

# ***Interactive comment on “Ship borne rotating shadow band radiometer observations for the determination of multi spectral irradiance components and direct sun products for aerosol” by Jonas Witthuhn et al.***

## **Anonymous Referee #4**

Received and published: 15 November 2016

Ocean-based radiation measurements of any type are relatively rare, so it's always good to see a study trying to do just that. There is one issue with shipborne measurements (shadowband type) that I've never heard discussed, and that is how confident one can be in identifying the precise sun-obscured moment from each shadowband pass? For clear sky conditions the exercise is straight-forward. For very overcast conditions one might follow the authors' example and only provide global data. What about everything in between? It's not hard for me to imagine sky conditions that obfuscate the actual sun-obscured moment, and lead the algorithm to an incorrect determination. I'll admit to never having worked with shipborne measurements, but it seems to me it

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would be important to develop an algorithm that compares each measurement with the preceding and subsequent data point(s) as a way to gain confidence in the exact timing of the moment when the sun is completely obscured. Such a test could be developed using clear sky data with the goal being to produce a confidence level for the timing of when the sun is blocked during each measurement set (or sweep). If this issue has been dealt with adequately in a prior paper, then please provide some text along with a reference.

A shadowband instrument is presented, along with land-based data, yet there are no Langley calibrations presented. A long enough time series of Langley calcs might show a temperature dependency that could be used to further improve data. (I do understand the instrument is temperature stabilized).

Uncertainties are given to two decimal places throughout the paper. One decimal at most for this work.

In the introduction the instrument is described as having "a constantly moving shadow band" (P3 L1). From the instrument picture (Figure 1), which, BTW, is an exceedingly poor picture, it's obvious the shadowband (one word) cannot move continuously. Later in the manuscript the shadowband motion is described as "sweeping" which sounds more accurate. Are measurements made in each direction, or does the shadowband always return home after a measurement set? How often are measurements taken? Is the frequency fixed or user configurable?

So in an effort to learn more about how this instrument operates I looked to the Seckmeyer et al., 2010 reference (P3 L16) as the manuscript strongly implies it to be a description of the instrument. It's not. Is there a peer-reviewed reference that describes this instrument in detail? Preferably with the BioSHADE accessory.

P3 L2 Should be channels, and "...includes all AEORNET and MFRSR channels." I would say rather it includes five channels that are very close to standard MFRSR channels and one that matches exactly (940). I cannot say if similar wording changes

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should made in respect to CIMELs.

P3 L22. At this location in the manuscript are the authors asserting the 18 channels are measured simultaneously?

P4 L8. black anodized not "anodized black."

P4 L9. "when the band is moving" to "during a measurement sequence." This goes back to the earlier statement that the band "is constantly moving." Also "rotates". To me rotation implies 360deg. I like the use of "sweep" better as is done later in the manuscript. It better describes the movement of the shadowband.

P4 L10. Band can't be "stowed" if it's constantly moving.

If there isn't an authoritative article on the GUVis-3511 then this section needs significant improvement. Also, there is no mention of why the band width is 2.5 cm and the diameter 26.7 cm. I'm hopeful there is a better picture of the instrument, preferable taken from slightly above the sensor.

P4 L24. extent not extend

P4 L31. "To improve stability..." sentence is poorly worded.

P5 L4. Is it possible to load one's own calibrations?

P6 L3. airplane is one word.

P6 L10. These factors...

P7 L2-4. Are the internal measurements of "pitch and roll" applied internally or during post-processing? Are these data part of the datastream? Consider using x-axis and y-axis for land-based situations as pitch and roll are ship/aircraft terms.

P7 L19. Figure 4 demonstrates... I read L19 - L21 many times. I now think I understand what is being conveyed, but the passage is confusing.

P7 L22. From these calculations...

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P7 L27. In this section detecting the minimum when skies are clear, or at least the sun is not obscured, and what to do when direct irradiance is very small are both discussed. There are many situations in between these extremes that are not addressed at all. I see this as a major deficiency. If the paper were only on AOD and direct beam that's one thing, but the opening sentence of the abstract promises us "shipborne (one word) measurements of the direct, diffuse and global spectral irradiance components..."

P10 L25. uncertainties are...

P11 L1. From these values...

P11 L22. ...reaches up to 0.5. The ending of that sentence leaves me hanging.

P10 L12. ...therefore been excluded

P10 L22. ..with an uncertainty

P14 L15. Why should I believe the Microtops II is an instrument worthy of making a claim the GUVis compares well with? The first referenced article in this section (Macke, 2009) only briefly mentions the Microtops, focusing mostly on its operation. The second referenced article (Smirnov et al., 2002) doesn't reference the Microtops II in the text at all. There is nothing here to give the reader confidence the Microtops II is anything more than an instrument that provides the operator a general idea of AOD. And actually, I don't understand the Smirnov reference in the context of the text at all.

P16 L24. ...the fact that the...

Fig 1. How about... GUVis mounted on research vessel Polarstern during cruise PS83. A total sky imager is to the left.

Fig 2. ...are in yellow... ... are in green...

Fig 3. How about... Figure shows factors for motion correction measurements of 305 nm and 510 nm GUVis channels. Existing caption is unnecessarily wordy. Why say "Additionally" when the opening sentence states this figure shows correction factors?

"By adapting...into account" is superfluous.

Fig 6. Relationship of precipitable water obtained from CIMEL sun photometer and GUVis shadowband radiometer during Melpitz-Column experiment.

Figs 7-13. Often more text than necessary.

Fig 11. This figure doesn't present the data clearly. Consider a different approach. Maybe plotting the differences?

Fig 12. I'm not sure what is being presented?

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