

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2022-116

Anonymous Referee #1

Referee comment on "Assessment of the error budget for stratospheric ozone profiles retrieved from OMPS limb scatter measurements" by Carlo Arosio et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-116-RC1>, 2022

Dear authors,

Congratulations on this comprehensive analysis and well-written paper. It was a pleasure to review this work. Error/uncertainty characterisation of satellite retrievals is more and more gaining the attention it deserves, and this paper clearly demonstrates the way to go about this. It is (almost, see below) complete in terms of identified sources of errors, and the propagation using numerical techniques ensures sensitivity to those tricky situations where random errors turn into systematic contributions.

The only source of errors I did not see addressed is that related to horizontal smoothing: if the actual sensitivity is not centered on the tangent point (and the atmosphere is inhomogeneous) this will lead to additional errors/uncertainty. Addressing this is not trivial (you'd need horizontal AKs and a 3-D model of the atmosphere, e.g. from a reanalysis), but it has been done before, e.g. for MIPAS on ENVISAT (von Clarmann et al., AMT, 2009, and application in Cortesi et al., ACP, 2007). I think this deserves to be at least mentioned.

That said, my other comments are all minor. See below for the list.

Again, congratulations for this work!
A Referee

Abstract:

- Maybe add a few words on the impact of the cross section source?

Intro:

- I'd reorder the arguments for the importance of the error characterization: foremost, correct uncertainty estimates are needed to ensure correct geophysical interpretation. Only in 2nd order are they important in the validation. Actually, the validation should validate also these ex-ante/prognostic uncertainty estimates (as you do).
- Can you not create a short reference, e.g. Rault and Loughman (2012), hereafter RL12. And then change "The authors" into "RL12". To be checked against the AMTD style guidelines.

Sect 2:

- I guess there is also an official NASA retrieval that deserves to be mentioned before presenting the Bremen retrieval? Or is the Bremen retrieval the official product?
- The SNR is in principle something to characterize random noise. But perhaps you see systematic features in the residuals? How are these accounted for?
- out of curiosity: how does your vertical resolution estimate compare to actually measuring the FWHM of the AK row? No need to invest much time in this, as you wish.

Sect 3:

- if I understand correctly, you first derive a SNR from the residuals and then use this as starting point for the Gaussian generator, forcing the input errors to have a normal distribution. Could you not take the actual residuals (of many retrievals) as a distribution to draw (randomly) from? That way, you'd also propagate potential systematic effects, no?

Sect 4:

- errors on these parameters can all be assumed to be random?
- pointing errors: out of curiosity: is there any drift in the platform that would lead to a systematic but slowly changing pointing error that could cause a long-term drift in the retrieved profiles?

Sect. 5:

- line 278: by "changing the used cross section", I guess you mean the source of the cross sections? For clarity, I'd rephrase to "cross section source" or "cross section database". This also needs to be changed in line 280.

Sect. 7:

- Eq. 11: you're entirely confident that they are all independent? Intuitively, I would agree. But maybe this assumption needs to be made explicit. EDIT: I guess Fig 13 demonstrates that they are not independent. What does that mean for Eq. 11?

Typos:

- abstract, line 3: complaint -> compliant
- line 36 (Sheese et al. ref): \cite -> \citep
- line 70: increases -> decreases; up to -> down to
- line 92: parameters -> parameter