

Aerosol Optical Depth in EUBREWNET

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Outline

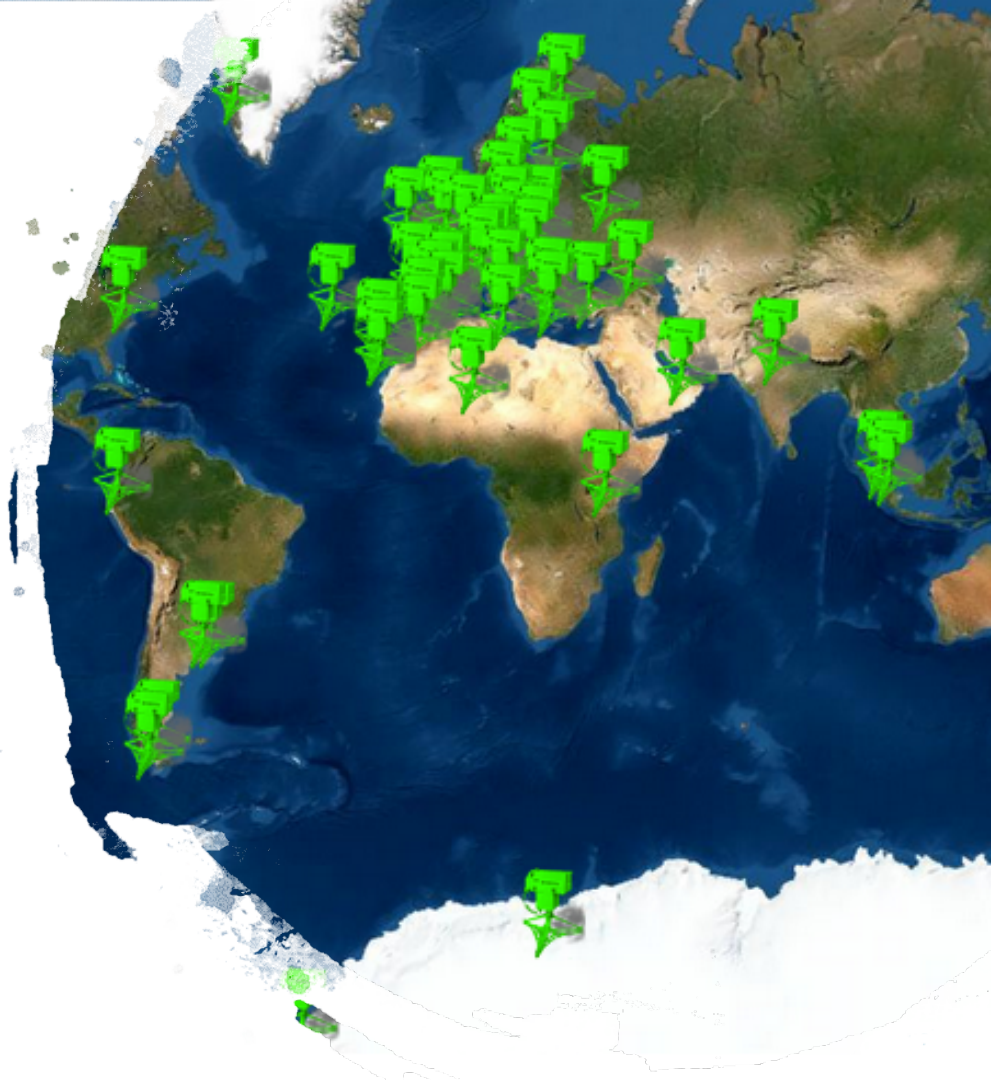
- EUBREWNET
- AOD in EUBREWNET
- AOD Measurements
- RBCC-C calibrations

High A
Spain)



AOD in EUBREWNET

- A spatially consistent network of Brewer Ozone Spectrophotometers providing O₃, SO₂, UV and AOD.
- European network developed on the COST action (2013-2017) with now with 70 spectrometers and 61 stations around the world and growing.
- QA/QC observations are central processed and distributed in AEMET
- Fiducial Reference Network for satellite validation (ESA) , Air Quality Copernicus CAMS and Copernicus Climate Studies



The brewer spectrometer: Canadian instrument developed in the 80's as Dobson replacement for ozone measurement.

-O₃, SO₂, Spectral UV, AOD and ozone profiles (Umkher).

Weather Services and Universities and Research Institutes 50 instruments around Europe independently managed.

Own processed data submitted to WOUDC and NDACC.

Two private calibration companies.

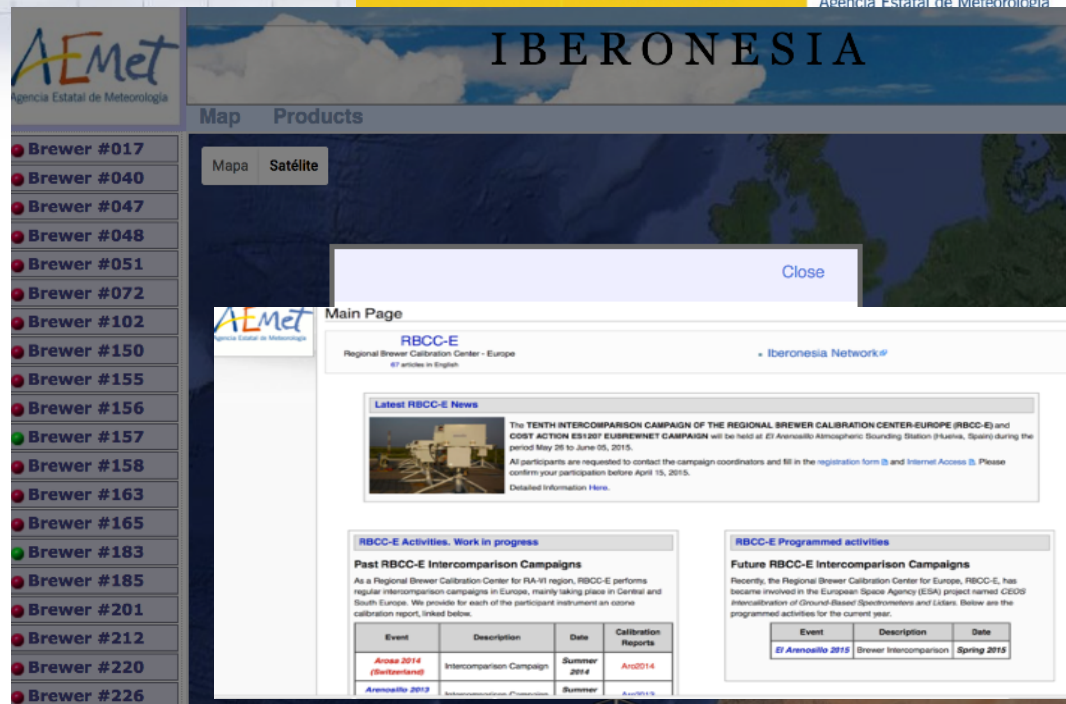


Past II

The Eubrewnet are based on the iberonesia application developed since 1999 to support the Spanish / Portuguese brewers.

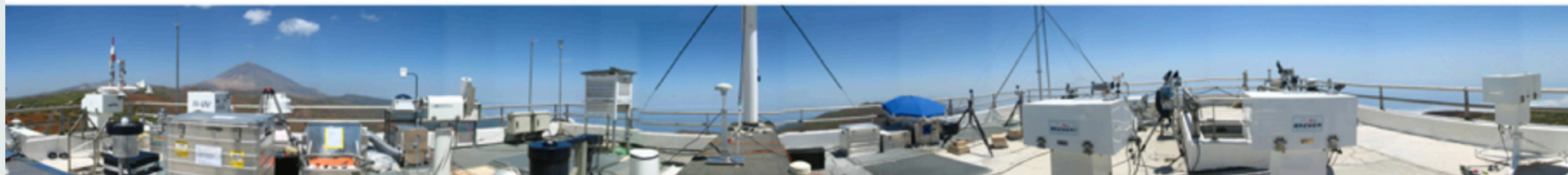
In 2008 were updated to IBERONESIA 2.0 with the objective to give support to the Regional Brewer Calibration Center-Europe (RBCC-E) campaigns (ESA-CALVAL funded)

The support of the RBCC-E were transferred to EUBREWNET application since 2015 EUBREWNET/ RBCC-E campaign in Huelva.



