Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
https://doi.org/10.5194/amt-2021-17-RC1, 2021

Comment on amt-2021-17

Anonymous Referee #2

Referee comment on "Rethinking the correction for absorbing aerosols in the OMI- and TROPOMI-like surface UV algorithms" by Antti Arola et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-17-RC1, 2021

Review of the paper "Rethinking the correction for absorbing aerosols in the satellite-based surface UV products" by Antti Arola et al.

The manuscript introduces a simple way to improve the aerosol effect accuracy into the satellite-based surface UV products, and more specifically to the OMI and TROPOMI UV algorithms. The innovation relies on the solar zenith angle and the non-linearity incorporation into the new aerosol absorption correction scheme. The proposed correction and the whole approach will be useful for the related community, since it will make the direct UV satellite retrievals more reliable under cloudless conditions.

General comments:

The title of the paper has to address the specific satellites that this correction is valid. In the current form implies that is can be applied to all UV-related satellites.

The authors mention the UV absorbing aerosol index (UVAI) and the aerosol absorption optical depth (AAOD) but in the analysis the focus is limited to the AAOD. A brief description of both and a related sensitivity analysis followed by the corresponding references could be added in the introduction.

The potential impact of the new correction was tested against the current correction for the OMI and TROPOMI UV algorithm in terms of global fields of climatological AAOD showing a difference of ±5%. This difference seems low but it is not for the UV impacts on human health. A small paragraph of the real impact of this ±5% has to be added in the conclusions section.

The whole analysis is based on the existing AAOD climatology since this is the way that OMI represents the aerosol absorption effect. However, a more generalized result and conclusion will be of value for the UV community in order to quantify the limitations and gaps of the current and the proposed correction and ideally to describe which is the optimum representation approach of the absorbing aerosol loads.

Is this study intended to upgrade only the OMI approach or targets to a more general UV estimation improvement that applies to more instruments and techniques? In the conclusions section a paragraph about the necessity for a more generalized approach for all UV satellite instruments could be added in order to strengthen the innovation of this publication and to mention the need for new ones in this field.

Corrections:

Line 35: Add a reference.

Line 38: The continuous global monitoring without time gaps requires geostationary satellites and a harmonization between their retrievals and their implicit radiative transfer and correction schemes.

Lines 52-54: Needs a connection also with other spectrometers, e.g. OMPS and GOME-2.

Line 59: The LER was first mentioned in the Abstract, so no need to repeat the full name.

Line 60: Add a reference.

Lines 62-63: This is a repetition from the Abstract. You can analyze more here with the corresponding references.

Lines 87 and 91: Probably you have to change the abbreviation of the scattering aerosol optical depth in order to avoid confusion with the cloud optical depth (or rename the later into cloud optical thickness).

Lines 96 and 98: The AAOD abbreviation was first introduced into the Abstract, so no need to repeat the full name.

Line 101: A comparison under a variety of conditions and exceptions has to be mentioned here and studied in this or in a next publication in order the new correction to provide a tangible improvement to the updated UV retrievals.

Lines 106-107: A list of abbreviations could be helpful for the readers.

Lines 109-110: Introduce the abbreviation of solar zenith angle in the Abstract.

Line 114: Add a reference.

Line 139: Add a reference.

Line 142: Add a reference.

Lines 142-146: This description could be supported by a flowchart plot, since it forms the base for the proposed new correction.

Line 151: Why only water clouds?

Line 152: Add a brief quantified value for the mentioned minor influence.

Line 153: Keep only the SZA and remove the full name.

Lines 154-155: Is the simulated cloud layer representative globally or needs a "rethinking" next years in order to provide more accurate results across the globe climatologically? Is this factor secondary to the overall UV estimation levels or to the focus of this study into the aerosol uncertainty? A brief description of the parameters that affect the UV and the corresponding order of magnitude of the impact could be added in this paragraph or in the last paragraph before the conclusions section (i.e. lines 238-245).

Lines 159-162: Needs more discussion.

Line 169: Add a reference.

Lines 169-170: Is this a critical assumption and which is the impact into the global scale in terms of percentage of potential similar cases? A literature analysis could be helpful.

Lines 172-173: Add a reference and some relevant numbers.

Lines 178-180: Provide a number about the current over-correction (under-correction) and the expected improvement with the new correction.

Line 198: Is it possible to add the expected difference in the calculation time? The addition of the SZA and the AAOD dependencies could result a more complicated calculation scheme in terms of calculation time (but still simple as a formula).

Line 204-205: Can you add a sensitivity plot for the constants (as a supplement material)?

Line 232: The additional maps can be added as well into a supplement document. It will be interesting for the readers to see the correction differences during all months.