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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Validation of satellite-based noontime UVI with NDACC ground-based instruments: influence of topography, environment and overpass time" *by* Colette Brogniez et al.

Anonymous Referee #1

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Review of the work: Validation of satellite based noontime UVI with NDACC ground – based instruments: influence of topography, environment and overpass time

This is an interesting work concerning the validation of satellite based UVI at local noon using GB spectroradiometric measurements at three sites. The main conclusions are in agreement with various similar comparisons that have been held and they are mentioned by the authors.

The use of satellite data in important parameters for public health (like UVI) is very important and such studies help in the direction of assessing these results. Well main-

tained and quality controlled ground based spectroradiometers, like the ones used in this study are the tools to perform such studies. The authors use up to date techniques and results from ground based and satellite measurements and retrievals.

In general the work is interesting and solid and I suggest that can be accepted for publication in ACP. However, there are several points that need clarifications. In addition, what I miss from the paper is the quantification/explanation of the different factors that cause these deviations.

These factors can be grouped as:

Satellite algorithm.

In CS cases after the OMI correction there is still a bias. Where this bias come from ? One factor can be an OMI underestimation of Total column Ozone (TOC). Has this been checked with GB measurements? Even if the TOC is more or less correct, what is the UVI calculated by a simple radiative transfer model using only OMI derived related inputs (solar zenith angle, TOC, AOD, albedo)?

CS cases OMI correction: Is the AOD and SSA used by Kinne et al. realistic for the particular locations? are there any GB measurements of AOD and SSA ? Finally, it would be interesting to point out a publication that describes in detail how this SSA at the 315nm has been derived. See also comment below.

Cloudy cases: It seems that there is a constant overestimation of Omi for cloudy cases. This can be a comparison (spatial, or temporal effects) or OMI algorithm problem:

Starting from the temporal comparison problems (satellite local noon calculation using the overpass time cloud conditions). This could be an issue, but other studies using only overpass data for the comparison showed similar results (see also comment below). In addition, it is more or less equally possible to have overestimation or underestimation by OMI as overpass cloud conditions could be either CS or cloudy while during the same day noon conditions could be cloudy or CS, respectively. So statistically, this

effect should not have a systematic bias on the GB-satellite differences.

The spatial issue: Satellites provide a cloud optical thickness and cloud coverage in percent for an area that can not simulate a measurement point. In this case the most important issue is the sun visibility (direct sun component) at the time of the measurement. Statistically there are cases that there are few or more clouds and the sun is not visible (in this case OMI should overestimate) but also cases that there are clouds and the sun is visible. In that case Omi should underestimate. From the analysis it is evident that 90% of the data fall in the first category. So this is not easily explainable quoting only spatial comparison differences.

To be more clear, let's assume that there is a case with 50% cloud coverage. The UVI measured from the ground can vary as much as 200% depending if the sun is visible or not. However, for almost all of these cases satellite based data overestimate UVI meaning that someone's got to have a closer look at the satellite algorithm and especially how this calculates direct and solar irradiance at such conditions, in order to explain this systematic bias. Figures 3, 8 and 12 show a systematic overestimation in the range of 20-40% for cloudy conditions plus a lot of outliers only in the direction of the satellite overestimation.

So in general some more discussion on the quantification of the results based for example partly on the discussion above is needed.

Finally, I miss some general conclusion about the quality of the satellite data. In what extend can these data be trusted by the public in order to use their derived UVI?

Probably this is simplified but also it has to be commented that at high UVI cases the results of the comparison are much better than in low UVI's. For public health a 200% satellite overestimation when UVI is in the order of 0-2 could be not as important as a similar one for higher UVI's.

Detailed comments

The sentences: "Observations at northern mid-latitudes help complete geographical coverage. Observations from Reunion Island, close to the tropic of Capricorn, are useful as well." Need some more clear scientific wording

Missing paper: http://www.atmos-chem-phys.net/15/7391/2015/ There is a lot of discussion on the above Bernhard publication that falls within the aims of this work.

QASUME instrument reference needed: https://www.osapublishing.org/ao/abstract.cfm?uri=a
44-25-5321

The cosine correction: it needs more discussion or a reference publication. As it is written does not help a reader who is not into spectroradiometer measurement uncertainties to understand this.

Uncertainties for local noon satellite "extrapolation'. Since ground based data exist for both overpass and local noon. You could make an accurate assessment on the satellite uncertainties due to the satellite local noon time extrapolation. This by comparing overpass and local noon differences at a station with/without clouds e.t.c.

You mention that CS data are judged according to ground based measurements. How is this done?

SEVIRI/MSG comes out of the blue here. Is this used in some part of this work and how ?

In general mean values for non-normal distributions (as are the Gb/satellite differences clearly here) has a limited value. I would suggest to use only median and percentiles (10%-90% for example) in figure captions and in tables. Distributions here are clearly skewed due to satellite (systematic plus outliers) overestimation for cloudy conditions.

OMI correction. Practically the OMI methodology for the AOD and SSA correction will lead to an improvement anyway. This is because a correction factor is applied for all data based on a (smaller or larger) aerosol absorption optical depth. So an additional input of this work could be a discussion on why this is not enough? As mentioned in

the introductory comments: is the AOD and SSA used realistic? Having a look at the AERONET data I can see that AOD at the VDA for 2010-2012 at 340nm is in the order of 0.23 to 0.26 as a yearly average. On the contrary Kinne et al AOD shown in the figures, is almost double. So in a first glance, probably this correction factor is already overestimated.

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