to MLS, to the REPORTED ozone error bars for SBUV and SBUV/2. Those errors could in principle be larger than reported if in fact SBUV was also biased by PMC's. Has that analysis been done (i.e., is this effect included in published SBUV error bars)?

Line 243 – I am not sure I understand the comment about how the different wavelength ranges used by OMI and SBUV explain the larger PMC effect on OMI. SBUV uses even shorter wavelengths than OMI, PMC scattering increase at shorter wavelengths, correct? Please clarify. (The horizontal resolution argument makes much more sense to me).

Line 269 and discussion in section 3.2 – Please define physically what VZA and AZA are. It is hard to understand the dependencies shown in this section without a physical picture of what these angles are. They are only given names in Section 2.2 but not described geometrically. The key point is how does either of these angles affects the scattering angle. What is the range of PMC scattering angles measured by OMI? Here's a related question – is the POD defined as the vertical optical depth? In other words, is it normalized by the slant view angle of the line-of-sight (path length effect)? If so that should normalize out effects of varying view geometries, other than the scattering angle dependence.

Figure 7 – I am confused about a couple of things in these results. Do the symbols in these figures represent all the pixels for this orbit? How is the classification of PMC/non-PMC made – is this based on the separate OMI PMC cloud detection algorithm? If this is correct then I assume what you're doing is running your combined POD+Ozone retrieval on all pixels regardless of PMC classification. The non-PMC/non-zero POD values (grey symbols) then represent "false detections" of your algorithm in some sense. These values seem highly structured in SZA – do you know the origin of this structure?

Minor/editorial corrections:

Line 47 – "… brightness, AND altitude…"

Line 49 – "Explore" should be "Explorer"

Line 55 – "through" should be "though"

Line 190 – this sentence needs to be edited.