Response to the Reviewers' Comments

Concerning manuscript amt-2017-210, *"The TROPOMI surface UV algorithm"* by Anders V. Lindfors et al.

We have received the comments on our manuscript by two reviewers. We thank the reviewers for their constructive comments. We have considered these comments in regards of our revised manuscript. Below, we detail the comments by the reviewers together with our response to them.

Reviewer #1

Reviewer #1 indicates in a general remark that our manuscript is important and should be published after minor changes.

General Comment: *"My main suggestion is to also include a short paragraph summarizing the difference between the UV algorithm currently used for the processing of OMI observations and the new algorithm to be used for TROPOMI."*

Reply: We have added such a paragraph, P4/L6-12 in the revised manuscript.

Comment #1: *P2, L5: Include reference for Montreal Protocol*

Reply: Added reference as suggested.

Comment #2: *P6, L14-18. Much of the information on total ozone is common knowledge (at least for readers interested in the paper) and could be removed. Also the following subsections on albedo, aerosols, and altitude could be reduced in lengths.*

Reply: It is true that much of this is common knowledge to readers with background in UV radiation and ozone science. However, we see that potential readers of this paper go beyond that community, including users of the satellite UV product, which may have a variety of backgrounds and thus are not necessarily familiar with this subject area. Therefore, we think this information could be useful for some readers and hence have chosen to include some detail on the different factors having an influence on solar UV radiation reaching the surface. In this respect, we have chosen not make any changes to the revised manuscript.

Comment #3: *P7, L26. High latitude profiles are quite different for the northern and southern hemispheres. Are different profiles being used for the two regions in the algorithm?*

Reply: The TOMS V7 profile climatology does not depend on hemisphere. According to Wellemeyer et al. (1997), it would be an unwarranted complication to include a small hemispheric asymmetry in the climatology. It is worthwhile pointing out, however, that the profile climatology depends on total ozone column and hence there is some indirect dependence on hemisphere at high latitudes (see Wellemeyer et al. for details).

Comment #4: *P8, L2. "AI" in "taken from the TROPOMI AI L2 output" presumably stands for Aerosol Index. It is a bit surprising that cloud optical depth is estimated from the Aerosol Index. Please clarify.*

Reply: The cloud optical depth is estimated based on the reflectance at 354 nm (R354). R354 is used also for calculating the Aerosol Index, which is why it happens to be included in the L2 AI product, which is consequentially used as input to the UV algorithm. We have made small changes to the text here to better reflect this background.

Comment #5: *P8, L12. I don't understand "flat-top response curve with a half-gaussian with a Half-Width-Half-Maximum". Please simply!*

Reply: It is a bit unclear what the reviewer is suggesting here ("Please simply!"): perhaps simply remove this part? The sentence aims to explain what kind of slit function (spectral response) is used when simulating the reflectance at 354 nm in our radiative transfer calculations. This may be a bit of a detail, but for completeness we would like to have this information included in the text. In an attempt to make the text more understandable, we have changed the sentence to: "…combined spectral response of these 5 consecutive pixels are represented by a 0.88 nm wide (corresponding to 5 pixels 0.22 nm apart), flat-top slit function with a half-gaussian with a Half-Width-Half- Maximum of 0.27 nm at each end."

Comment #6: *P9, L9. Please describe how values in the look up tables are interpolated (e.g., linear, spline, etc.)*

Reply: LUT interpolation is performed using polynomial (Lagrangian) interpolation in multidimensional space, choosing 4 points from the surrounding space if available (resulting in 3rd degree polynomial interpolation). If the wanted point is closer to the boundary of the LUT, then 3 closest points are chosen (resulting in 2^{nd} degree polynomial interpolation), while for points outside the LUT space 2 points are used (resulting in linear extrapolation). This information has been added to the revised manuscript.

Comment #7: *P12, L2. Regarding "For the UV irradiances at selected wavelengths (i.e, 305, 310, 324, and 380 nm), we apply a wavelength-specific aerosol correction." Does the aerosol climatology by Kinne mentioned earlier provide aerosol properties at these wavelengths, and if not, how is the climatology interpolated and extrapolated to these wavelengths?*

Reply: Kinne's aerosol climatology utilized for the aerosol correction includes wavelengths from the UV all the way into the infrared. For the TROPOMI aerosol correction, we have used the following wavelengths: 290, 315, 345, and 380 nm. The AOD and SSA data have then been linearly interpolated to the wavelengths required by the UV algorithm, that is, 305, 310, 324, and 380 nm. Information on this has been added to the revised manuscript.

Comment #8: *Figure 5: Please indicate the time of the satellite overpass in these figures.*

Reply: The satellite overpass UVI (and its time) is now included in the figure.

Comment #9: *P9, L23: I don't understand "a measure of the effectiveness of radiation as regards a specific effect". Please reword.*

Reply: Rephrased to "In order to quantify the effectiveness of radiation with respect to a specific effect"

Comment #10: *P11, L9 "valid the whole day" > "valid for the whole day"*

Reply: Changed as suggested.