

Atmos. Meas. Tech. Discuss., referee comment RC2  
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## **Comment on amt-2022-23**

Anonymous Referee #2

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Referee comment on "Tropospheric ozone retrieval by a combination of TROPOMI/S5P measurements with BASCOE assimilated data" by Klaus-Peter Heue et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-23-RC2>, 2022

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### GENERAL

The paper is dedicated to tropospheric ozone column retrieval using a combination of TROPOMI total ozone measurements with stratospheric ozone from the BASCOE assimilated data. The paper describes the retrieval algorithm, intercomparisons with other tropospheric ozone datasets, and the illustrations of geographical distributions.

The paper introduces an important work, and it contains important information. However, the presentation need significant improvements. Please find my comments below.

### MAIN COMMENTS

- 1) The language must be improved: too many misprints and unclear formulations. Several of them (but not the full list) are in the "Detailed comments" and "Technical corrections".
- 2) The structure of the paper is not optimal, from my point of view. It would be easier for reading, if comparison results would be placed immediately after a short description of other tropospheric datasets used for validation. I suggest: name Sect. 3: "Comparisons

with other tropospheric datasets” with subsections like:

### 3.1. Comparison with TROPOMI\_CCD

#### 3.1.1 TROPOMI\_CCD dataset

#### 3.1.2 Comparison results

### 3.2 Comparisons with OMPS-MERRA-2

... and so on for other datasets.

3) There is no information about S5P-BASCOE data availability.

4) All acronyms should be explained at first appearance (note that the abstract is considered separately).

5) It would be advantageous showing more details of global tropospheric ozone morphology, in particular, global maps in different seasons. This would also support subsequent illustrations of tropospheric ozone in specific regions.

## DETAILED COMMENTS

In Abstract, instead noting that the “algorithm is similar to the well established OMI-MLS or OMPS-MERRA-2 retrieval” (Lines 3-4), please say about the main principle of the retrieval (residual method). Information about temporal resolution and vertical coverage should be present in the abstract.

Lines 31-32: A better formulation of the sentence is needed. MLS measures sometimes below the tropopause.

Lines 33-35: For OMI-MLS, both original and with assimilation datasets are available, this is worth to state more clearly.

Lines 37-39: Is SCIAMACHY retrieval approach similar or different compared to OMI-MLS? A short note would be useful.

Lines 53-54: Please be consistent: for other datasets, the validation results are not mentioned.

Lines 58-62: A link to CAMS tropospheric ozone data would be useful.

Lines 117-119: Is the bias stationary?

Line 128: "the correction is in the order of 2 DU" Is this the same as in Figure 2?

Line 131: "TROPOMI/S5P has a daily global coverage with a spatial resolution of 5.5 x 3.5 km<sup>2</sup>". This information is given above in the text and its repetition is not needed here.

Lines 157-159. I believe that even within tropics this approximation (uniformity in longitude) has an uncertainty. If known, it would be good to specify it.

Line 196: OMPS-MLS -> OMPS-MERRA-2 ?

Lines 200-205: Do I understand correctly that not all available ozonesonde data are used? A map showing location of sounding stations, preferably with coloring according to number of observations, would be useful.

Lines 220-221: "The stripe in the south is caused by a well known and documented retrieval problem in the CCD data." A reference or an explanation would be useful.

Figure 6 and discussion: Note also different spatial pattern, with large values over oceans in NH in S5P-BASCOE. Is this due to different tropopause height definition? To evaluate this, difference in tropospheric ozone column in Figure 7 should be for the same period as in Figure 6, and presented with the same color scaling.

Line 246: "For BASCOE data after August 1 " which year?

Lines 251-252 : " The influence of the different tropopause definitions on the tropospheric ozone is about 1-2 DU" According to Fig.7, it can be up to 10-15 DU.

Lines 262-263: " This allows ... and the potential deviations might be separated"  
Rephrasing is needed

Lines 264-266: "In version 2 of UPAS a new albedo retrieval scheme was implemented (Loyola et al., 2020) and respective comparison improved significantly. " Are these improvements with respect to UPAS v 1? If this is not show, there is no need to mention.

Line 268: "This deviation propagates into the tropospheric column..." I do not see strong correlation between deviations of full and tropospheric ozone columns (Figure 9 bottom).

Line 270: Any reference on presentation by W. Steinbrecht?

Lines 271-272: "The ozone effective temperature is not considered in the Dobson spectrometer observations and the sonde data are scaled to the Dobson total ozone column." What is the consequence for data quality?

Figure 10: The latitudes with zero collocations should be removed. Please add zero line and use better scaling. The caption says: "The stars indicate the mean of the tropospheric observations closest to the stations". Why some values indicated by stars are negative (for example, for 25N)? Is this correct? Deviations and absolute values should be shown either on different vertical axes with distinct colors, or stars should be removed.

Line 286: "In the tropics the typical wave one-pattern is found..." Since this pattern is not related to wave activity, I believe, it should not be called "wave-one pattern".

Sect 5.1. It would be advantageous to show also the seasonal dependence of total global maps. This would be useful in the discussions below. Figure 11 can have subplots corresponding to different seasons.

Sect. 5.2 Please explain the shift to the ocean and not observing strong ozone enhancement over Africa.

Section 5.3: For Europe and Mediterranean, I suggest using the cities, for which also ground-based observations are available. Adding the curves from ground-based observations to Figure 13 would confirm the validity of S5P-BASCOE time series

Lines 322-324: "When the different .... data product is reasonable" This needs rephrasing. You probably mean "the data agreement is reasonable".

Lines 330-333. This paragraph on future plans looks strange in the middle on conclusions. The second sentence is not clear, in particular, why long-term dataset is needed for evaluation of COVID-19 lockdown measures.

## TECHNICAL CORRECTIONS

Line 1 Misprint in TROPOMI

Line 3. Microwave Limb Sounder (capitalize first letters)

Line 7 "S5P\_O3\_TCL" is not needed in the abstract

Line 83: TROPOMI acronym should be explained above in the next.

Line 88: Remove "Clouds as Layers" before "Loyola et al., 2018".

Line 94 UPAS version 1.x ? (Should be a number instead of "x"?)

Line 95: misprint in "latest"

Line 123: alternate -> alternative

Line 184: (0, 3, 6, ?, 21 UTC) -> (0, 3, 6, ..., 21 UTC)

Line 248 Figure7

Line 256: date -> data

Line 258:100km -> 100 km

Line 275 found, which ...

Figure 14 caption, misprint in "tropospheric"