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Atmospheric Measurement Techniques Discussions

Interactive comment on "Validation of the Suomi NPP Ozone Mapping and Profiler Suite total column ozone using Brewer and Dobson spectrophotometers" *by* K. Bai et al.

Anonymous Referee #1

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APOLOGIES FOR THE MULTIPLE POSTING, IN YESTERDAY'S REVIEW SOME LINES OF TEXT WENT MISSING, PLEASE READ THIS REVIEW INSTEAD. ——————————

General comments.

This paper presents a first attempt of a "Validation of the Suomi NPP Ozone Mapping and Profiler Suite total column ozone using Brewer and Dobson spectrophotometers". While it is of great importance for all new satellite products to be validated quickly so as to become part of the scientific pool of data, this paper fails to provide the necessary

analysis as to the quality of the OMPS TOCs.

There are numerous reasons why this paper should not be published in AMT. Firstly, a purely validation paper is beyond the scope of AMT and more appropriate to more geophysically-oriented journals. Secondly, the paper lacks in most parts that should be provided for e.g. the OMPS algorithm discussion, the validation criteria discussion as well as a more comprehensive statistical analysis of the comparisons between ground and satellite. As explained in the Specific Comments section below, a number of questions arise when reading this paper, not least of all the fact whether the differences seen can be attributed to sampling or other statistical reasons apart from the behavior of the OMPS instrument. The scientific methods are not clearly outlines, not is there enough traceability of results. A global mean difference of 0.21% and 0.86% for the Brewer and the Dobson comparisons respectively, while impressive, cannot shed a light as to individual features inherent in the OMPS dataset nor provide with a substantial conclusion as to further usage of the OMPS data.

I hence recommend that the authors withdraw the manuscript, perform the suggested alterations on the text, greatly enhance the analysis and discussion section and resubmit to a more appropriate journal. The paper has a good structure and can form the basis of a valuable reference article once the necessary work is performed.

Specific comments.

1. Page 1, Line 10: is this value a global value? A mean of daily or monthly values? What is the associated r-squared? I think that in the abstract great care is needed when quoting actual numbers since those are the ones to be references in the future by other studies.

2. Page 7: maybe some error estimates from the ATBD can be mentioned in the text as well? What is the instrumental/algorithm uncertainty of OMPS?

3. Section 2.1.2. Was any filtering applied to the OMPS data?

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4. Section 2.2. This Section should be enhanced by extensive reference to other validation papers that have used the WOUDC data focusing of course on the ground-based instruments and not the satellite data. Also, how where the Brewers/Dobsons chosen? In WOUDC there are far more than 35 of the one and 39 of the other. Any filtering applied?

5. Section 2.2. There are also various networks online that monitor other satellite TOCs using the WOUDC ground-based stations such as the Canadian Ozone and Ultraviolet Research and Monitoring network, http://exp-studies.tor.ec.gc.ca/e/ozone/ozone.htm, the EUMETSAT ozone validation facility [http://lap.physics.auth.gr/eumetsat/index.php] and the World Meteorological Organization Ozone Mapping Center found here http://lap.physics.auth.gr/ozonemaps2/. All these manage and/or use the WOUDC data for validation purposes.

6. Section 2.3. A very quick online search in Google Scholar has led me to the following OMPS validation works: http://cires.colorado.edu/events/rendezvous/2007/posters/II35R.pdf and http://larss.science.yorku.ca/QOS2012pdf/6156.pdf and http://satelliteconferences.noaa.gov/2013/docs /Tuesday%20Poster%20Session%20Final%20Posters/ T61_NSC_2013_OMPS_LEf.pdf . These, and other similar works by the PIs of the instrument should be referenced and discussed in this work also.

7. Page 9, line 2: why was 30km chosen when the instruments' footprint is 50km? what do you mean by "Except the spatial and temporal inconsistency between satellite instrument and ground measurements caused error.."?

8. Figure 1. It is not surprising that a scatter of daily ozone values between Brewer/Dobson and OMPS would provide such excellent results since the number of observations is so large, around 6500 and 8500 values reported. The authors should first present either some individual station statistics both at typical mid-latitude regions

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as well as at the more challenging regions such as the Arctic, the Antarctic and the Tropics. It is well-known that the NH ground-based stations perform better than the SH ground-based stations, and it would be of value to see how OMPS performs at different latitudes.

9. Page 9, last paragraph. A global daily average of 0. 213% with a scatter of 3.1% cannot be considered as an "over-estimation" of the part of the satellite. Especially since the ground-based errors can be as high as 2-3% for the ground-based zenith sky measurements that the authors used in their work. How do these estimates change if only direct sun measurements are used?

