The 18th RBCC-E campaign: processing UV data in EUBREWNET

J. López-Solano,[1,2] A. Redondas,[2] V. Carreño,[2] A. Berjón,[1,2] A. Serrano,[3] J.M. Vilaplana,[4] G. Hülsen,[5] F. Zeilinger,[5] J. Gröbner,[5] L. Egli,[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, Rovaniemi, Finland

eubrewnet@aemet.es

The 18th RBCCE campaign at El Arenosillo (INTA, Huelva, Spain)

Outline

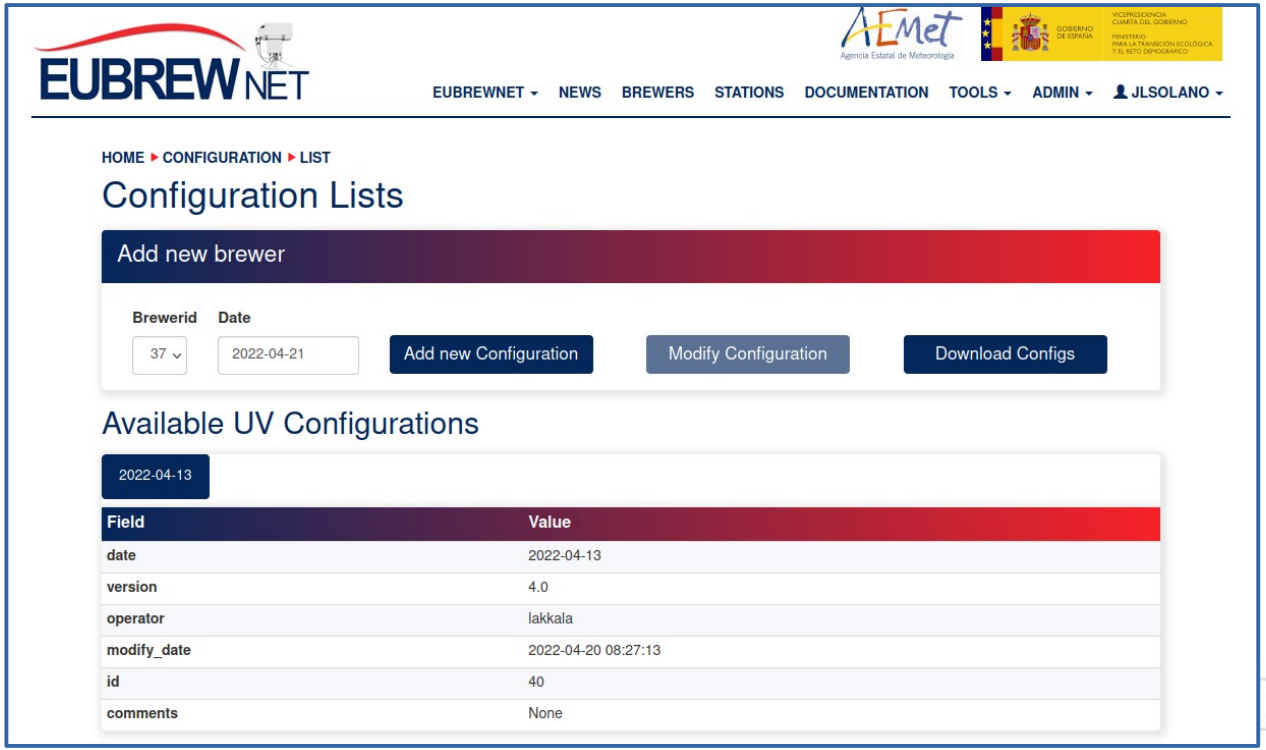
- UV configuration
- UV levels
- The 18th RBCCE campaign
- Future
- Off topic: AOD JG news

Brewers at the 18th RBCCE Intercomparsion campaign (El Arenosillo, INTA, Spain)

UV configuration

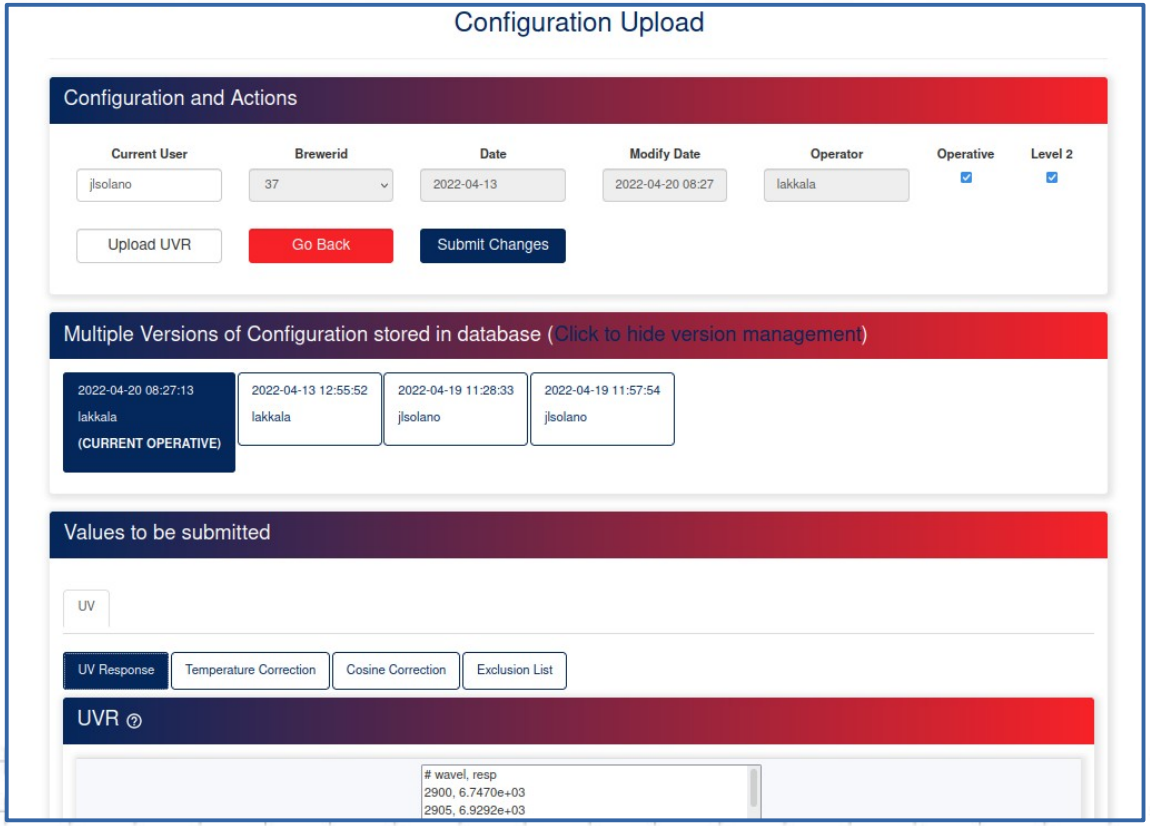
Add, modify, or just check which configurations are available:

