RC1: 'Comment on amt-2024-13', Anonymous Referee #1

We highly appreciate your comments on our manuscript. We hope that you will find our responses and the corresponding revisions for the original manuscript satisfactory. Please find below your comments/suggestions (blue color) and our responses (red color).

The paper is suitable for AMT, and I recommend publishing after correcting web links and references as suggested in my technical recommendations below.

Technical suggestions:

44: *infrequently (typically several times a day) and do not capture the diurnal cycle*

There are now Geostationary aerosol measurements from NASA:

https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/applications/geoleo/

Done (lines 44-46)

72 add MFRSR SSA references:

Mok, et al., Comparisons of spectral aerosol absorption in Seoul, South Korea, *Atmos. Meas. Tech.*, https://doi.org/10.5194/amt-11-2295-2018 , 2018

Mok, et al., Impacts of atmospheric brown carbon on surface UV and ozone in the Amazon Basin, *Sci. Rep*., https://doi.org/10.1038/srep36940 , 2016

Corr, et al., Retrieval of aerosol single scattering albedo at ultraviolet wavelengths at the T1 site during MILAGRO (2009), *Atmos. Chem. Phys*., 9, 5813–5827, https://doi.org/10.5194/acp-9-5813-2009 , 2009

Krotkov, et al., Aerosol ultraviolet absorption experiment (2002 to 2004), part 2: absorption optical thickness, refractive index, and single scattering albedo, Opt. Eng., 44, 041005, https://doi.org/doi:10.1117/1.1886819 , 2005

Added (lines 74-78)

143:. Better to move to Figure 2 caption. Explain color bar units.

Good suggestion! Moved, and added description of colorbar within caption (lines 162-164).

Section 2.2:

Describe if tilt and misalignment corrections if applied, e.g.,

Mikhail D. Alexandrov, Peter Kiedron, Joseph J. Michalsky, Gary Hodges, Connor J. Flynn, and Andrew A. Lacis, "Optical depth measurements by shadow-band radiometers and their uncertainties," Appl. Opt. **46**, 8027-8038 (2007)

Thank you for the reference. We have not applied the tilt and misalignment corrections (now noted in lines 195-200) due to having been installed in a solid surface as opposed to ground susceptible to shifting.

In 2.2.5 give more details of the angular calibration and figure with the Lab optical setup and example of the measured cosine response at different wavelengths.

Done. New figure (Figure 3) and details have been added regarding the cosine correction (lines 186-193).

Describe corrections to the diffuse irradiance due to blockage of the forward scattered light by shadow-band (aureole correction), e.g.,

Min, Q., E. Joseph, and M. Duan (2004), Retrievals of thin cloud optical depth from a multifilter rotating shadowband radiometer, J. Geophys. Res., 109, D02201, doi:10.1029/2003JD003964.

Clarification (lines 83-86) and the corresponding references (Segal-Rosenheimer et al., 2013; Min et al, 2004; Norgren et al., 2022) have been added.

In 2.2.6 give a more detailed description of the non-linearity correction if this has not been published before or give a reference.

Done (lines 211-217).

Acknowledge that MFRSR DDR is biased for coarse aerosols (e.g., dust) and cirrus clouds, due to the blockage of the forward scattered aureole light as discussed in Min et al., JGR 2004

Done (lines 83-86).

170-175: Show lab setup and add figure with the lab measured angular response at different wavelengths.

New figure (Figure 3) shows response at different wavelengths as a function of incident angle.

179: Add figure which shows results of non-linearity testing or add reference.

Figure 4 shows the results of the non-linearity testing.

180-181: clarify this sentence: *To first order, the non-linearity of the direct irradiance measurement becomes incorporated in the cosine correction described above*

Clarified (lines 211-217).

Figure 4: Give units for Y-axis

Done, thank you!

231: Gaseous NO2 absorption becomes important for single scattering albedo retrievals at small AODs, e.g., Krotkov, et al (2005), Partitioning between aerosol and NO2 absorption in the UVA (https://doi.org/10.1117/12.615285)

Highlighted (lines 276-277).

235-236: Give proper references and correct URLs:For TOMS total ozone product: https://acd-ext.gsfc.nasa.gov/anonftp/toms/

TOMS Science Team (Unreleased), TOMS Nimbus-7 Total Column Ozone Daily L3 Global 1 deg x 1.25 deg Lat/Lon Grid V008, Greenbelt, MD, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed:

, https://disc.gsfc.nasa.gov/datacollection/TOMSN7L3dtoz_008.html

Done (lines 279-280).

For OMI total ozone product:

Pawan K. Bhartia (2012), OMI/Aura TOMS-Like Ozone and Radiative Cloud Fraction L3 1 day 0.25 degree x 0.25 degree V3, NASA Goddard Space Flight Center, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed , https://doi.org/10.5067/Aura/OMI/DATA3002

For OMI instrument: https://aura.gsfc.nasa.gov/omi.html

Done (lines 280-281).

Figure 7 and Tables 3,4: Explain significant differences in AOD comparisons at 1020nm during TRACER and EPCAPE.

Thank you for pointing that out! We had noticed this previously. However, we had not been able to identify this spectrometer degradation issue until recently. We have replaced the previous plots, which used the 1020 nm pixel from the degraded NIR spectrometer with new figures using the corresponding pixel from the UV/VIS spectrometer. Such replacement yields consistent agreement for all three campaigns. We attribute the previous disagreement at the TRACER and EPCAPE to degradation of the NIR spectrometer affecting its short wavelength range, but apparently leaving the 1.6 micron values unaffected.

Figure 8: Extend Y axis to show full range of DDR variability.

Done.