UV processing in EUBREWNET: results of the 18th RBCC-E campaign

J. López-Solano,[1,2] A. Redondas,[2] V. Carreño,[2] A. Berjón,[1,2] A. Serrano,[3] J.M. Vilaplana,[4] C. González,[4]
J. Gröbner,[5] L. Egli,[5] G. Hülsen,[5] F. Zeilinger,[5] K. Lakkala,[6] A. Keskinen.[7]

[1] TRAGSATEC, Madrid, Spain. [2] Izaña Atmospheric Research Center, AEMET, Tenerife, Spain. [3] Universidad de Extremadura, Badajoz, Spain. [4] National Institute of Aerospace Technology (INTA), Huelva, Spain. [5] Physikalisch-Meteorologisches Observatorium Davos/World Radiation Center, Davos, Switzerland. [6] Finnish Meteorological Institute, Rovaniemi, Finland. [7] Finnish Meteorological Institute, Helsinki, Finland

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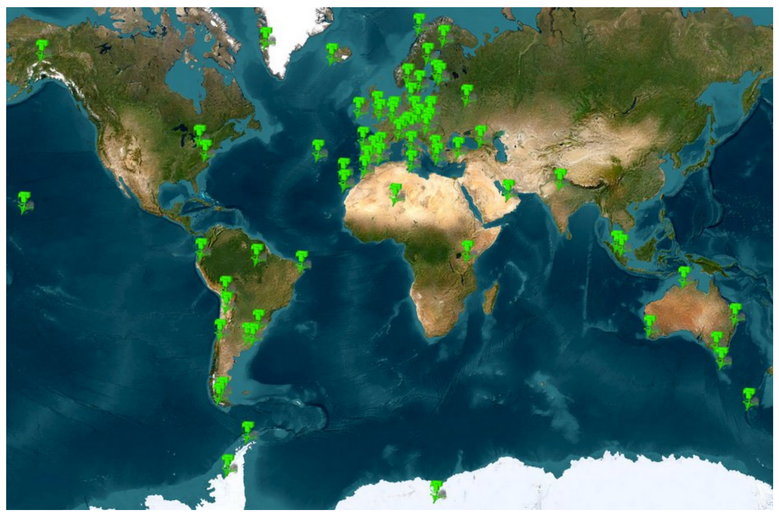
https://eubrewnet.aemet.es
eubrewnet@aemet.es

EUBREWNET

EUBREWNET started as a European network, and was developed in a COST action between 2013 and 2017 (Rimmer, 2018). Nowadays it integrates more than 100 Brewer instruments and 60 stations located all around the world. Spain's meteorological agency, AEMET, provides financial support to the network.

The main objective of the network is to provide consistent O_3, SO_2, UV and AOD data measured by Brewer instruments. All the data is processed at EUBREWNET's server using the same algorithms and are subject to the same QA/QC procedures.



Stations with data in EUBREWNET

The 18th RBCC-E campaign

Since the early 2000s, the Regional Brewer Calibration Center for Europe (RBCC-E) conducts annual Brewer intercomparison campaigns. The 18th RBCC-E campaign was held from September 4th to 15th, 2023, in the south of Spain, at El Arenosillo observatory operated by the National Institute of Aerospace Technology (INTA).

Besides sixteen Brewer instruments, the QASUME UV traveling reference from the PMOD/WOUDC (Switzerland) was also present at the campaign, giving us the oportunity to test the new UV processing recently implemented in EUBREWNET.

Brewers at El Arenosillo station

UV processing

UV level 0 data, taken directly from the Brewer without further processing, is available in EUBREWNET's data server since 2014. We have now implemented four additional processing levels, each one starting from the previous level, as outlined in the diagram on the right. Besides the raw measurements, some extra parameters are needed at each processing step, as indicated in the arrows of the diagram. These parameters have to be provided by the Brewer operator in EUBREWNET's UV configuration.