https://eubrewnet.aemet.es/eubrewnet/configuration/list/UV



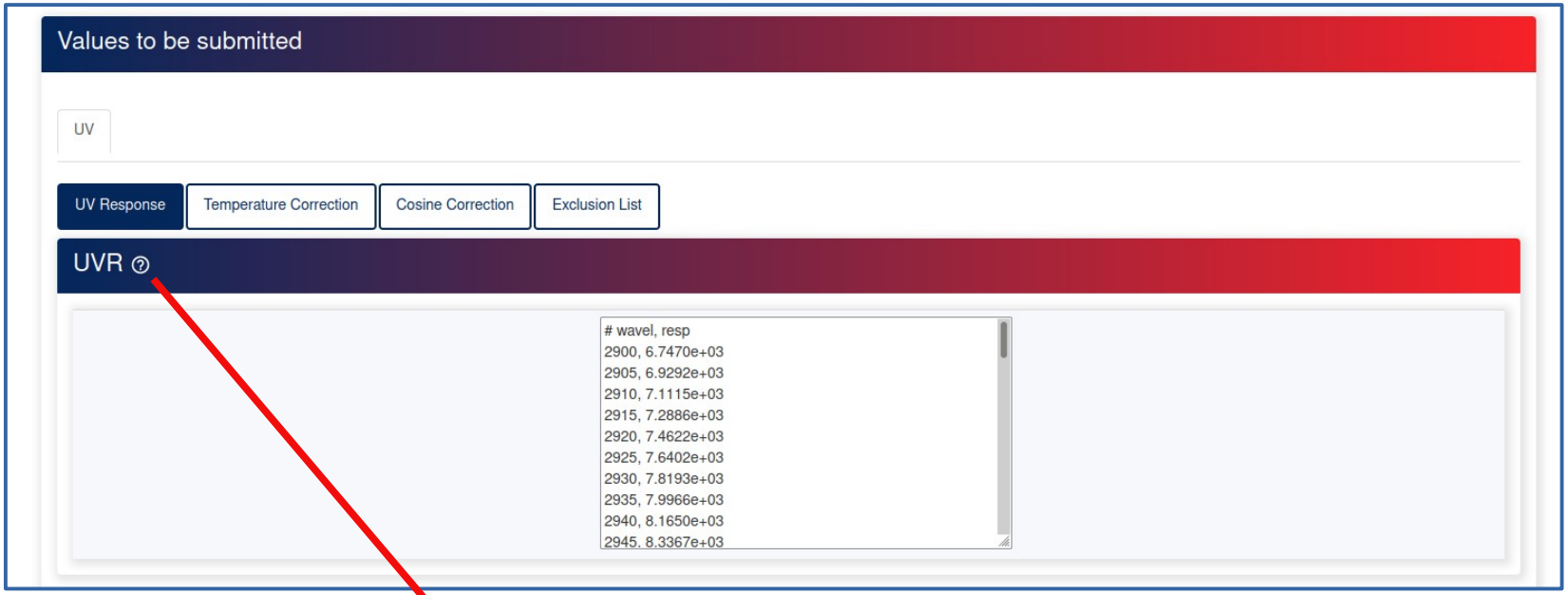
UV configuration

After clicking on add or modify:



UV configuration

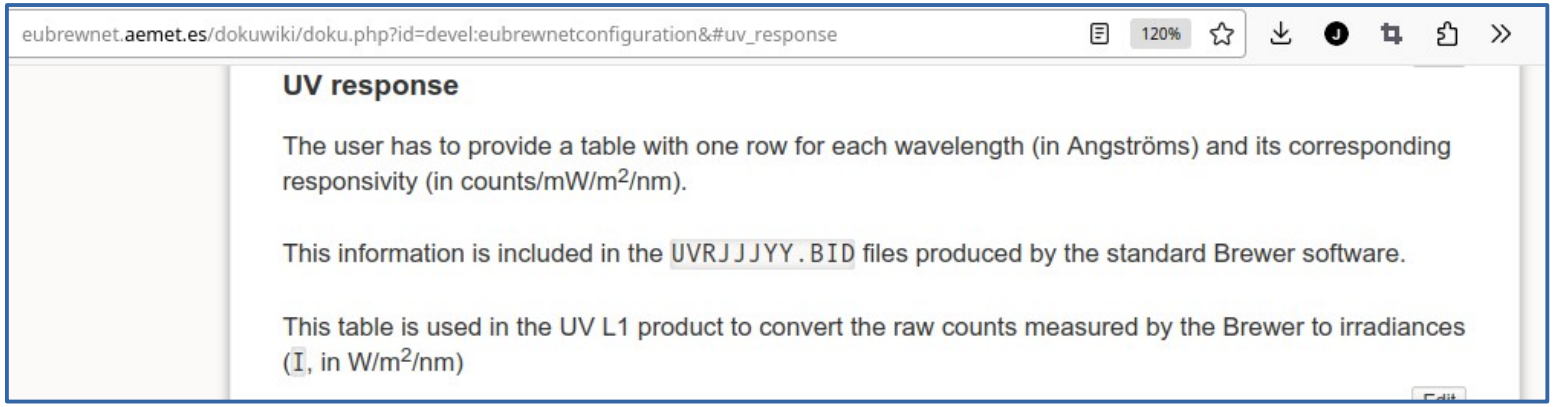
UV Response:



http://eubrewnet.aemet.es/dokuwiki/doku.php?id=devel:eubrewnetconfiguration&#uv_response

UV configuration

http://eubrewnet.aemet.es/dokuwiki/doku.php?id=devel:eubrewnetconfiguration&#uv_response

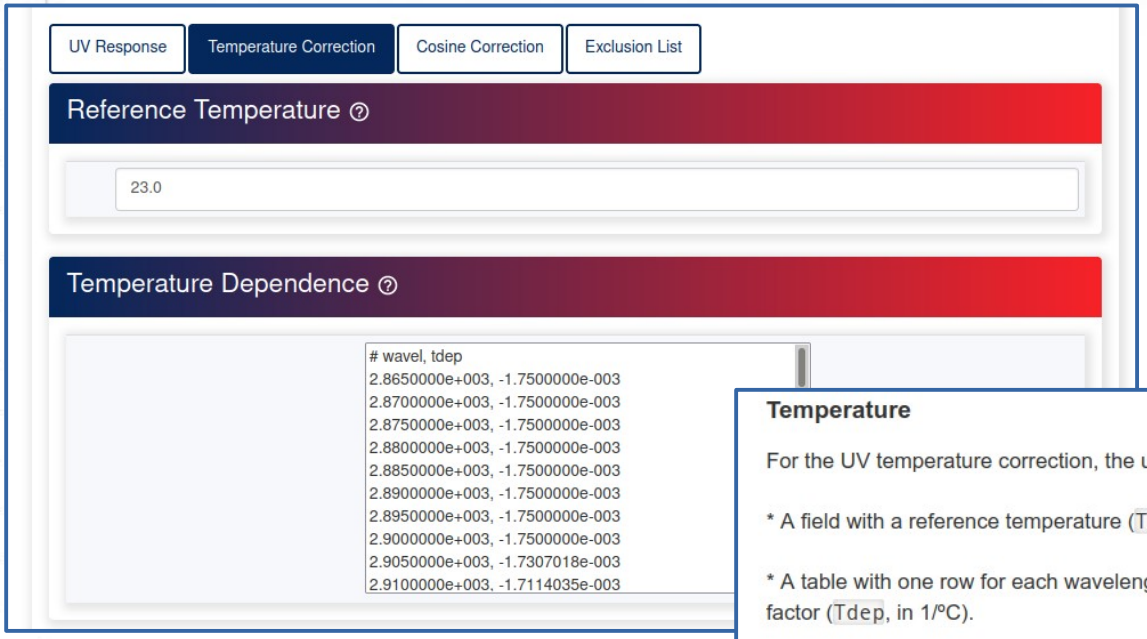


http://eubrewnet.aemet.es/dokuwiki

UV configuration

VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO
AEMet Agencia Estatal de Meteorología

Temperature:



Temperature

For the UV temperature correction, the user has to provide

* A field with a reference temperature (`Tref`, in ºC), and

* A table with one row for each wavelength (in Angströms) and the corresponding temperature dependence factor (`Tdep`, in 1/ºC).

