

QOS2016-108, 2016

Quadrennial Ozone Symposium of the International Ozone Commission

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## **Measurements of the angular response of Brewer spectrophotometers with a new portable device**

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The Brewer spectrophotometers are considered as reference instruments for ozone and ultraviolet irradiance measurements. They are expected to provide highly accurate measurements, which are of great interest for monitoring the ozone recovery and for many other applications. To reach this goal, the European Cooperation in Science and Technology program supports EUBREWNET COST ES1207 Action focuses on the improvement, homogenization and adoption of homogeneous protocols for calibration and measuring using Brewer spectrophotometers.

One of the main sources of uncertainty for the UV spectral irradiance measurements is the angular response of the Brewer spectrophotometer. Although there is a general agreement that the angular response should be measured for each individual spectrophotometer, this information is not generally available due to the difficulty to obtain those measurements routinely, usually requiring carrying the heavy instrument to a laboratory indoors.

In this framework, researchers from the University of Extremadura (UEX) and the National Institute of Aerospace Technique (INTA), Spain, have worked on different solutions to comply with this need. As a result of this collaboration, a new portable device for measuring the angular response of the Brewer spectrophotometer has been designed and prototypes built and tested. This initiative has been partially funded by the "Ministerio de Economía y Competitividad" of Spanish Government under contracts CGL2011-29921-C02 and CGL2014-56255-C2-R, and is promoted by COST Action ES1207 "The European Brewer Network (EUBREWNET)".

The device consists of a semicircle box with open holes at fixed angles, where a radiation source is placed giving a light beam which illuminates the center of the circle at fixed slant directions. This device aims to measure the angular response of Brewer spectrophotometers directly at their working location without the need to carrying it inside to a laboratory or attempting an angular characterization during the night. This possibility enables to operatively characterize the angular response of the many instruments participating in a calibration campaign and to identify deficiencies and fix them when possible. In fact, the new portable device has been tested at the IX and X Regional Brewer Calibration Center for Europe (RBCC-E) intercomparison campaigns held at Arosa (Switzerland) in July 2014, and at El Arenosillo (Spain) in June 2015, respectively.

This work presents the improvements achieved in measuring the angular response of Brewer spectrophotometers with the new portable device and its performance in the mentioned campaigns.