

Interactive comment on “Modelled and measured effects of clouds on UV Aerosol Indices on a local, regional, and global scale” by M. Penning de Vries and T. Wagner

Anonymous Referee #1

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General comments

The authors simulated the effect of clouds on the UV Aerosol index using MERIS and SCIAMACHY data. The method could be interesting for the study of effect of clouds on aerosols. The authors mainly discussed the negative part of the UV aerosol index, which is not so popular for readers. It might be good to emphasize the differences between the UVAI used here and the positive part used to detect absorbing aerosols. As I understand the authors try to use UVAI quantitatively, it would be nice to see some examples, especially the negative UVAI.

Specific comments

C10730

Page 24137, line 20 'If aerosol radiative effects are to be quantified on a global scale, both ...' What aerosol radiative effects do you mean here? How to calculate aerosol radiative effects using aerosol index? Do you mean the effect of aerosols on the radiative fluxes, the radiative forcing of aerosols?

Page 24138, line 1 "The quantitative interpretation of UVAI is not straightforward ..." Why do you want to use UVAI quantitatively? SSA can be derived from smoke particles, is it possible to derive SSA for the scattering aerosols from UVAI?

Page 24138, line 14 "Much less known is the fact (2)..." Is it (2) or (3)? What is the effect if the clouds and aerosols are mixed? Could you explain more about (2)?

Page 24138, line 24 - 25. What UVAI do you get after the correction, subtracting the cloud UVAI from UVAI? Is the corrected UVAI equal to the clear UVAI?

Page 24139, line 2-3 "information on cloud heterogeneity" It is not clear to me. Do you mean the 3D structure of the clouds?

Page 24139, line 13-15 The UVAI sensitive to aerosols is because of less Rayleigh scatter event? Why not to explain aerosol and Rayleigh scattering have different wavelength dependence and the scattering phase matrix of aerosol particles and air molecules are different? If the aerosols is close to the surface it will not shield the underlying atmosphere.

Page 24140, line 26-27 'SCIAMACHY was developed to by use of ... (DOAS)? Could you reformat this sentence? Although many DOAS algorithms are used in SCIAMACHY product, SCIAMACHY is more than a DOAS instrument.

Page 24141, line 4 'The feature that make SCIAMACHY unique is the limb-nadir matching ...'. Could you reformat this sentence? Normally people understand that SCIAMACHY has limb and nadir observation mode. If you say 'limn-nadir matching' it feels like more emphasized on the matching but not limb or nadir measurements themselves.

Page 24141, line 25 'visible wavelength range'? Do you mean UV wavelength range

C10731

or visible? Why do you use H-G phase function? How difference is the H-G phase function compare to phase function for ice clouds particles? How can you know the clouds are water, ice or mixed phase? Change 'Henye-Greenstein parameterization' to 'Henye-Greenstein scattering phase function parameterization', also for the texts later in the paper.

Page 24142, line 8-12? Do you need to mention cloud droplet size?

Page 24142, line 24-25 What do you mean 'homogeneous and heterogeneous clouds'? From your example it seems that the cloud algorithm cannot distinguish cloud fraction and cloud albedo.

Page 24143, line 4-5? '...determined by the sub-pixel structure..?' What is the sub-pixel structure of the cloud? Do you use the sub-pixel structure in your correction for UVAI?

Page 24143, line 13 '...UVAI does not depend strongly on cloud altitude' Could you give some numbers here? How strong is the UVAI dependence on cloud altitude? What is the surface albedo used in your calculations in Fig. 1?

Page 24143-24144 Could you refer to 'Fig. 1(a)' instead of 'left panel in Fig. 1'? Please change it for all the figures in the page. Fig. 1b Why do you use effective cloud fraction for 'thick clouds' instead of 'thin clouds'? Are they the same values? Is the UVAI actually cloudUVAI? Could you specify in the caption of the figures what results instead of 'Results from...'? Please clarify UVAI and cloudUVAI in the texts.

In Fig. 1 The thin and thick cloud type are not important for C_{Eff} larger than 0.7 which means in reality the thin or thick cloud type assumption is important. How many percentage of the clouds with C_{Eff} larger than 0.7?

Page 24144, line 8 Change 'Figure 2' to 'Fig. 2' Can you add the lines in Fig. 1(a) to Fig. 2 to make the comparison more clear?

Page 24145, line 11 – 19 In your simulation you use positive and negative viewing
C10732

angle. Is it better to explain the east-west bias as relative azimuth dependence? Have you looked the UVAI dependence on the scattering angle?

'The scatter on the curve in Fig. 3b is caused by ...'. Why are there small errors in the calculated cloud reflectances? How accurate is SCIATRAN for these calculations? The scatter in Fig 3b might indicate that the simulations are not stable. Why does it not happen in Fig. 3a? Have you used enough 'streams' or 'quadrature angles' in the simulations.

Fig. 3 caption, please move '(a)' in front of 'Viewing geometry is nadir', because viewing angles are changing in Fig. 3b. The symbol in Fig. 3b should be 'triangle' according to the caption, but 'circle' is used.

Page 24145, line 24 'The LUT of cloudUVAI contain ...', please also add relative azimuth angle. Do you have surface albedo in the LUT? How about O3 absorption?

Page 24146, line 3 '...compared to UVAI measured by SCIAMACHY'. UVAI cannot be measured. Please reformat this sentence.

Page 24147, line 6 Change 'unclouded pixel' to cloud-free pixel

Page 24147, line 9 Can you give the UVAI values?

Page 24148, line 1-4 Have you tried other cloud models or RT models in the simulations? What are the possible calibration problems? Can you do some stimulation including the calibration errors? It could be interesting to see the effects on cloudUVAI due to different calibration errors.

Page 24149, line 15 How do you explain the small variability in the simulated UVAI? What parameters could impact the simulated UVAI values?

Page 24150, line 13 Fig. 8-9, the labels for the figures are wrong. Change Fig. 8 A2-F2, A3-F3 to A1-F1, A2-F2. Also change the labels in Fig. 9

Page 24152, line 25 '... the clouds cause significant UVAI'. What is significant UVAI?

Page 24153, line 3-6 Does the aerosol and clouds information have the same resolution? It seems that your aerosols information has higher resolution than clouds.

Page 24153, line 10-12 Why the thick cloud assumption is better than the thin cloud assumption?

Page 24152, line 7 How can you know the phase function for a specific cloud?

Fig. 5. caption change (G, F) to (G) (F). change '(for the thin clouds)' to '(for thick clouds)'

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C10734