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Atmospheric Measurement Techniques Discussions

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

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The manuscript "Improved ozone profile retrieval from spaceborne UV backscatter spectrometer" by B Mijling et al. discusses the performance of the OPERA algorithm for a set of GOME measurement for the period February to October 1998. Here the performance analysis is mainly based on the convergence behavior of the algorithm. Furthermore de degrees of freedom for signal (DFS) is used as a diagnostic tool. For one particular case also a validation of the retrieval with microwave ozone profiles is performed. The manuscript mainly focuses on the retrieval of ozone profiles for near real time applications which puts a burden on the numerical efficiency of the algorithm. Thus approximations have to be made in the forward simulations to meet the performance requirements.

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Interactive Discussion

Discussion Paper

Overall, the manuscript covers relevant scientific questions and is within the scope of AMT. The paper is clearly structured and contains novel concepts. To my knowledge it is the first time that an algorithm performance for ozone profile retrieval from UV measurements is performed on a global set. Furthermore the retrieval analysis at the area of the South Atlantic Anomaly is new including the spectral filtering of the measurements. Also the retrieval approach for low cloud contamination provides novel aspects.

Concerning the overall approach of the study I doubt that it is sufficient to evaluate the algorithm performance only on the convergence behavior of the code. To use an extreme, a very strict regularization will cause only little changes in the retrieved profile of two consecutive retrievals and thus eases to achieve a convergence as defined in Section 3. However the quality of the fit may be poor and in turn the retrieved ozone profile is of low quality. To my opinion it would be very useful and also would emphasize the strength of the presented methods if the overall quality of the retrieved data is discussed as well. For example the SAA filtering in section 4 improves on the number of iterations needed in the SSA zone. But is the quality of the remaining data sufficient? Although this point is probably hard to address due to the lack of validation points in this area, it is crucial to judge the overall benefit of such a filtering.

In general the authors give proper credit to related work. Only in Section 5 I miss a short overview on previous work. I did not follow the most recent discussion on this subject but I remember the work of Lui et al. 2005 and van Diedenhoven et al., 2007, which both proposed a retrieval approach to deal with clouds of GOME ozone profile retrieval. The authors of the manuscript choose for a different approach which is probably motivated by the computational cost of the algorithm. I would appreciate here a more thorough discussion of the literature and also a validation of the OPERA ozone profiles for cloudy conditions.

The use of Section 6 is not clear to me. To my opinion it mainly confirms findings of Liu et al. in the context of the OPERA algorithm. It is not clear to me if the presented

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validation with microwave measurements provides new insides respect to the work of De Clerq et al and Liu et al. If the authors think that this section is really needed then I suggest to shorten this section significantly and to put emphasize on the significance of this improvement for a global data set in relation to other error sources.

The methodology presented in Section 4-6 is clear and well described. I have some difficulties with Section 7 where the authors discuss the effect of different choices of prior information coming from three different ozone climatologies. The ozone climatology is used as a first guess to start the iterative approach and as a side constraint to solve the ill-posed inversion problem by regularization. Here the retrieval is effected by the mean prior profile and the corresponding prior covariance matrix. The intercomparison (section 7.4) is based on the convergence behaviors and the DFS of the retrieval which raises two main questions to me: First is the convergence behavior of the algorithm mainly governed by the first guess assumption or by the regularization i.e. the covariance matrix. Second, is a large DFS an indication for a better retrieval or only for a weaker regularization? I am convinced that in this context a validation with independent measurements can improve the analysis.

Some minor comments: Page 1172 line 15. The effect described in the text is hard to see in the corresponding fig 5c. A zoom-in would be very helpful. Figure 7: typo in capiton 1018 molecules -> 1E18 molecules Figure 8: What is the reason for the larger number of iterations for the TOMS climatology at the SSA area?

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