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Atmospheric Measurement Techniques Discussions

Interactive comment on "The design and development of a tuneable and portable radiation source for in situ spectrometer characterisation" *by* Marek Šmíd et al.

Anonymous Referee #3

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The manuscript by Smid et al. presents a portable near-monochromatic light source for calibration of Dobson spectrophotometers. A description of this "Tuneable and Portable radiation Source" (TuPS) is presented and the manuscript shows convincing performance data. The application of the TuPS for characterization of Dobson spectrophotometers is discussed.
Overall, the manuscript does a nice job in the description of the TuPS, although a few more details of its setup would be helpful (see below). The characterization of the TuPS is generally convincing and the example of application to Dobson instruments is helpful to understand the motivation for the development of the TuPS. What the manuscript is currently missing is to provide the reader with a frame of reference on

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how the TuPS improves operation of Dobson spectrophotometers, i.e. how the TuPS will improve the accuracy of ozone column data. The introduction also mentions the disagreement between Dobson and Brewer spectrometers as a motivation for the development of the TuPS. This is not further discussed in the manuscript and the reader will be left wondering if the TuPS does in fact solve this problem. Without discussing these issues, the manuscript lack a clear tie to the science the TuPS is intended to support, reducing its impact and making it less useful to the community.
The topic of the manuscript is suitable to publication in AMT. However, without a more detailed discussion of the improvements the TuPS brings to Dobson spectrophotometers and the consistency between Dobson and Brewer observations, the manuscript lacks scientific relevance. I therefore can recommend publication only after this aspect of the study is added and my more detailed comments below are addressed.

Detailed comments:
Section 1.

- Information on why a better characterization of the spectral characteristics would improve the consistency between Brewer and Dobson spectrometers would be helpful to better motivate the rest of the manuscript. Are the 3% difference due to difference in how absorption cross sections are derived for each instrument? Is this solely due to an imprecise characterization of the spectral characteristics of the two spectrometers?
- Why is it necessary to develop the TuPS? Could a small commercial monochromator not fulfill the same function? What makes commercial, or previously developed research grade, options unsuitable to solve the characterization problem?
- Since the scientific problem identified here seems to be the comparison of Dobson and Brewer spectrometers, why was the instrument only developed for Dobson systems?

2. Methods:

- Line 48. Define ‘OR’
- It would be helpful to add a table with details of the optical components, such as diameter and focal lengths of mirrors, size and blaze angle of grating, etc.
- Provide more detail on the motorized rotation stage. What is its angle interval per step, repeatability (precision), etc. How does the stage determine its absolute position, does it have a reference point that is used determine the absolute position at start-up?
- Figure 1 and 2: Add a scale to these figures to provide some sense of the size of the TuPS.
- Throughout the manuscript please ensure to consistently use a decimal point or a decimal comma, but not both.

3. Results

- Line 109: What does “(k=1)” mean?
- Line 110: More information on the difference of the calibration before and after in-field use would allow the reader to better assess the stability of the TuPS.
- Line 115: Where is the temperature measured? Is this measurement built into the TuPS or are ambient air temperatures used? How long does it take for the TuPS to stabilize thermally? How is the temperature dependent wavelength scale used?
- Line 117: I don’t understand this sentence.

- Lines 118 – 121: This is a repeat of the prior five lines.
- The discussion of temperature dependence also begs the question on the dependence on atmospheric pressure, especially considering that some of the Dobson Instruments are located in mountain observatories.
- Figure 5: Provide the errors of the linear fit as a measure of the precision of the wavelength determination.
- Figure 6 would be easier to understand if plotted vs. wavelength rather than angle. Alternatively, a second x-axis could added.

5. Comparison of the TuPS in-field calibration

- Line 155 “curried” should be “carried”
- Figure 9 shows the same data as Figure 10 and can be deleted.
- Line 169: Provide more detail about this comparison. When were the measurement made? Was the Dobson instrument transported in-between the measurements?
- Line 171. I don’t understand this sentence

6. TuPS temporal stability

- Line 174. This is confusing. The TuPS participated in 5 field experiments and was calibrated before and after each experiment. However, data is only shown for three calibrations in Figure 11.
- Line 177 and Figure 11: Can you explain the difference of wavelength calibration of 0.04 nm?

– Line 181: I do not understand this sentence.

– Lines 184-186: I am not certain what the authors want to convey here. Does this demonstrate that the TuPS is stable or that the Dobson spectrometers are all well calibrated?

– This entire section could use a more detailed description of the various measurements, shipping, calibrations in order to convince the reader that the TuPS is in fact as stable as needed for in-field calibrations. Also, this may be a good place to discuss how the use of the TuPS as an in-field calibration helps in making the Dobson data more accurate.

7. Conclusion

– Line 198-199: Elaborate how the TuPS will improve the determination of effective absorption cross sections for Dobson instruments. Did you see a difference between the one currently used and those that would be calculated based on the TuPS measurements? How will this help to decrease the inconsistency with the Brewer spectrometer?

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