All this information can be obtained by the experimental characterization described in Lakkala et al., Atmos. Chem. Phys., 8, 3369–3383, 2008

In the level 1.5 UV product, these data are used to calculate irradiances normalized to the reference temperature, `I(Tref) = I(T)/[1+Tdep(T-Tref)]`.

UV configuration

Cosine correction:

UV Response | Temperature Correction | **Cosine Correction** | Exclusion List

Angular Response

```
# sza, resp_1, resp_2, resp_3, resp_4
0, 1, None, None, None
5, 1.001041500, None, None, None
10, 0.995994232, None, None, None
15, 0.966591892, None, None, None
20, 0.948325589, None, None, None
25, 0.905864445, None, None, None
30, 0.868098061, None, None, None
35, 0.810286813, None, None, None
40, 0.756289056, None, None, None
```

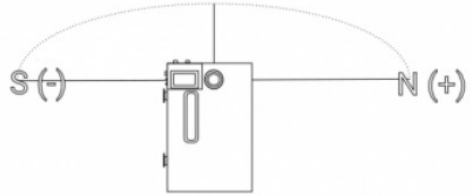
Default Meteorological Data

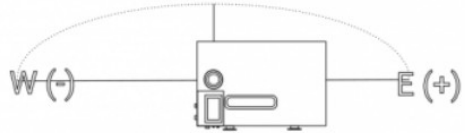
Albedo	Alpha	Beta	Clouds

Daily Meteorological Data

```
# date, albedo, alpha, beta, clouds
2023-09-05, 0.22, 1.371, 0.039066, 1
2023-09-06, 0.22, 1.371, 0.039066, 1
2023-09-07, 0.22, 1.371, 0.039066, 1
2023-09-08, 0.22, 1.371, 0.039066, 0
2023-09-09, 0.22, 1.371, 0.039066, 0
2023-09-10, 0.22, 1.371, 0.039066, 0
2023-09-11, 0.22, 1.371, 0.039066, 0
2023-09-12, 0.22, 1.371, 0.039066, 0
2023-09-13, 0.22, 1.371, 0.039066, 0
```

- A table with five columns: angle (between 0 and 90 degrees), and angular responses (measurements from the CR file normalized to the maximum value at 0 degrees) in the N, S, W, and E directions, see the next figure (**as of February 2022, only the angular response in the N direction is used**)





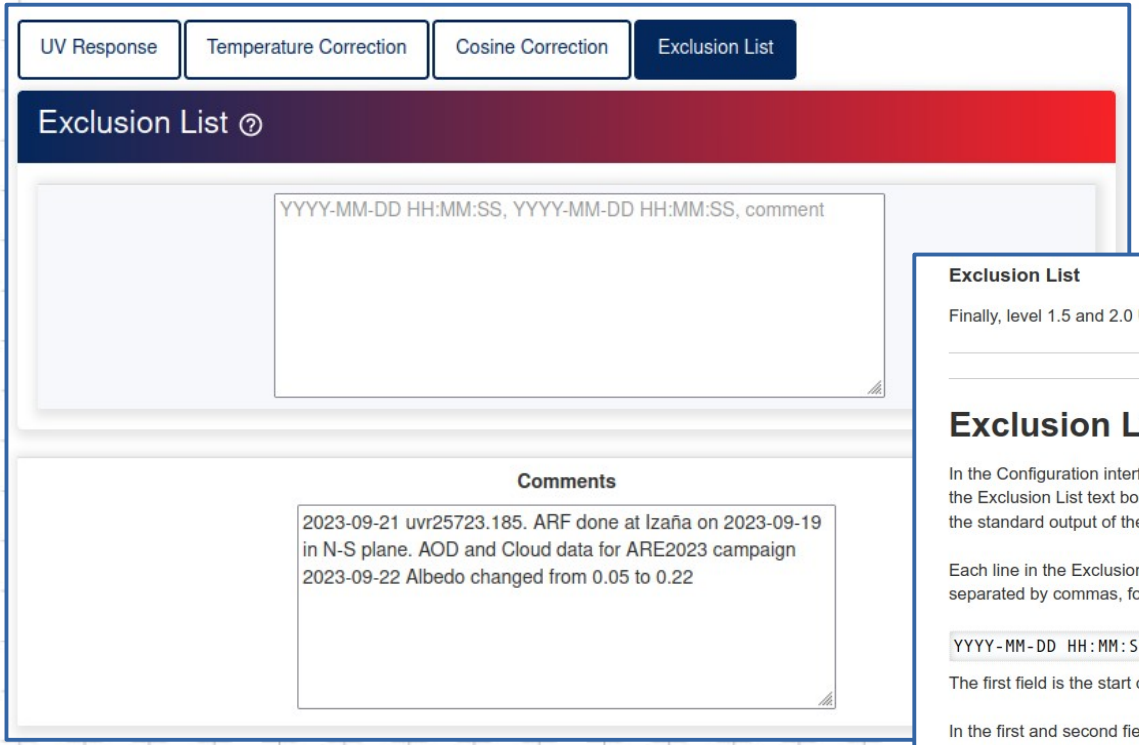
- Fields with default values for the surface albedo in the UV, Angström's alpha and beta of aerosols, and the cloud cover (with values from 0 for clear sky to 1 for completely overcast conditions; the cosine correction is only applied for values lower than 0.9). These meteorological parameters will be used if no information for a specific day is provided in the following table.

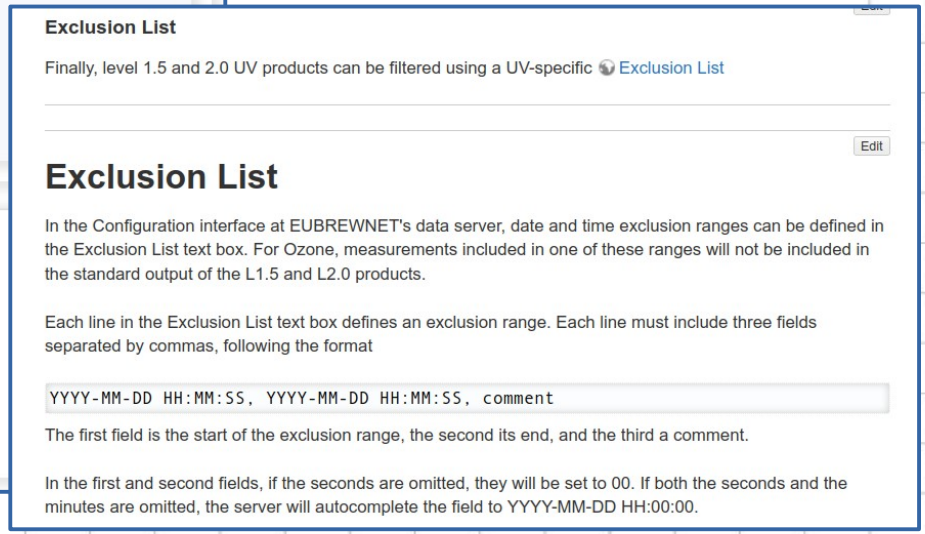
- A table with 5 columns: date (in YYYY-MM-DD format), surface albedo in the UV, Angström's alpha and beta of aerosols, and cloud cover. The cloud cover takes values from 0 (clear) to 1 (completely overcast), and the cosine correction is only applied for values lower than 0.9.