The screenshot shows the IBERONESIA website interface. On the left, there is a vertical list of Brewer IDs from #017 to #226. The main content area features a map and a sidebar with navigation options like 'Map' and 'Products'. A 'Close' button is visible in the top right of the main content area. Below the map, there is a 'Main Page' section with a header for 'RBCC-E' (Regional Brewer Calibration Center - Europe) and a link to 'Iberonesia Network'. A 'Latest RBCC-E News' section contains a news item about the Tenth Intercomparison Campaign of the RBCC-E, scheduled for May 28 to June 05, 2015, at the Arenalillo Meteorological Sounding Station in Huelva. Below this, there are sections for 'RBCC-E Activities, Work in progress' and 'RBCC-E Programmed activities'. The 'Past RBCC-E Intercomparison Campaigns' section includes a table with the following data:

Event	Description	Date	Calibration Reports
Autos 2014 (Switzerland)	Intercomparison Campaign	Summer 2014	Aut014
Arenalillo 2013	Intercomparison Campaign	Summer	Aut013





Calibration and characterisation

Level 0

EuBrewNet
Central processing and QA/QC

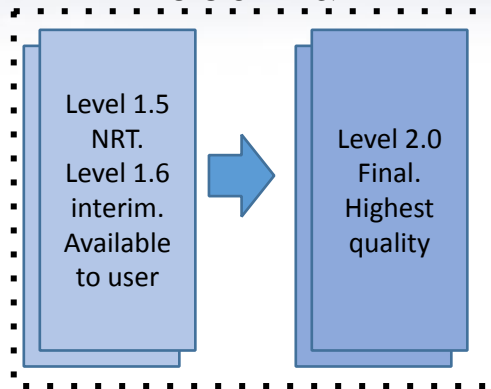
Level 0

Level 1.0
Operator only

Level 0

WOUDC
Archive.
Contributors only

Level 0



Level 0

O3, UV, AOD.
Available to user
WOUDC, NDACC and
EVDC

Documentation: <http://rbcce.aemet.es/dokuwiki/doku.php?id=start>

Open Project: Source code on free access :
https://bitbucket.org/rbcc_e/iberonesia3-git/src/master/

Eubrewnet manuals

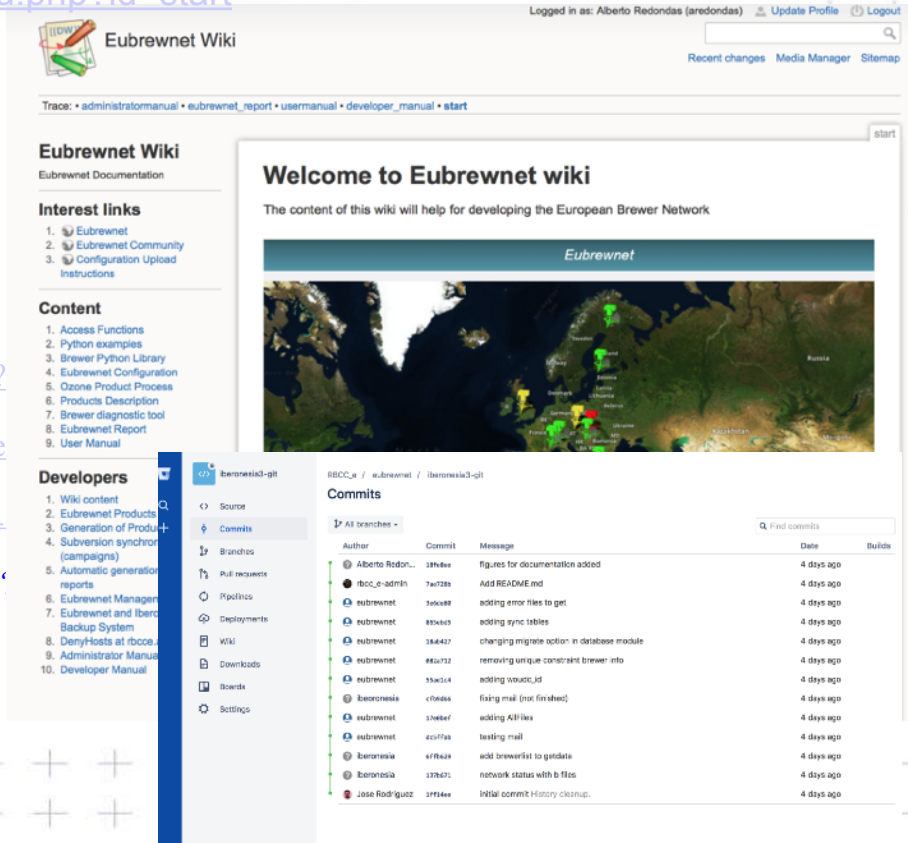
[System Description](http://rbcce.aemet.es/dokuwiki/doku.php?) <http://rbcce.aemet.es/dokuwiki/doku.php?>

[User Manual](http://rbcce.aemet.es/dokuwiki/doku.php?id=code) : <http://rbcce.aemet.es/dokuwiki/doku.php?id=code>

[Administrador Manual](http://rbcce.aemet.es/dokuwiki/doku) <http://rbcce.aemet.es/dokuwiki/doku>

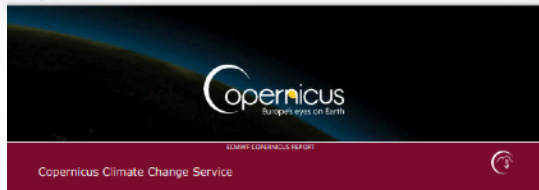
[Developer Manual](http://rbcce.aemet.es/dokuwiki/doku.php) : <http://rbcce.aemet.es/dokuwiki/doku.php>

by Ilias Fountoulakis, Bentorey Hernández ,
Javier Lopez, Alberto Berjon



The screenshot shows the Eubrewnet Wiki page. At the top, it says "Eubrewnet Wiki" and "Eubrewnet Documentation". There is a search bar and a "Log out" button. Below the header, there is a "Trace" section with links to "administratormanual", "eubrewnet_report", "usermanual", "developer_manual", and "start". The main content area is titled "Welcome to Eubrewnet wiki" and includes a map of Europe with various locations marked. On the left side, there are sections for "Interest links" and "Content". The "Interest links" section lists: 1. Eubrewnet, 2. Eubrewnet Community, 3. Configuration Upload Instructions. The "Content" section lists: 1. Access Functions, 2. Python examples, 3. Brewer Python Library, 4. Eubrewnet Configuration, 5. Ozone Product Process, 6. Products Description, 7. Brewer diagnostic tool, 8. Eubrewnet Report, 9. User Manual. Below the main content, there is a "Developers" section with a list of links: 1. Wiki content, 2. Eubrewnet Products, 3. Generation of Products, 4. Subversion synchronizer (campaigns), 5. Automatic generation reports, 6. Eubrewnet Manager, 7. Eubrewnet and Iberona Backup System, 8. Dem/Heats at rbccs, 9. Administrator Manual, 10. Developer Manual. On the right side, there is a "Commits" section with a table of recent commits.

