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Atmospheric Measurement Techniques Discussions

Interactive comment on "Merging of ozone profiles from SCIAMACHY, OMPS and SAGE II observations to study stratospheric ozone changes" *by* Carlo Arosio et al.

Anonymous Referee #2

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The manuscript presents two interesting new merged satellite data sets of ozone vertical distribution, based on SAGE II, SCIAMACHY and OMPS observations. Two different methods are used for merging the data sets. The first one uses MLS data as a transfer function to evaluate the bias between SCIAMACHY and OMPS data sets, which overlap for only 2.5 months, while the second merges deseasonalized anomalies. Both data sets have the advantage of being longitudinally resolved, which is generally not the case for similar merged records except for the SWOOSH data set. Yet, the deseasonalized anomalies record when extended with SAGE II observations is zonally averaged. Ozone trends are then computed from the merged data sets using classical multilinear regression over the 2003 – 2018 and 1985 – 2018 periods for the

SCIAMACHY – OMPS and SAGE II – SCIAMACHY – OMPS records respectively. The paper is well written and reference to previous work is adequate. It is suitable for publication in AMT provided that following important comments and recommendations are taken into account.

Major comments

1. The paper is lacking an assessment by the authors themselves of which SCIAMCHY – OMPS merged record they think is best suited for their initial objective of ozone trend evaluation. Comparisons are displayed with MLS data in Figure 3 and 4 of the article, but this record is used as transfer function in both records. What is the advantage for potential users to of using one record over the other one?

2. An assessment of both records could be provided by comparing them to other independent merged records that have been produced recently, e.g. GOZCARDS, SWOOSH, and others.

3. The issue of diurnal variation of ozone deserves some more attention in the article. It is mentioned in page 9 that diurnal ozone variation has to be accounted for above 50 km. However, Sakazaki et al (2013) found significant diurnal variation of ozone well below 50 km and down to 30 km in some latitude ranges.

4. More precision is needed on the use of MLS as a transfer function for both records. What is the processing of MLS data in equations 1 and 2? Are they interpolated to the location of SCIAMACHY and OMPS observations? Similarly, not enough attention is given to differences in vertical resolution between the various data sets. Could it be an issue for the merging? In addition, ERA-Interim is used for the MLS data conversion to number density versus altitude. Did the authors test the sensitivity to other reanalyses such as MERRA2?

Specific comments

P2-l7: The CFCs have been banned by 2010 in Article 5 developing countries.

P2-l23: Sentence starting with N2O is a long-life GHG needs to be rephrased.

P3-l13: What is the reference for the NASA LORE/SOLSE instrument?

P3-l20: Mention instruments on board SCISAT that use the solar occultation technique.

P3-l24: It is an improper description of the Harris et al. (2015) paper. In this paper, merged satellite records are used for trend studies but the merging is not made by the authors. Intercomparison of the merged records is made in Tummon et al. (2015).

P3-l26-27: In general, provide trend results from published studies with error bars.

P3-l30: Ozone-CCI is not the name of a record but the name of a project. More generally in this paragraph it would be better to distinguish articles that describe merged records with those retrieving ozone trends from those records.

P4-l1: Mention the name of the method used in Ball et al. (2018).

P4-l23: The SWOOSH record is resolved in longitude.

P4-l24: Sentence starting with 'In addition': Explain why it is better not to extract the seasonal cycle.

P5- Table1: typo on the unit of the spectral resolution. The latitude coverage could be added in the table as additional information.

P6-l10: A short summary of validation results of OMPS and SCIAMACHY should be added here.

P7-l15: Figure 1 does not include altitude information.

P8-Figure 2: at 28.3 km in the 40°S-20°S latitude range, the SCIAMACHY seasonal cycle looks very different. Can the authors comment on this discrepancy?

P9-l8-9: Equations 1 and 2 should include indices linked to latitude, longitude and altitude.

P13-l6: Sentence starting with 'For the 50-60°N latitude': please clarify. Why is seasonal variation handled differently in this latitude range?

P13-l14: Several studies are mentioned but only one (Park et al., 2017) is cited.

P13-l21: The solar cycle is also used as a proxy in MLR regression of total ozone for trend retrieval in various studies including that from Weber et al. (2017). The solar activity has thus an impact on ozone also in the lower stratosphere. This is worth mentioning.

P17-Fig. 8: Mention for which merged data set are the trends displayed. Trend results should be restricted to the range of validity of the data.

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