We are grateful to the editor for dedicating valuable time and effort to reviewing our manuscript. Also, the previous version contained several errors, and we apologize for not reviewing it carefully enough. The comments raised by the editor have significantly improved the quality and clarity of our work. We agree with most of the provided feedback and accordingly we have made several changes to the manuscript. We have shortened the manuscript, clarified the main message, removed the repetitions that appeared in Sect. 3 and revised the abstract and conclusions to follow the guideline.

Please note that the editor's comments are in black italic, while our responses are in blue. Any modified or additional text in the revised manuscript is highlighted in red.

Editor comments on Manuscript egusphere-2024-3758

Natural and anthropogenic influence o tropospheric ozone variability over the Tropical Atlantic unveiled by satellite and in situ observations by Okamoto et al.

The manuscript has been improved in terms of data sets being used and the kind of data analyses done. However, with the revision the manuscript became even longer and the point of critique that has not been solved is that the manuscript is still not concise. The manuscript is in many places quite lengthy and there are several repetitions as e.g. Section 3.4.1-3.4.3. Exactly the same has already been discussed/described in the sections before.

The entire manuscript needs to be thoroughly revised so that it has a clear focus and only presents and describes what is necessary in a clear and concise way. Note, the abstract and conclusions are not in agreement with the new ACP guidelines for preparing these parts of the manuscript. Please check their guidelines.

https://www.atmospheric-chemistry-and-physics.net/policies/guidelines_for_authors.html

and prepare these parts accordingly. I will provide more detailed suggestions for improvement of your manuscript below.

Response: Thank you for your valuable comment. We have shortened the manuscript, clarified the main message, removed the repetitions that appeared in Sect. 3 and revised the abstract and conclusions to follow the guideline. For details regarding the revisions, please refer to our responses to each of comments listed below.

General comments:

1. *The reanalysis are also an essential data set for this study. Why are these not mentioned in the title?*

Response: We have changed the title. The new title of the manuscript:

"Natural and anthropogenic influence on tropospheric ozone variability over the Tropical Atlantic unveiled by satellite, reanalyzes and in situ observations"

2. *What is/are the main data set(s) of this manuscript. The data sets are used for intercomparison and for analysis. What is your intention with using exactly these data sets? Why have you picked a combination between satellite, in-situ and reanalysis data? My problem here is that the motivation is missing what has been done and why.*

Response: The main datasets of this manuscript are IASI+GOME2 satellite observations and TCR-2 and CAMS reanalyses. IASI+GOME2 provides observations of the horizontal distribution of ozone concentrations in the lowermost troposphere (surface–3 km of altitude). On the other hand, the two reanalyses provide both ozone and carbon monoxide distributions, while assimilating a variety of satellite observations (mostly total and tropospheric columns) for better describing their spatiotemporal variability and long-term trends. We believe that the intercomparison of these three products characterize the strengths and limitations of the reanalysis products, in particular at the surface and in the lower troposphere, as no in situ observations are assimilated. We use ATom observations as a reference data by its high accuracy, that allows a quantitative qualification of the accuracy of the three mentioned products and also the availability of measurements of multiple chemical tracers that describe in detail the origins of the air masses analyzed in the intercomparison.

The motivation of this manuscript is described in Sect. 1 (line 118–129 on page 4):

"The paper aims to describe the tropospheric ozone variability over the South and Tropical Atlantic in two seasons of 2017 extracting the best of three datasets: IASI+GOME2 satellite measurements and two global chemistry reanalyses. We use in situ measurements performed by a research aircraft within the Atmospheric Tomography Mission (ATom) in February and October 2017, for their high accuracy (thus providing a reference) and the availability of measurements of multiple chemical tracers for understanding the origins of the air masses with high and low abundances of tropospheric ozone. This highly valuable describing remains although limited to local to regional scales, following the track of the aircraft. IASI+GOME2 satellite data is a key and new observational dataset, providing a unique 3D observation of the tropospheric ozone distribution from regional to large scale, generalizing at larger spatial and temporal scale what is described more locally by ATom and whose good match provides confidence with good representativity. Reanalysis products are used to describe the ozone distribution together with those of its precursors as a key wrapping up elements of the study. The use of three datasets also allows an intercomparison which is additional useful to highlight the strengths and limitations of the satellite datasets and the reanalyzes, with in situ measurements as reference."

3. *What is the intention of the intercomparison and why does it take such a large part in the manuscript if according to the title the focus is on the ozone variability over the tropical Atlantic? I think the way of writing in these sections is wrong. If your goal is to analyze these processes and check how these are represented in the different data sets, I think you first should describe the phenomena and then how these compare in the data sets.*

Response: Thank you for your valuable comment. As mentioned in the previous point, it is through these multiple datasets, while intercomparing their capabilities, that we describe the ozone variability over the Tropical Atlantic and the origin of their precursors.