Note EUBREWNET's UV processing relies on two external codes:

- SHICrivm (Slaper, 2002) is used to calculate the shift-corrected irradiances. We also use its QA/QC output.
- BUVIC (Gröbner and Maret, 2020) is used to obtain cosine-corrected irradiances in clear sky conditions.

Further information on the UV product levels, configuration parameters, and how to access the data is available at the EUBREWNET wiki, https://eubrewnet.aemet.es/dokuwiki

UV Level 0
- Raw data from the Brewer

UVR

UV Level 1
- Correct by dark counts and deadtime
- For single Brewers, apply the straylight correction: substract the average of all the counts below 2922Å

T reference
T dependence
Exclusion list

UV Level 1.5
- Remove spikes (Meinander, 2002)
- Convert measurements to a reference temperature using a experimentally-determined temperature dependence (Lakkala, 2008)
- Apply an exclusion list to remove bad measurements

Brewer slit function

UV Level 1.6
- Run SHICrivm (Slaper, 2002)
- Calculate the shift-corrected irradiances using a Brewer-specific slit function
- Get the wavelength shifts and QA/QC flags
- Retain only the UV measurements with GREEN and YELLOW flags

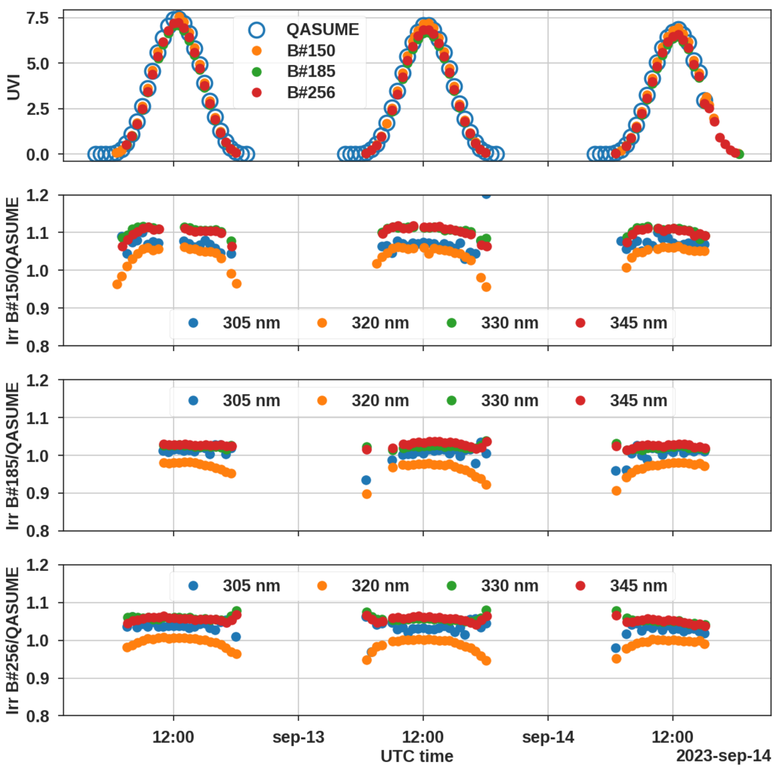
Angular response
UV surface albedo
Ångström's α and β
Cloud cover

UV Level 2
- Run BUVIC (Gröbner and Maret, 2020)
- Return the cosine-corrected irradiances taking into account the the daily UV surface albedo, Ångström's alpha and beta, and cloud cover

