

## **Here are my comments concerning the publication to ACP**

**line 9: you have to explain what exactly you mean smoothness. What is the algorithm?**

Answer:

An explanation of the algorithm is contained in the current version of the manuscript, P4, L20-24:

“Cloudless-sky conditions are identified using a two step algorithm. The first step is a preliminary search for such days using the criterion: the solar UV irradiance derivative with solar zenith angle is negative. In the next step, the smoothness of the time series for the day which fulfilled the first criterion, is examined, i.e. the bell-shape of the UV time series must be identified. There is no strict mathematical criterion applied here, but rather an intuitive inspection of the time series shape.”.

**Figures 1 and 2. How much stray light issues mentioned before in the text affect the ratio especially on low elevation (winter) and cloudy (low signal) conditions?**

Answer:

We take into consideration only doses around local noon, when the effect of stray light on instruments is the weakest, thus we assume that it does not have a significant influence on the ratio.

**Why a 6h cloudless period with the model when you measure 3h with the BS?**

Answer:

In the revised manuscript, this discrepancy was removed. We did not simulate the ratio between doses, but the ratio between irradiances for a fixed SZA or time. Please, see the section 3.3.

**analysis: 1. The real day to day AOD has to be used in order to quantify the real AOD effect 2. A sensitivity study has to be included in order to specify the effect of ozone variability within the 6 hour period to the model results 3. Using the same TOC for the two locations the solar zenith angle effect of the 60 km distance on erythemal dose can be exactly quantified with the model help. 4. Figure 3 TOC differ within 5 % which can be  $\pm 15$  DU. This can not be considered negligible. 5. There is a clear solar zenith angle dependence on the ratios in the order of 5% (for all albedos) probably related with the solar zenith angle differences 6. A 6 to 12 % albedo in the UV without snow. Is there any publication or theoretical document to support this?**

Answer:

The revised manuscript contains a new section 3.3, where these problems were explained taking into account the Editor's suggestions. The albedo values are based on the reports of Castro et al. (2001). The reference is used in the text (P8, L11): Castro, T., Mar, B., Longoria, R., Ruiz-Suárez, L. G., and Morales, L.: Surface albedo measurements in Mexico City metropolitan area. *Atmósfera*, 14(2), 69-74, [http://www.scielo.org.mx/scielo.php?script=sci\\_arttext&pid=S0187-62362001000200002&lng=es&tlng=en](http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0187-62362001000200002&lng=es&tlng=en), 2001.

**AOD from cimel you have to specify the wavelength and the level (1.5 or 2 ) of data used and also to mention that Cimel SSA is measured at the visible region and you have assumed that it can be extrapolated to the UVB. In addition there is no documentation for the uncertainties of CIMEL SSA for AOD <0.4 so since you are using it you should comment on this.**

Answer:

In the revised manuscript, we do not use AOD from CIMEL, but AOD from measurements with MODIS at 550 nm. Measured values of AOD were used in simulations with LibRadtran, where the type of aerosol was selected to rural. As for SSA, we included this information in the text, P5, L6-12:

“Other input parameters are constants representing typical values used in the UV modelling, e.g. albedo of 0.03 for rural surfaces and SSA=0.92, which is a mean value measured by the CIMEL sunphotometer at Belsk (level 1.5 from AERONET – Aerosol Robotic Network) at 440 nm (<http://aeronet.gsfc.nasa.gov>). We used SSA at 440 nm as a constant for the whole ultraviolet spectrum, as it was found that monthly averages estimated from BS at Uccle were in close agreement with the CIMEL measurements at 440 nm, especially for 320 nm (Nikitidou et al., 2013). Furthermore, Liu et al. (1991) performed Mie calculations for the rural aerosol model (Shettle and Fenn, 1979) and suggested that for this type of aerosol, SSA is approximately independent of wavelength. There are no measurements performed for SSA at the UV wavelength range.”

**Figure 5. Erythemal : there is a clear solar zenith angle dependence of the ratio. You can show this if you plot this ratio against minimum solar zenith angle for each of the days used.**

Answer:

This issue is discussed in the modelling section (section 3.3 of the current version of the manuscript). Also, we added Figure 6 to show the dependence.

#### **Discussion**

**Line 11: It is not straight forward to extrapolated AOD amplification factors and percentages from 550nm to the UV.**

Answer:

In this version of the manuscript, the AOD effect on ratios was calculated directly using measured AOD at 550 nm (from MODIS) and LibRadtran, where the type of aerosol was selected to rural.

**The paper needs clear restructuring in order to quantify different effects: Here we have spatial and temporal related differences mixed that are also linked with AOD, ozone, and albedo variability.**

**First issue is the 60Km distance. Using the model you can quantify this. It is related with the 6h window and also ozone (and partly aerosol effects). To make things easier I would suggest to use a constant solar zenith angle (e.g. X +/- 1 degree) for both places in the comparisons to get rid of this problem or to try to homogenize the series based on the model results. In addition, using a constant solar angle you get rid of problems like ozone variability over the 6 hour period, AOD changes, averaging (measurement frequency) issues. What remains is a. the ozone difference, b. the AOD difference, c. the albedo possible differences d. instrumental issues such as stray light and absolute calibration. Its important to try to separate them for example starting from UVA where ozone plays no role so to quantify the AOD effects.**

**Also working in a constant solar zenith angle provides the possibility to calculate indirectly the AOD that has to be used in order to match the Belsk and Warsaw measurements for a constant SSA. Then to compare your results with the MODIS related study.**

**In the end if all do not add up you can quantify the SSA needed to be used in order to match the measurements of the two sites.**

Answer:

We reorganised the paper and calculated separately all possible factors that may have an impact on the ratios between the sites. The results are in section 3.3 and in the discussion.

**SHICRIVM: Since you are not actually measuring the UVA1 but you are using SHICRIVM to simulate the spectrum, this adds an additional uncertainty especially for the single monochromator measurements.**

Answer:

In the revised paper, we have used a single wavelength (324nm) for UV-A, which is measured directly by both BSs, instead of UV-A1, to eliminate additional uncertainty connected with the SHICRIVM method.