Dear Reviewer,

Thank you very much for your comments on our manuscript. We took your comments into account in the revised version of the manuscript. Please find below our detailed replies (black font) on your comments (blue font).

General comments:

This manuscript introduces a new methodology aiming to infer global distributions of tropospheric ozone columns making use of the synergy between nadir and limb-viewing satellite ozone observations. Although the principle of the residual method used is well established and was applied in a number of other studies, the approach proposed here is innovative because it is based on the combination of several limb-viewing satellite instruments to infer the stratospheric column reference. This greatly expands the potential of applicability of the method and may lead (in the future) to the generation of long-time series suitable for trend evaluations. In this study however, the authors concentrates on a demonstration of the concept. Difficulties inherent to the residual technique are investigated in details using 3D CTM simulations by the SILAM model and these simulations are used to design a retrieval approach that mitigates at best the main sources of uncertainty. Reading through the manuscript is very instructive and leaves the reader with a better understanding of the information content of the technique and its limitations. In particular, I found the approach used to deal with uncertainties quite robust and convincing. Practical applications are limited to a few example based on OMI and TROPOMI data and therefore it remains to evaluate whether the proposed approach will be stable over time, especially when different limb-sensors have to be combined. The validation effort concentrates on an assessment of the homogenised stratospheric ozone profiles data generated as an input to the algorithm, as well as a few comparisons of the resulting tropospheric ozone product with alternative products (OMI-MLS and CCD). At this point, one may wonder: why not attempting to also validate the tropospheric ozone product with ozone sonde data? Since a data base of ozone sonde measurements was already assembled to validate stratospheric profiles, it seems to me that it could also be used for comparison with the resulting tropospheric ozone columns.

In the revised version, we added a figure with comparison of time series of tropospheric ozone column from SUNLIT (OMI-LIMB) and from integrated ozonesonde profiles, at locations of several ozonesonde stations. We compare also seasonal cycle of tropospheric ozone derived from these SUNLIT and ozonesonde data. We added also a discussion on differences in sampling pattern of ozonesonde and satellite data.

Anyway, I found this study very interesting and promising and I look forward to see the method applied on a larger scale. The English writing however is not always up to AMT standards and I strongly recommend that authors get help from a native English speaker to polish their text.

All Copernicus publications are proofread by a native speaker at the final stage.

Other than that, the manuscript is clear overall, figures are of good quality and adequate in number and references give a good credit to the published literature on the subject. I therefore recommend publication in AMT, after attention to the few comments and suggestions below.

Detailed comments:

Pg. 1, l. 14: replace 'using' (at the end of the line) by 'supported by'

Corrected.

Pg. 2, l. 42: this sentence does not read well. 'Ozone' is not a concern as such, but the impact of its changes on human health, climate change, etc are clear environmental concerns.

Rephrased as suggested

Pg. 2, l. 55: 'an effective combination of the limb and nadir measurements … can provide a new information'. Here I would rather say 'provide additional information'

Corrected

Pg. 3, l. 63: add a reference to Heue et al., 2016, after Ziemke et al., 1998. This reference is already in your list.

The reference is added.

Pg. 3, l. 90: I think that it would be useful to already mention in the introduction that the methods being developed in the study have a focus on optimizing monthly-averaged tropospheric ozone values, which are mostly interesting for long-term studies and climatological analysis.

Thank you, we added this note in the introduction.

Pg. 4, l. 100: mention here that the GODFIT v4.0 processor was developed as part of the ESA Ozone_cci project (like you do in Pg. 5 for the HARMOZ data).

We mention this in the revised version.

Pg. 5, Fig. 1: there seems to be some mismatch in the instrument's labels. I suppose that ACE should be replaced by OMPS-LP. Also one curve seems to be missing (only 5 curves are displayed while Table 1 refers to 6 instruments). Again, I suppose that OMPS-LP is the missing one.

The instruments labels are indeed incorrect, there should not be ”ACE-FTS”. Since the limb instruments operated in different years (and there is no period when all 6 instruments operated), we selected year 2008, when data from 5 out of 6 instruments are available. That is why OMPS-LP is not present in Fig.1. We corrected Figure 1

Pg. 7, l. 172: you might add a reference discussing the chemical links between tropospheric ozone and its precursors (NOx and VOCs).

We added the reference: Seinfeld, J.H., Pandis, S.N., 2006. Atmospheric chemistry and physics: from air pollution to climate change, 2nd ed., ed. J. Wiley, Hoboken, N.J., chapter on Tropospheric Chemistry.

Pg. 7, l. 186: add ‘gradient’ between ‘concentration’ and ‘drops’

Corrected

Pg. 7, Fig. 2: add a name or short description for the different layers considered on the figure

We will add names of layers in Figure 2

Pg. 9, l. 225: indicate which limb satellite instrument was used to prescribe the sampling applied in Figure S2. Is it MLS only or the combined data set of MLS, OSIRIS and OMPS instruments (as shown in Fig. 7). Same comment regarding Fig. 4.

The sampling patterns correspond to the combined datasets. In the revised version, we name explicitly the instruments used in the combined datasets in Figure S2 and Fig.4

Pg. 11, l. 271: the OMI row anomaly is currently not introduced in the manuscript. Please add a reference or better describe the nature of the problem.

We added the reference (Schenkeveld et al., 2017).

Pg. 22, Fig. 14: replace ‘pressure altitude’ by ‘altitude’ as legend for the right y-axis

The right vertical axis is “pressure altitude”, not geometric altitude.

Spelling, typos:

Pg. 1, l. 1-2: avoid repetition of the word ‘provide’

Pg. 3, l. 80: remove ‘the’ between ‘using’ and ‘simulations’

Pg. 4, l. 107: remove ‘In our work’ (to avoid repetition with the previous paragraph)

Pg. 7, l. 173: remove ‘the’ between ‘at’ and ‘altitudes’

Pg. 7, l. 176: remove ‘the’ between ‘from’ and ‘fluctuations’

Pg. 7, l. 182: … the model data ‘are’ either used in their entirety or sub-sampled at ‘the’ location and times of…

Pg. 9, l. 210: add ‘the’ between ‘consider’ and ‘possibility’

Pg. 9, l. 221: add ‘of’ between ‘averaging’ and ‘data’

Pg. 10, l. 256: …we have developed ‘a’ method of estimating…

Pg. 11, l. 273: remove ‘the’ between ‘If’ and ‘values’

Pg. 12, l. 295: correct ‘horizonal’ by ‘horizontal’

Pg. 14, l. 320: remove ‘the’ between ‘provides’ and ‘random’

Pg. 14, l. 328: remove ‘the’ between ‘By’ and ‘construction’

Pg. 15, l. 347: replace ‘The example…’ by ‘An example…’

Pg. 22, l. 456: remove ‘the’ between ‘dataset’ and ‘examples’

Pg. 23, l. 461: add ‘However’ at the beginning of the sentence starting with ‘The availability of gridded interpolated ozone profiles…’

Pg. 23, 471: add ‘the’ between ‘in’ and ‘ozone CCI’

Pg. 23, l. 477, remove ‘but’ after ‘However’

All are corrected, thank you.