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Atmospheric Measurement Techniques Discussions

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.

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Thank you for your comments. Please note that the OMI UV index data in the revised version of the manuscript is now corrected for absorbing aerosols, as suggested by Referee #2. Our answers to your comments are below:

Referee comment: "The paper deals with the OMI UV index compared to ground based measurements in Finland. An algorithm is set up to distinguish between clear sky, broken sky and overpass in order to better understand the OMI UV index performance compared to ground based SL501 radiometer measurements. Major Objections: - the

last line of the abstract together with the last paragraph of the conclusions summarizes the overall objection: there is little progress reported in understanding the observation that the OMI UVI algorithm overestimates ground based observations. This observation alone would not be enough ground for a new paper, as this was already established previously. The authors should make a far better effort in explaining what is gained with the approach presented in this paper and what is gained in understanding the cause of the overestimation."

We think, that earlier studies have been able to show valuable indications, that OMI UV index is overestimated in overcast conditions. However, we were unable to find any studies where the overcast cloud conditions had been determined both from ground based and from the satellite point of view at the same time. When this aspect is not considered, OMI may see broken cloudiness when ground based view of the sky is entirely overcast at the same time. This way OMI could underestimate the UVI attenuation by clouds, which then may contribute to the observed positive bias in OMI UVI.

In our paper we make efforts to minimize this error source by sampling overcast conditions, when both ground based view (using cloudiness classification algorithm) and satellite based view (using MODIS cloud data) are entirely covered in clouds. This together with an optimized time window for averaging SL 501 UV index gives us, in our view, as comparable conditions as possible for OMI to SL 501 comparison. Finally, when the large positive bias still remains in these (overcast) conditions, we conclude that the bias is not likely caused by broken cloudiness in OMI FOV (this was not confirmed by earlier studies), but by some other factor very likely related to the presence of clouds. We try to bring this message through more efficiently in the revised version of our paper.

Referee comment: "It should also be reflected in the title of their paper. - the current title is a bit of a problem "..focus on cloud-free and overcast conditions". It reads as if all cloud conditions are considered, hence, there is no focus. On second thought, it could mean that broken cloud conditions are not considered in this paper (why?). However,

broken cloud conditions are equally discussed and presented in tables and figures as clear sky and overcast conditions."

The title has been changed so readers could avoid this misconception. Still, we focus on clear sky and overcast situations, because 1) the calibration of SL 501 using Brewer UVI has problems in broken sky cases and 2) the main conclusions are drawn from clear sky and overcast cases. Broken sky situations are nevertheless discussed and presented to bring up the challenges broken sky creates to our methods.

Referee comment: "- the authors are encouraged to cite at first original work instead of (only) their own papers that are of a more recent date."

We have made efforts to find the original papers as our reference.

Referee comment: "Minor comments: Please explain what is meant with the FOV for the ground based instruments. All instruments, Brewer, Solar Light radiometer and pyranometer measure an irradiance. One could say that for these instruments the FOV is the full hemisphere. However, it is stated that the FOV of OMI is larger. Please clarify and add text to explain this issue."

This point is certainly important. In short, the FOV of OMI is represented by the data pixel or footprint projected on the ground. Its size is 13*24 km2 at best in nadir and it is larger towards the ends of the swath. The FOV of the ground based instrument is ideally, as you mentioned, the full upper hemisphere. Because of this, the area of the sky seen by ground based viewer can be relatively small, especially in low cloud overcast situations when only the cloud bottom is visible. This is why the FOV differ between the instruments. Explanation on the difference in FOV has been added to Section 2.4.

Referee comment: "First paragraph of 2.4 leads to the suggestion of MODIS being a ground based instrument."

The paragraph has been edited to avoid that conclusion.

Referee comment: "The use of the word "validated" seems a bit odd when differences are found of 21% to 56%."

We agree, thus the comparison has now been described using alternative expressions.

Referee comment: "Figure 5 is not clear."

The figure describes qualitatively how the observed overestimation of OMI UVI is affected by differences in cloudiness between OMI FOV and ground based FOV at the time of the satellite overpass. We added explanation of the figure to Section 3.1.

Referee comment: "English: many missing words like 'to' and 'the' Example: 504 L27 ". . .is due to the presence of clouds and is not mainly due [to] clear sky patches within the OMI pixel.

p500 l20 ".. was less than one .." please use "..was less than 1.."."

The grammar has been improved.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 487, 2015.