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Interactive comment on "Impact of the Ozone Monitoring Instrument Row Anomaly on the Long-term Record of Aerosol Products" *by* Omar Torres et al.

Anonymous Referee #1

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The paper describes the characterization and correction of view-angle dependent OMI retrieval results of AOD, SSA, and UVAI. Particularly in view of the loss of data from certain OMI detector rows due to the so-called row anomaly, a dependence of retrieval results on view angle (or row number) causes biases in temporal and spatial averages. Torres and co-workers identified the spherical particle assumption to be the reason for the observed view-angle dependency of AOD and SSA retrieved over desert and were able to strongly decrease the bias by using phase functions more appropriate for mineral dust. The UVAI view-angle dependency was found to be mainly caused by the commonly used approximation of clouds as opaque LER surfaces. The UVAI bias over regions affected by clouds could be strongly reduced by adapting the UVAI algorithm

to incorporate a more realistic cloud parameterization.

This manuscript is in a very good condition: the results are impressive and well presented, and the conclusions are of importance to the scientific community, particularly to users of OMI data. My recommendation to the editor is to publish the manuscript as soon as the minor and technical comments below have been addressed in a satisfactory way.

Minor Comments

1. Several sentences are extremely long and hard to read (e.g., lines 7-10 on page 4). Please read through the manuscript critically and try to make the sentences shorter, thereby improving readability.

2. Please add one or two literature references to phase functions of small spherical particles (Mie Theory)

3. On page 4, line 9, you mention that "the angular variability of the scattering phase function of aerosols and clouds" is the "ultimate driver of the angular distribution of scattered radiation", but that is disregarding Rayleigh scattering, which is also very anisotropic. This is of course taken into account in your RT calculations and should not cause any trouble within your retrieval, which is probably why it is not mentioned here. But the statement as it is given here is inaccurate.

4. On page 5, starting from line 30, the calculation of new dust phase functions is described, but it is kept rather short. Please be more specific, e.g. by mentioning the assumed fraction of non-spherical particles. How realistic is the selected set of parameters? Regarding the results (particularly in Fig. 4), how representative are they, and what happens if you try different fractions of non-spherical particles? Or different shapes? It would be nice to see this analysis for different particle mixtures (like that shown for different SSA), and in the best case a plot with the range of retrieval errors found for all particle mixtures used by the retrieval algorithm.

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5. On page 6, lines 5-6, it says "Retrieval errors transition from overestimations to underestimations at about $155°$ scattering angle". But this is not the case for SSA = 0.97. Any thoughts on why this is so?

6. In the last paragraph of Section 5.3 (page 9), the improvement of the modified-Mie UVAI algorithm with respect to the old version is pointed out. However, the positive UVAI artefacts that appear in the Southern part of each orbit appear to have increased in the new version. Can you comment on that?

7. The modified-Mie UVAI algorithm varies from the SLER algorithm in more than one aspect. In keywords: cloud phase function, cloud opacity, cloud height, surface albedo. Although introducing a more appropriate cloud phase function intuitively seems to be responsible for the decrease in view-angle dependence, the other changes may also have an effect. Did you investigate that? Did you compare results from the MLER (as described in the appendix) to the Mie algorithm?

8. In Fig. 8, there is a large difference between the blue line at row number 20 and the red line at row number 0, although the scattering angle is nearly the same. Is this within the statistical error, or could there be another reason?

9. Please improve the readability of the appendix and add some references (e.g. to Herman et al., JGR 1997 / Torres et al., JGR 1998). The term on the right in eq. A-1 is only equivalent to the term in the middle if the calculated and measured radiances at lambda0 are equal. This requirement is mentioned later in the section, so I suggest to split the equations. It might be more useful to replace the description of the MLER algorithm by one of the Mie algorithm, as the MLER is not used in the presented study.

Technical Corrections

p.2, l.4 and 17 *global daily* — daily global

p.2, l.16 *row-anomaly* — row anomaly

p.2, l.18 *two-days* — two days

p.2, l.33 *making use of* — consisting of

p.3, l.23 *slow* — slowed

p.3, l.32-33 *no detection* — missing

p.4, l.3 *The NEUS region (...) representative* — The NEUS region (...) is representative

p.4, l.15 *using separately observations* — treating observations East and West of the nadir separately

p.4, l.18 *monthly average* — average monthly *or* monthly averaged

p.4, l.21 *minima* — minimal *or* minimum

p.4, l.21 *take place* — occur

p.4, l.24 *sulphate aerosols is the most commonly observed aerosol type.* — sulfate and secondary organic aerosols are most common.

p.4, l.26 *produce* — produces *or* provides

p.4, l.30 *region from February through September* — region, particularly from February through September

p.4, l.34 *are in good agreement with each other at the annual minima AOD values* — are in good agreement.

p.5, l.1 *Minima* — Smallest

p.5, l.20 *reproduce* — reproduces

p.5, l.22 Move the citation to the end of the sentence, after the term in brackets.

p.6, l.16 *aerosol models in the* — aerosol models as in the

p.6, l.18 *take place* — occur

p.8, l.14 Which water cloud model? C1?

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p.8, l.14 *wavelength-dependent refractive index* — Does the refractive index vary so much between lambda and lambda0 that you need to take the wavelength dependence into account?

p.8, l.15 *prescribed top and bottom levels* — What does this mean?

p.8, eq.(1) and following — Put some space between the equation and the equation number. It's confusing.

p.8, l.24-26 The treatment of surface albedo is also an important change.

p.9, l.22 *set* — sets

p.9, l.25 *actual angular scattering* — actual scattering

p.10, l.4 *were* — where

Fig. 6-8 UVAI is written UV-AI in the figures and the caption. In Figs. 6 and 7, the UVAI method is called LER-based, whereas in the text and in the appendix it is abbreviated SLER. Please be consistent.