UV configuration

VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO
AEMet Agencia Estatal de Meteorología

Exclusion list and comments:





UV level 1

- Definition: start with the Brewer raw counts, then correct by dark counts, dead time, and straylight (MK IIs and IVs), then divide by the UVR to get irradiances
- Configuration: fill the UVR box
- Output: https://rbcce.aemet.es/eubrewnet/data/process/UVL1?brewerid=185&date=2023-09-11&format=text

UV level 1

VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO
AEMet Agencia Estatal de Meteorología

https://rbcce.aemet.es/eubrewnet/data/process/UVL1?brewerid=185&date=2023-09-11&format=text

CSV file

t2 Scan at time1 Header

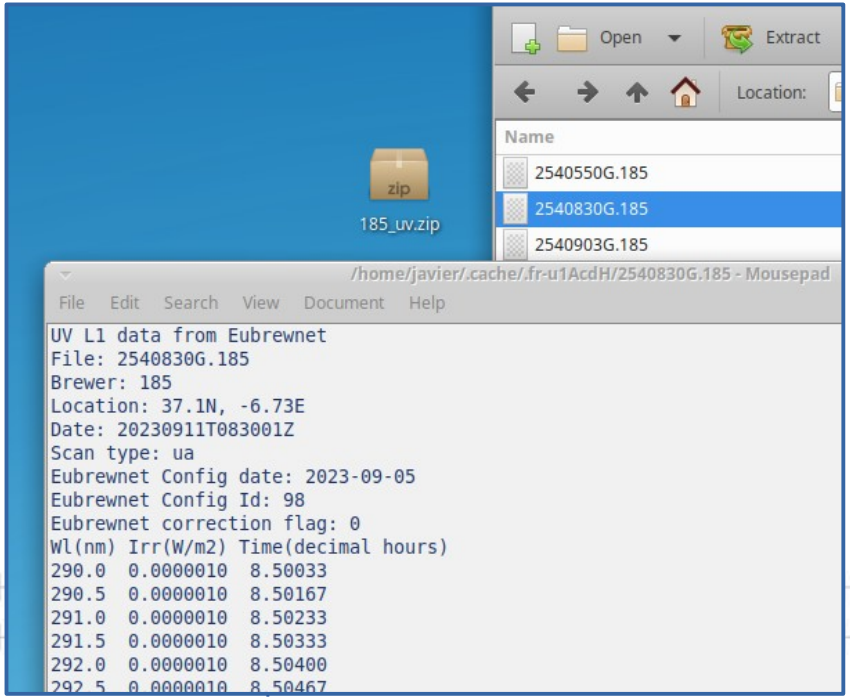
https://rbcce.aemet.es/eubrewnet/data/process/UVL1?brewerid=185&date=2023-09-11&format=text

```
brewerid,config_id,config_date,mmmm,gmt,scan,num_wl,irr_2865,irr_2870,irr_2875,irr_2880,irr_2885,irr_2890,irr_2895,irr_2900,irr_2905,irr_2910,irr_2915,irr_2920,irr_2925,irr_2930,irr_2935,irr_2940,irr_2945,irr_2950,irr_2955,irr_2960,irr_2965,irr_2970,irr_2975,irr_2980,irr_2985,irr_2990,irr_2995,irr_3000,irr_3005,irr_3010,irr_3015,irr_3020,irr_3025,irr_3030,irr_3035,irr_3040,irr_3045,irr_3050,irr_3055,irr_3060,irr_3065,irr_3070,irr_3075,irr_3080,irr_3085,irr_3090,irr_3095,irr_3100,irr_3105,irr_3110,irr_3115,irr_3120,irr_3125,irr_3130,irr_3135,irr_3140,irr_3145,irr_3150,irr_3155,irr_3160,irr_3165,irr_3170,irr_3175,irr_3180,irr_3185,irr_3190,irr_3195,irr_3200,irr_3205,irr_3210,irr_3215,irr_3220,irr_3225,irr_3230,irr_3235,irr_3240,irr_3245,irr_3250,irr_3255,irr_3260,irr_3265,irr_3270,irr_3275,irr_3280,irr_3285,irr_3290,irr_3295,irr_3300,irr_3305,irr_3310,irr_3315,irr_3320,irr_3325,irr_3330,irr_3335,irr_3340,irr_3345,irr_3350,irr_3355,irr_3360,irr_3365,irr_3370,irr_3375,irr_3380,irr_3385,irr_3390,irr_3395,irr_3400,irr_3405,irr_3410,irr_3415,irr_3420,irr_3425,irr_3430,irr_3435,irr_3440,irr_3445,irr_3450,irr_3455,irr_3460,irr_3465,irr_3470,irr_3475,irr_3480,irr_3485,irr_3490,irr_3495,irr_3500,irr_3505,irr_3510,irr_3515,irr_3520,irr_3525,irr_3530,irr_3535,irr_3540,irr_3545,irr_3550,irr_3555,irr_3560,irr_3565,irr_3570,irr_3575,irr_3580,irr_3585,irr_3590,irr_3595,irr_3600,irr_3605,irr_3610,irr_3615,irr_3620,irr_3625,irr_3630,mmmm_2865,mmmm_2870,mmmm_2875,mmmm_2880,mmmm_2885,mmmm_2890,mmmm_2895,mmmm_2900,mmmm_2905,mmmm_2910,mmmm_2915,mmmm_2920,mmmm_2925,mmmm_2930,mmmm_2935,mmmm_2940,mmmm_2945,mmmm_2950,mmmm_2955,mmmm_2960,mmmm_2965,mmmm_2970,mmmm_2975,mmmm_2980,mmmm_2985,mmmm_2990,mmmm_2995,mmmm_3000,mmmm_3005,mmmm_3010,mmmm_3015,mmmm_3020,mmmm_3025,mmmm_3030,mmmm_3035,mmmm_3040,mmmm_3045,mmmm_3050,mmmm_3055,mmmm_3060,mmmm_3065,mmmm_3070,mmmm_3075,mmmm_3080,mmmm_3085,mmmm_3090,mmmm_3095,mmmm_3100,mmmm_3105,mmmm_3110,mmmm_3115,mmmm_3120,mmmm_3125,mmmm_3130,mmmm_3135,mmmm_3140,mmmm_3145,mmmm_3150,mmmm_3155,mmmm_3160,mmmm_3165,mmmm_3170,mmmm_3175,mmmm_3180,mmmm_3185,mmmm_3190,mmmm_3195,mmmm_3200,mmmm_3205,mmmm_3210,mmmm_3215,mmmm_3220,mmmm_3225,mmmm_3230,mmmm_3235,mmmm_3240,mmmm_3245,mmmm_3250,mmmm_3255,mmmm_3260,mmmm_3265,mmmm_3270,mmmm_3275,mmmm_3280,mmmm_3285,mmmm_3290,mmmm_3295,mmmm_3300,mmmm_3305,mmmm_3310,mmmm_3315,mmmm_3320,mmmm_3325,mmmm_3330,mmmm_3335,mmmm_3340,mmmm_3345,mmmm_3350,mmmm_3355,mmmm_3360,mmmm_3365,mmmm_3370,mmmm_3375,mmmm_3380,mmmm_3385,mmmm_3390,mmmm_3395,mmmm_3400,mmmm_3405,mmmm_3410,mmmm_3415,mmmm_3420,mmmm_3425,mmmm_3430,mmmm_3435,mmmm_3440,mmmm_3445,mmmm_3450,mmmm_3455,mmmm_3460,mmmm_3465,mmmm_3470,mmmm_3475,mmmm_3480,mmmm_3485,mmmm_3490,mmmm_3495,mmmm_3500,mmmm_3505,mmmm_3510,mmmm_3515,mmmm_3520,mmmm_3525,mmmm_3530,mmmm_3535,mmmm_3540,mmmm_3545,mmmm_3550,mmmm_3555,mmmm_3560,mmmm_3565,mmmm_3570,mmmm_3575,mmmm_3580,mmmm_3585,mmmm_3590,mmmm_3595,mmmm_3600,mmmm_3605,mmmm_3610,mmmm_3615,mmmm_3620,mmmm_3625,mmmm_3630,duv,duv_cost,uvi,uvi_cost,temp,longitude,latitude,press,correction_flag,process_date
185,98,20230905,350.97,20230911T055058Z,ux,147,None,None,None,None,None,None,None,