Author	Commit	Message	Date	Builds
Alberto Redon...	3786aa	figures for documentation added	4 days ago	
rbccs-admin	7ae1285	Add README.md	4 days ago	
eubrewnet	35e6488	adding error files to get	4 days ago	
eubrewnet	855e6c3	adding sync tables	4 days ago	
eubrewnet	384427	changing migrate option in database module	4 days ago	
eubrewnet	882a732	removing unque constraint brewer info	4 days ago	
eubrewnet	55ac314	adding source_id	4 days ago	
iberonesia	c70e684	fixing mail (not finished)	4 days ago	
eubrewnet	32e6e7	adding Allfiles	4 days ago	
eubrewnet	4c31fa8	testing mail	4 days ago	
iberonesia	478ea24	add brewerkit to getdata	4 days ago	
iberonesia	378605	network status with b files	4 days ago	
Jose Rodriguez	37f46a	Initial commit History cleanup.	4 days ago	



Product User Guide and Specification for Total Column Ozone data from the European Brewer Network (EUBREWNET)

C3S_311a_Lot3_CNR – SC1
Access to observations from baseline and reference networks

Issued by: CNR-IMAA / Fabio Madonna
Date: 29/06/2021



EUBREWNET Maturity index matrix H2020 GAIA-CLIM (www.gaia-clim.eu)

Metadata	Documentation	Uncertainty characterization	Public access, feedback and update	Usage	Sustainability	Software (optional)
Standards	Formal Description of Measurement Methodology	Traceability	Access	Research	Siting environment	Coding standards
Collection level	Formal Validation Report	Comparability	User feedback mechanism	Public and commercial exploitation	Scientific and expert support	Software documentation
File level	Formal Measurement Series User Guidance	Uncertainty Quantification	Updates to record		Programmatic support	Portability and numerical reproducibility
		Routine Quality Management	Version control			Security
			Long term data preservation			
Legend						
1	2	3	4	5	6	Not applicable

Network for the Detection of Atmospheric Composition Change

NDACC 

STATIONS

INSTRUMENTS

DATA

ABOUT NDACC

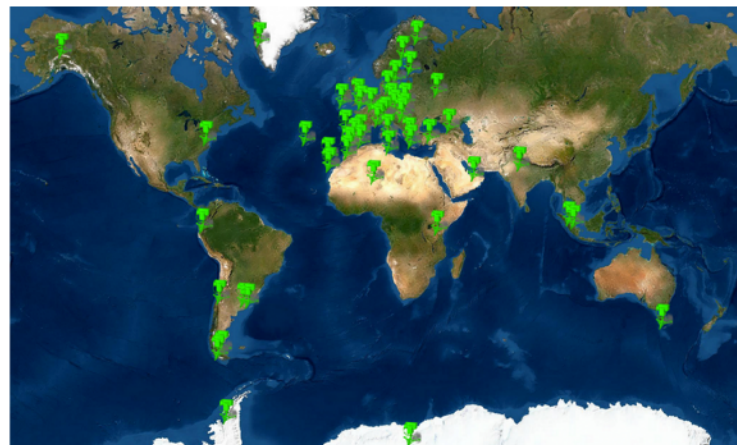
[Home](#) / [About](#) / [Cooperating Networks](#) / [European Brewer Network](#)

About NDACC

- ▶ [About NDACC](#)
- [NDACC Perspectives](#)
- [NDACC History](#)
- [News and Events](#)
- [Publications](#)
- [Contact Us](#)

European Brewer Network (EUBREWNET)

[EuBrewNet Website](#)



1349px

<http://www.ndaccdemo.org/about/cooperating-networks/european-brewer-network>

Select Dataset, Station, Instrument, Time Period

Dataset

EUBREWNET

Country | Optional

...

Station | Optional

Izaña (Tenerife) (300)

Instrument | Optional

...

Range slider

Start

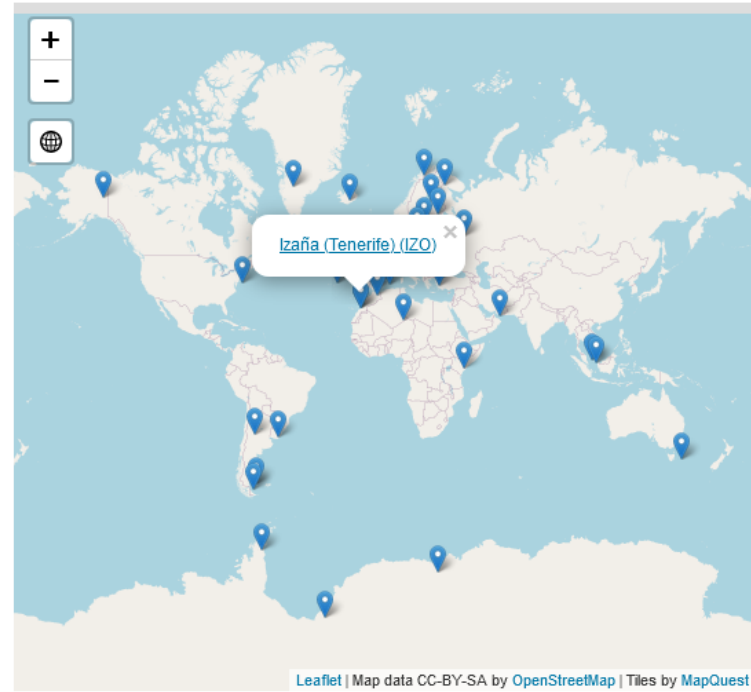
1924

End

2022

Set Your Map Extent

[How to Use: Interactive Map](#)

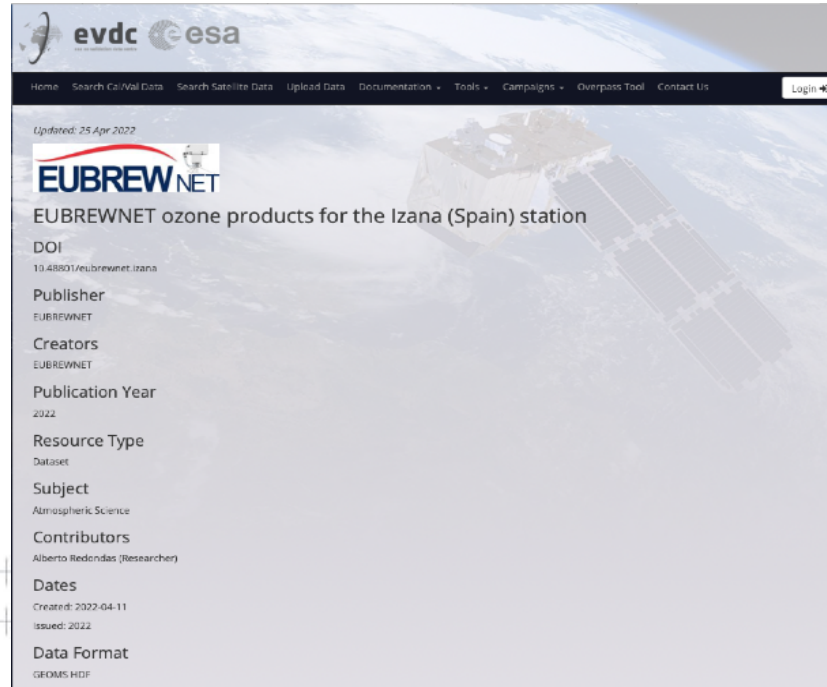


DOI

- Permanent location and landing page will be provided by NILU, on behalf of EVDC, through the DataCite metadata service.
- EUBREWNET reports the metadata needed to generate the DOI and landing page:
https://rbcce-test.aemet.es/eubrewnet/metadata/active_dois.json
- Granularity: One DOI for **each product** (O3, UV, AOD) from **each station**.
- The DOI is assigned to a "collection" will not change when the data are processed and updated.
- The metadata will follow the ESA/AVDC guidelines (<http://evdc.esa.int/documentation/doi-docs/>), except the rights (copyright info) all the information is already on the database.