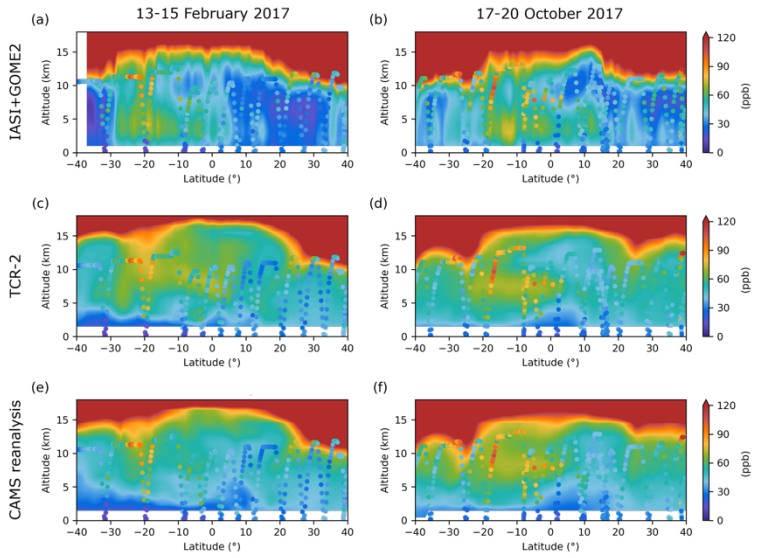
Following your suggestion, we have extensively rewritten Sect. 3.3 and 3.4 so that it first describes the phenomena and then compares the datasets. In Sect. 3.3, we used ATom-2 and ATom-3 observations to estimate the origins of tropospheric ozone and CO. In Sect. 3.4, we examined the vertical distributions of ozone and CO by region and discuss the characteristic differences among the datasets.

4. *The data and method section could also be shortened. I had the feeling that here details on the data sets were provided that were not of importance for your study and thus could be omitted.*

Response: Agreed and done. We have moved descriptions of the source identification and the lightning to the Supplement (S2 and S3) to shorten this section.

5. *The figure title and y-label fonts for most of the figures are too large (especially Fig 1-5, for the others only the titles are too large). The fonts should be decreased to a normal size and all figures should have a similar layout concerning font size.*

Response: Agreed and corrected in all figures like the following figure.



6. *Section 3.4.1-3.4.3 are a repetition of what has been described and discussed before. Please adjust your manuscript that there is a clear line for presenting the results and not too many repetitions. Also jumping back and forth between the figures makes the manuscript hard to read. If there is something that has been discussed or written in the sections before rather that section should be referenced. Here and there you can also refer to a previous figure, but not to the extent as it is done currently.*

Response: Thank you for your comments. We agree that the previous structure of the manuscript led to repetitions, making it more difficult to follow. To enhance readability, we have revised the structure by reordering some figures and descriptions, only tackling each aspect at a time and progressively. The structure of the sections is as follows:

3.1 Monthly evolution of tropospheric ozone and related variables over the Tropical Atlantic

3.2 Spatial distributions of tropospheric ozone during ATom campaign

3.3 Origins of ozone and CO reaching the Atlantic

3.4 Vertical distributions of tropospheric ozone and CO

3.4.1 The Southern Atlantic

3.4.2 The Tropical Atlantic

3.4.3 The Northern Atlantic

7. *Section 4 is a much too long and too detailed conclusion section. There is a lot of repetition of detailed descriptions of the results that have been presented before. Please shorten the conclusion section and follow the ACP author guidelines (see link provided above).*

Response: Agreed and shortened. We have kept the important conclusions, to only keep an overview of the results of the paper.

Specific comments:

P1, L28: A statement on what is the importance and implications of your results is missing.

Response: Agreed and revised.

This is explained as (line 27–28 on page 1):

"These results emphasize the need to evaluate the seasonal variability of each of the multiple sources of ozone precursors within atmospheric chemistry reanalyses."

P5, L125: I am bit astonished about the term "multispectral satellite approach". Isn't that a merging of satellite data sets that you have done here? Even if you already have used this data set in other studies and it is thus described elsewhere, I would appreciate if you could add here a few sentences describing how these data sets have merged and why this is possible despite the different observation techniques.

Response: Clarified. The IASI+GOME2 product is intrinsically a multispectral satellite approach, since it jointly uses radiance measurements from multiple spectral domains (UV and thermal infrared) to retrieve at once a single vertical profile of ozone. It is a true level 1 synergy of satellite measurements of two different spectral domains, which is very different from merging several different satellite ozone products. This term has been used widely in about 15 scientific papers since its development back in 2013.

An explanation of IASI+GOME2 is provided in Sect. 1 (line 98–114 on page 4).