1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1.04797873512e-06,1e-06,1.04860160853e-06,1e-06,2.79760241897e-06,1e-06,6.2969347214e-06,1e-06,2.79942033667e-06,1.04990078205e-06,2.80001090998e-06,1e-06,1e-06,4.55108857191e-06,1.33041010498e-05,9.80367843803e-06,6.30280079733e-06,1.33069198517e-05,6.3037869249e-06,9.8067937201e-06,2.8022282031e-06,1.85669845792e-05,2.20731446179e-05,1.68201632582e-05,2.03278340177e-05,1.33207639938e-05,2.91016008655e-05,1.85872919233e-05,3.26239452322e-05,2.91242179694e-05,4.31733453325e-05,3.61652732074e-05,3.09095048037e-05,4.84903810449e-05,5.02677531643e-05,5.38062198536e-05,5.0312361267e-05,7.32169059099e-05,8.73410655219e-05,7.3292023375e-05,8.03831888043e-05,0.000106885800108,0.000106948263405,0.000124671899261,0.000100011049838,9.30021876842e-05,0.000100139884575,0.000151550221266,0.000188858733848,0.000160622553253,0.000150090525195,0.000208787067316,0.000308436787221,0.000354893479012,0.000344480261806,0.000318027579581,0.000239857434099,0.000300678444593,0.000456195860098,0.000558374418l7,0.000523061174296,0.000371401864943,0.000362749929023,0.000415016650445,0.000531943700155,0.000597016560839,0.000543627186673,0.000484759103671,0.000463590498912,0.000575695752955,0.000646545829842,0.000766271959909,0.000494218354591,0.000585115821l68,0.000469858008642,0.000575432698354,0.000601432933047,0.000778222381128,0.000753633071708,0.000721729175877,0.000835540014342,0.000725254756099,0.000817464955953,0.000780079910643,0.000949539790548,0.000862761049293,0.000920813735595,0.000848508455499,0.000626915096251,0.000666477173709,0.000872277021945,0.000938159397564,0.000798755900139,0.000892485574218,0.000986434224786,0.000800001346722,0.000923740417686,0.000924779315797,0.000884720399573,0.000898602569083,0.00108047708834,0.00119729939727,0.0010622969683,0.000997370145575,0.0010982724447,0.000884141150324,0.00106374685464,0.00121523794372,0.0012942732521,0.00124463406609,0.00126813532929,0.00116615295376,0.00124773046552,0.00104258082917,0.00090468796868,0.00106808294846,0.000839995418133,0.000716582761892,0.00105498870148,0.00129275681857,0.00142138736421,0.00112277499,0.00101455859362,0.00124843469077,0.00102695907698,0.00145288637123,0.00125483902851,None,None,None,None,None,None,None,
350.97,351.01,351.05,351.1,351.14,351.18,351.22,351.26,351.3,351.35,351.39,351.43,351.47,351.51,351.55,351.59,351.63,351.68,351.72,351.76,351.79,351.83,351.86,351.89,351.93,351.96,352.0,352.03,352.06,352.1,352.13,352.17,352.2,352.23,352.27,352.3,352.34,352.37,352.4,352.44,352.47,352.51,352.54,352.57,352.61,352.64,352.68,352.71,352.74,352.78,352.81,352.85,352.88,352.92,352.95,352.98,353.02,353.05,353.09,353.12,353.15,353.19,353.22,353.26,353.29,353.33,353.36,353.39,353.43,353.46,353.49,353.53,353.56,353.6,353.63,353.66,353.7,353.73,353.77,353.8,353.84,353.87,353.91,353.94,353.97,354.01,354.04,354.07,354.11,354.14,354.18,354.21,354.25,354.28,354.31,354.35,354.38,354.42,354.45,354.49,354.52,354.56,354.59,354.63,354.66,354.7,354.73,354.77,354.8,354.83,354.87,354.9,354.94,354.97,355.01,355.04,355.08,355.11,355.15,355.18,355.22,355.25,355.39,355.42,355.46,355.49,355.53,355.56,355.6,355.63,355.67,355.7,355.74,355.77,355.81,355.84,355.88,355.91,355.95,355.98,356.01,356.05,356.08,356.12,356.15,356.19,356.22,0.0538556607306,0.0641979158785l341,0.00215422642922,0.00256791663514l05365,20.0,6.73,37.1,1000.0,0,20240408T122212Z
185,98,20230905,510.02,20230911T083001Z,ua,147,None,None,None,None,None,None,None,
1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1e-06,1.39023543154e-06,1e-06,1e-06,3.13291570019e-06,6.617346035l9e-06,5.74952325674e-06,2.75413797302e-05,3.45297586932e-05,3.62893957049e-05,8.51755007567e-05,0.000144574352516,0.00016209102599,0.000232032582884,0.000437468304627,0.000682352182254,0.000630914670418,0.0012529169577,0.00219550227092,0.00282430996216,0.00285794671704,0.00403528932008,0.00596688533495,0.00656437171267,0.00662274642645,0.00826062940758,0.0118958815689,0.0148030722031,0.0160577934479,0.0184490790014,0.0169231568071,0.0197278043722,0.0206051980219,0.0329660698l32,0.04068
```

