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Atmospheric Measurement Techniques Discussions

AMTD

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Interactive Comment

Interactive comment on "Improved ozone profile retrieval from spaceborn UV backscatter spectrometers" *by* B. Mijling et al.

Anonymous Referee #1

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General comments:

This study mainly used the convergence behavior of the OPERA algorithm to identify retrieval problems and develop some methods to overcome these problems so as to improve speed and the rate of successful retrievals. It also uses the DFS to evaluate the retrieval performance. It presented some novel ideals to improve the retrievals (e.g., spectral filtering of spikes over SAA, set fc to 0 over desert over desert). I think that this paper address relevant scientific questions and is within the scope of AMT. The title reflects the contents of this paper and the abstract is concise and generally accurate. The overall article is well structured and the language is fluent. Proper credits have generally been given to previous works except that one reference is inappropriate and one is missing. However, I have the same concerns as by reviewer 1. This study seems

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to emphasize too much on the use of convergence behavior to evaluate the retrieval performance. Furthermore, the use of DFS to evaluate the retrieval performance due to different climatologies is not justified because the DFS (same measurements and measurement errors, but with different climatologies) merely indicates the strength of the a priori constraint instead of the retrieval performance. Instead, other than the improvement of convergence behavior over special conditions, they should use other correlative measurements to evaluate and determine the choice of a priori constraint, which can have significant impacts on the quality of the retrievals for different altitude regions. Please see specific comments for more detail.

Specific comments:

1.Page 1165, line 25, miss reference by Liu et al., 2005, JGR, 110 (D20307, doi:10.1029/2005JD006240)

2.Page 1166, line 5, it would be very useful to summarize the quality of GOME OPERA retrievals based on the validation work of De Clerq et al. (2007) either here or in section 2.

3.Page 1167 line 22, it says version “4.01”, Table 1 says “GDP 3.02”, so which version is used?

4.In Table 1, what measurement error is assumed for level 1b data? Please provide this information since it is also very critical to retrievals just as the a priori covariance matrix and it affects the magnitude of the DFS.

5.Page 1170, in the equation before line 10, how is the reflectance error assumed/calculated?

6.Page 1170, line 2, is the SAA filter only applied in the SAA region? At high latitudes, radiances at shorter wavelengths might also be affected by high energy proton particles (although much less frequent) or similarly affected by NO gamma and metal emission lines. The SAA filter might also be applied to these conditions.

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7.In section 5, it was suggested that the retrieved negative surface albedo over dust conditions is mainly caused by the overestimate of FRESCO small cloud fractions. It should also be mentioned that the neglect of very absorbing dust aerosols (in the radiative transfer simulation) might also partly cause this occurrence of negative surface albedo values. I guess that negative values can still occur under heavy dust loading conditions even assuming no clouds.

8.Page 1176, line 16, a more appropriate reference for the TOMS V8 climatology is: Bhartia, P. K., and C. G. Wellemeyer (2002), TOMS-V8 total ozone algorithm, in OMI Algorithm Theoretical Basis Document, edited by P. K. Bhartia, Greenbelt.

9.In section 7, the use of DFS as an indicator to evaluate the retrieval performance due to different climatologies is not useful and inappropriate here, which has also been suggested by reviewer 1. Higher DFS here mainly indicates weaker constraint and weaker constraint/larger DFS is achieved at the cost of larger retrieval errors. According to the optimal estimation, we should use the actual climatological a priori error so as to optimally combine the information from our a priori knowledge and measurements. So by using a fixed a priori error of 20 percent, which can be too tight for the UT/LS but too loose for middle stratosphere, the inversion is strictly speaking not optimal estimation any more. Although the convergence behavior is improved especially under some extreme conditions (due to the poor representativeness of the FK and MLL climatologies for these conditions), the overall retrievals might not be improved. As matter of fact, the choice of a priori error can have a significant impact on the quality of the retrievals. I also agree with reviewer 1 that the authors should use correlative measurements to determine which choice of climatology is more appropriate to improve the retrievals. Figure 9 may be deleted because it does not really provide much useful information to evaluate the retrieval performance.

10.In the last paragraph of section 7.4, the authors suggest choosing a priori error based on the application needs (e.g., speed, maximum information from the measurements). In addition to the comments about DFS mentioned above, the speed (due to different climatologies) is also not a critical issue here. The differences in No. of iterations between 15-25 percent is about 3-5 percent, which is too small to be concerned for operational processing. What matters a lot more is the quality of the retrievals. Therefore, I suggest deleting this paragraph.

11.Page 1180, line 2, I think that it is always good if you can carefully remove those spikes. Including them will cause larger retrieval errors. The nominally large DFS (when including these pixels) is mainly due to the underestimate of measurement errors for those pixels affected by spikes.

Technical corrections

1.Title: change spaceborn to “spaceborne”

2.Page 1166, line 5, should “De Clerq” be “De Clercq”?

3.Page 1173, lines 17-18, change “Pauer” to “Paur”

4.Page 1178, line 9, add “by” before “up to 70 DU”

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 1163, 2010.