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Brewer - OMI ozone comparisons in EUBREWNET

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Introduction

The European Brewer Network (EUBREWNET), supported through COST Action 1207 [**1**], aims to stablish a consistent and spatially homogenous network of Brewer spectrophotometers located across Europe. Currently, more than 20 stations are integrated in EUBREWNET and submit data to the network's data server [**2**] in near real time. Besides the scientific possibilities offered by such large concentration of data at a single source, EUBREWNET's data server can be also useful to Brewer operators in their day-to-day activities, providing enough information to check the status of their spectrophotometers. In this regard, near real time comparisons with satellite data can be very useful. In this poster, we present some results of the comparison between selected Brewer instruments and the two ozone satellite products of NASA's Ozone Monitoring Instrument (OMI), the OMTO3 and OMDOAO3 (see [**3**] and references therein).

Brewer and OMI data

For the Brewer instruments, we use the level 1.5 data as defined within EUBREWNET. This product level includes corrections to the data acquired by the Brewers to compensate for changes in the calibration tracked by the internal reference lamp, for the dependece with the wavelength of the instrument's attenuation filters, and for the scattering on the single grating of MK II and IV Brewer instruments, the so called stray light effect. It should be noted that during the calibration campaigns, held every 2 years, each spectrophotometer is evaluated to determine if these corrections are necessary, not all being included by default for all instruments. Besides these corrections, level 1.5 data also includes three data quality filters, to remove observations affected by fast passing clouds or instrumental wavelength shifts, or taken at very high air masses when the stray light effect is more important and the Sun moves too fast for the observations to be considered reliable.

With regard to the OMI products, we use the level 2.0 station-overpass data provided by the Aura Validation Data Center [**4**]. Usually, a single daily satellite observation is available for each station. We compare this single data point to the mean of all the data acquired by the station's Brewer within 30 minutes of the satellite measurement. We then calculate the relative percentage difference between the Brewer and OMI ozone as

$$\text{Relative difference (\%)} = \frac{X_{Brewer} - X_{OMI}}{(X_{Brewer} + X_{OMI})/2} \cdot 100$$

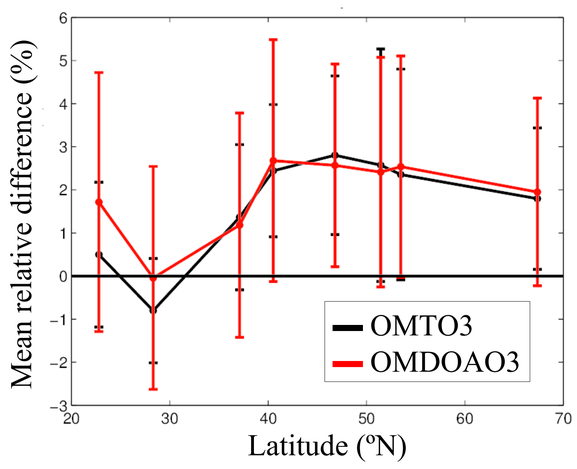
We have carried out two different Brewer-OMI comparisons: for selected Brewer instruments operating at their stations during the 2015-2016 period, and for the X Intercomparison Campaign of the Regional Brewer Calibration Center for Europe (RBCCE), held at the El Arenosillo station (INTA, Spain) in May-June 2015. The latter provides an opportunity to compare different Brewers operating in the same conditions.