"Satellite observations offer a great potential to overcome the limited spatial coverage of ground-based measurements. However, standard single-band ozone retrievals are not able to provide quantitative measurements of ozone abundance within the planetary boundary layer. Ultraviolet (UV) spaceborne spectrometers, like GOME-2 (Global Ozone Monitoring Experiment-2), have been used to observe tropospheric ozone with maximum sensitivity at about 5–6 km altitude (e.g., Liu et al., 2010; Cai et al., 2012). Space-based thermal infrared (TIR) instruments, such as the Infrared Atmospheric Sounding Interferometer (IASI) on board the MetOp satellites, have shown good performance for observing ozone in the lower troposphere but with sensitivity peaking at lowest at 3 km altitude (e.g., Eremenko et al., 2008; Dufour et al., 2012). More recently, synergetic approaches using UV and TIR radiances simultaneously have been developed to improve the sensitivity to lower tropospheric ozone (e.g., Cuesta et al., 2013; Fu et al., 2018; Colombi et al., 2021). These multispectral methods are different from merging different satellite products, as all information on ozone vertical distribution is extracted from measurements of different spectral domains at once into a single ozone product. The multispectral approach called IASI+GOME2, combining IASI observations in the TIR and GOME-2 measurements in the UV, shows remarkable skills in observing the horizontal distribution of ozone concentrations in the lowermost troposphere (LMT - here after defined as the atmospheric partial column below 3 km of altitude, Cuesta et al., 2013). Air-quality-relevant capabilities of IASI+GOME2 have been demonstrated by quantitatively describing the transport pathways, the daily evolution, and photochemical production in the lowermost troposphere during transboundary ozone pollution events across east Asia (Cuesta et al., 2018) and Europe (Cuesta et al., 2013; 2022; Okamoto et al., 2023)."

P6, Table 1 caption: I would suggest to remove "in 2017" since you provide here the information on the data which is valid for all years and not solely 2017.

Response: Agreed and removed (line 168 on page 6).

"Table 1: Overview of the global atmospheric chemistry reanalysis products."

P9, L226: Abbreviation "ER" introduced? Do you mean with ER the emission ratio? Nevertheless, I would suggest not to use an abbreviation for this.

Response: Not used anymore. We have deleted the descriptions about the analysis using "ER" to shorten this manuscript.

P9, L239: Interpolated to what?

Response: Agreed and rephrased (line 223–224 on page 8).

"We use the back trajectories driven by National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS) meteorology."

P9, L234: What parameter is this? Or do you mean that you are checking if the trajectories passed through the boundary layer?

Response: Clarified. These are two products provided by ORNL DAAC NASA's data centre along with ATom data, contained in the dataset "ATom: Back trajectories and influences of air parcels along flight track" (Ray, 2021). They are the boundary layer influences estimated as the probability (%) to identify air masses influenced by lightning.

This is explained in the manuscript as (line 222–228 on page 8) :

"A dataset containing back trajectories and boundary layer influences of air parcels along the ATom flight tracks is also provided by the ORNL DAAC NASA's data centre (Ray, 2021, last access 22 December 2023). We use these two products, that are driven by National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS) meteorology. They are calculated by initialising model trajectories at receptors spaced 1 min apart along the ATom flight tracks, followed backwards for 30 days, and reported at 3-hour resolution. We also use average probability of boundary layer influence in the dataset to identify air masses influenced by lightning (Sect. 3.3). The boundary layer influences product provided by ORNL DAAC is determined based on the location of these air masses along 30-day back trajectories."

P9, L245: "between models and thus uncertainties" does not make any sense. Please correct the sentence.

Response: Agreed and corrected (line 236–237 on page 8).

"The NOx production by lightning is generally represented by parameterizations in global chemistry transport models, resulting in uncertainties put in evidence by differences between models."

P10, L280: So far it has nowhere clearly been described which time period has been considered and why.

Response: We have described the time period in the beginning of Sect. 3 (line 264–265 on page 9).

"This is done with coincident ATom in situ observations, satellite measurements and reanalysis during the periods 13–15 February and 17–20 October 2017."

P10, L281: Here you state that the analysis of ozone distribution is the focus of the following sections, however, there mainly the differences between the data sets are discussed and it rather reads like an intercomparison (which is however not the focus of this study). Thus, what is the focus? Looking at the remainder of the manuscript, it would be really important to focus on the ozone distribution and not on the differences between the data set. These can of course be discussed, but this should be done to a much lesser extent as it is done now.

Response: Agreed. We first describe the phenomena and then compares the datasets, as mentioned in the response to the general comment 3.

P10, L284: This statement needs a reference.

Response: Agreed and added (line 267–268 on page 9).

"The climate in the tropics is characterised by alternating wet and dry seasons depending on the position of the ITCZ (Nicholson, 2018)."

P11, L289: Why are you starting the result section with the supplementary figures instead of the figures that are presented in the main text?

Response: Agreed and revised. We have revised the structure by reordering some figures and descriptions.

