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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "In search of traceability: two decades of calibrated Brewer UV measurements in Sodankylä and Jokioinen" *by* J. S. Mäkelä et al.

Anonymous Referee #1

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The paper presents the calibration procedures followed at FMI for the calibration of the UV measurements conducted by two Brewer spectrophotometers. Such a study would be a useful contribution to the scientific community if it would provide the basis for assessing the quality of the data and the significance of the derived results in studies using and analyzing these data. From the title one would expect to see an assessment of the calibration history of the two Brewers and of course a discussion of the quality of the UV measurements. Unfortunately the paper does not provide any quantitative estimates that can be used to assess the uncertainly and quality of the data. It is a bare description of procedures and behavior of the lamps, but it does not get into the analysis of the measurements. The only worth publishing, quantitative result is

the estimation of the drift rate of the primary calibration lamps presented in section 3.2. My overall assessment is that the paper is not well written and needs substantial improvement before it is accepted for publication.

From the discussion in several places, I get the feeling that the paper criticizes the lack of standardized procedures for some steps of the calibration chain (no doubt that there are gaps), but I would expect proposing solutions on this issues.

There is need to polish the language, less in terms of the English, but mainly in terms of meaning and precision of the discussion. There are repetitions in different sections which confuse the reading of the paper.

In many places the discussion is very brief so that only experienced with the Brewer spectrophotometer readers can follow. For example, in line 21, page 5, the statement "the device switches the slit through which it measures the radiation" is not understandable by inexperienced Brewer users.

The figures are not very informative. More than half of them could be eliminated without affecting the discussion. The presentation quality can also be improved by adding legends to identify the different lines and symbols and by providing units of quantities in the axes titles.

The Discussion and Conclusions sections are very brief and really insufficient.

Specific comments

2, 23: "almost certainly the largest unanalyzed source of uncertainty". Indeed there is a lot of discussion in the scientific literature about the uncertainties in the absolute calibration. Please rephrase.

3, 25: I wouldn't say that the Brewer is "a standard device", because it may be regarded as "ideal". It could be probably better to say "a widely used instrument to monitor UV. . .."

4, 15: If lamp measurements are done only after sunset, doesn't this mean that they cannot detect any effects from temperature changes during daylight hours?

4, 24: Please state to which Standard Laboratory are the lamps traceable. It has been shown that there are differences among scales of different Laboratories.

5, 4-15: If the primary lamps are no replaced since 2005, how one can assure that they have not drifted during these 10-year period? From the discussion later on it seems that there are regular annual checks of the lamps calibration but this is not clear. In addition, please state if the seven lamps are secondary working standard lamps. Please clarify, distinguish the primary 1kW lamps that are calibrated at the National lab and the secondary 1 kW lamps which are usually calibrated locally.

5, 18: Is this really what it means? (counts(cycle)$-$1 s$-$1). Usually the output is in counts per second and not per cycle per second. Please check.

5, 22: These figures are the most important part of the results, because they can be directly related to the stability of the instrument's response. However, it would be much more valuable to draw the figures with the corrected signal after accounting for the drift in the calibration lamps, or better, the response function of the instrument. If the downward tendency of the signal is due to drifting of the lamps then the trend would be zero assuring that the instrument and eventually the measurements are of good quality. If not, then this has to be explained and discussed.

7, 25: The issue of applying the changes in the annual calibration of the lamps is very important, but the section ends without saying how they treat these changes. This is particularly important, if these changes are of the order of a few percent (as the authors state).

8, 15: The three figures 6-8 are not really necessary. They add nothing to the paper. Fig 6 is essentially the same as Figure 1b. In addition, there are no axes titles and units.

9, 1-8: The methods of applying backwards the calibration seems to be slightly different between the two stations. Is any of the two better or the final result is similar?

9, 17: This probably the most interesting part of the paper and I would really like to see a more extensive discussion and some clarifications on a few points. I understand form the text that these are the irradiance measurements reported by the Standards Laboratory each time the primary lamp has been sent for calibration.

If this is the case, why in the grey line (Fig. 4) there are two points at the same day in 2013? Why the last two points of the pink line in Fig. 4 are shown one on top of the other in Fig. 5?

I am not sure I see a very different behavior in the drifting of the lamps between Figures 4 and 5. Have you tried to plot the data against the burning hours of the lamps?

Technical

I suggest using consistently in the text "short" and "long" to define wavelength, instead of "small" and "large".

The caption of Figure 1: "Typical raw outputs from a lamp calibration" could better be "Typical spectral irradiance measurements of a calibration lamp as raw counts s-1".

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