DOI, landing page (on develop)

<https://evdc.esa.int/publications/eubrewnet-ozone-products-for-the-izana-spain-station/>



The screenshot shows the landing page for the EUBREWNET ozone products for the Izana (Spain) station on the ESA EVDC portal. The page features the ESA and EVDC logos at the top, a navigation menu, and a main content area with the following details:

- Updated: 25 Apr 2022
- EUBREWNET**
- EUBREWNET ozone products for the Izana (Spain) station**
- DOI: 10.48801/evdc.eubrewnet.izana
- Publisher:** EUBREWNET
- Creators:** EUBREWNET
- Publication Year:** 2022
- Resource Type:** Dataset
- Subject:** Atmospheric Science
- Contributors:** Alberto Redondas (Researcher)
- Dates:** Created: 2022-04-11, Issued: 2022
- Data Format:** GEOMS HDF

• Operator training Courses.

- Tenerife, March 2014
- Huelva , June 2015
- Edinburgh, Sept 2016
- Sydney, Sept 2017
- Huelva, June 2019
- Online , June 2020/June 2021
- **Brasil, Jan 2024 ?**

- **South America 2024?**





How EuBrewNet supports monitoring in A5 countries.

- The operator courses cover care and maintenance, scheduling, principles of operation and data management.
- The importance of regular calibration is emphasised.
- Calibration data can be stored in EuBrewNet database.
- Software can be installed to enable automatic transfer of raw data to the EuBrewNet database for QA/QC and processing into NRT products.
- Once set up – ***higher submission rates***.

HOME ▶ STATS ▶ SHOW

Select One Stat

B Files

Direct Sun Measurements

Zenith Sky Measurements

Standard Lamp Measurements

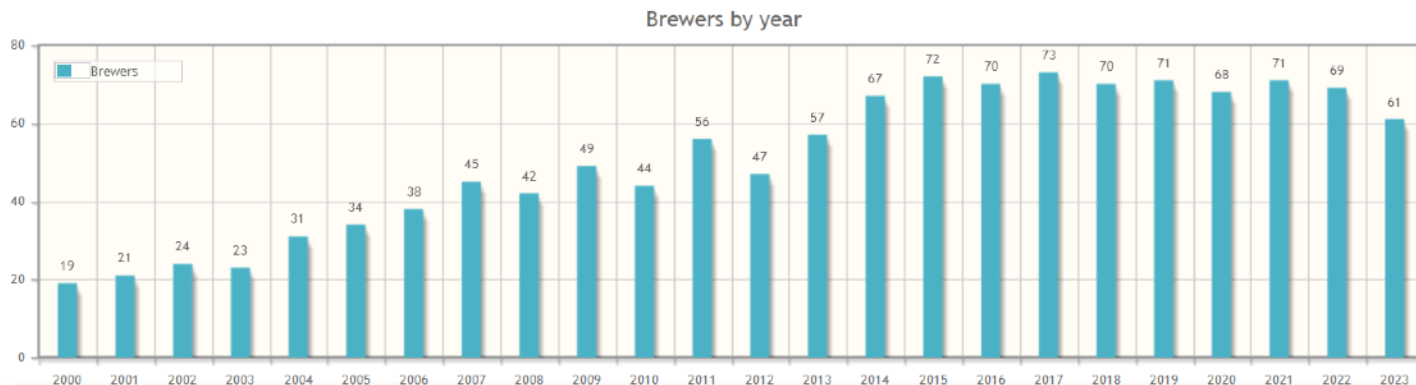
Focused Moon Measurements

FZ Measurements

DZ Measurements

UV Measurements

Eubrewnet Stats



2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
38	45	42	49	44	56	47	57	67	72	70	73	70	71	68	71	69	61

HOME ▶ STATS ▶ SHOW

Select One Stat

B Files

Direct Sun Measurements

Zenith Sky Measurements

Standard Lamp Measurements

Focused Moon Measurements

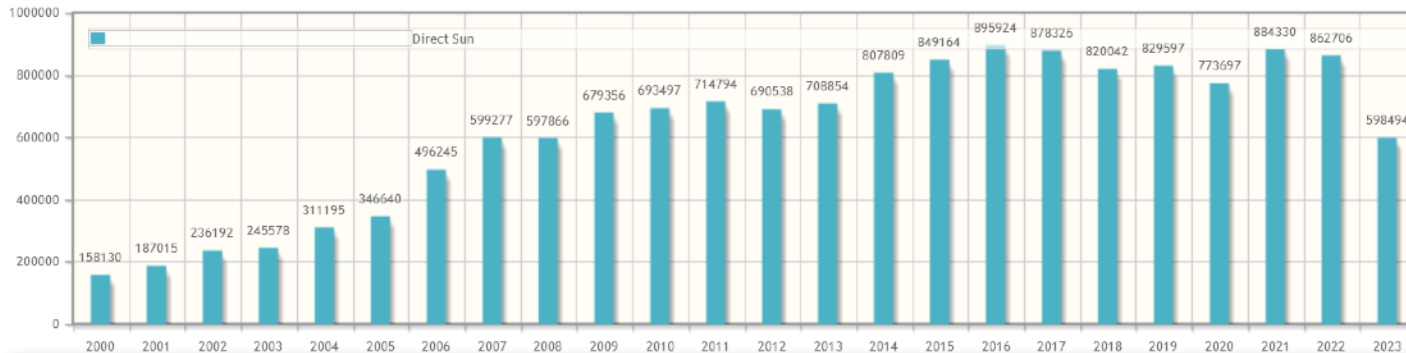
FZ Measurements

DZ Measurements

UV Measurements

Eubrewnet Stats

Total Direct Sun Measurements



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	693497	714794	690538	708854	807809	849164	895924	878326	820042	829597	773697	884330	862706	598494

HOME ▶ STATS ▶ SHOW

Select One Stat

B Files

Direct Sun
Measurements

Zenith Sky
Measurements

Standard Lamp
Measurements

Focused Moon
Measurements

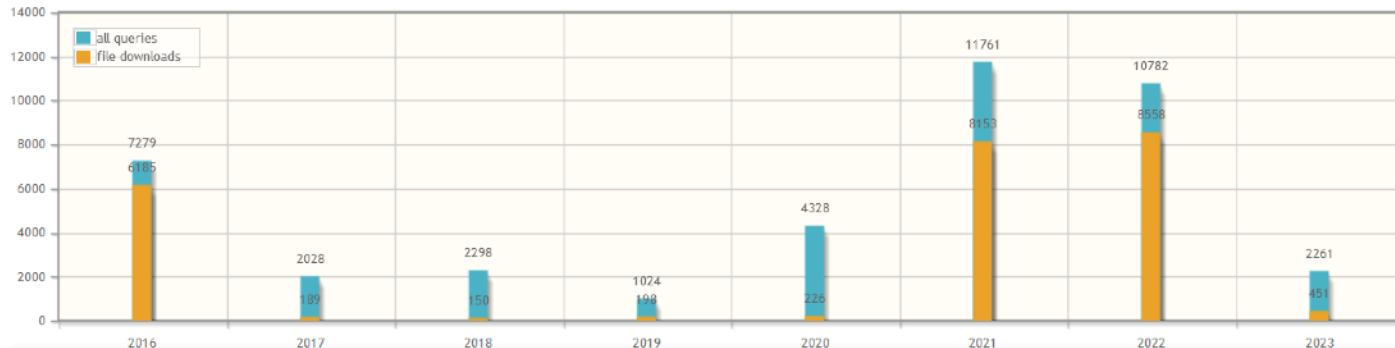
FZ Measurements

DZ Measurements

UV Measurements

Eubrewnet Stats

DB queries by year



DB queries by year: 65871

Year	2016	2017	2018	2019	2020	2021	2022	2023
all queries	7279	2028	2298	1024	4328	11761	10782	2261
file downloads	6185	189	150	198	226	8153	8558	451

