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Atmospheric Measurement Techniques Discussions

Interactive comment on "Optimal use of Prede POM sky radiometer for aerosol, water vapor, and ozone retrievals" *by* Rei Kudo et al.

Anonymous Referee #2

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The work of Kudo et al., is very important in the field of retrieving aerosol and trace gases properties from radiance measurements. A full method consisting of algorithms for these retrievals is presented for the first time and is evaluated using POM data. Results are validated by a closure study and by comparing in situ aircraft data from a campaign. Uncertainties are calculated and causes of errors are treated separately. In general, it is a very good manuscript that will be make an impact on future works. I suggest accepting it for publication after minor revisions.

In particular

A)My main concern is the SSR closure study presented briefly in 5.1.3 and it could be a separate manuscript on its own. I assume it includes only clear sky data (otherwise it would also need cloud properties). I think it would be more useful to present also

some results using V42 V5, in order to convince that the results of the new method are closer to actual conditions. Also, since aerosols (and o3, PWV) accounts for a small part of the variability of Global Irradiance, I suggest presenting not the absolute values, but the differences from measured irradiances. There is a huge potential discussion here, about which how different properties affect the components of SSR, which might be a bit out of the scope of this study. But I think a wider discussion should be reserved for this study, since it is important and complex and not presented in such a brief. B) A general comment is that the discussion on the results and the corresponding figures/tables is very brief. I think an effort should be made to deepen a little the discussion for all figures 6-14 C)Since the use of PP data is a main advantage of the method, I would like to read a small discussion about the suggested measuring schedule of a photometer (regarding PP and ALM , zenith angle and measuring frequency) in respect to the estimated uncertainties, in order to best the exploit method.

L55 in the world⇒around the world L77 please rephrase, for example "low altitude sites" L158 Some details regarding the calibration of pyranometers should be provided. How close to a calibration are the months used in the study? F Section 3.1.2 is mainly discussing and explaining the terms of equation 4. I think it is more reasonable to have the equation and the discussion in the same section. I recommend reorganizing a bit the way the text is separated to sections here. L201 We gave the value→ we assumed or employed the value L209 These unnatural oscillations should be discussed and explained or at least provide some literature examples for them. L339 This means 8.3% of the simulations are rejected. I think these simulations should also be included in the error analysis, since they should reduce the quality of the algorithm. I understand it is difficult to quantify, if there is no output, but It is misleading to ignore such a number of runs, which I understand is expected at this frequency in operational runs. Figure 1 and corresponding discussion. SSA is a parameter that has values up to 1, and variations in the scale of 0.03-0.05 could change the nature (absorbing) of aerosols. Differences up to 0.5-0.6 are unreasonable and should be filtered out by some QC algorithm (these are SSA values of 0.2 or 0.3). Probably you should implement this

plot to a zoomed one in the reasonable range. Still the thickness of the main cloud of data seems to wide to have a robust retrieval, and it doesn't seem to get narrower at higher SZA or AOD (at least from what I can see at this scale). For AOD<0.2 the errors are higher. Differences for shown in table 3 are too high for water soluble aerosols. Probably an acceptable approach could be to ignore SSA retrievals for very low AOD. Finally, I cannot understand why for the lower uncertainties are in the UV region and not in the visible.

L365. After the discussion about the advantage of this method In retrieving bigger particles, I don't understand why this analysis is not up to 30μm. L390 even for PWV and TO3. I assume this means even for these retrievals. Please restate to be clear. Figure 8 The caption should be rewritten in a clearer way. Figure 10: It seems that MRIv2 retrieves lower SSA even for high AOD, at all wavelengths above 500nm, compared to both V42 and V5. I strongly suggest narrowing the axis range, because all the info is concentrated in the upper right corner and it cannot be seen.

Figure 14: No units for both x and y axis. L 565 giant particles. Since you refer to particles up to 100μm and even retrieve SD up to 30μm, It does not add up to name the 10μm particles as giants. L569-574 It seems that the fact that AOD was 1/3 compared to 16 August could explain a big part of the inconsistencies with the in situ measurements. Figure A2, please express the complex number with same number of significant digits.

Please also note the supplement to this comment:
https://amt.copernicus.org/preprints/amt-2020-486/amt-2020-486-RC3-supplement.pdf

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