P11, L293: You mean the wind vectors are added to the figure? Thus, you should write "Therefore, wind vectors at 10 km of altitude have been added……"

Response: Agreed and rephrased (line 65–66 on page 3 in the Supplement).

"Therefore, wind vectors at 10 km of altitude have been added in Fig. S2 and 1a–b."

P11, L293: If you discuss Fig. S2 in detail here, it should be moved to the main text. Checking the figures here and in the supplement I came to the conclusion that a wrong referencing of the figures has been used in the main text. This comes from the revision you made due to the referee and community comments. However, the referencing should have been adjusted before resubmission, because this makes reading your manuscript really tough.

Response: Agreed and corrected. We have moved details of lightning and fire activities to the Supplement. We have checked and corrected the number of figures throughout the manuscript.

P13, L322: Has the abbreviation "SD" been introduced?

Response: Clarified. Yes, it is introduced in section 1 (line 52 on page 2 in Section 1).

"Huijnen et al. (2020) intercompared four atmospheric chemistry reanalysis products and reported that the standard deviation (SD) is the largest over South America, the Tropical Atlantic and Central Africa because of their differences of the representations of biomass-burning emissions and its impacts on ozone production, the representation of convective transport, and large uncertainties in biogenic emissions."

P13, L336: Here I was wondering If the figures were also in the wrong order in the manuscript or if this is due to the wrong referencing of the figures. Fact is that here the figures are not discussed in a consecutive order, but without any order. First Fig. S2 and S3, then Fig. 2 and 3 and then Fig. 1.

P13, L348ff: Here you describe what is shown in Fig. 2, but Fig. 2 has already been discussed in the paragraph above. It should be first described what is shown in the figure and then the discussion should follow, thus this paragraph should be moved higher up (to L318).

Response: We have revised the structure by reordering some figures and descriptions.

P13, L349: Instead of referring here to Fig. S4 I would suggest to write which period is considered.

Response: Agreed and added (line 317–319 on page 13).

"Figure 3 shows horizontal distributions of monthly mean ozone and the CV in the lowermost troposphere in February and October 2017, within the period shown from Fig. 1 as that with the second largest (February) and the second smallest (October) differences."

P13 and P17, Figure 2 and 3 caption: Sentence "Black rectangles indicates the region to calculate average ozone and coefficient of variation in Fig. S4". Sentence need to be corrected. I think it should read "is shown" in Fig. S4 and it this is the region "for which" the average ozone and coefficient of variation have been calculated.

Response: Agreed and corrected (current Figs. 3 and 4).

"Black rectangle indicates the region for which the average ozone and coefficient of variation have been calculated in Fig. 1 (25° S–25° N, 34° W–18° W)."

P18, L390: It should be described in one or two sentences what ATom is. Are these instruments or were these measurement campaigns?

Response: Agreed and added (line 369–371 on page 17).

"In order to better understand the differences between atmospheric chemistry reanalyses and satellite observations, we use the observational data of the ATom airborne campaigns. We focus here on the periods and locations of ATom-2 and ATom-3 in situ observations of tropospheric ozone and CO in February and October 2017."

P18, L401-2: Isn't that a contradiction? Both times you state that higher ozone concentrations are found. It is not clear which of the data sets has higher ozone concentrations.

P18_L402: Do you mean that IASI+GOME2 has everywhere higher ozone concentrations except in the St. Helena anticyclone?

Response: Clarified (line 381–383 on page 17). We mean that IASI+GOME2 showed higher concentration in the north of St. Helena anticyclone (20° S–5° S over the ocean).

"Only IASI+GOME2 shows high ozone concentration (> 50 ppb) in the north of St. Helena anticyclone (30° S–10° S over the ocean, Fig. 5a). TCR-2 and CAMS reanalysis show relatively higher concentration in the Northern Hemisphere (>10° N) as compared to IASI+GOME2."

P18, L406: Isn't that a repetition of L401-402?

Response: Rephrased (line 377–386 on page 17).

"Figs. 5 and 6 show horizontal distributions of ozone for the period from 13 to 15 February and from 17 to 20 October 2017. These ozone distributions are generally similar to the monthly mean distributions of Figs. 3 and 4. During the period of ATom-2 from 13 to 15 February, all products show enhancements of ozone concentrations over active biomass burning areas near the coast of the Gulf of Guinea and over the nearby sea following the wind flow in the lowermost troposphere (10° S–10° N, panels on the left of Fig. 5). Only IASI+GOME2 shows high ozone concentration (> 50 ppb) in the north of St. Helena anticyclone (30° S–10° S over the ocean, Fig. 5a). TCR-2 and CAMS reanalysis show relatively higher concentrations in the Northern Hemisphere (>10° N) as compared to IASI+GOME2. In the middle troposphere, all products show the ozone plume forming a horseshoe-shape from Southern Africa to the east of Brazil (20° S) and until the Gulf of Guinea (panels on the left of Fig. 6). Especially, ozone concentrations from TCR-2 are the highest ones over the South Atlantic (about 80 ppb). IASI+GOME2 shows overall lower concentrations in comparison with the two reanalyses (Fig. 6a)."

