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Interactive comment on "Comparing OMI UV index to ground-based measurements at two Finnish sites with focus on cloud-free and overcast conditions" *by* M. R. A. Pitkänen et al.

Anonymous Referee #2

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General comments:

This paper presents comparisons between the UV index derived from OMI measurements and from ground-based instruments at two sites over a rather long period (from 2005 to 2011). Previous works have shown a positive bias of OMI product for all-sky conditions, i.e. cloud-free and cloudy cases. The type of cloudiness was not detailed in these studies, so the authors focus here especially on cloud-free and overcast conditions. The aim of their work is to understand the link between the positive bias and the cloudiness. The authors use several ancillary measurements, ground-based and space-borne, to characterize the cloudiness situations. The analysis of the measure-

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ments is comprehensive, the quality of the ground-based UV data being carefully assessed. The influence of the width of the time window for averaging ground-based data to account for the OMI-pixel size is studied. The way to estimate the cloud modification factor (CMF) is also discussed, comparing products obtained with the CMF currently used in the OMI algorithm (assuming a homogeneous plane parallel cloud layer) and another CMF (assuming a lambertian cloud), as used in earlier products.

While the cloudiness classification does not enable to fully understand the role of the clouds in the bias, the study leads to the conclusion that the CMF seems to be incorrectly estimated in some cases. This paper brings a useful contribution to the understanding of the OMI bias.

My most important critics concern the use of the old version of OMI data and the statistical evaluation.

Specific comments:

Abstract:

- p. 488, lines 13-14: The sentence is not clear, 21 % is for the average of the 2 sites, while 56% is only for Jokioinen.

Section 2.1:

- p. 491, line 10: The authors should state that the cloud corrected UV index UVIomi corresponds to overpass (UVI is also available at solar noon).

- p. 491, lines 13-14: I don't understand the sentence 'Additionally, UVIomi,cs was used to calculate CMF=UVomi/UVomi,cs . . .'. Indeed, in the following the authors describe the OMI algorithm (according to Tanskanen et al, 2006) where it is stated (lines 25. . ., and p. 492, lines 1-4) that a cloud optical thickness is determined and THEN the CMF is derived, and finally UVomi is computed. The authors must reconsider the order of the various steps in the algorithm. Their explanations are very confusing.

- p. 492, lines 22-23: In the present study the authors use the old version of OMI products where the aerosol absorption is not accounted for. They give an order of the correction factors that are not negligible especially in Jokioinen, leading to about 5-10% difference. So, I think it would be better if they used the new version, available since March 2014 in the AVDC website. It would thus also avoid the comment in p.502, lines 10-13. I strongly recommend reprocessing the comparisons with the new data.

- p. 493, lines 11-13: What do the words 'combines', 'adjusted' and 'standardized' mean in 'combines the measured spectra with an adjusted extraterrestrial spectrum to obtain a standardized irradiance' ? The authors must explain clearly what the SHICrivm software makes (not only 'combines. . .').

Section 2.3:

- p. 495, lines-26-27: The threshold of irradiance between uncovered and cloud covered solar disc is set to 120 Wm-2. How is determined this value? Is it independent on solar zenith angle, i.e. on site location and time?

Section 2.5:

- p. 498: The statistics are performed with quantities that seems rather strange to me: a/ I agree with the definition of the bias MB, but I am surprised with that of the relative mean bias rMB. Maybe it should be better to define the 'mean relative bias', the denominator should not be an average, and it should be inside the parentheses within the summation. Thus, the new rMB would be what the authors call after rE. b/ What is called 'relative error' is badly named : it is a mean relative DIFFERENCE, so in fact it is the bias, rMB (the new one, see above). c/ I agree with the definition of the RMSD, but again not with the rRMSD definition. As for the rMB the denominator should not be an average, and it should be inside the parentheses (and therefore squared) within the summation. The authors must use the correct definitions. I am afraid that the results will be completely different.

- p 499, line 12: The authors say 'Kazadzis et al. also concluded that a longer averaging time window...'. The time window should be 'longer' than what? Please, complete.

Section 3.2:

p. 502, lines 10-13: The correction for absorbing aerosols is given only approximately. As I told in the comment above, for p. 492, this part could be removed if the authors were making use of the new OMI dataset. And thus the remaining bias would be attributable only to cloudiness (assuming of course that the previous aerosol correction is correct).

p. 502, lines 28-29: the scatter SD(diff) is about 0.40UVI for broken sky situations (according to Table 1), that does not sound similar to 0.22UVI and 0.13UVI. Please explain/reconsider your comment.

Technical corrections:

- p. 489, line 28: 'specific' -> 'specific'

- p. 492, line 7: set 'Krotkov et al. (2001)' in parentheses

- p. 495, line 5: 'Fig. 1 a' -> 'Fig. 1a'

- p. 495, line 11: 'Rop varies more' -> 'Rop is no more representative of the actual R'

- p. 496, line 10: 'spaceborn' -> 'spaceborne'

- p. 497, line 3: 'don' -> 'do'

- p. 497, line 12: 'SD = 0 s min-1' -> 'SD = 0 min'

- p. 499, line 5: remove the extra 'the' at the end of the line

- p. 500, line 4: 'singificant' -> 'significant'

- p. 500, line 23: 'form' -> 'from'

- p. 503, line 24: remove the extra 'from' before 'by OMI'

- p. 504, line 8: remove 'UVI' after 0.15 and 0.11 (they are relative values)

- p. 505, line 1: remove the ',' after 'error is'

- p. 508, Table 1: add 'UVI' when needed (for MB, RMSD, SD)

- Caption of Fig. 2: 'cloudiness is deduced to clear sky...' , what does it mean ?

- Fig. 3, top panel: the unit of sunshine duration should be 'min', not 's/min', as I told previously

- Fig. 5 : on the Y-axis I wonder if there should not be a tic labeled '1'.

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