

## Response to the third reviewer

We thank the referee for his/her short, but nevertheless useful, positive review, which contain various useful comments and suggestions. Here we answer them to our best ability. The reviewer comments are in italic. Our responses are in regular font, and changes to the manuscript are given in bold.

*This paper inter-compared tropospheric ozone reanalysis products from CAMS, CAMS-Interim, TCR-1, and TCR-2. This study is of scientific importance and the research is well conducted. The presentation is generally clear with logic flow and convincing discussions. The paper provides an enhanced understanding of issues related to tropospheric ozone reanalysis products. I only have some minor issues for the authors to consider when revising their paper. Minor issues:*

*1. In the abstract and conclusions, it is useful to summary where and when the reanalysis products perform strongest and weakest, in term of relative difference with ozonesonde data.*

In response, we now specify in the abstract a sentence on the evaluation against ozone sondes:

**For instance, for the NH mid latitudes the tropospheric ozone columns (surface to 300 hPa) from the updated reanalyses show mean biases to within 0.8 DU (3% relative to the observed column) with respect to the ozonesonde observations.**

Also in the conclusions we describe the main strengths of the reanalyses, and suggest potential application areas:

**The well-characterized, small mean bias in tropospheric columns in these reanalyses suggest that they can be used to provide a climatology of present-day tropospheric ozone. This may serve as a reference for the present-day contribution of tropospheric ozone to the radiation budget, or may provide a climatology for a-priori ozone profiles as required for satellite retrieval products (e.g., Fu et al., 2018). The ability of the CAMS Reanalysis to capture the variability of (near-)surface ozone on multiple time scales, and for many regions over the globe, indicates it is fit for use as boundary conditions for hindcasts of regional air quality models.**

*2. Figures and tables need more annotation.*

In response, we have extended the descriptions of (new) Figures 1, 4, 6, 7, 15.

*Fig. 1, What are the boxed areas?*

We now specify the regions used in the analyses in the legend of Figure 1, together with specification of the other regions.

*Table 5-7, the area definitions can be provided in Fig. 1.*

This is a good suggestion, thank you. We now provide this information, see above.

*Fig. 4. Relative difference is more meaningful.*

We prefer to stick to the absolute values here, to remain close to the physical quantity. Nevertheless, in our revisions we now report relative differences much more frequently, e.g. by adding bar-plots presenting the relative biases and standard deviations in the Supplementary material, and referring to this in our analyses, as well as in the abstract and conclusions.

*Fig. 11, what is the time zone for this figure? How are the model errors removed?*

For the diurnal cycle we use UTC, we now include this in the x-axis label in the Figure. The model bias was removed by subtracting the seasonal mean analysis bias with respect to the corresponding observations. We now write this explicitly.

**3. *The definition of the tropopause needs some discussion and references.***

As was also commented by the other reviewers we have updated our analysis of tropospheric columns. This now refers to subcolumns from the surface to 300hPa. In this way we circumvent any potential ambiguity regarding the definition of the tropopause, and make the reanalysis products better comparable.

**4. *The paper appears lengthy. Please shorten the paper and move less significant contents to Supplements.***

The reviewer is correct that the manuscript benefits from a more stringent priority in presenting material, thank you for your comment. In response, we decided to move most of Sec. 7 into the supplementary material. Only an assessment of the correlation with the ENSO is retained, as well as the concluding sentences which describe the consistency in time series between the various reanalyses.