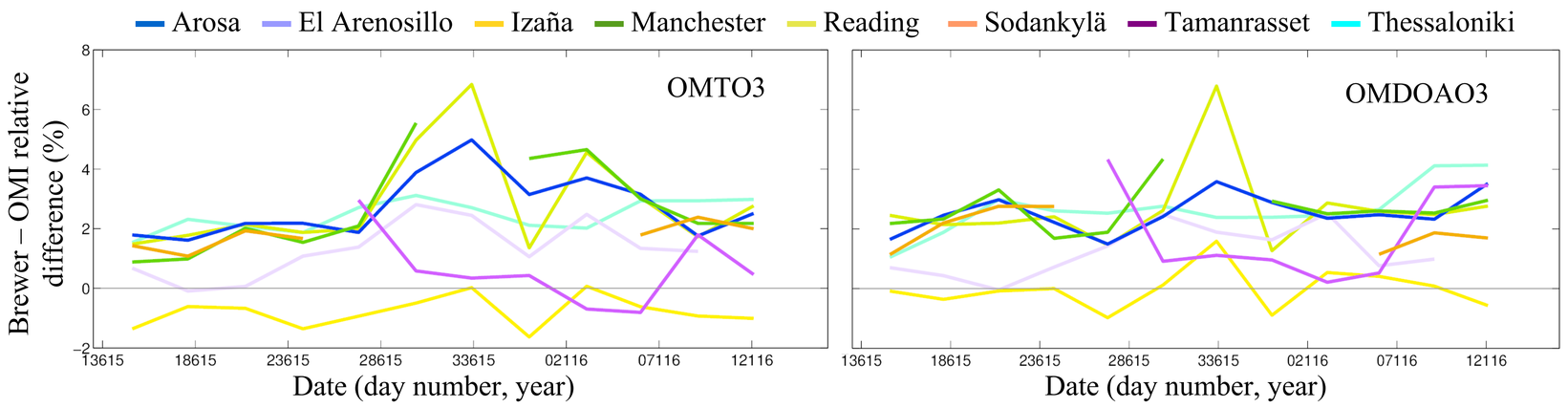
2015-2016 Brewer-OMI validation

We have compared the Brewer and OMI data for one year, from June 10th 2015 to June 10th 2016, while each spectrophotometer was operating at its own station. All the Brewer instruments considered took part in the X RBCCE Intercomparison Campaign, where their calibrations were checked and updated as needed.

As show in the figure below, there is an overall good agreement between the Brewer and OMI data, with relative differences within 5% in most cases. The two satellite products show a similar behaviour, the OMTO3 producing slightly lower differences with respect to the Brewer data. Although we have plotted monthly averages, the same kind of comparison could be carried out using daily data. That could be useful for Brewer operators to check the status of their instruments.

The calculated relative difference does not seem to show any temporal dependence, although the time span used in this comparison is too short to draw any clear conclusions. Using EUBREWNET's data server, it is very easy to produce other types of comparisons, like for example checking the dependence with respect to the station's latitude. As shown in the figure above, in this comparison the two OMI ozone products again display a very similar behaviour when compared to the Brewer data. No clear dependece with the latitude is evident from this comparison using 8 different stations.

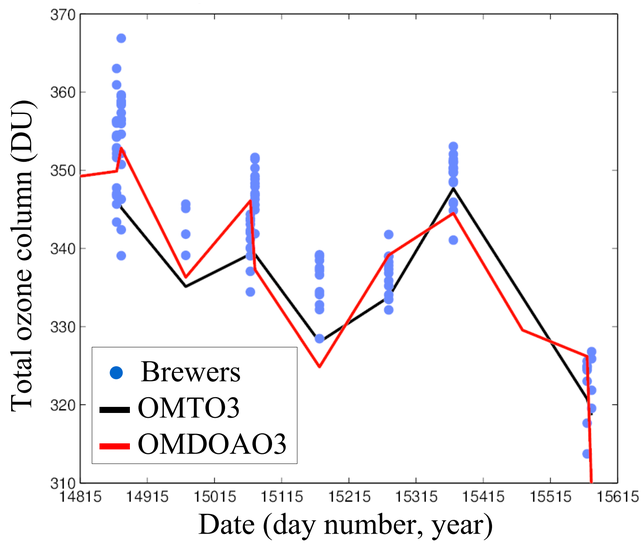




The X Brewer Intercomparison Campaign

From May 25th to June 5th 2015, 21 Brewer spectrophotometers from 10 different countries took part in the intercomparison campaign carried out at the El Arenosillo station. A new calibration was issued using as reference the travelling standard Brewer from the RBCCE. Operating within the Izaña Atmospheric Research Center (AEMET, Spain), the RBCCE maintains a triad of Brewer instruments, two regional references and a travelling standard. Since 2005, 130 Brewer calibrations have been provided by the RBCCE.

The next figure shows the total ozone column measured during the campaign by the Brewer instruments, plus the data from the OMTO3 and OMDOAO3 OMI products. Note we show the average of the Brewer observations within 30 minutes of the satellite pass. As before, there is a reasonable agreement between all three datasets, with a clearly strong correlation.



A larger spread of the Brewer data is observed in the first days of the campaign, but this should be expected, because at that point no maintenance work had been carried out. By the end of the campaign, measurements of most Brewer spectrophotometers were within ~1% of the RBCCE travelling standard.

Summary

►We have compared EUBREWNET's Brewer data with the two NASA OMI ozone products, the OMTO3 and OMDOAO3, as provided by the station-overpass data available at the Aura Validation Data Center.

►A good agreement is found between the three datasets, both while the Brewer instruments operate at their own stations in the 2015-2016 period, and during the X RBCCE Intercomparison Campaign (May-June 2015, El Arenosillo, Spain)

►Comparisons of this kind can be useful to check the status of the instruments integrated in the European Brewer Network, and EUBREWNET's data server allows to perform them easily and fast.

References

[**1**] Website of COST Action 1207 – EUBREWNET, http://www.eubrewnet.org/cost1207

[**2**] EUBREWNET's data server, http://rbcce.aemet.es/eubrewnet

[**3**] OMI Data User's Guide, the OMI team (2012)

[**4**] Aura Validation Data Center, http://avdc.gsfc.nasa.gov

Acknowledgments

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