Atmos. Meas. Tech. Discuss., 8, C2749–C2752, 2015
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Atmospheric Measurement Techniques Discussions

Interactive comment on "Operational surface UV radiation product from GOME-2 and AVHRR/3 data" *by* J. Kujanpää and N. Kalakoski

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Received and published: 28 August 2015

We would like to thank the Referee #1 for the review and for the suggestions to improve the paper. We respond to each of the review comments below. For the sake of clarity, the review comments are given in italics whereas our response is printed in normal font.

The paper deals with the description of the operational UV product of GOME-2. Although the reviewer thinks this paper should be published it must be improved on several items, mostly textual. Generally, the paper is a bit too long. This holds especially for: Abstract and introduction Paragraph 2.4. This paragraph can either be omitted or summarized to a few lines. Figure 3 in this paragraph is not used to discuss

matters, it just present old results that are well known.

The introductory Paragraph 2.4. explains the product contents in full detail while Figure 3 gives an overview of the wavelength regions involved with the product quantities. It is important to define precisely what the product contains (see next comment and response), and therefore we would like to keep the Paragraph 2.4. Abstract is a compulsory item and therefore, we disagree to remove it from the paper.

On the other hand, the authors could explain more precisely - what the UV radiation product is. Since a comparison is made with UV-index measurements, it is likely that the product involves irradiance and not an actinic flux or something else.

The introductory Paragraph 2.4. and the associated Table 1 describe the product contents in full detail.

Please clarify - what is meant with cloud optical depth? It is most likely the optical depth that describes the attenuation of unscattered radiation following Lambert Beer law. However, the cloud optical depth and UV irradiance at the ground or TOA are not trivially linked. (Paragraph 3.2 3.3). Some extra discussion on this could be helpful.

Clarified in the beginning of Sect. 3.2. as: The attenuation of radiation through the homogenous cloud layer in our model is described by cloud optical depth τ_c, following the Lambert-Beer law.

Figure 4. Plotting derivatives, and in the same figure, is not helpful. The curvature of the reflectance is not that complicated. What is rather puzzling is the large influence of the surface albedo on the reflectance for large cloud optical depth. At an optical depth of 100, the difference between a ground albedo of 0 and 0.6 is not

noticeable, but going to a=1 the reflectance jumps to approximately 0.95. This could be due only to the rather coarse grid used to create this plot (both in steps albedo and cloud optical thickness). A better plot on a higher resolution grid (additional steps between a=0.6 and a =1) should clarify this. Figure 5 Same applies.The title above figure 4 is a bit obscure "Metop-A ch.1: $\theta_0 = 40$, $\theta = 40$, $\Delta\phi = 120$, $P_s = 1.0$, $\tau_a = 0.0$, M325", same applies to figure 5. The authors should better explain the used parameters for their calculation. τ_a =0.0 implies not absorption. That rather contradicts Fig. 2 where absorption in the Chappuis band is explicitly mentioned. Do the authors suddenly neglect absorption, or does $\tau_a = 0.0$" refer to something else?

We agree that readers with a strong mathematical background can imagine how the derivatives behave. However, we expect readers with a background on biology and health sciences who might not be used to derivatives and therefore would like to keep the plots of derivatives. We also agree that the albedo step from 0.6 to 1 is large, but the plots are done using the surface albedo nodes of the cloud optical depth look-up table (Table 2) to indicate the spacing used. Furthermore, the $A_s = 1$ values are mainly to show the problems at this extreme albedo and a detailed analysis is out of the scope of this paper. τ_a refers to aerosol optical depth, and the plot refers to the look-up table node with no aerosol absorption. We added a column explaining the symbols to Tables 2 and 3 and refer to these in captions of Figures 4 and 5.

Table 2 Aerosol optical depth: an indication of the wavelength at which the used num- bers apply is lacking

We agree and added the wavelength of the aerosol optical depth (550 nm) to the Tables 2 and 3.

Figure 7 How can there be zero overpasses per day in (local) winter for a polar orbiting satellite? The authors probably mean something else like useful readings

per day to obtain a cloud optical depth or something the like. In addition, the authors should comment on the asymmetry of this figure, i.e. the difference in shape of the red+ orange coloured area for the North and South hemisphere.

We agree that our terminology is somewhat misleading here and satellites do not stop flying in the winter. Our term “overpass” referred implicitly to a useful overpass. We now use: “average number of cloud observations per day” in the figure caption and the associated text. To explain the asymmetry we added the following sentences to the caption of the figure: In the Antarctic region, the number of successful cloud observations is reduced due to high surface albedo. During the quality control, the cloud observations over highly reflecting surfaces are ignored and clear-sky conditions are assumed (see Sect.4.2.3.).

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4537, 2015.