10. Page 10, discussion of Figure 3: are these issues due to the ground-based measurements, the ground-based coverage or the OMPS data? Great care should be taken when making such statements. For e.g. there is only one Brewer near the Equator hence the statistics and RMSEs etc. is meaningful only as far as the performance of this one instrument is concerned.

11. Page 10, Figure 4. The actual TOCs by the satellite and the ground should be plotted so that it can be understood whether the features seen are due to one or the other. Is the reported "large positive bias is observed near equator with MBE of 1.5%$\pm$2.1% as negative bias observed over Antarctic with MBE of $-1.8\%\pm2.8$ %" for the Brewers due to the Brewers or the OMPS data? The authors claim that "This effect is mainly associated with little reliable measurements over these regions due to bad viewing conditions" for the Dobson comparisons. This is a very strong statement to make for both the ground-based measurements which have been observing since time immemorial the ozone layer from the Antarctic as well as the satellite data. Who has little reliable measurements? What are considered bad viewing conditions?

12. Page 11, line 1: what degradation of the OMPS instrument? This is the first time this issue is raised in this work. How big a degradation? Numbers? References? How does it affect the validation of total ozone?

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13. Page 11, Line 4: SZAs themselves cannot introduce errors in satellite observations, unless the authors are referring to something else?

14. Page 11, discussion of Figure 7: it is obvious that a more comprehensive discussion of the cloud algorithm employed by the OMPS algorithm is needed before any discussion of the comparisons may be performed.

15. Page 12, Figure 9: Extreme care is needed when discussing the dependency of TOC differences on the TOC itself. The ozone hole conditions are represented by very few co-locations [information that can be inferred by other works, since the collocations are not provided in this one] which will surely bias the comparisons. Large SZAs coupled with low TOCs indeed may cause problems in both the ground and the satellite algorithm. Which is which? Also, the comparisons are bound to change if Figure 9 is shown with the Ground TOC on the x-axis. As discussed in detail in" Fioletov, V. E., D. W. Tarasick, and I. Petropavlovskikh (2006), Estimating ozone variability and instrument uncertainties from SBUV(/2), ozonesonde, Umkehr, and SAGE II measurements: Short-term variations, J. Geophys. Res., 111, D02305, doi:10.1029/2005JD006340" natural ozone variabilities coupled with instrumental uncertainties may affect greatly such comparisons and lead to erroneous conclusions.

16. All Figures: since a little more than one year of data are presented in this work, it is of great importance to the discussion to also note the amount of collocations and how these alter from month to month.

Technical corrections.

1. The paper requires comprehensive reading and re-writing of the pertinent parts by a native English speaker. I begun to alter the text where appropriate however by line 15 of page 2 it became obvious that this cannot be the role of the scientific reviewer. I strongly urge the authors to either request that a native English speaker colleague of theirs reads through the text or to make use of the Copy-Editing for English service offered by most journals.

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2. Page 2, Line 1: Place the references in chronological order. Please apply this rule throughout the text as the same issue occurs numerous times.

3. Page 2, Line 23: provide references and full title of the Dobson & Brewer spectrophotometers.

4. Page 2, Line 29: add the references for the GOME/GOME2 instruments themselves and not only the validation papers.

5. Page 5, line 7: add references.

6. Page 5, line 16: is there no more recent reference on the instruments than Dittman et al., 2002?

7. Page 6, line 8: add references, such as the instrument web pages, etc. Who is the PI of the instrument?

8. Page 7, line 6: is there an article describing the OMPS algorithm? It is customary for an algorithm paper to appear before the associated validation paper. Maybe there is one in press or in print?

9. Page 8, line 4: it is more appropriate to reference articles such as for e.g. " Fioletov, V. E., et al. (2008), Performance of the ground-based total ozone network assessed using satellite data, J. Geophys. Res., 113, D14313, doi:10.1029/2008JD009809" and "Fioletov, V. E., J. B. Kerr, C. T. McElroy, D. I. Wardle, V. Savastiouk, and T. S. Grajnar (2005), The Brewer reference triad, Geophys. Res. Lett., 32, L20805, doi:10.1029/2005GL024244" and many similar other works than Anton et al., 2010 and Bai et al, 2013.

10. Table 1 : there are a few errors on this Table. For e.g. station 111, Amundsen-Scott is in Antarctica and managed by NOAA - Climate Monitoring and Diagnostics Laboratory in Boulder. Similarly, station 499, is also in Antarctica, managed by the Royal Meteorological Institute of Belgium in Brussels. Please go through the stations with great care and update the information.

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11. Table 2: as per Table 1. For e.g. station 232, Faraday is in Antarctica and is managed by the British Antarctic Survey.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 4577, 2013.