New products and functions

- Ozone uncertainty determination
- UV level 1.6 using SHICrivism
- UV level 2.0 using BUVIC
- AOD-specific (JG) measurements
- Calibration tools (langley & filters)



For all the details, see

Atmos. Chem. Phys., 18, 3885–3902, 2018

<https://doi.org/10.5194/acp-18-3885-2018>

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Atmospheric
Chemistry
and Physics



Aerosol optical depth in the European Brewer Network

Javier López-Solano^{1,2,3}, Alberto Redondas^{1,3}, Thomas Carlund^{4,5}, Juan J. Rodríguez-Franco^{1,3}, Henri Diémoz⁶, Sergio F. León-Luis^{1,3}, Bentorey Hernández-Cruz^{2,3}, Carmen Guirado-Fuentes^{7,1}, Natalia Kouremeti⁴, Julian Gröbner⁴, Stelios Kazadzis⁴, Virgilio Carreño^{1,3}, Alberto Berjón^{2,3}, Daniel Santana-Díaz^{2,3}, Manuel Rodríguez-Valido^{2,3}, Veerle De Bock⁸, Juan R. Moreta⁹, John Rimmer¹⁰, Andrew R. D. Smedley¹⁰, Lamine Boulkelia¹¹, Nis Jepsen¹², Paul Eriksen¹², Alkiviadis F. Bais¹³, Vadim Shiroto¹⁴, José M. Vilaplana¹⁵, Keith M. Wilson¹⁶, and Tomi Karppinen¹⁷

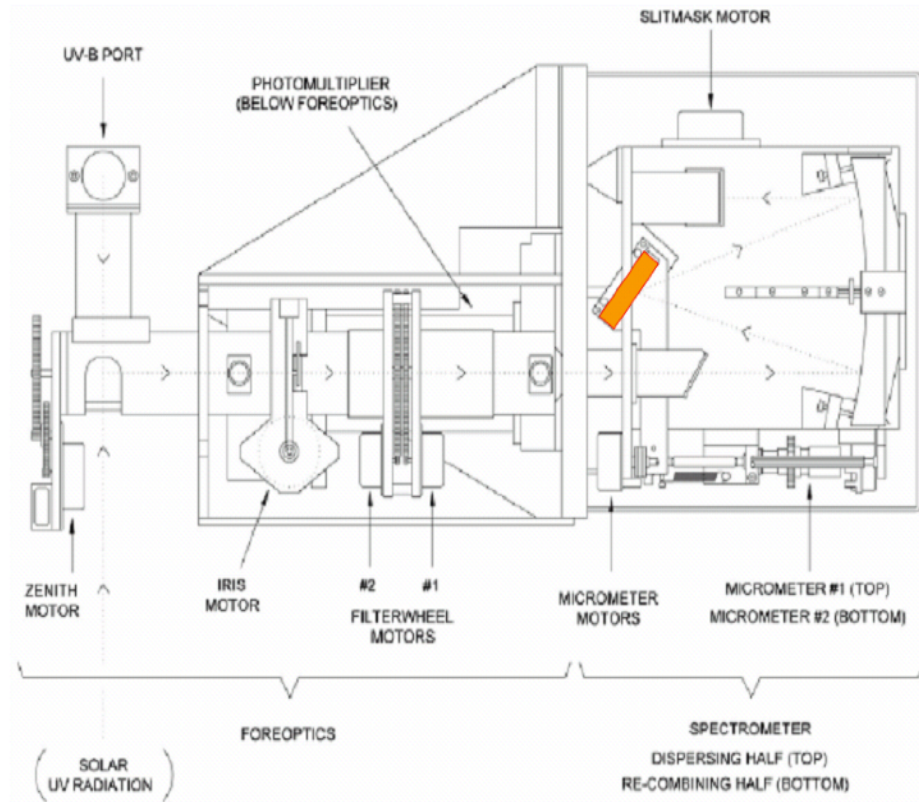
$$\tau_a(\lambda) = \frac{1}{m_a} \left\{ \log_e I_0(\lambda) - \log_e I(\lambda) - X_o k_o(\lambda) m_o - \frac{p}{1013} \tau_{R0}(\lambda) m_R \right\}$$

Aerosol Optical Depth \downarrow
 Extra-terrestrial constant \downarrow
 Corrected counts/s \downarrow
 Bass & Paur absorption coefficients \downarrow
 Station's pressure \downarrow
 Rayleigh airmass \downarrow

\uparrow Aerosol airmass approximated by the Rayleigh airmass
 \uparrow Ozone with Nicolet's Rayleigh
 \uparrow Ozone airmass
 \uparrow Rayleigh optical depth



Modified Ebert Grating Spectrometer with photon counting detection and six exit slits



Basic design features:

- Spectral purity
- Wavelength step 0.0075 nm/step
- Passive temperature compensation
- High wavelength stability

AOD mode

Brewer op mode	Ozone	UV	AOD
grating	Fixed at O ₃ position	Rotating	Rotating to fix positions
slit	6 quasi simultaneous	#1 and #5	6
FOV	~2	2pi	2
Attenuation	ND automatic	ND fixed	automatic
Temperature , correction	From Lamp ratios	Not implemented	
Measurement	Relative (Ratios)	Absolute	Absolute
Calibration	Travelling Langley	Lamp	Travelling / Langley
QA/QC	Travelling RBCC-E	Travelling (QASUME)	

Potential wavelengths for AOD-specific measurements

Micrometer pos., slit no.	Wavelength (nm)	Micrometer pos., slit no.	Wavelength (nm)
1, 0	311	3, 0	339
1, 2	314	3, 2	342
1, 3	318	3, 3	345
1, 4	321	3, 4	348
1, 5	324	3, 5	351
1, 6	327	3, 6	354
2, 0	326	4, 0	349
2, 2	328	4, 2	351
2, 3	332	4, 3	355
2, 4	335	4, 4	358
2, 5	338	4, 5	360
2, 6	341	4, 6	363



•

	Ozone calibration	AOD calibration
	- Instrumental	- Instrumental
	o DT	o DT
	o TC (Relative)	o TC (Absolute)
	o Filter no linearity (Ratios)	o Filter Matrix
	o	o Polarization
	- Wavelength Calibration	- Wavelength Calibration
	o Ozone absorption coefficients	o Ozone
	o SO ₂	o SO ₂
	o Rayleigh	o
	- ETC transfer	-
	o Langley (double ratio)	o Langley (wv)
	o Transfer From Reference	o Transfer From Reference
	- Ratios-> No absolute calibration needed	- Relative calibration for AOD
		-

$I_0(\lambda)$: Langley-plot method at Izaña or calibration transfer during the RBCC-E Intercomparison campaigns

Aerosol Optical Depth

$I_0(\lambda)$ + filter correction

- stored as a single matrix
- “real” space, counts/second

For example:

8.24E+07	6.13E+07	($\lambda\#1$, f#2)	($\lambda\#1$, f#3)	...		
6.33E+07	4.72E+07	($\lambda\#2$, f#2)	($\lambda\#2$, f#3)	...		
		($\lambda\#3$, f#0)	($\lambda\#3$, f#1)	($\lambda\#3$, f#2)	($\lambda\#3$, f#3)	...
...		

