

EUBREWNET RBCC-E Huelva 2015 Ozone Brewer Intercomparison

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Response to Reviewer #1

Comment: One major deficit is that SO₂-calibration is not discussed. The effect of SO₂-values on the comparison with Dobsons and also between the different Brewers is important for the interpretation of the results. As far as I know the SO₂-values of BR017 in clear air is around Zero, whereas Brewers calibrated against the Tenerife triad show up to -5 DU equivalent SO₂ and subsequently higher TOC values. This leads to misinterpretation when only TOC is looked at.

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Answer: The work is focused on the ozone calibration and our work during these years, unfortunately we don't perform SO₂ transfer and use the Software from IOS (International Ozone Services) to derive it (?). However in some cases we perform the SO₂ calibrations performed by the RBCC-E as is discussed in the supplement. In this work we don't find significant differences between the Langley Calibration and the "zero calibration" usually performed by the International Ozone Service traveling #017, but we cannot find the 5 DU differences ?.

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We agree with the referee that is an important issue to address in future intercomparisons and also need some review concerning the SO₂ cross sections and the validity of the assumptions of the ozone/so₂ coefficient used on the brewer.

Comment: Only the influence of internal stray light (unwanted radiation of “wrong” wavelengths inside the instrument) is discussed, but the external one (scattered sun light from the sky around the sun disc) is not mentioned and discussed as a source of similar effects.

Answer: We have introduced this source of stray-light in the paper and a more detailed description of it

5 **Comment:**

- p1, line 6 and p3, line 7/8:li Davos as location for the WRC-UV should be mentioned; the exact name is World Calibration Center – Ultraviolet Section (WCC-UV) at the Physikalisch-Meteorologisches Observatorium Davos / World Radiation Center (PMOD/WRC).

Answer: Done

10 **Comment:** - p2, line 8: it is not easy to find the correct name of the mentioned SAG, but in any case ozone should be added: “WMO/GAW Scientific Advisory Groups (SAG) on Ozone” as proposal.

Answer: done

Comment: p5, section 2.1.: Stray light effect should be distinguished between internal stray light, which means unwanted measured radiation in other wavelengths inside the instrument (double Brewers show a better stray light suppression than
15 single Brewers) and external stray light: scattered sky light around the sun disc with a different spectral composition than direct sun light. This external stray light also leads to a drop in ozone values at lower sun depending on the turbidity (aerosol amount and or haze) and the instrument’s field of view (similar effect with single and double Brewers). This is one reason why the TOC measured with Dobsons with their wider FOV drops earlier than TOC even from single Brewer, although this old sepectrometer is a double monochromator with relatively small amount of internal stray light.

20 **Answer:** We add this distinction in the revised version of the paper.

Comment: - p5, line 26: OSC is the product of TOC and relative slant path through the ozone layer mue and not the airmass, which are significantly different at low sun.

Answer: the correction is introduced.

Comment:

25 p5, line 28: in this context the statement “For this type of Brewer, only the stray-light- free region is used to determine the ETC, which generally ranges from 300 to 900 DU in the OSC, depending on the instrument.” is a little bit misleading. The given maximum of 900 DU of a stray light free region of single Brewer seems to be very low. It means, that the single Brewer TOC of 300 DU already drops when a mue-value of 3 is reached, which should not be the case under normally clear sky condition for normal Brewers. In this special case an OSC of 600 for BR 117 shows a very bad instrument with
30 strong internal stray light effect. This should be mentioned explicitly.

Answer: , we agree that this fact has to be mentioned, we have choose the #117 because with also the #017 and the

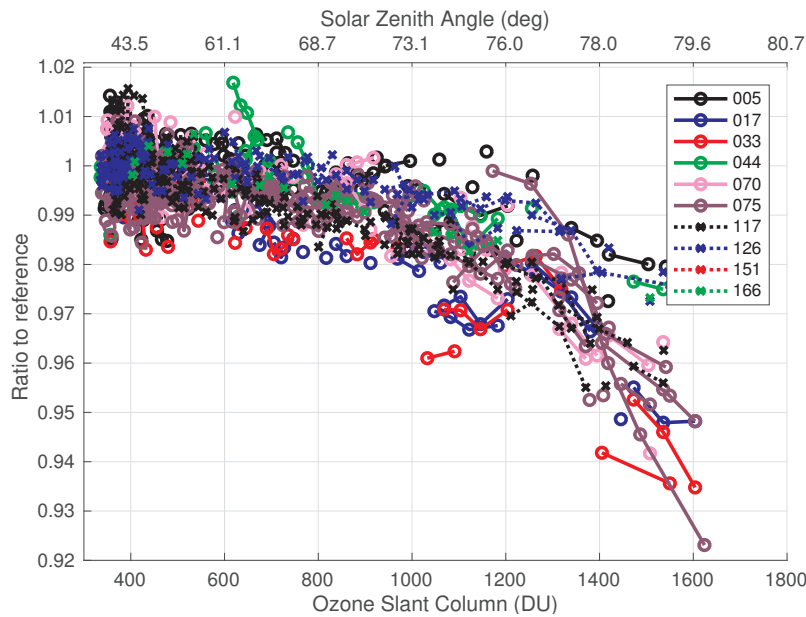


Figure 1. Ratio to the reference of the single brewers during the campaign the upper x-axis indicate the solar zenith angle with the assumption of a constant Ozone of 300 DU.

have the strongest stray light, we have added the corresponding information, but we cannot consider the 117 as a bad instrument and is not an outlier (See Figure below) .

Comment: - p6, line 5, an amendment with the word “empirically” before the word “corrected” would make it clearer, that it is not a physically based correction.

5 **Answer:** done

Comment: p8, line 5-6: the statement that BR017 is underestimating ozone at high OSC above 600 DU seems to be too strong, although it is shown in Fig. 8, which is, however, not mentioned in the text. In my opinion (see also second last comment) 600 DU represents very small μ -values of around 2 at normal TOC of 300 DU. These μ -value is not common for TOC-drops of single Brewer observations after my experience. Perhaps it would be helpful to present a graph for different Brewers (reference, single and double) showing the daily course of TOC with μ as x-axis.

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Answer: Agree that 600 DU is too low, but it is in agreement with what we found in previous campaigns. We will add a plot with the comparison in time and μ x axis for the single brewer of the campaign.

Comment: - p8, line 13: the SL test is not an ozone measurement, as there is definitely no amount of ozone between the lamp and the PMT. It is a check of the spectral response as mentioned in line 14.

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Answer: The SL is a test but it use the same instrumental configuration as the ozone measurements and use the same ratio. The sentence is rephrased to avoid confusion.

Comment:

- p9, Figure 6 and p10, Figure 7: no explanation is given in the text of the caption for the numbers of the boxes. For an insider it is clear that the rel. deviation in the different OSC bins is mentioned. In Figure 7 some blue and red circles are drawn. What do they mean? - p11, Figure 9: BR151 is outside the range.

5 **Answer:** A description is included of the plots, the brewer 151 is outside the range but is not an operative instrument as is now described on the text.

Comment: - p12, Figure 10: is not very clear, the difference between the two panels is not explained; are there differences between the captions for the y-axis?

Answer: A better description of the plot is included on the caption.

10 **Comment:** - p15, Figure 13 caption: in even years correspond to Arosa and in odd years in Huelva.

Answer: corrected

References