UV level 1

https://rbcce.aemet.es/eubrewnet/data/process/UVL1?brewerid=185&date=2023-09-11&format=zip

Zip file with one text file for each measurement, with the QASUME format



UV level 1.5

- Definition: start with the UVL1 data, then remove spikes (Gröbner, Meinander), correct by T (Lakkala), and apply the exclusion list
- Configuration: T coeffs and exclusion list, both optional
- Output: https://rbcce.aemet.es/eubrewnet/data/process/UVL1_5?brewerid=185&date=2023-09-11&format=zip

UV level 1.6

- Definition: run SHICrivm (Harry Slaper, RIVM) on the UVL1.5 data to get the QA/QC flags, wavelength shifts, shift-corrected spectrum
- Configuration: nothing for now, will likely add a box for the instrument's slit function (a generic one is used now)
- Output: https://rbcce.aemet.es/eubrewnet/data/process/UVL1_6?brewerid=185&date=2023-09-11&format=zip

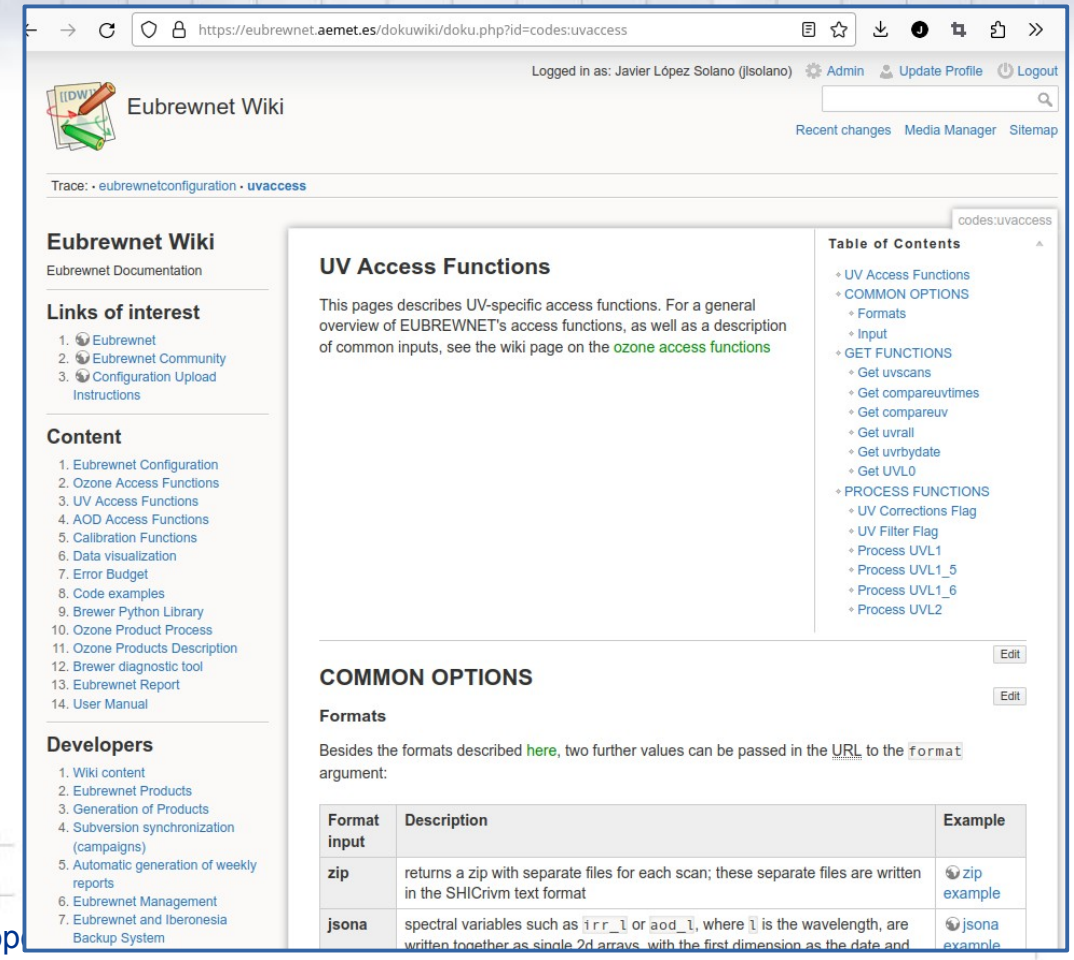
UV level 2

- Definition: run BUVIC (Gröbner & Maret, PMOD) on the UVL1.6 data to correct the cosine effect
- Configuration: fill the angular response box, and UV surface albedo, Ångström's alpha & beta, and cloud cover params (the cosine correction is only applied for clear sky, with cloud cover <0.9)
- Output: https://rbcce.aemet.es/eubrewnet/data/process/UVL2?brewerid=185&date=2023-09-11&format=zip

Wiki

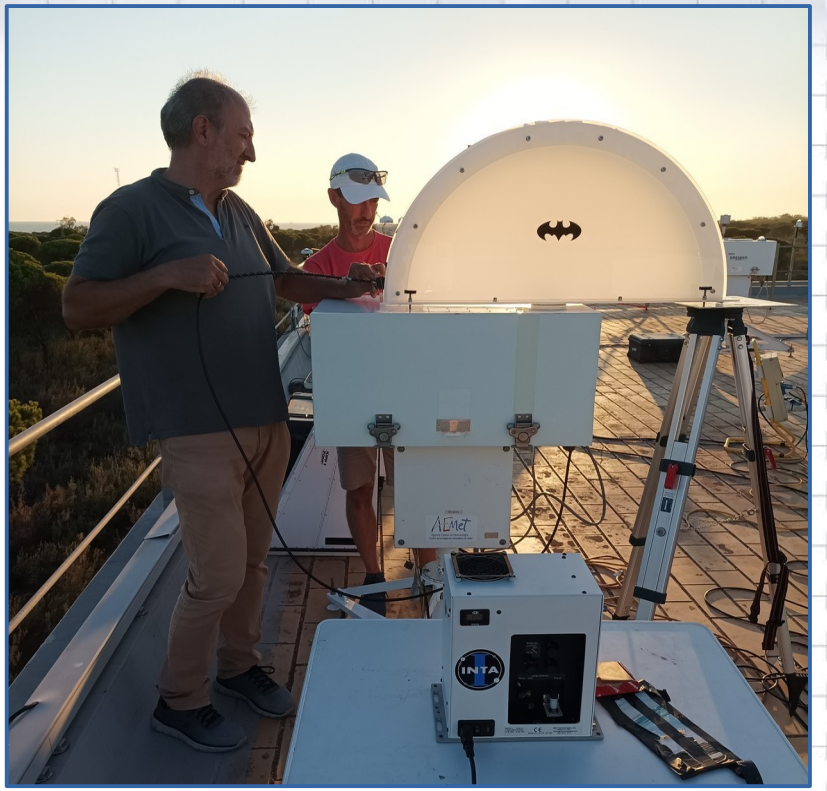
All this (and much more) can be found in the EUBREWNET wiki:

https://eubrewnet.aemet.es/dokuwiki/doku.php?id=codes:uvaccess



The 18th RBCCE

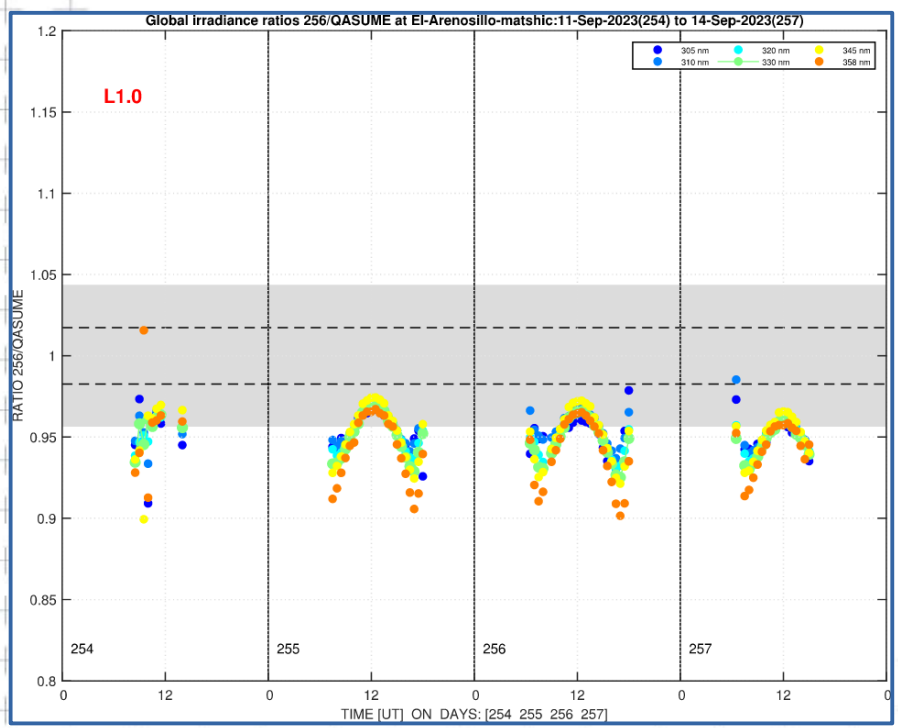
- September 4th to 15th, 2023
- El Arenosillo Observatory (INTA, Huelva, Spain)
- 16 Brewers from Spain, UK, Denmark, The Netherlands, and Canada
- QASUME reference from PMOD/WRC
- Brewer Angular Tester (INTA & Universidad de Extremadura) to characterize the angular response

