

Interactive comment on “UV aerosol indices from SCIAMACHY: introducing the SCattering Index (SCI)” by M. Penning de Vries et al.

Anonymous Referee #2

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General

This paper presents an analysis of the negative part of the UV residue – called scattering index, SCI, in this paper –, and tries to find a correlation with scattering aerosols.

The UV residue is obtained from a pair of UV reflectance measurements by subtracting the Rayleigh reflectance. This method was initiated by the TOMS team for ozone correction, and has been used already for more than 10 years to study absorbing aerosols, like desert dust, smoke, and volcanic aerosols. These types of aerosols give positive residues. With the launch of new UV satellite spectrometers (GOME, SCIAMACHY, OMI, GOME-2) the UV residue has become more or less a standard product, and remains a powerful indicator of absorbing aerosol plumes.

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This paper addresses the negative part of the residue, which has been discarded by most earlier studies, because of the influence of clouds. The positive point of the paper is that it tries to find information on scattering aerosols in the negative residue, despite of the problem of clouds. This reviewer likes the idea of the authors to look into this issue and appreciates their effort to investigate which aerosol information might be hidden in the negative residue. However, the proof-of-concept given in the paper is quite weak. The influence of clouds should be shown with more simulations and more validation with Aeronet stations is needed.

Several comments are given below, which should be addressed satisfactorily before the paper could be accepted.

Comment 1:

Since it was already known from earlier studies (referenced in the paper) that the negative residue (or SCI) is a cloud-dominated quantity, more simulation results on the effect of clouds on the SCI are needed. Therefore, Sect. 3, which deals with the sensitivity of the UV residue but only discusses the effect of aerosols, needs extension with the sensitivity of the UV residue to clouds. This information is now given at the end of the paper, in Sect. 7 with the important Fig. 6, but that is too late: this information is needed earlier, especially in the discussion of Figs. 2 and 3. Figure 6 shows that cirrus clouds could be the cause of the negative residue, which is important information. So, Sect. 7 should be moved to Sect. 3 (which will also avoid the frequent forward references to sect. 7).

The sensitivity to clouds should be extended with more cloud types: please vary also the asymmetry parameter g , the solar geometry, and the (effective) cloud fraction. For g , typical cirrus cloud values should be used. The current choice of geometry (SZA=20 deg.) is an exceptional geometry for SCIAMACHY, only applicable to the tropics. Cirrus clouds have small effective cloud fractions.

Comment 2:

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The SCI is not a new quantity, as suggested by l. 6 on p. 13574, or l. 11 on p. 13576. It is simply the negative part of the residue, as demonstrated by Eq. 3. The residue is a term already in use for more than 10 years, and has been used for TOMS, GOME, SCIAMACHY, OMI, and GOME-2. Values of the residue, positive and negative, are operationally being provided from these instruments by operational data processing centers. Therefore, a new term “SCI” is not needed, and only confuses the literature.

Comment 3:

Similarly, the term “UV Aerosol Indices”, introduced below Eq. (3), is not needed, since it is identical to the term residue, which is also used in the paper. Please refrain from using multiple terms for the same quantity. Please note that the negative residue is dominated by clouds, not by aerosols. This is unlike the positive part of the residue, which is dominated by aerosols.

Comment 4:

The relation of the SCI to the residue should be discussed in the introduction.

Comment 5:

In the regions where according to the authors the SCI indicates scattering aerosols (“hot spots”), there should be a comparison to at least one, but preferably more Aeronet stations. This holds for the list of regions mentioned on p. 13576, l. 12-14. Especially in Asia there should be several comparisons. Currently, there is only a comparison to sites in SouthEast USA with scattering aerosols. This evidence is too weak.

Comment 6:

Sect. 3: please indicate which s.s. albedo values belong to which aerosol types.

Comment 7:

Abstract: the last paragraph should be removed, because this combination is not shown in this paper. It could only be used in an outlook.

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Comment 8:

Why not use the altitude of the scattering particles, as follows e.g. from the SCIAMACHY O2 A-band, to separate aerosols from clouds?

Comment 9:

In the abstract and in later sections (e.g. sect. 5, 7 and 8), the term “scattering aerosols” is used, with scattering in quotation marks. This looks as if there is something strange with the scattering process of these aerosols. But this is not the case. Furthermore, this notation is not used for absorbing aerosols. Please remove the quotation marks, and clearly define in the beginning what you mean with scattering aerosols and with absorbing aerosols. The definition given on p. 13578, l. 14-15 should be moved to an earlier section.

Smaller and textual comments:

- De Graaf et al., 2006 > De Graaf et al., 2007 (two times)

- p. 13571:

l. 5: time scales > periods

l. 25: 2006 > 2007

l. 25: Aerosol Indices > the AAI

- p. 13572:

l. 16: add reference to De Graaf et al., 2007.

- p. 13575:

l. 17: *the* solar zenith angle

l. 22: “may not be simply summed...”: was this degradation correction already applied to the data in Fig. 2?

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- p. 13576:

l. 9: add "see the TEMIS website <http://...>"

l. 11: "The SCI have not been shown ...before". This is not correct, because the (negative and positive) residue is shown in operational data products. Please remove sentence.

l. 27 ff.: also in the cloud-filtered data of Fig. 3 there are several effects not related to aerosols, like the large-scale patterns over the ocean, probably related to ocean color.

- p. 13577:

l. 21: backed > supported

l. 25: four square degrees: do you mean 2x2 degrees? That would be clearer.

- p. 13579:

l. 7: upwards > upward

l. 14: which AOT corresponds to a HICRU cloud fraction of 5 % ? This would be important to know for the reader.

- p. 13580:

l. 7: the fact that thin clouds produce a negative residue, according to Figure 6, suggests that cirrus instead of aerosols could be the reason of the SCI in Fig. 3. Could this explain the SCI over Indonesia?

l. 18: "the SCI... can nevertheless be used": please be more cautious in the formulation, depending on the proof shown in the paper. You should also mention that clouds are a strong contributor to the SCI, so that cloud detection is an essential element of the interpretation of the negative residue.

- p. 13581:

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l. 5: the residue is already being provided operationally for OMI and GOME-2.

l. 7-8: this is very vague. Please be more precise or remove.

- Fig. 2 and Fig. 3: please make the legend clearer regarding the minus signs of the residue.

- Please show the validation sites also on the map in Fig. 3.

- Please explain the term "effective cloud fraction" in Fig. 6.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 13569, 2009.

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