Ozone

ETC and “ETC filter correction”

- stored by separate
- Brewer log space

For example:

1616 and [0, 0, 0, 5, 8, 0]
 f#0 f#1 f#2 f#3 f#4 f#5

Direct-Sun measurements at different micrometer steps

Source code:

```
10000 REM ***** jg routine 16/04/19 *****
55555 ' 4 feb 2014 Julian, based on original js . jump scan for aod retrieval, to be used after ds
55555 ' 4 oct 2014 Alberto, based on original js . Add slit 7 for DT calculation
55555 ' 12 Jan 2016 Added Summary in line 13005
55555 ' 16 Apr 2019 Added check for extended range. Volodya
55555 ' *** Setup ***
55555 '
11010 DATA jg
11020 TR$="d"+"s":UC%=0
11028 IF TYP$="mkii" or (TYP$="mkiv" AND ZERO+VAL(MC$)>3000) OR (TYP$="mkiv" AND Q9%=0) THEN XR%=0 ELSE XR%=1
11030 IF VAL(SQ$)<128 AND M2<2 THEN SQ$="128"
11050 GOSUB 6610:IF MDD$="o3" THEN GOSUB 6630 ELSE GOSUB 6636 'Filter#1 to 1 or 4
11060 M5$=SQ$:GOSUB 6650 'Filter#2 to SQ$
11070 GOSUB 6690:GOSUB 7750 'Iris closed, ZE to zenith
11080 LOCATE ,SP:PRINT "4 - Point Brewer at zenith"
11090 GOSUB 9650 'Wait until ready, test intensity
12000 '
12001 ' *** Take Set of Observations ***
12002 '
12010 GOSUB 2450:CZ$="10":GOSUB 9700
12020 GOSUB 8000:MS(0)=11:DS%=0
12025 GOSUB 21000 ' move to 1st pos
12030 GOSUB 7500:SQ$=M5$:CZ$="5":GOSUB 9700
```

B-file:

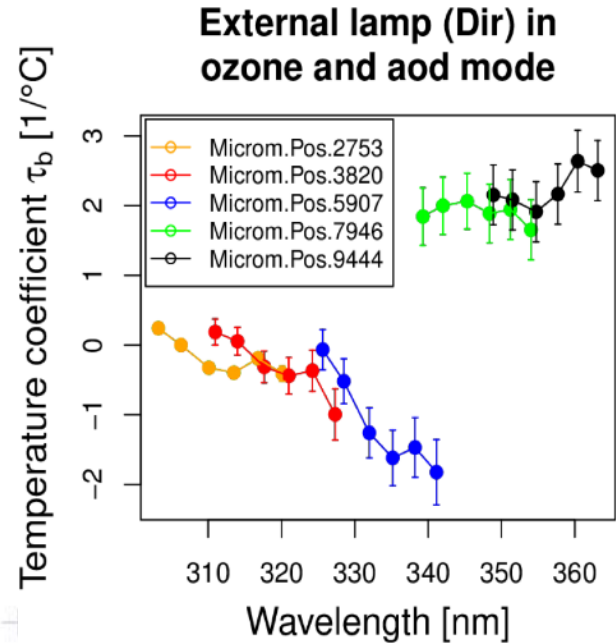
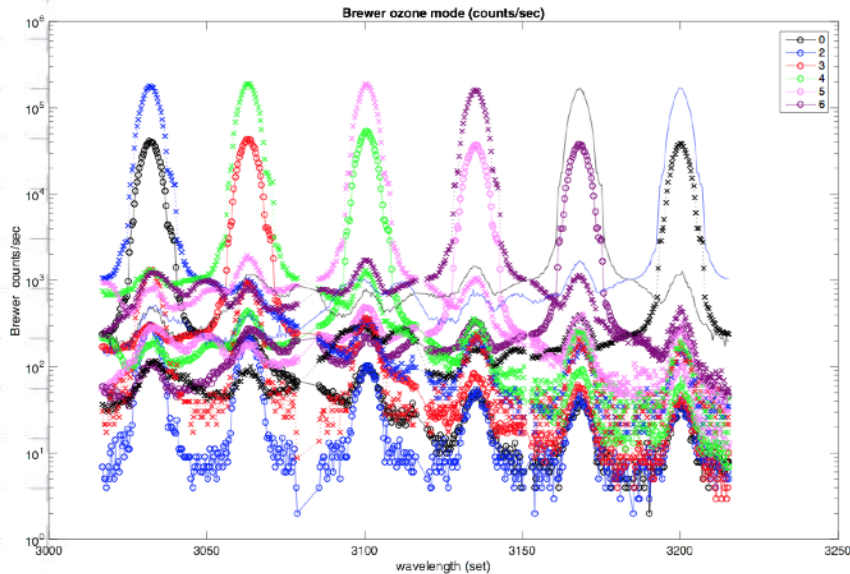
```
08:58:37
jg: Running jg from o319722a line -67.03
hk
08:58:44
27
30
27
14
4.24
-99
-38

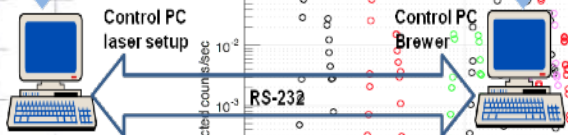
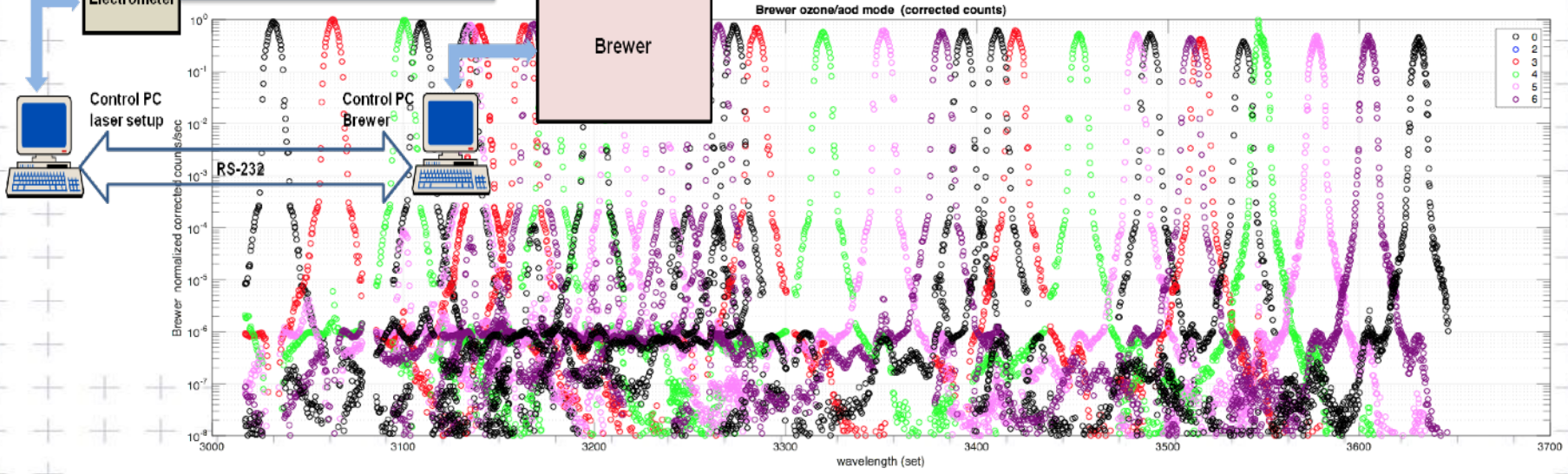
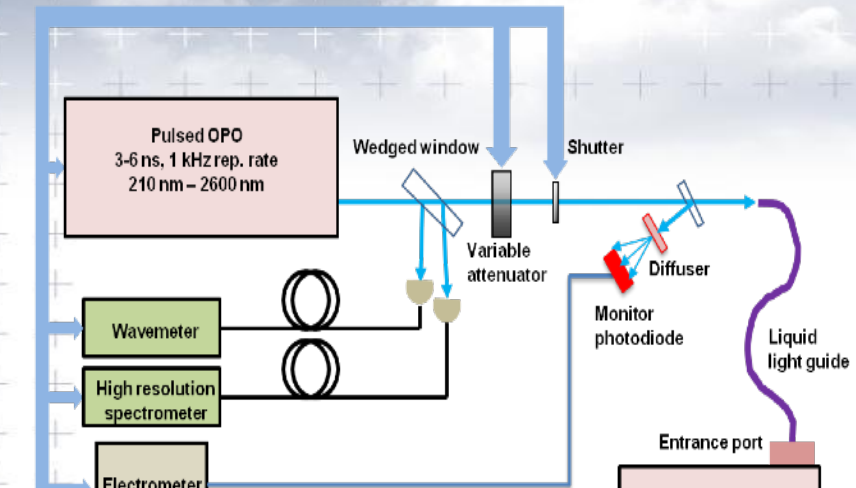
jg
a
192
539.34
0
6
5
84888
31
122857
176112
228198
300241
388081
rat
27.1411
29.99208
26.66594
2090 ← Mic step
jg
```

