Overall Comments:

The second version of the OMPROFOZ research product (OMPROFOZ v2) has been introduced in this paper, which incorporates several improvements to enhance the accuracy and long-term consistency of ozone profile retrievals from the OMI instrument. The retrieval quality of tropospheric column ozone has been improved. The presented methods are presented clearly and the paper is generally well written.

.→ We appreciate the useful comments, and tried to improve the manuscript, in accordance with reviewer's suggestion.

General comments:

C1. Could the authors also provide a comprehensive discussion of the limitations of the OMPROFOZ v2 algorithm and the potential sources of error in the ozone profile retrievals, and plans for the next version if there will be.

R1. The main objective of this paper is to describe the implementation changes for reprocessing OMI collection 4 ozone profile product. We have no plan for the next version with the fact that the OMI in-orbit operation is scheduled to be terminated soon. The OMPROFOZ v2.0 better represents the tropospheric ozone distribution with the less striping errors and the reduced spectral residuals (Fig. 12) and the UTLS profiles (Fig.13). As well, the seasonal and long-term consistency of the tropospheric ozone is improved compared to the previous version (Fig. 14). However, our product quality is still suffering from instrumental degradation, row anomalies, calibration errors, insufficient measurement information/a priori ozone dependence, and forward model errors. This paper includes the validation results with ozoensonde soundings at three EU stations because of the computational budget. When the reprocessed OMI dataset is available, OMI collection 4 product will be extensively assessed in the similar approach to be done for OMI collection 3 by Huang et al. (2017;2018) that evaluated the tropospheric and stratospheric ozone variables against global ozonesondes and MLS measurements with respect to the retrieval quality and long-term consistency. And then we will experiment OMI datasets to see how OMI ozone profiles could contribute to the trend analysis. We have revised the conclusion section to specify a validation plan for the upcoming version as follow:

"*In the follow-up paper to this work, the reprocessed OMI collection 4 ozone profile dataset will be thoroughly evaluated against a comprehensive dataset of ozonesonde soundings and MLS stratospheric ozone profiles for establishing geophysical validation results and for assuring the long-term consistency of OMI ozone profile product data quality*"

C2. Can you address the potential impact of cloud and aerosols on the accuracy of the ozone profile retrievals and is it possible to derive reliable near-surface ozone from UV measurements after significant improvements in the calibration and retrieval algorithm?

R2. The impact of cloud and aerosols on the spectral fitting is partly accounted for by fitting the cloud fraction and first-order wavelength dependent surface albedo. However, this treatment could be insufficient for thick clouds and heavy loading aerosols. These could be better simulated with the bi-directional reflectance distribution functions for the surface and the treatment of clouds as scattering layers, but which are not feasible in the operational use due to the computational budget. The spectral calibration and forward model calculations are of importance to determine the retrieval quality in the boundary layer. However, the measurement noises should be much improved. In this algorithm, we set 0.2 % in the UV 2 and 0.4 % in the UV1 for random-noise errors to stabilize the iterative fitting process.

C3. Better to summarize this analysis of the uncertainties associated with the improved algorithm updates and their impact on the accuracy of the ozone profile retrievals, maybe in a table.

R3. According to this comment, we have edited table 5 to provide a summary of comparison between PROFOZ v2.0 and ozonesonde.

Table 5. lists of ozoensonde stations* and comparison statistics# of the tropospheric column ozone between PROFOZ and ozonesondes

Station	**Hohenpeissenberg**	**Payerne**	**Uccle**
Instrument	Brewer-Master	ECC+	ECC+
Country Lon, Lat (°) Elevation (km)	Germany 11.01, 47.3 0.98	Switzerland 6.57, 46.49 0.49	Belgium 4.35, 50.80 0.10
PROFOZ v1.0 No. of comparison pairs Mean Bias ± **1σ** (DU) Mean Bias ± **1σ** (%) Correlation coefficient	 726 4.20±7.38 DU 13.87±22.04% 0.66	 1025 2.22±6.85 DU 7.50 ± 19.78 % 0.73	 893 -0.74±6.08 DU -0.81±17.34 % 0.74
PROFOZ v2.0 No. of comparison pairs Mean Bias ± 1σ (DU) Mean Bias ± 1σ (%) Correlation coefficient	 815 3.30±5.95 DU 9.94±16.52% 0.81	 1084 0.99±5.15 DU 2.87 ± 13.88 % 0.85	 946 -2.09±5.12 DU -5.11±13.05 % 0.83

*All data are downloaded from the World Ozone and Ultraviolet Data Center (WOUDC) data via http://www.woudc.org.
+Electrochemical concentration cell (ECC)
#The number of comparison pairs between OMI and ozonesonde for the tropospheric column ozone (900-200 hPa) during the period 2005 to 2020. Mean Biases and 1σ standard deviations are in both DU (Dobson Unit) and % from (OMI−ozonesonde) × 100/ozonesonde.

Specific comments:

C1 Line 182-183: "three kinds of parameters are newly added to implement the slit function linearization and common mode correction as a pseudo absorber." Please clarify in this sentence if the slit function linearization parameters are also implemented as pseudo absorbers?

