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Atmospheric Measurement Techniques Discussions

Interactive comment on "A geometry-dependent surface Lambertian-equivalent reflectivity product at 466 nm for UV/Vis retrievals: Part I. Evaluation over land surfaces using measurements from OMI" *by* Wenhan Qin et al.

Anonymous Referee #2

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This paper introduces an interesting approach in which MODIS BRDF information is used to calculate a geometry-dependent surface LER (GLER) for each of the measurements collected by the OMI instrument. Users of OMI data can very easily include surface BRDF information in their retrieval algorithms by using the pre-calculated GLER product.

The topic is fitting for AMT. The paper is interesting to read and well written. I think this paper deserves publication.

I do have some comments and questions:

(1)

The paper provides some explanations for the differences that are found between the MODIS-based GLER and the OMI-derived LER. These explanations are neglect of aerosol in the simulations, the possibility of cloud contamination in the OMI observations, and calibration differences between the MODIS and OMI instruments.

What is actually known about the calibration of MODIS compared to that of OMI? Haven't there been any studies comparing the two instruments? What are the calibration differences needed to explain the systematic differences between the MODIS-based GLER and the OMI-derived LER?

For the GLER no OMI measurement data are used. Only the OMI ground pixel extent and geolocation are used and MODIS BRDF data are then used to calculate the GLER for that OMI pixel. So, the MODIS-derived GLER, which is to be used for OMI retrievals, inherited the calibration differences that exist between MODIS and OMI.

It might be good to mention (more explicitly) in the paper that using the GLER for OMI-based retrievals can result in the introduction of calibration inconsistencies in these retrievals.

(2)

What are, to your knowledge, the expected differences between MODIS-derived GLER and the MODIS BRDF? In other words, what are the errors the user would introduce if he/she would use the MODIS-derived GLER as if it would be a BRDF?

Is the 0.8% mentioned in section 2.1, page 5, lines 18-19 a representative percentage for this? Is this 0.8% valid for 466 nm?

Does the term "green band" in line 20 refer to the 555-nm MODIS band (band 4)?

(3)

The paper introduces GLER calculated at 466 nm. For this, MODIS BRDF information is used from MODIS band 3. However, MODIS band 3 is centered around 470 nm, and not around 466 nm.

On page 7, lines 6-7, an explanation for the 4-nm difference is given which suggests that the 470-nm MODIS BRDF is just used "as is" at 466 nm.

If this is the case, wouldn't it be better to say that the GLER is representative for 470 nm (and not for 466 nm, even though the GLER retrieval is performed at this wavelength)?

What are the technical reasons for doing the GLER retrieval at 466 nm and not at 470 nm? Is it because of absorption by trace gases at 470 nm? If so, which trace gases?

(4)

section 1, page 3, line 9:

Here the paper mentions a few papers on LER databases. Could you also mention the databases/instruments behind these references?

Please also add the (more recent) reference to Tilstra et al. (2017), about LER retrieval from the GOME-2 instrument. https://doi.org/10.1002/2016JD025940

(5)

section 2.3/Fig. 3:

When explaining how the point-in-polygon method is used, please mention briefly that the "real" OMI pixel is not rectangular, and that this fact alone already can lead to (small) differences between the (MODIS-derived) GLER and the OMI-derived LER.

Perhaps you could refer to the paper by De Graaf et al. (2016) about the size and shape of the OMI pixels. https://doi.org/10.5194/amt-9-3607-2016

In this paper, OMI and MODIS (band 3) reflectances are compared to each other using different sizes and shapes for the OMI point-spread function.

(6)

section 3.2, page 13, line 16:

The paper mentions here that surface BRDF does not change on a day-to-day basis. But this can happen in certain cases, as explained in section 3.3, page 15, lines 12-14.

Perhaps you could change the sentence to "While surface BRDF in general does not ..." (or something similar)?

(7)

In the paper the GLER and the OMI-derived LER are also compared to the Kleipool climatology. Which field is taken from the Kleipool climatology? Is it the field "MonthlyMinimumSurfaceReflectance" or is it the field "MonthlySurfaceReflectance"?

If it is the "MonthlySurfaceReflectance" field, then that would probably explain part of the higher values of the Kleipool climatology compared to the OMI-derived LER for at least some of the land cover types in Figure 9. In fact, I think that in these analyses it would be better to use the traditional "MonthlyMinimumSurfaceReflectance" field.

In any case, it would be good to mention in the paper which of the two fields was used in the analyses.

(8)

small typo in a reference, page 27, line 20:

Haines, E.,: –> Haines, E.:

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