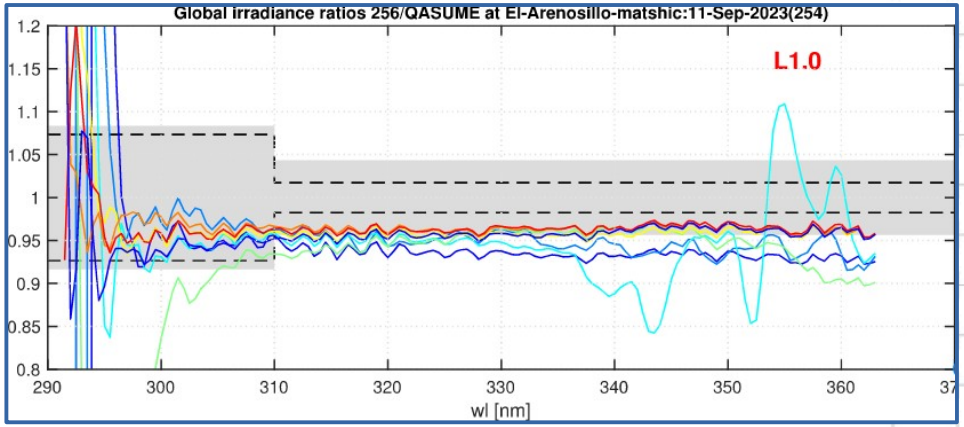


JM Vilaplana (INTA) and V Carreño (AEMET) using the BAT on B#185

UV L1.5 vs QASUME

B#256: UVR from 1000W reference lamps at the Izaña Observatory (AEMET), no T correction

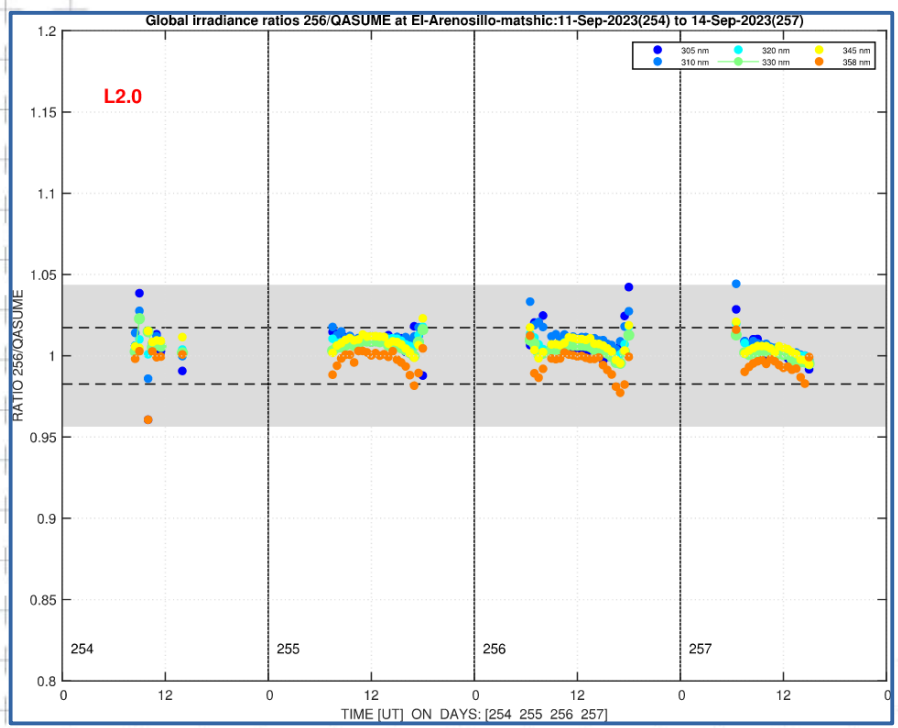


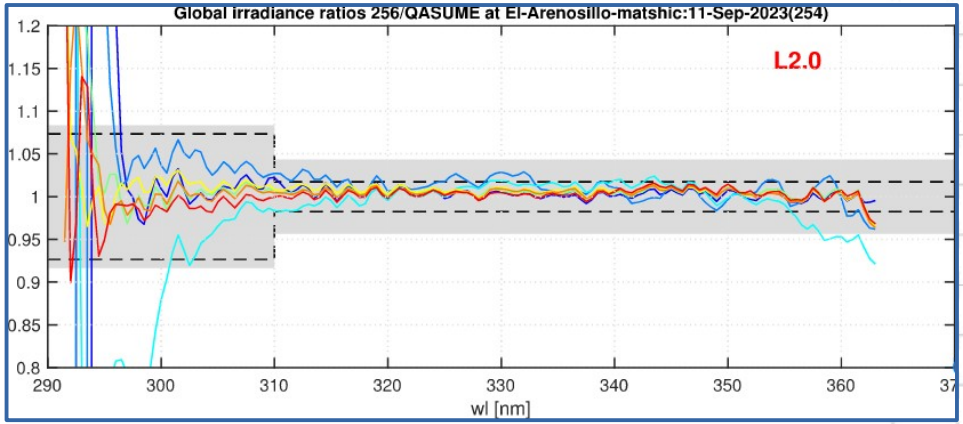


UV L2 vs QASUME

VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO
AEMet Agencia Estatal de Meteorología

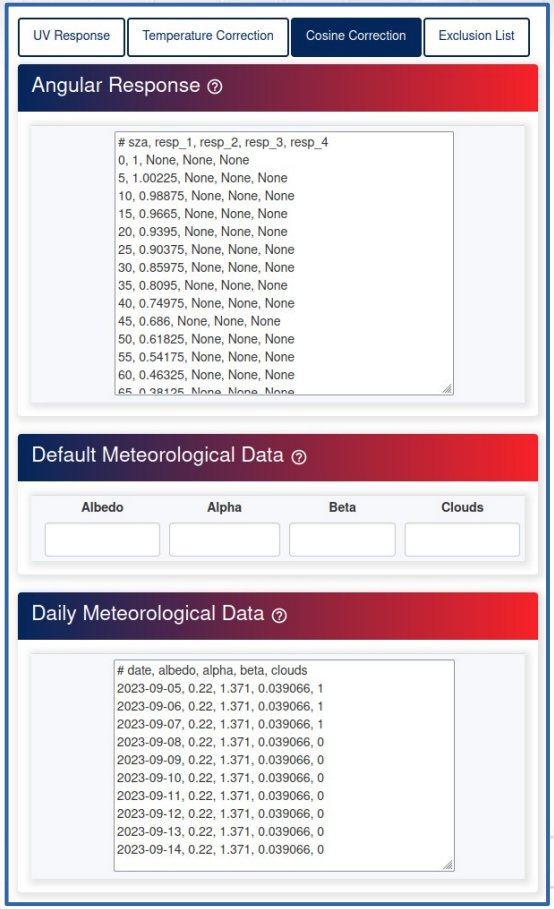
SHICrivm (data QA/QC, wavelength shifts) + BUVIC (cosine correction)