P21, L431: which values? Please be more precise.

Response: Clarified (line 449–450 on page 23).

"The concentrations derived from the two satellite products (IASI+GOME2 and IASI) and the two reanalysis products (TCR-2 and CAMS reanalysis) are extracted from the grid of the 1° × 1° datasets along the flight tracks of ATom-2."

P22, L445, Figure 6 caption: What is actually shown here are vertical cross sections with vertical profiles of ATom overplotted. I would suggest to move the first two sentence at the end of the figure caption. Same holds for P25, Figure 7 caption.

Response: Modified. We have modified the figure title and the caption in Figs. 11 and 12 (former Fig. 6–7).

"Figure 11: The ozone concentrations of (a–b) IASI+GOME2, (c–d) TCR-2 and (e–f) CAMS reanalysis are averaged for the period from 13 to 15 February 2017 and from 17 to 20 2017, respectively, and are

extracted along the ATom flight tracks. Vertical profiles of ozone concentrations for the periods from 13 to 15 February and from 17 to 20 October 2017. Dots indicate ATom-2 and ATom-3 observations."

P22, L455: Which region? Please be more precise.

Response: Clarified (line 513–514 on page 27).

"The region between 30° S to 5° N is where only IASI+GOME2 shows high concentration in the north of St. Helena anticyclone (Figs. 3a and 5a)."

P24, L498-499: Sentence "At about 5°S, the CO maximum underestimated by the reanalysis are located at 2-3 km altitude." not clear, please rephrase.

Response: Rephrased (line 553–554 on page 29).

"At about 5° S, the CO peak located at 2–3 km of altitude is underestimated by the two reanalyses as compared to the ATom-2 observations."

P24, L499: Please don't start the sentence with "It". Clearly state what you mean with "it".

Response: Rephrased (line 554–555 on page 29).

"This CO maximum is composed of three CO plumes:"

P25, L511: "indicated in Fig. 4 and 5" You mean "as shown by the bold lines in Fig. 4 and 5"?

Response: We have deleted the sentence.

P25, L514: Why "might". You are comparing the data sets and thus you should be able to clearly see if they reproduce the shape or not.

Response: Agreed and rephrased (line 525 on page 28).

"IASI does not seem to reproduce the shape of the CO plume."

P25, L515: "IASI+GOME2 and TCR-2 show such enhancement. Only CAMS reanalysis shows this enhancement." This sounds for me like a contradiction. Please check and rephrase these sentences.

Response: Corrected (line 560–561 on page 29).

"ATom-3 observation indicates an enhancement of CO in the upper troposphere at about 10° S. Only CAMS reanalysis reproduces this enhancement (Fig. 12f)."

P26, Figure 8 and Figure 8 caption: I would suggest to only write the time period in the figure title since also other data is shown. As for Figure 6 and 7, here vertical cross sections are shown. Move the first two sentences at the end of the caption.

Response: We have deleted this figure.

P27, L533. Shouldn't it read Fig. 8c and e?

Response: We have deleted the descriptions of the ratio of ozone and CO.

P27; L539-540: Also here I could not follow. Either the sentence is not correct or the reference to the figure is wrong.

Response: We have deleted the descriptions of the ratio of ozone and CO.

P27, L545 and 546: And also Fig. 10. Here you should mention both figures and add also ATom-3.

Response: Agreed and rephrased (line 407–409 on page 20).

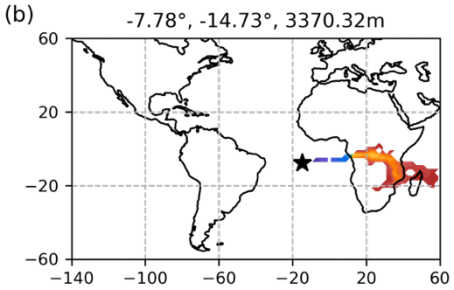
"Figure 7a and 8a show a classification of multiple air masses (stratospheric air, marine air, urban air, biomass burning air, mixed pollution air, and well-mixed and aged air) during ATom-2 and ATom-3 based on the method of Bourgeois et al. (2021)."

P27, L555-556: Sentence grammatically not correct and needs to be revised.

Response: We have deleted the sentence.