Counts

Mic step

Wavelength Calibration (Redondas *et al.*, Temperature analysis (Berjón *et al.*, 2016, https://presentations.copernicus.org/QOS2016/QOS2016-110_presentation.pdf)





Calibrations and data

Calibration file: just a CSV with one row for each wavelength (only ozone DS ones for now) and a lot of columns (many of them not used yet!)

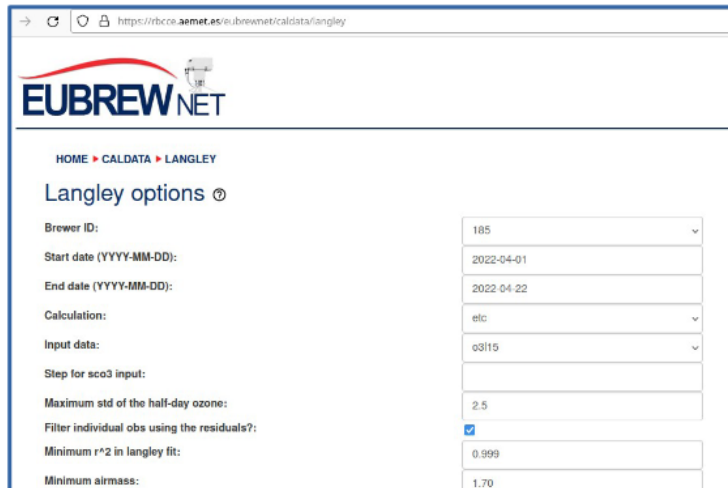
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	
1	#wavel	sht	cabstep	hwmm	etc_10	etc_11	etc_12	etc_13	etc_14	etc_15	rayleigh	o3_abs	so2_abs	no2_abs	tc_const	tc_lin	tc_quad	at_f1	at_f2	at_f3	at_f4	at_f5	strayl_const	strayl_coeff	strayl_exp	sl_ref	sl_slope	sl_quad	aod_ex1	aod_ex2	aod_ex3	
2	303.207	1	1021								5049.500	2.594						4244	9051	13715	21832	25111										
3	306.338	2	1021		8.24E+07	6.13E+07	1.07E+08	1.06E+08			4831.700	1.778						4264	9068	13718	21787	25045										
4	310.052	3	1021		6.33E+07	4.72E+07	8.37E+07	8.33E+07			4584.600	1.005						4262	9073	13714	21740	24971										
5	313.504	4	1021		9.85E+07	7.38E+07	1.32E+08	1.32E+08			4370.800	0.676						4279	9094	13723	21708	24824										
6	316.789	5	1021		9.91E+07	7.37E+07	1.34E+08	1.34E+08			4178.700	0.875						4286	9103	13728	21676	24890										
7	320.021	6	1021		1.05E+08	7.82E+07	1.44E+08	1.45E+08			4002	0.2936						4295	9122	13738	21638	24842										
8																																



O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
tc_const	tc_lin	tc_quad	at_f1	at_f2	at_f3	at_f4	at_f5	strayl_const	strayl_coeff	strayl_exp	sl_ref	sl_slope	sl_quad	aod_ex1	aod_ex2	aod_ex3
			4244	9051	13715	21832	25111									
			4264	9068	13718	21787	25045									
			4262	9073	13714	21740	24971									
			4279	9094	13723	21708	24924									
			4286	9103	13728	21676	24890									
			4295	9122	13738	21638	24842									

AOD: configuration

Right now, we're doing a lot of approximations to many of these configuration parameters, but to determine the ETCs at each wavelength and filter position, we have a new Langley code which is quite complete



The screenshot shows the EUBREWNET website interface. The page title is "Langley options". The form contains the following fields and values:

Brewer ID:	185
Start date (YYYY-MM-DD):	2022-04-01
End date (YYYY-MM-DD):	2022-04-22
Calculation:	etc
Input data:	o3i19
Step for sco3 input:	
Maximum std of the half-day ozone:	2.5
Filter individual obs using the residuals?:	<input checked="" type="checkbox"/>
Minimum r^2 in langley fit:	0.999
Minimum airmass:	1.70

```
def doLangleyFunc(myData, langleyFunc, filters_minobs, showplots, verbose):
    """Do the requested Langley

    Langley methods:

    * Paper:  $\text{contr\_counts}_i + \text{contr\_rayleigh}_i = -\tau_i \cdot \text{airmass\_ozone} + \log_{10} I_i$ 

        So, for each wavelength i:
         $x = \text{airmass\_ozone} + \text{airmass\_aero} \rightarrow \text{airmass\_ozone}$ 
         $y = \text{contr\_counts}_i + \text{contr\_rayleigh}$ 
         $\text{slope} \rightarrow -\tau_{\text{ozone}}$ 
         $\text{intercept} = \log_{10} I_i$ 

    * Separate ozone:  $\text{contr\_counts}_i + \text{contr\_rayleigh}_i + \text{contr\_ozone}_i = -\tau_{\text{aero}} \cdot \text{airmass} + \log_{10} I_i$ 

        So, for each wavelength i:
         $x = \text{airmass\_aero}$ 
         $y = \text{contr\_counts}_i + \text{contr\_rayleigh}_i + \text{contr\_ozone}_i$ 
         $\text{slope} = -\tau_{\text{aero}}$ 
         $\text{intercept} = \log_{10} I_i$ 

    Fit methods:

    * fit without dummies, using numpy's polyfit
    * fit with dummies to take into account the filters, using
      sklearn's LinearRegression

    202207 JLS
    """
```

In the future, you will be able to run this code directly on EUBREWNET's data server, as you can do right now with the ozone Langley, see <https://eubrewnet.aemet.es/dokuwiki/doku.php?id=codes:calibration>



