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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Validation of OMI total ozone retrievals from the SAO ozone profile algorithm and three operational algorithms with Brewer measurements" *by* J. Bak et al.

Anonymous Referee #1

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General Comments

This paper presents results of comparisons between Brewer ozone data (from selected stations based on data quality and the SAUNA campaign) and OMI total ozone columns retrieved from four independent algorithms. Through these comparisons, the authors have conducted a thorough and systematic examination of the performance of these algorithms, and quantified the uncertainties of the corresponding total ozone columns. Their investigation yields expected findings and some surprises.

As expected, the optimal estimation algorithm developed by Liu et al., named SOE,

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which includes soft calibrations and accurate radiative transfer modeling of measured spectra and other advanced features, provides the most precise and accurate total ozone columns under most observing conditions. Surprisingly, the TOMS total ozone algorithm, which uses spectral measurements at two wavelengths under most conditions, performs really well in this validation study, achieving nearly the same retrieval precisions as the SOE algorithm, but having higher biases. Unexpectedly, the KNMI ozone profile algorithm, which is based on the same optimal estimation approach and use the similar spectral range as the SOE algorithm, yields OMI total ozone columns with the highest biases, lowest precisions, and lowest correlation with ground based data among the four algorithms. These findings illustrate the large impacts of algorithm implementation and soft calibration on the quality of retrieved ozone products. While this is beyond the scope of this paper, future efforts to further identify the causes of these differences would be beneficial to the UV remote sensing community.

In this paper, the authors need to provide more discussions about the possible impacts of cross-section change. Ground-based Brewer measurements are employed to characterize the accuracy of the ozone retrieval algorithms. However Brewer data are retrieved using Bass and Paur (1985) ozone cross-sections, which are also used by the OMI TOMS algorithm, but are different from the BDM cross-sections used by the SOE, the KOE, and the OMI DOAS algorithms. It is mentioned in this paper that Brewer retrieved ozone columns would be significantly different if the BDM cross-sections are used instead of Bass and Paur (page 4059, lines 5 – 8). Furthermore, the temperature dependence of these two ozone cross-sections are different, indicating that switching one with the other would not be a simple bias in the Brewer data, but more complex differences that depend on the observing conditions. It is therefore important for the authors to expand the discussion about the impacts of Brewer errors on the evaluation of algorithm performances, whether smaller differences between OMI and Brewer columns would signify more accurate retrievals, and if the scatter would be changed.

There are a few items listed below needs to be addressed for publication in ACP.

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1. Page 4059, line 9, “can be a problem”. Perhaps re-phrase this sentence, and specify the problem.

2. Page 4057, line 13, “soft calibration” for TOMS needs to be characterized, similar to that for SOE, page 4056, lines 8 – 10.

3. Page 4054, lines 18 – 20, “Both OMTO3 and OMDOAO3 were validated previously by several groups using various reference data (e.g., Balis et al., 20 2007; Kroon et al., 2008; McPeters et al., 2008; Antón and Loyola, 2011)”. Need to describe somewhere in this paper if the findings of this work are consistent with those of previous comparisons.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 4051, 2014.