R2. According to this comment, we have clarified the slit function linearization parameters as follows:

"*three kinds of parameters are newly added to implement the slit function linearization (slit width coefficient, shape factor coefficient) and common mode correction as a pseudo absorber.*"

C2 Line 186: It's better to describe how the "covariance matrix" be constructed or refer to some references that has described it (May be Liu et at., 2010).

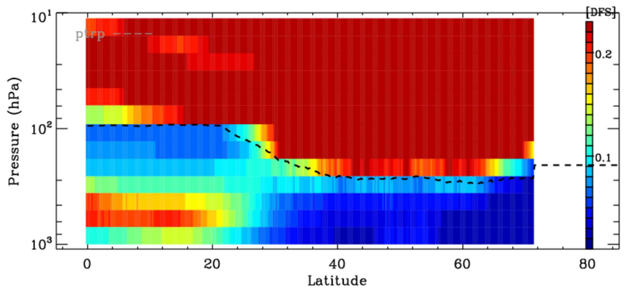
R3. According to this comment, we have clarified this by editing the associated sentence, "*They are assumed to be uncorrelated between fitting parameters, except for atmospheric profiles with a correlation length of 6 km, which gives* $S_a\ (i,j) = \sigma_i^a \sigma_j^a \exp(-|i-j|/6)$, [illegible] σ^a [illegible] *with i and j being layer numbers*."

C3 Line 237: I guess *Ie* represents the measured random noise errors.

R4. According to this comment, we have revised the one from *"measured errors"* to *"measured random noise errors"* for clarification.

C4 Line 283: May be add a plot of information contents or averaging kernel in Figure 2 for the layer of tropopause helps understanding the sentence "In the subtropical region, LLM may also provide incorrect information in the presence of high tropopause height…"

R4. Figure 2 clearly shows that LLM a priori provides the inconsistent information on tropospheric ozone in the latitude above 30ºN where the tropopause height is higher, compared to that taken from TB a priori. That is because that the LLM ozone climatology is only able to represent the ozone profile shape constrained with the lower tropopause height in the latitude above 30ºN during the winter. As a result, the LLM based TCO gives the abnormally high ozone features in the northern Europe area, consistently with the LLM a priori, implying the dependence of retrievals on a priori (less measurement information content). On the other hand, LLM based TCO gives independent ozone distribution in the subtropical area in spite that LLM a priori also gives the abnormally high ozone features, implying the existence of more independent measurement information. We think that Figure 2 is sufficient to address the importance of the a priori information on our OMI ozone retrievals and improvements of a priori data/PROFOZ v2.0 ozone data. The following figure illustrates the zonal mean DFS profile. This indicates the existence of a relatively larger measurement information over the upper troposphere in the subtropical area (25-30 N) than in the mid/high latitude. However, we decided not to include this figure in the revised manuscript for conciseness and just clarify it in this section.



Same as Fig. 2, but for mean Degrees of Freedoms (DFS) for Signal at each layer in the troposphere and lower troposphere. The dashed black line represents the tropopause.

C5 Line 357-359: How does the monthly averaged irradiance spectrum cancel out the common degradation existing in radiance and irradiance?

R5. Our retrieval prefers to the use of normalized radiance (radiance/irradiance) rather than radiance itself with the benefit of removing the extraterrestrial absorption signatures and canceling out the calibration uncertainties commonly existing in radiance and irradiance. As commented by the first reviewer (C8). optical elements are similar for radiance and irradiances, except for diffuser and folding mirrors. Actually, the solar diffuser degradation is one of main sources to degradation errors to irradiance measurements. Therefore, we revised from *"cancel out the common degradation existing in radiance and irradiance"* to *"to address seasonal variations of instrument characteristics that are common in both radiance and irradiance measurements"*. And we also prefer to the use of the monthly averaged irradiance than daily irradiance with the benefit of reducing the short-term noises in individual irradiance measurements, which improves out RMS of fitting residuals for both collection 4 (0.15→0.14) and collection 3 (0.24→0.17) as shown in Figure 7.

C6 In section 3.6, how about the correlation between slit functions parameters and ozone parameters in the retrieval?

R6. The correlation is ~ 0.01 for UV1 parameters, but increase 0.1 between UV2 slit width coefficient and the tropospheric ozone and 0.2-0.3 between the UV2 shape factor coefficient and the tropospheric ozone. We have pointed out this information in the revised manuscript as follows:

"*These PA coefficients are weakly correlated with ozone variables, except for the UV2 shape factor coefficient (*Δk*) [illegible] (0.2–0.3).*"

C7 In section 3.9, does the common mode correction improve the ozone profile retrieval other than just improving the fitting residual?

R7. The common model correction is implemented to address the remaining spectral residuals after soft calibration and hence to improve the fitting quality. In addition, this correction helps to smooth out the cross-track dependent biases in the tropospheric ozone retrievals, in particular at the extreme nadir-off pixels (please take a look at Fig. 8 d-f vs Fig.12 a-c).