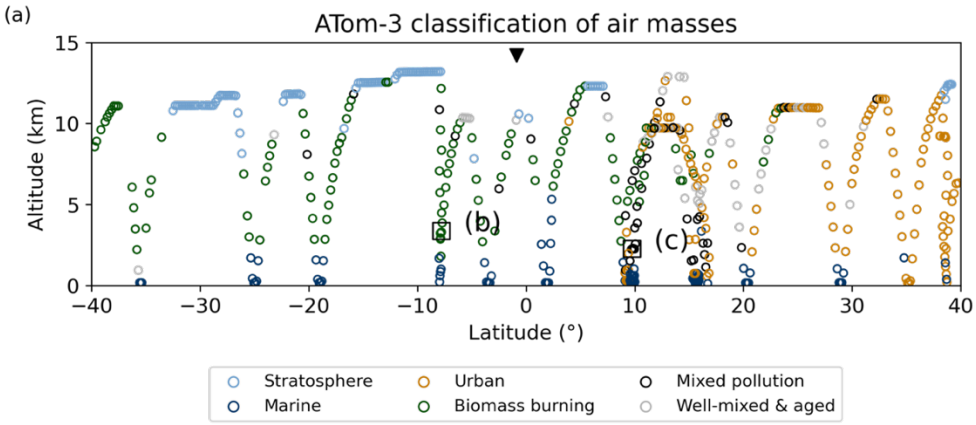
P28 and 30, Figures 9 and 10: Adjust font size or frequency of tick labelling so that the x-axis labels are not overlapping.

Response: Agreed and corrected (Figs. 7 and 8).



P31, L574 and 586: grey triangles? I do not see any triangles. Do you mean the black squares in panel a?

Response: Clarified. There is only one triangle near the equator during ATom-3 period. We have changed the color and enlarged triangles to improve visibility in Figs. 7a and 8a.



P32, L594ff: Clearly write which data sets and not just "satellite" and "reanalysis".

Response: Clarified (line 447–458 on page 23–24).

"The capability to identify the origin and nature of air masses by IASI+GOME2 and IASI observations is illustrated in Fig. 10a is terms of the relationship of the abundance of CO and ozone, coloured according to their origin (derived from ATom-2 measurements). The concentrations derived from the two satellite products (IASI+GOME2 and IASI) and the two reanalysis products (TCR-2 and CAMS reanalysis) are extracted from the grid of the 1° × 1° datasets along the flight tracks of ATom-2. We remark a rather similar distribution of values as obtained for the scatter of values of HCN vs NOx in Fig. 9a. Urban-influenced air masses (light brown circles in Fig. 7a) are mostly associated with moderate abundances of both CO and ozone (up to respectively 150 and 60 ppb). Larger concentrations of ozone (> 70 ppb) retrieved by IASI+GOME2 correspond to stratospheric air masses around 40° N. Some of these samples identified as influenced by the stratosphere and some as urban (as the air masses below, maybe due to a coarser vertical resolution of the satellite retrieval). CO-rich air masses correspond to those influenced by biomass burning, mixed-pollution and marine (with CO mixing down near the ocean surface). Whereas these features are clearly depicted by IASI+GOME2 and IASI observations, they are not clearly modelled by TCR-2 (Fig. 10c) and CAMS reanalysis (Fig. S4). The patterns distinguishing the chemical composition air masses are less clear."

P33, L611: Instead of referring to Fig. 9a and 10a you should refer to the respective section.

Response: We have deleted the sentence.

P33ff: Section 3.4.1-3.4.3 are a repetition of what has been described and discussed before. See my general comment on this above.

Response: Agreed and revised. Please see our response in page 2 of this document.

P33, L614: It should read "one satellite and two reanalysis" and not "three satellite and reanalysis". Rather in referring to the number of reanalysis and satellite data you should rather use the instrument names.

Response: We have deleted the sentence.

P35, L638: "It" please rephrase and be more precise.

Response: We have deleted the sentence.

P38, Section 4: This is a too long and too detailed conclusion. Don't discuss the details of the comparison here once again, just shortly state how good or bad the data sets compare with each other.

Response: Agreed and revised. Please see our response in page 2 of this document.

P39, L758: "CO plume caused by biomass burning from the Congo Basin and Brazil and is located between 20°S and the equator". This sentence needs to be corrected.

Response: We have deleted the sentence to shorten the section.

P40, L786: As mentioned before the conclusions are much too long and should be considerably shortened. What are the implications of your result? A clear statement on this is missing in the conclusions (see ACP guidelines for authors).

Response: Agreed and revised. Please see our response in page 2 of this document.

Technical corrections:

P1, L21: Add CAMS2 in parenthesis.

Response: Agreed and rephrased (line 17–21 on page 1).

"The present study characterises the vertical and horizontal distribution of tropospheric ozone over the South and Tropical Atlantic during February and October 2017 using a multispectral satellite approach called IASI+GOME2, two global chemistry reanalysis products - the Copernicus Atmosphere Monitoring Service reanalysis (CAMS reanalysis) and the Tropospheric Chemistry Reanalysis version 2 (TCR-2) - and in situ airborne measurements from the Atmospheric Tomography Mission (ATom)."

