**Atmospheric
Measurement
Techniques**
Discussions

Interactive comment on "Ozone ProfilE Retrieval Algorithm for nadir-looking satellite instruments in the UV-VIS" *by* J. C. A. van Peet et al.

Anonymous Referee #2

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General comments:

This paper introduces a new version of an existing ozone profile retrieval algorithm known as OPERA. The algorithm is based on the optimal estimation method commonly used in the field. The same algorithm is applied to similar UV-VIS instruments GOME and GOME-2, and evidence on the algorithm performance is given by comparing the retrievals with ozone soundings. GOME-2 retrievals are also shown to be capable of detecting the Antarctic ozone hole, in conditions where the true ozone profiles are not covered by the prior information. After my initial comments, the sections on OMI and SCIAMACHY have been dropped as there was no validation data shown for them in the first version. The paper now focuses solely on the GOME family of instruments. It is mentioned that the development of the OMI and SCIAMACHY parts

of the algorithm is ongoing. Even with the reduced scope of the paper, it is suitable for publication in the GOME-2 special issue with the corrections listed below. The scientific methods are commonly used in the field and presentation quality is generally good.

Specific comments:

p. 9072, sect. 3.2.6:
I understand that any erroneous reflectances are not used as reference points in the filtering algorithm. If so, I would clarify this by saying "previous accepted wavelength" instead of "previous wavelength" on lines 6 and 8.

p. 9072, sect. 3.2.7:
I suggest to add a small paragraph on wavelength calibration. Are there any residual wavelength shifts between the radiance and solar irradiance to account for in the fit? If the level 1 of both instruments is good enough in this respect, then mention it.

p. 9072, sect. 3.2.7, line 18:
please specify that the bias is wavelength independent.

p. 9072, sect. 3.2.8:
The discussion refers to convergence and the number of iterations in many places. Therefore, I suggest to add here the formula for the next step of the iteration to give the reader better understanding on the contributions of the weighting function and covariance matrices in the iteration process.

p. 9074, eq.5:
Equation 5 is just a repeat of equation 1 with $x_t = x$. Please remove eq. 5 and refer to eq.1 here.

p. 9075, lines 10-12:

Too generic statement about all UV-VIS retrievals. At the end of section 3.2.3, you mention that only a cloud-free retrieval is done if snow or ice is detected. Therefore you should be more specific here, saying something like: "Since the current algorithm only does a cloud-free retrieval over snow and ice, this ..."

figs. 3 and 6:
Is it ambiguous what the "relative means of the differences" means. I believe you take the relative difference of each (satellite,sonde) pair first, and then the latitude band mean of these relative differences. I would call this "means of the relative differences". Please clarify what you mean and indicate it (i.e. where the average is taken) in the formula given in the x-axis label.

sections 4.2. and 4.3.
The retrieval aims at both improving the profile values (eq. 1) and reducing the prior uncertainty (eq. 2). These sections lack discussion on the latter aspect. When the prior profiles are close to the true profiles (taken as the sondes here), the retrieved profile is close to the prior (eq. 1), and the performance of the retrieval can only be seen as a reduction of the prior uncertainty (eq. 2). I suggest to add plots similar to figs. 3 and 6 but for the errors, plotting for example $\langle 100 * (\sigma_{sat} - \sigma_{pri})/\sigma_{pri} \rangle$, to see how the prior error (σ_{pri}) at different pressure levels is reduced by the retrieval (σ_{sat}) on average for the different latitude bands and for both instruments. Please add a short discussion on the reduction of the uncertainty for both instruments.

Suggestions for technical improvements:
p. 9063, l. 27: "Clouds are modelled" should refer to the old version as "Clouds were modelled".
p. 9064, l. 18: "That version does an performs well", should read as "That version performs well".

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