Reply to reviewer #3

We thank anonymous reviewer #3 for her/his valuable comments. Please find below the reviewer's comments (in black), our responses (in blue), and changes or additions to the text (in red).

All page / line numbers refer to the old version of the manuscript.

Please note that we identified an issue in the GTO-ECV data record, which affected ozone values from 2017 onward, in particular in the middle latitudes of the southern hemisphere. We had to reprocess the data record for this period. The comparison with Adjusted-MERRA was repeated and all figures were updated. In general, the main findings did not change, except for the unclear behavior in 2017/18 in the middle latitudes of the SH (see p.6, ll.25-26), where the differences are smaller now.

The authors present a comparison of two total ozone datasets, which generally is of interest for the atmospheric community.

Main drawback of this study is that both datasets are NOT independent, as both involve OMI measurements. This is mentioned in the paper (paper 6, line 10), but ignored in other parts and not thoroughly discussed. The GTO-ECV product, involving satellite measurements, is compared to an assimilated ozone product, also involving satellite measurements. In fact, both products involve O3 from OMI (from different algorithms, but based on the same OMI spectra). This should be clearly stated in the manuscript (earlier than in section 3). It remains unclear to me how far the differences between GTO-ECV and MERRA after 2005 reflect just the difference between the DOAS vs. SBUV algorithm, or how far the assimilation model contributes. So please add a comparison of the OMI input data used in GTO-ECV vs. MERRA, or provide a reference on such a comparison. The impact of having data from the same instrument contributing to both datasets, and the meaning of such an intercomparison between dependent datasets, has to be discussed in more details in the manuscript.
→ We agree with the reviewer that it is a little drawback of this study that both data records involve OMI measurements, which will obviously introduce an inevitable interdependence. We add a corresponding statement in the introduction. However, the data records involve OMI measurements from two different retrieval algorithms. Our opinion is that such comparison nevertheless is of value.
We broke up the analysis of the gridded data into the periods before and after the ingestion of OMI (10/2004). The spatial pattern of the differences does not change from one period to the other (see Figs. 6 and 7) which gives evidence that the differences do not reflect just the difference between the retrieval algorithms.
Furthermore, as stated in the beginning of Section 3.1 for the zonal means both data records can be regarded as virtually independent, because of the normalization of MERRA-2 w.r.t. SBUV MOD.

Detailed comments:

- add a statement in the introduction that both datasets are not independent and provide arguments why the comparison still makes sense and what can be learned from it.
→ We added a statement in the introduction (p.3, ll.13-16):
"Beginning in late 2004, total ozone column data from the OMI instrument are assimilated in the MERRA-2 reanalysis. GTO-ECV also includes OMI measurements, meaning the two data sources are not completely independent. However, the OMI data assimilated by MERRA-2 is retrieved using a different algorithm than that included in GTO-ECV. To estimate the effect of the shared OMI data on our results, we analyze differences in two periods, before and after the OMI data are included in the data products."

- Page 6 line 18: after the introduction of OMI in GTO-ECV AND in MERRA!
→ We added "and in MERRA-2" here.

- Page 6 lines 22ff: when discussing differences here, the respective comparison of the input OMI data to GTO-ECV vs. MERRA has to be provided.
→ We included basic information about both OMI ozone retrieval algorithms here, and we refer to a number of papers providing more detailed technical information, results of the geophysical validation and a comparison of both retrieval algorithms.

- Page 8 line 11: introduction of OMI in GTO-ECV AND in MERRA!
→ Here, we would like to refrain from including “and in MERRA”, because for the zonal means both data records can be regarded as independent due to the normalization of MERRA-2 w.r.t. SBUV MOD (see beginning of Sec. 3.1).

- Figure 3: please provide these plots also for before-OMI and post-OMI periods.
→ We split this plot into before-OMI and post-OMI periods, but the difference is almost invisible for this kind of plot. Thus, we would prefer to leave the plot as it is.

- Extend the discussion/conclusions wrt both datasets not being independent. What is the worth of an "excellent agreement" between two datasets that are not independent?
→ We extended the summary/discussion w.r.t. both data records not being independent.

Minor comments:

- Table 1: please add a column for local overpass time.
→ Done.

- Page 4, line 13: if gridded on 1°, the smaller OMI pixels compared to SCIAMACHY do not matter that much.
→ We do not fully agree, since the smaller ground pixel size and the almost daily global coverage in case of OMI increases the representativeness of the monthly means a lot, compared to the representativeness of monthly means obtained from SCIAMACHY data (global coverage every 6 days) alone.

- Page 5, line 18: please provide a detailed description of the "renormalization"
→ A more detailed description of the normalization is provided in lines 29-33 on the same page.

- Fig. 7: why do the difference plot on the right have such strong latitutde-dependency, e.g. a jump at 30°N in spring?
→ We think that this is related to the quite steep gradient in standard deviation which occurs at ~30°N/S, in particular in spring of the respective hemisphere. The standard deviation drops down from >40DU to <20DU within a very tight latitude range.