UV L2 configuration

- UV surface albedo: 0.22
- Ångstrom's alpha and beta: 1.371 and 0.039
- Clear sky conditions since September 8th
- Angular response characterized on September 11th using the BAT



Takeaways

- UV processing in EUBREWNET is easy
- For L1, you just need to fill the UVR box in the configuration
- L2 is a noticeable improvement
- For L2, you need the angular response, UV surface albedo, Ångström's alpha and beta, and cloud cover
- Angular response at El Arenosillo with the BAT: contact A Serrano (Universidad de Extremadura) and JM Vilaplana (INTA) in advance
- Data for QASUME comparison: https://rbcce.aemet.es/eubrewnet/data/process/UVL2?brewerid=256&date=2023-09-11&format=zip

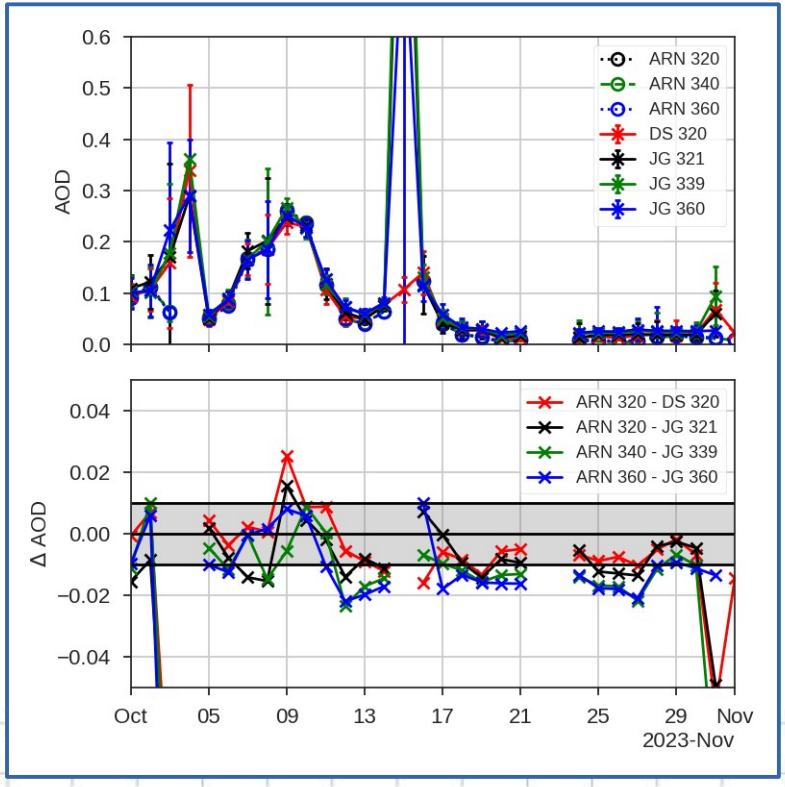
Future

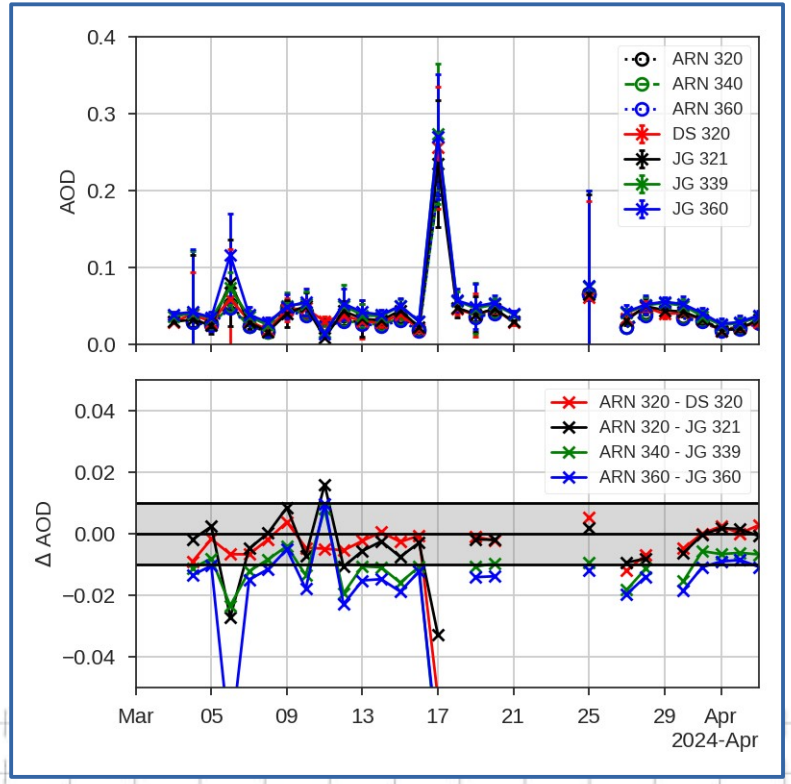
- Run tests and more tests
- One slit function for each Brewer
- Interface and usability suggestions?
- Format of the product text files?
- Anything else?

Brewers #150 (back), #256, and #185 at the El Aeronosillo Observatory (INTA, Huelva, Spain) during the 18th RBCCE

AOD JG

B#185 vs AERONET





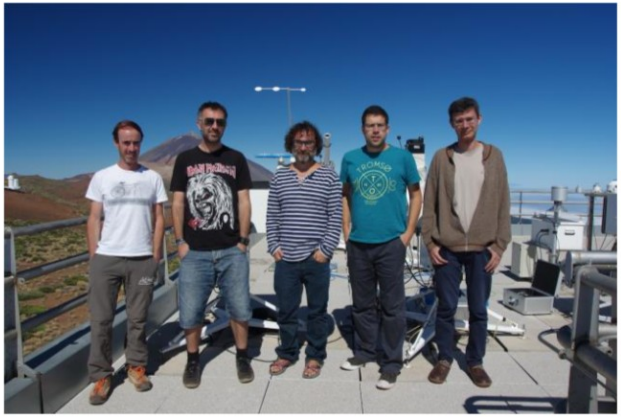
The End

Questions, suggestions, and bug reports are always welcome!

eubrewnet@aemet.es

Past and present of the RBCCE

Back to front, left to right: Alberto Redondas (AEMET), Alberto Berjón (TRAGSATEC), Javier López Solano (TRAGSATEC), Bentorey Hernandez (ECMWF), Virgilio Carreño (AEMET), Manuel Rodríguez Valido (ULL), Daniel Santana (Lüftblick), Sergio F. León Luis (TRAGSATEC)



Left to right: Virgilio Carreño (AEMET), Francisco Parra-Rojas (UIPR), Alberto Redondas (AEMET), Sergio Fabián León Luis (TRAGSATEC), Javier López Solano (TRAGSATEC)