

## ***Interactive comment on “Stability of the Regional Brewer Calibration Center for Europe Triad during the period 2005–2016” by Sergio Fabián León-Luis et al.***

### **Anonymous Referee #1**

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#### General Comments:

It is surely a very important information for the ozone community how stable the Brewer triad at the RBCC-E is, as these reference Brewers are used for the calibration of a large part of the Brewer network. Unfortunately this paper is in some parts confusing and although I have to commit that English is not my first language, I have the feeling that the text is not written in good English. These issues cause sometimes problems to understand the text. Additionally there are some statements and descriptions which are not correct or at least unclear: SO<sub>2</sub> as parameter (additionally to the main parameter TOC, UV and AOD) is in fact mentioned in section 2.1, but not in the correct context.

C1

Brewer spectrometers measure in five wavelengths and not four to get SO<sub>2</sub>-values too. This parameter should be nowadays close to zero under normal conditions and clean air, but is important in polluted areas and under volcanic plumes. And it is important when a comparison between Dobson and Brewer is investigated.

Another unclear description is the use of airmass  $m$  instead of the relative optical path through the ozone layer  $\mu$  ( $\mu$ ).

The description of the triad system is not profound and clear. Where is the second triad located? In Toronto too? How are this triad and in addition the travelling Brewer No. 17 calibrated? It is good to know how stable the RBCC-E triad is, but what about its accuracy? The agreement between this triad and the World Reference Triad is confirmed by the 0.5% - agreement with #017. But how good is the agreement of #017 with World Reference Triad? When was its last absolute Langley calibration performed?

My recommendation is, that, in addition to the specific comments correction, the paper needs a basic rewriting taking into account the above mentioned shortcomings.

#### Specific Comments:

- In the entire text: behavior or behaviour should not be mixed. Replace tractability with traceability.
- P1, I9 (abstract): add . . . . .from “two different” methods previously. . . . .
- P1, I10: it should already be mentioned here that the World Reference is the Toronto triad.

#### Introduction:

- P2, I5: “on” instead “in”.
- P2, I6: “cause” instead “produce”.

C2

- P2, I9 and in references P20, I4: "Varotsos" instead "varotsos".
- P2, I9: "...which are considered to be reference instruments..." Is not correct. The triads or Brewer #17 are references (or standards). May be "basic instruments in the global network" or similar is better.
- P2, I10: "Brewer spectrophotometers are widely used" since when?
- P2, I12/13: "ozone concentration" is not correct, "TOC" is better.
- P2, I16: Why is "although" used? Better "After the development of the first Brewer in the early 1980s it has had continuous..."
- P2, I21: 70 degrees as limit for single Brewer observations seems small, as it corresponds to  $\mu$ -values of smaller than 3. Even single Brewers can measure reliable TOC up to 75 degrees ( $\mu$ -values around 3.5) under normally clear air conditions. Perhaps it would be good, to describe the different stray light issues: internal straylight-problem, which is larger for single Brewers, and external stray light (diffuse sky light around the sun), which is similar for all Brewers, but larger for Dobsons. The effect is the same in both cases: drop of TOC, when the SZA ( $\mu$ ) increases and gets large depending on instrument and turbidity.
- P2, I24: The calibration of the Brewer "in the first years" is traceable.
- P2, I31: by the "manufacturer" Kipp & Zonen.
- P3, I5: Add "triad" behind RBCC-E.
- P3, I9: Replace "in the island" with "on the island".
- P3, I16: "These values have been".
- P3, I20: "more than 150 Brewers have been calibrated".
- P4, I5/6: This is not a complete sentence.

Chapter 2 (is in general confusing):

C3

- P4, I13 ff, p5: see under general comments (SO<sub>2</sub>!). The reference Dobson 1957 is out of place here and I think anywhere in the text. So omit it in the references. The presentation of the corresponding absorption spectra (O<sub>3</sub> and SO<sub>2</sub>) might be helpful.
- P5, I15: DS observations are done in 6, not in 7 slits: 4 ozone, 1 SO<sub>2</sub> and 1 dark, the seventh slit is for HG-test.
- P4/5/6: Use of m instead of  $\mu$  is not correct.
- P6, I7: "clear" instead of "clean"-sky.
- P6, I11: Why does the use of 1/m (should also be  $\mu$ ) allow obtaining two ETCs? I thought it is the splitting in fore- and afternoon observations.
- P6, I 32-35: no complete sentence.

Chapter 3:

- P8, I6: Giving a number for the low standard deviation would be helpful.
- P8, I9: "Langley technique can be used" instead of "Langley-technique is used".
- P8, I17: The criterion lower than 0.6 under item 4 is not clear: standard deviation of 0.6 DU? Seems to be a very low standard deviation for a day with small ozone variation.
- P8, I18: correct "a an".
- P8, I20: what does "(condition 3 above)" mean in the context with simultaneous? Does it mean, that in addition to condition 3, these selected measurements should be simultaneous?

Chapter 4:

- P10, 4: "mean of daily differences" or "daily mean of the difference"?
- P10,I5: Replace "analyzed" with "analyze".
- P10, I8/9: what does slight mechanical miscalculation mean?

C4

- P10, l 10; replace “inconvenient” with “inconvenience”.
- P10, l11 and P11, l11: isn't Izana a subtropical station?
- P10, l15: “another” instead of “other”.
- P11, figure 4: The “A” from Eq. 10 is missed. Shouldn't it be placed behind “ozone reference value”? The colors are not assigned to the Brewers.
- P11, last section, P12, first section: Sorry, but I have problems to understand what is meant. The beginning of two consecutive sentence with “Therefore” does not sound good. It is described that the polynomial method show similar results regardless of the data set and the order of the fit. Why is then the daily mean method more appropriate?
- P13, Fig.5: Again the colors are not assigned to the Brewers.
- P13, l5: Why are parentheses used?
- P13, l7: tropical replaced with subtropical.
- P12 – P15: What about Brewer #183? Tables 3 and 4 (Data set 1) and Figures 5 and 6 show a larger ratio in 2007, which cannot be seen in the graph of Arosa method. Only the table 4 gives a negative shift median and larger percentile numbers for Brewer #183 data set 1. Is the reason known? The same is valid for the larger scattering of all RBCC-E Brewers around 2010.
- P14, l9 (and in abstract too): Where do the numbers for the RBCC-E triad come from? I cannot find them in the tables.
- P14, l10: how is 40% lower dispersion determined?
- P14, l12: Is the 0.3% value for RBCC-E also calculated in the 2004 – 2012 period of the Stübi-paper.
- P15, Figure 6: The order of the panels does not coincide with the order of the mentioned methods in the figure caption.

C5

- P15, l10: correct “surprising”.
- P15/16: The explanation for the larger scattering at high sun is good and comprehensible. But the obvious difference of low sun in the forenoon and in the afternoon is neither mentioned nor explained. Is there also an explanation, why Brewer #183 shows larger scattering in the relative difference than the other two Brewers?
- P16/17: The values in table 5 are not clear. Where do they come from? Fioletov daily of 0.47% is mentioned on P16, l8. In the same context the RBCC-E triad number is given as 0.41% in the Conclusion, but as 0.37 in the table, which is confusing.
- P17, table 5: Replace “Stuevi” with “Stübi”.

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