

Interactive comment on “Effects of clouds on the UV Absorbing Aerosol Index from TROPOMI” by Maurits L. Kooreman et al.

Anonymous Referee #1

Received and published: 29 May 2020

General comments: This manuscript presents a generally well written study on the effect of clouds on the UV AAI. The presented structural features can be also found on next generation satellite instruments such as Sentinel-4, GEMS, TEMPO. Therefore, I recommend this study for publication in AMT after minor revisions.

Specific comments: Line 24-26: Please provide some references.

Line 41: Please provide some references.

Line 55: I recommend to add one more simple sentence related to physical meaning of using positive AAI for ALH retrieval. For example, only for scenes with a positive AAI value, the ALH retrieval is performed because AAI gets positive for high AOD and absorbing aerosols. For low AOD and scattering aerosols, the TOA reflectance

C1

sensitivity to ALH gets lower.

Line 74: Please add degree symbol here.

Line 76: As I know, there are two products of UVAI in the TROPOMI. One is 354/388, and the another is 340/380. Are there specific reason for choosing 340/380? For the heritage of GOME?

Line 77: Please provide this QA value meaning.

Line 77: I think the word ‘Scene albedo’ is very important and key word in this manuscript. Scene albedo in this study means, ‘Lambertian Equivalent Reflectivity (LER)’ or ‘Rayleigh Corrected Reflectance (RCR)’ in general. But the author probably did not use the ‘LER’ expression and using ‘Scene albedo’ because there is a Lambertian assumption for LER. I recommend to add clear physical meaning for ‘Scene albedo’, for example, as an expression for Rayleigh corrected reflectance in section 3.1 (or at some appropriate location).

Line 81: ‘values. An’ → ‘values. An’

Line 138: Please add additional explanation about exact position. “intersection of scanline 3600 and ground pixel 0, scanline 600 and ground pixel 0”.

Fig4: Could you please change the figure with higher resolution, or make the character bigger?

Line 142: It is not defined. Please describe as scene albedo.

Line 144: Could you please add exact place of scanline and ground pixel for each case? Other readers may not understand this clearly.

Line 159: I recommend to describe the following sentence, otherwise it could mislead the reader. “The effect of aerosol on the backscattered radiation in the near-UV (320-400 nm), where the ozone absorption is weak and does not affect the interaction between the aerosols and the molecular atmosphere.”

C2

Fig12-14: Have you ever seen these effect as a function of mean cloud fraction? The author has explained BRDF effect through the manuscript (e.g., Line 199, Line 202, Fig.6, Discussion part), and also mentioned at Line 199 that 'much smaller Rayleigh optical thickness, and causes a strong impact of surface BRDF on the TOA reflectance'. But, I guess the relative portion of surface reflectance from TOA reflectance might be still small at 340 nm and 380 nm especially for the clear sky vegetation (land) region, so that we could assume $BRF = LER$ at those two wavelengths (usually over land). Actually this study are investigated over the Pacific area, so if the LCM, SCM model work well for the small cloud fraction region over Pacific ocean, that could be due to bright ocean surface reflectance. In general, the surface reflectance over ocean would be bright compared to the land surface reflectance due to water-leaving radiance (including the effect of chlorophyll, CDOM) at 340, and 380 nm.

Fig 10: Please add (a), (b) on the figure and caption.

Fig 10: Also, there are many Surface Albedo (A_s) terms in this thesis, so little bit confusing. So In this Fig 10. the x-axis Surface Albedo +0.05(left) or + 0.9(right) corresponds to Surface Albedo in left term of equation (6), or equivalent to Surface Albedo in left term of equation (5), right? And, the x-axis Surface Albedo is actually, $d(\text{Surface Albedo})$ or $\Delta(\text{Surface Albedo})$, right?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-112, 2020.