Simultaneous Retrievals of Polar Mesospheric (PMCs) with Ozone from OMI UV measurements Bak et.al.

General comments:

The manuscript discusses the ozone profile retrieval algorithm improvements as applied to Ozone Monitoring Instrument (OMI). The authors introduce a methodology for fitting simultaneously ozone profile and PMC parameterization to the OMI retrieval using UV wavelengths. Presently PMCs are not considered in the retrieval, which causes negative bias at altitudes above 2 hPa, with largest effect around 0.2 hPa compared to MLS ozone profiles. The manuscript shows that the biases can be reduced if the novel retrieval method is used.

The topic of the manuscript is interesting and techniques to diminish systematic biases in ozone observations are important. The results of the paper are, in particular, interesting for OMI type of nadir observations of atmospheric ozone profiles. While mainly concentrating on the effects on ozone retrievals, the manuscript does not discuss, characterize or validate further the PMC observations. The manuscript is generally well written and clear. I appreciate that the manuscript is kept rather short.

The main focus of the paper is in improving the retrieval algorithm in specific (however important) conditions rather than demonstrating the geophysical implications or novel observations. Therefore, a more methodological journal (like Atmospheric Measurement Techniques) might be more suitable forum for this work. The title of the paper seems also somewhat misleading and I would suggest changing it to something like "Improving OMI ozone profile retrieval by simultaneously fitting PMCs" . Alternative, the authors should consider deepening strongly the discussion about the PMC retrievals and the data quality and usefulness, including validation and data characterization, etc. In general, I would also like to suggest that more attention is put to formulating the algorithm as it plays an important role in the manuscript.

Some important references are missing:
- General references for OMI, MLS and Aura should be given
- Spurr references are mentioned but not given
- Optimal estimation references are missing

Detailed comments

1. It would be good to note that there are several ozone products available for OMI. Also, it would be nice to have some idea how PMCs in general affect also the other OMI ozone products (total ozone DOAS and TOMS algorithms, and KNMI ozone profile product). Are PMCs taken into account in these algorithms?

2. Please, include an image of the angles discussed VZA, SZA, AZA as they play important role in the modelling. Alternatively, the authors can give a

reference to a figure where the angles are given. Is azimuth zenith angle generally known concept?

3. All figures are given in relative values. It would be good to have at least one figure where the ozone profiles are plotted with error bars so that the differences found with different retrieval techniques and their significance can better be understood.

4. Around P 25909: It is mentioned that limb observations of PMCs are useful. It would be good to give a bit more information on that, which instruments can be used and which parameters can be retrieved (several Envisat instruments e.g.). How does OMI PMC detection compare with these?

5. P 25909 L 18: one could add here: ... when nadir observations are used.

6. Around: P 25909: How do the ozone trends of nadir observations and the limb observations agree in upper stratosphere ?

7. P25910 The OE solution could be opened a bit more. I think it is important to mention that it is an iterative optimization algorithm. I would prefer saying that Bayesian a posteriori solution is searched using EO optimization algorithm - or something like this.

8. P25910 Please, open what is meant by weighting function matrix.

9. P. 25911 L3: is -> has?

10. P. 25911 Please, define what is meant by norm: $\| . \|_2$

11. The prior is based on McPeters & Labow climatology which is based on using MLS data. Also here the comparison is done with MLS data – it would be good to comment this and speculate how it impacts/does not impact the results.

12. P25912 line 19, notation i=0, ..., 23 would be more clear.

13. P25913 line 20 – something missing here?

14. Fig 8b) The interpretation of the figure is somewhat unclear to me. I get the impression from the figure that in all cases (non-PMC and PMC) cases the retrieval with PMC fit results in somewhat lower ozone values, being typically between 0-5% when no PMCs are detected and larger up to 15% when PMCs are detected. However, at SZA 57 – 67 it seems that the results are similar, so that the difference is also larger in case there are no PMCs detected.

15. P 25916 L24 This could be opened a bit more: which figure specifically is meant.

16. Fig 7 and elsewhere. The terminology a priori error value is used many places. I suggest being more specific on this: std or variance? Also term "solution error" is used – std?