P1, L25: is ~13 ppbv -> of about 13 ppbv

Response: We have deleted the sentence including "~13 ppbv".

P2, L53: were over -> were found over

Response: Corrected (line 66–68 on page 3).

"Krishnamurti et al. (1996) demonstrated that recirculation within the South Atlantic gyre allowed the ozone to accumulate so that the highest ozone amounts were found over the ocean rather than the continents."

P3, L82: See S1 in the Supplement -> see Fig. S1

Response: Corrected (line 96 on page 4).

"However, most of IAGOS data is acquired in the extratropical upper troposphere/lower stratosphere (UTLS) and in the tropical upper troposphere when the aircraft attain cruising altitude in the altitude band of 9–13 km (see Sect. S2 and Fig. S1 in the Supplement)."

P5, L148: remove comma and add "are" after "this paper" and also remove the second comma in L149 and add "and" before "are".

Response: Corrected (line 162–163 on page 6).

"The global atmospheric chemistry reanalysis products compared in this paper are the Tropospheric Chemistry Reanalysis version 2 (TCR-2) and the Copernicus Atmosphere Monitoring Service reanalysis (CAMS reanalysis) and are listed in Table 1."

P7, L186. Precursors -> precursor

Response: This "Precursors" is a part of emission inventory's name (line 200 on page 7).

"Natural emissions from soils and oceans are taken from the "Precursors of Ozone and their Effects in the Troposphere" (POET) database (Granier et al., 2005; Olivier et al., 2003)."

P8, L214: literature -> studies

Response: Corrected (line 27 on page 2 in the Supplement).

"These two tracers are chosen because their lifetime is similar to that of CO (being between three and five months for these three tracers), and they have been used as a tracer in the previous studies."

P8, L219: delete "following"

Response: Deleted (line 32 on page 2 in the Supplement).

"The normalized excess mixing ratio (NEMR) of biomass burning and urban tracers is calculated according to Eq. (1):"

P9, L248: has -> have

Response: Corrected (line 45 on page 2 in the Supplement).

"The OTD on the Orbview-1 satellite and the LIS aboard the Tropical Rainfall Measuring Mission (TRMM) satellite have been most widely used."

P9, L249: neither -> not

Response: Corrected (line 46 on page 3 in the Supplement).

"However, the LIS/OTD 0.5 Degree High Resolution Monthly Climatology (HRMC) covers the period 1995–2014, and is not updated (Cecil et al., 2014)."

P9, L253: Add "resolution" after "spatial" and "and" so that it reads "spatial resolution and with daily and monthly temporal resolution"?

Response: Agreed and rephrased (line 50 on page 3 in the Supplement).

"Recently, a global, high-resolution gridded time series and climatology of lightning stroke density, the WWLLN Global Lightning Climatology (WGLC) has been published (Kaplan and Lau, 2021a) and is freely available at 0.5° and 5 arcmin spatial resolution and with daily and monthly temporal resolution (Kaplan and Lau, 2021b, last access: 19 April 2023)."

P10, L271: rather "processes" than "elements".

Response: Corrected (line 255 on page 9).

"First, in Sect. 3.1, we analyse the monthly evolution of key processes that influence ozone distribution, namely tropical convective activity described by lightning and biomass burning emissions estimated by fire detections."

P12, L311: Has the abbreviation "FRP" introduced in the text?

Response: Clarified. Yes, it is introduced in Section 2.5 (line 250–251 on page 9 in Sect. 2.5).

"This dataset provides the values of fire radiative power (FRP) and the inferred hotspot type:"

P13, L326: One closing parenthesis is obsolete.

Response: Corrected (line 285 on page 10).

"While the ozone minima is seen in January through April or May, its maximum occur largely from imported biomass burning air masses at 6–8 km from September to November based on SHADOZ records from the surface to 20 km between Natal, Brazil (5.4° S, 35.4° W) and Ascension Island, the United Kingdom (8.0° S, 14.4° W)."

P15, Figure 2 caption: Remove space between "variation" and full stop.

P17, Figure 3 caption: Same here.

Response: Agreed and rephrased (currently Fig. 3 and 4).

"Figure 3: Distribution of monthly mean ozone from surface to 3 km in February and October 2017. (a and e) IASI+GOME2, (b and f) TCR-2, (c and g) CAMS reanalysis and (d and h) coefficient of variation. Winds at 3 km altitude from ERA5 are indicated by black arrows. Black rectangle indicates the region for which the average ozone and coefficient of variation have been calculated in Fig. 1 (25° S–25° N, 34° W–18° W).

Figure 4: Distribution of monthly mean ozone from 6 km to 9 km in February and October 2017. (a and e) IASI+GOME2, (b and f) TCR-2, (c and g) CAMS reanalysis, and (d and h) coefficient of variation. Winds at 9 km altitude from ERA5 are indicated by black arrows. Black rectangle indicates the region for which the average ozone and coefficient of variation have been calculated in Fig. 1 (25° S–25° N, 34° W–18° W)."