Brewer *vs* QASUME: a brief comparison

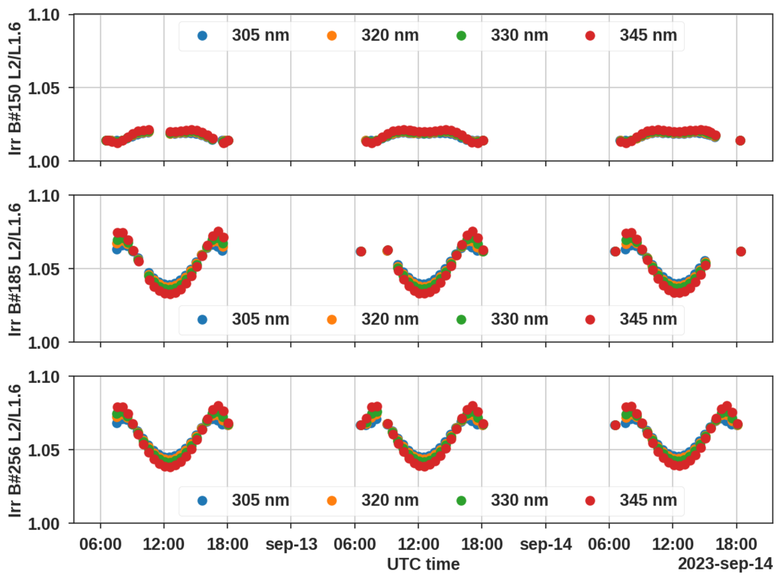
Among the instruments at the 18th intercomparison campaign were two Brewers operated by the RBCC-E, #185 and #256. El Arenosillo station is also the home of Brewer #150, which was operating normally during the whole campaign. We now show a brief comparison between these three instruments and the QASUME traveling reference from the PMOD/WRC. Note each instrument uses its own slit function. A more complete comparison, with a normalized slit, can be found in Hülsen (2023).

The figure to the right shows data from the last three days of the campaign, once the maintenance on the Brewers had finished. For EUBREWNET's product level 2, we show the UV index and the Brewer/QASUME irradiance ratios of selected wavelengths. Only Brewer #150 data is corrected for temperature, while all three Brewers include the cosine correction. The angular response was measured with the Brewer Angular Tester (BAT) developed at INTA and the Universidad de Extremadura (Serrano and Vilaplana, 2014). The UV surface albedo and Ångström's parameters were obtained from previous studies at the station.



Level 2 UVI and Brewer/QASUME irradiance ratios

A good agreement between the QASUME and Brewer is apparent, with irradiance ratios close to one. For Brewers #185 and #256, the cosine correction plays a large role, improving the comparison noticeably. Brewer #150's diffuser has a better angular response, as shown in the figure below where we plot L2/L1.6 irradiance ratios.

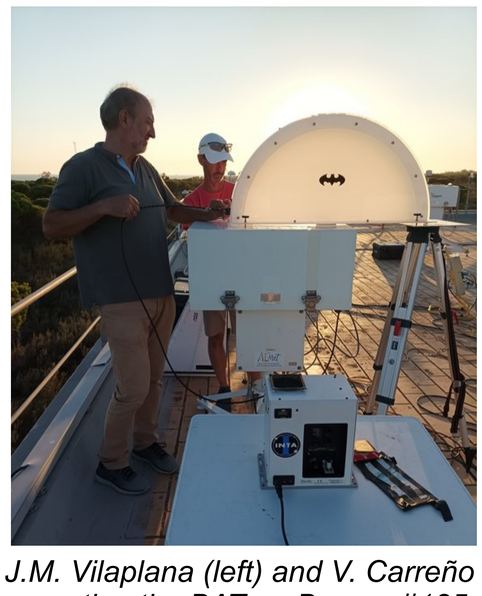


EUBREWNET's UV L2/L1.6 irradiance ratios

Concluding remarks

Over the last years, EUBREWNET's UV data processing has matured and now provides four additional product levels. As shown by the results of the 18th RBCC-E campaign, the corrections introduced by the different UV product levels can improve significantly the quality of the Brewer data with little effort – once the UV configuration is set, EUBREWNET's data server automatically processes all the data it receives. Data is also available in different formats, including the one usually required for the comparison with the QASUME UV traveling reference.

Finally, we would like to thank the Brewer PIs and operators for their work at the stations affiliated to the EUBREWNET network.



J.M. Vilaplana (left) and V. Carreño operating the BAT on Brewer #185

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