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Atmospheric Measurement Techniques Discussions

Interactive comment on "Relative drifts and biases between six ozone limb satellite measurements from the last decade" *by* N. Rahpoe et al.

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Final Response to Referee 3

N. Rahpoe

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Abstract

We would like to thank the Anonymous Referee 3 for their effort to carefully read the paper and giving us valueable comments to improve the paper.

0.0.1 1.)Provide referenced uncertainty estimates for each instrument (as you did for GOMOS), and a reference for outliers removal criteria if used.

Additional table is added (See Table 1) to highlight the estimates of uncertainty and other informations for each sensor.

0.0.2 2.) Provide more details of the data used, source, availability, and reason for selecting specific dataset if there are different versions/sources available

See Table 1 and the reference therein. The reason for selecting the data sets were their availability at the time of the analysis and their participation in the Ozone CCI project, i.e. mainly scientific products.

0.0.3 3.) Given that all measuerements needed to be converted to common grid and units, can you explain how and which data set were converted.

We used the VMR for all comparisons on a fixed altitude grid of 1 km spacing. This information is added in Sect. 3. Only instruments with number density, e.g., SCIAMACHY, GOMOS, and OSIRIS have been converted to VMR.

0.0.4 4.) Section 4 and Fig 1-4, The authors use of SCIAMACHY as the reference sensor; I am not sure SCIAMACHY is the best option despite its dense sampling. Ideally, an outside instrument of good quality measuerements such as MLS, is better option. If not, then one of the 'balanced range' instruments, OSIRIS or GOMOS should be selected. It's difficult to interpret the figures (especially fig 4) when the reference instrument is part of the study and exhibit some biases at certain altitudes.

This additional sentence may explain the reason we selected SCIAMACHY:

'In this part, only a brief example of mean relative difference timeseries are presented with SCIAMACHY as the presentation instrument. We could chose any instrument in this section but SCIAMACHY is the only data set under investigation from a dense sampler covering the full Envisat observation period. In Sect. 5 the results from the regression analyses (relative bias and relative drifts) of all sensors as reference instrument are discussed for selected latitude bands. Further details from all possible pair combinations from 5 degree latitude bin analyses can be viewed as contour plots for $\beta(z)$ *and* $\alpha(z)$ *as Supplement.'*

On the other hand we dropped Fig.4 (global bias and drift toward SCIAMACHY) to avoid confusion and discuss the derived relative drift and bias solely Figs. 4-9 (Figs.

5-10 previously) where results are presented with each instrument as reference instrument.

0.0.5 5.) Page 3706, Line 24: 'Most probably, this is due to diurnal ozone variations.' This is upproven explanation as the authors show no evidence to support it, given that other instruments don't show such bias (see supplement plots for OSIRIS vs. GOMOS vs. ACE).

This statement has been dropped. Instead we added a short paragraph (Sect. 5.1) clarifying the possible impact of local time differences on the differences in ozone for different altitudes and refer to Studer et al. 2013 paper.

0.0.6 6.) Figures 5-10 are difficult to follow given the amount of information on display. Maybe it can be changed from one panel per latitudinal zone to one panel per instrument, just an idea.

We increased the size of the text for Figs. 5-10 (now Figs. 4-9). The suggestion to replace the error plots was very helpful. We now replaced the error plots by the same plot of the instrumental range, but shading out the insignificant values with grey colour. This will help the reader to identify immediately the significant values.

0.0.7 7.) Page 3711, Conclusions: The paper is missing an important conclusion, once you asses the relative bias and drift of these instruments, how do you proceed to merge it into combined climate data record.

We added now a concluding remark on how we think the errors on trend analysis can be interpreted from our drift and bias analysis. Since most of the drifts does not show any significant drifts we can calmly merge the data sets by excluding data points of a

reference sensor which show significant drift with respect to majority of instruments. In addition we recommend that the uncertainties for the trend analysis in other works should be extended by the drift values given in this paper for different instruments.

- Exlusion of significant drift data points.
- The added drift uncertainty is estimated at about 3 $\%\, decade^{-1}$ (1σ)

This text has been added at the end of Section 5 and the Conclusion: *'The evaluation of relative biases and relative drifts between pairwise sensors demonstrates its value in understanding the differences between the sensors and differences of the derived trends and can be used to estimate the added uncertainty in physical trends from the drift. The added drift uncertainty is estimated at about 3*$\%\, decade^{-1}$ *(1*σ*).'*

0.0.8 8.) page 3706 line 10: 'shows a negative bias of about -5 to 10 percent', change to -10 percent.

Corrected.