P18, L390: ATom or Atom? Use a consistent writing throughout the manuscript.

Response: Clarified. "ATom" is correct. We have checked and corrected throughout the manuscript.

P18, L393: space between "to" and "7" missing.

Response: Corrected (line 374 on page 17).

"On 17, 19 and 20 October 2017, the transect covers from 53° S to 7° S, from 7° S to 16° N and from 9° N to 39° N (see the flight track on the right panels of Figs. 5 and 6)."

P18, L406: compared with -> in comparison with the

Response: Agreed and rephrased (line 385 on page 17).

"Especially, ozone concentrations from TCR-2 are the highest ones over the South Atlantic (about 80 ppb). IASI+GOME2 shows overall lower concentration in comparison with the two reanalyses (Fig. 6a)."

P19 and 20, Figure 4 and 5 caption: Make a full stop after reanalysis and move "Black bold lines" before "indicate" so that it reads "Black bold lines indicate……".

Response: Agreed and rephrased (currently Fig. 5 and 6).

"Figure 5: Distribution of mean ozone from surface to 3 km during 13–15 February and 17–20 October 2017. Black bold lines indicate the ATom-2 and ATom-3 flight tracks in (a–b) IASI+GOME2, (c–d) TCR-2 and (e–f) CAMS reanalysis. Winds at 3 km altitude from ERA5 are indicated by black arrows.

Figure 6: Distribution of mean ozone from 6 km to 9 km during 13–15 February and 17–20 October 2017. Black bold lines indicate the ATom-2 and ATom-3 flight tracks in (a–b) IASI+GOME2, (c–d) TCR-2 and (e–f) CAMS reanalysis. Winds at 9 km altitude from ERA5 are indicated by black arrows."

P21, L430: compare -> intercompare?

Response: Agreed and rephrased (line 473 on page 25).

"and then, we intercompare the vertical profiles of three products (IASI+GOME2 and two reanalyses) to assess the accuracy of the satellite and reanalysis ozone products."

P21, L431: omit "indicated by black bold lines in Figs. 4 and 5".

Response: Deleted.

we intercompare the vertical profiles of three products (IASI+GOME2 and two reanalyses) the accuracy of the satellite and reanalysis ozone products.

P21, L443: until? Do you mean "except for" or from the lower stratosphere onwards?

Response: We have deleted this sentence.

P32, Figure 11 caption: Scatterplots -> scatter plot

Response: Corrected (currently Figs. 9 and. 10).

P33, Figure 12 caption: Full stop after "Figure 12" should be a colon and move "respectively" after "IASI+GOME2" and delete "(idem as Figs. 9a and 10a)".

Response: Agreed and corrected.

"Figure 9: Scatter plots of NO_X vs. HCN (biomass burning tracer) of ATom-2 observation with colours indicating (a) the air masses classification into six categories: marine (navy), stratosphere (light blue), urban (light brown), biomass burning (dark green), mixed pollution (black), well-mixed and aged air (grey), and (b) the probability of boundary layer influences.

Figure 10: Scatter plots of CO vs. ozone for air masses sampled by ATom-2 derived from (a and b) satellite measurements of IASI and IASI+GOME2 and (c and d) TCR-2, respectively. Colours indicate (a and c) the air masses classification into six categories and (b and d) the latitude location."

P37, L677: stratosphere -> stratospheric

Response: Corrected (line 495 on page 27).

"According to the classification shown in Fig. 7a, most of air masses within this plume correspond to stratospheric air, biomass burning air, well-mixed and aged air, or mixed pollution air."

P37, L689: "in a lower clearly lower magnitude" -> please check and correct

Response: We have deleted the sentence including "in a lower clearly lower magnitude".

P38, L709: omit "reanalysis" after "CAMS"

Response: We use "CAMS reanalysis" as the abbreviation of "the Copernicus Atmosphere Monitoring Service reanalysis".

P38, L714: form -> from

Response: Corrected (line 627 on page 31).

"In this last period, the region is likely influenced by biomass burning emissions from the southern part of West Africa and Central Africa and deep convection over the Gulf of Guinea (over the Ocean), Central and Southern Africa (as depicted by the frequent lightning activity)."

P38, L727-728: If you provide the time period of ATom once again it should be done rather in L710.

Response: Agreed and corrected (line 621–623 on page 31).

"We have presented an analysis of the tropospheric ozone spatial distribution and its origins using satellite (IASI+GOME2), in situ observations (ATom-2 during 13–15 February and ATom-3 during 17–20 October 2017) and two global reanalyses (TCR-2 and CAMS reanalysis) over the Tropical and South Atlantic."

P39, L756: link -> linked

Response: We have deleted the sentence including "link".