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Comment

Interactive comment on “Validation of Ozone Monitoring Instrument (OMI) ozone profiles and stratospheric ozone columns with Microwave Limb Sounder (MLS) measurements” by X. Liu et al.

Anonymous Referee #4

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General This paper validates the important advancement in the use of OMI data in producing a stratospheric ozone column, which can be used by itself or to calculate a tropospheric ozone column solely from the OMI instrument. Previous work in calculating a tropospheric ozone column has relied on combining OMI and MLS data or TOMS and MLS data, and is susceptible to biases due to combining data from different instruments or errors arising from non-colocated measurements. The comparisons to MLS are comprehensive and compare both "raw" estimates and comparisons which consider the OMI sensitivity. The methodology is good and presentation of results is

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comprehensive except with the caveats below.

One important update for this paper is that comparisons to MLS should always show the total error of OMI and MLS, and comparisons of OMI to convolved MLS should always show the combined measurement error of OMI and MLS. This will validate both the OMI product and the OMI predicted errors. Specifically, errors should be shown for Fig 1g-l, Fig 2f-j, Fig 3, Fig 8 (note smoothing error should be shown not as a bias but as +- dotted lines. Measurement error should also be shown as separate +- lines), Fig 10-11 (not sure what the "upper limit" of errors means. The mean error should be shown.). This will put all comparisons between MLS and OMI into context to determine if and when the estimated errors are accurate versus the suggestion of significant systematic errors either in OMI or MLS (which would also address the concern of reviewer #2).

Comparisons to sondes should be added between 215 and 100 hPa where comparisons to MLS are significantly worse. This would validate OMI between 215 and 100 hPa. The only reason not to add these comparisons is if more comprehensive comparisons to sondes are planned in one of the two other validation papers mentioned below. If comparison to sondes is planned in a future validation paper, than I change the recommendation to "accepted subject to minor revisions".

The introduction mentions that this is the first of 3 validation papers. A brief summary of the next validation papers should be mentioned so that the scope of the current paper within the full validation of the OMI profile results is established.

Specific comments The abstract and conclusion sections should mention the OMI predicted errors to place the comparisons to MLS into context. The authors can use their judgment about the amount of detail provided for the predicted errors.

Introduction switch wording: minimize significantly to: significantly minimize

Section 3: If there was a reason 347 days was used rather than a full year, can this be stated? It seems odd to use 347 days rather than a full year.

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The text near Equation 1 describes it as degrading MLS resolution, but later text describes it as convolving MLS profiles. To be clear, specifically say: convolved MLS profiles using Eq. 1. Apparently this degradation does not impact the SOC?

Figures 5 and 11 show issues with large solar zenith angles. However, the impact or mitigation of these errors this on the OMI SOC is not addressed. Is there a suggestion to screen off of SZA? What is the estimated effect of the SZA-dependent systematic errors on the SOC in DU or % error?

In section 3, the last sentence should be worded a bit more carefully, as it seems to suggest that limb ozone measurements' main purpose is to create a tropospheric ozone column. The MLS ozone product has been used for many other purposes, perhaps not for air quality other than calculations of transport from the stratosphere into the troposphere. Could this be worded: This has high cost significance in designing future air quality missions in that OMI alone can now be used to measure tropospheric ozone column values.

In section 4: the word original in original MLS profiles seems redundant.

Figure comments: Figure 3 Can the predicted errors be shown as dotted or dashed lines to more easily distinguish them from OMI-MLS differences?

Figure 6 The mirroring makes the figure more confusing. Is it like this because SZA has a correspondence to latitude?

Figure 7 This figure is very impressive. The MLS dots overlaid on panel (b) are not showing up well. These should be updated for better comparison. Perhaps a black circle filled in with the MLS value.

Figure 9 I wonder what this looks like when high latitudes and high SZAs are screened out. Does the quality change significantly?

Figure 10 Symbols are mixed up as noted by reviewer #2

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