QOS2016-110-1, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

Characterization of the Temperature Dependence of Brewer Spectrophotometer

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The Dobson and the Brewer spectrophotometers are the primary ground-based instruments used to report total ozone column (TOC) which is obtained from the differential absorption of select wavelengths in the UVB part of the solar spectrum. However, ozone measurements from Dobson and Brewer instruments network have shown systematic discrepancies of up to 3%, which is significantly larger than can be achieved within Brewer and Dobson instruments. These discrepancies have been partly traced back to uncharacterized instrumental features. Brewer temperature dependence has been established in the EMRP ATMOZ Joint Research Project (https://projects.pmodwrc.ch/atmoz/) as one of these features that require further study.

To make a thorough study of the effect of temperature on Brewer measurements, we have performed a characterization of the temperature dependence of RBCC-E (http://rbcce.aemet.es) Brewer spectrophotometer #185, from 23 to 26 of January, using a dedicated climate chamber at PTB in Braunschweig, Germany. We have performed measurements with the Brewer at different temperatures in the thermal chamber, the direct and the global input ports being irradiated by a fiber coupled Xe lamp system. In parallel, the Brewer internal standard lamp was measured as well. Furthermore, data from the European Brewer network (EUBREWNET) have been used to complement this study.

In this work we present the results of the characterization of temperature dependence of the Brewer, comparing the measurements made through the different input ports of the instrument. The effect of temperature on the Brewer observations modes O_3, UV and AOD were examined and the implications of this measurements evaluated. It is also presented a comparison of the temperature correction coefficients obtained in the laboratory and those obtained using the current standard procedure in EUBREWNET, which uses field data of the Brewer standard lamp. Special attention is paid to the observed non-linear behaviour of the temperature dependence, as well as the possible interaction with other variables, as relative humidity inside the instrument.