GOBIERNO
DE ESPAÑA

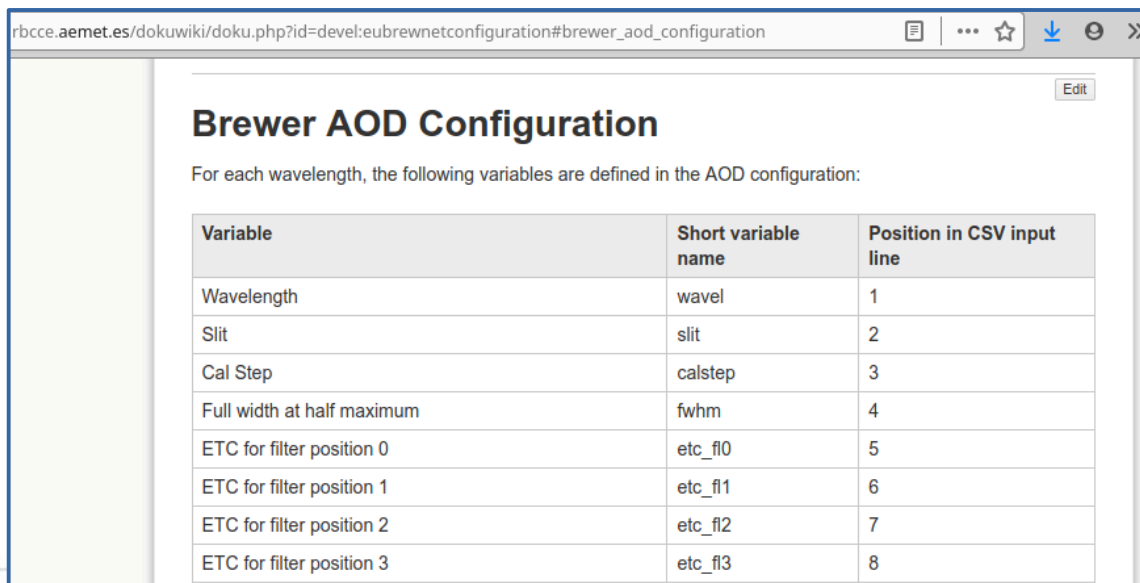
VICEPRESIDENCIA
TERCERA DEL GOBIERNO

MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO

Aemet
Agencia Estatal de Meteorología

More information on the format of the file is available at EUBREWNET's wiki:

http://rbcce.aemet.es/dokuwiki/doku.php?id=devel:eubrewnetconfiguration#brewer_aod_configuration

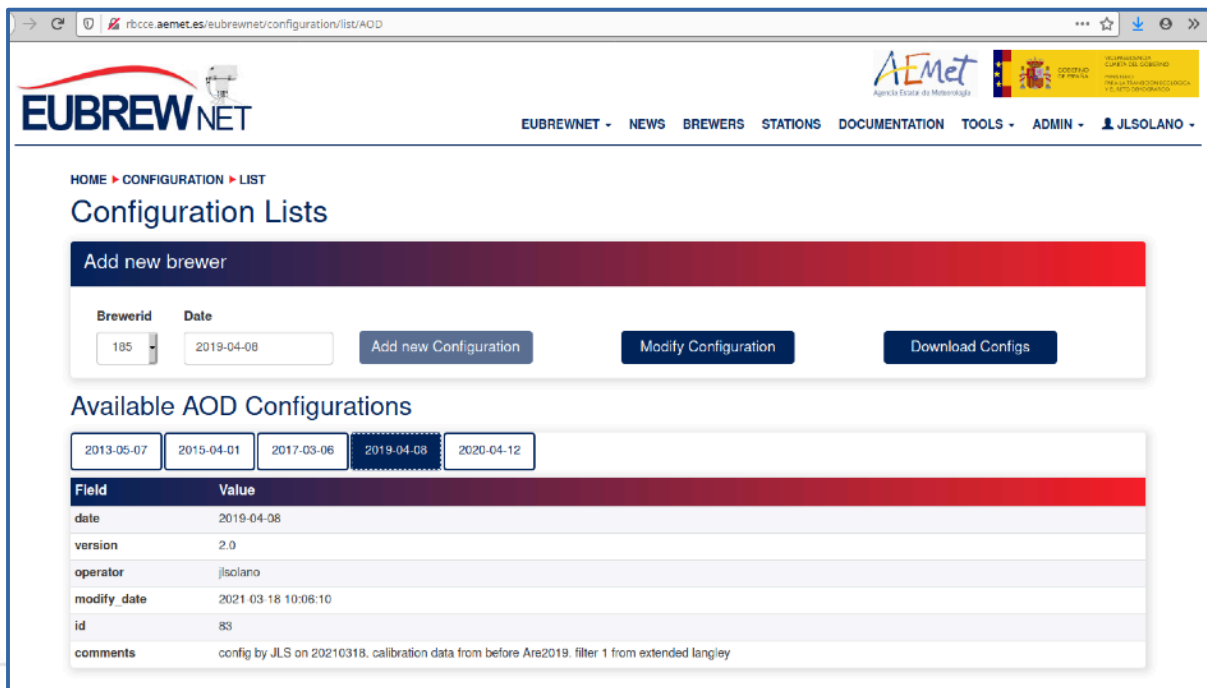


Variable	Short variable name	Position in CSV input line
Wavelength	wavel	1
Slit	slit	2
Cal Step	calstep	3
Full width at half maximum	fwhm	4
ETC for filter position 0	etc_fl0	5
ETC for filter position 1	etc_fl1	6
ETC for filter position 2	etc_fl2	7
ETC for filter position 3	etc_fl3	8

Calibrations and data

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

<http://rbcce.aemet.es/eubrewnet/configuration/list/AOD>



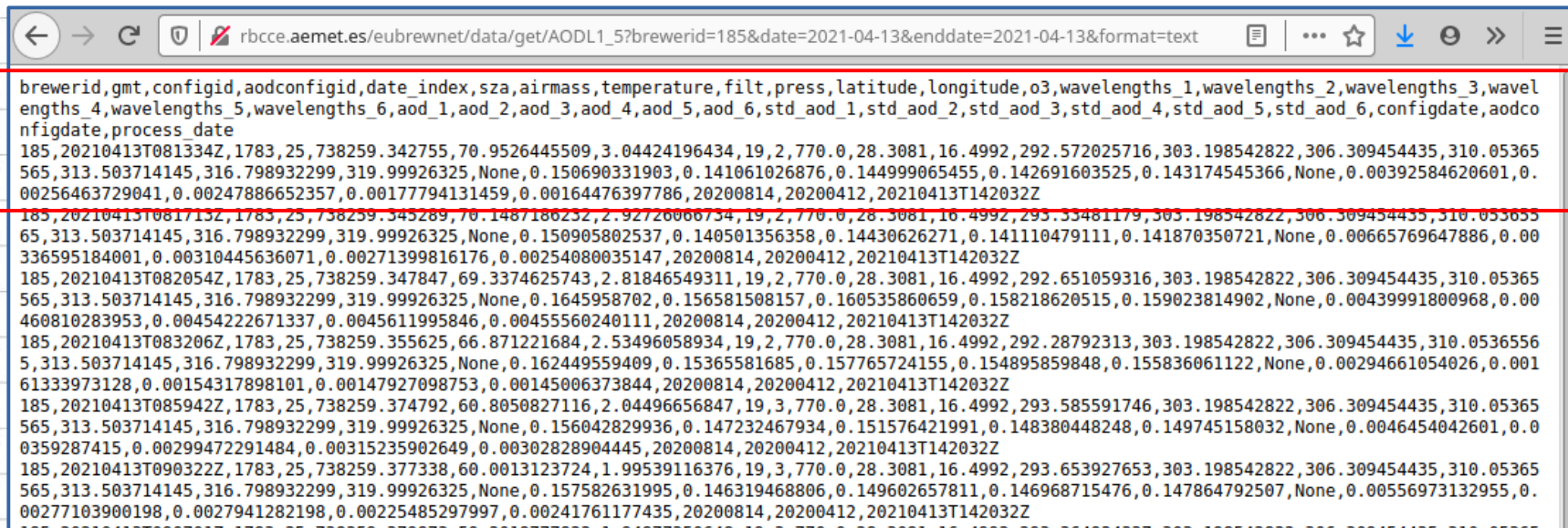
The screenshot shows the EUBREWNET web interface. At the top, there is a navigation bar with the AEMet logo and the text 'Agencia Estatal de Meteorología'. Below the navigation bar, the page title is 'Configuration Lists'. There is a section for 'Add new brewer' with a form containing a 'Brewerid' field (value: 185) and a 'Date' field (value: 2019-04-08). Below the form are three buttons: 'Add new Configuration', 'Modify Configuration', and 'Download Configs'. The 'Available AOD Configurations' section shows a list of dates: 2013-05-07, 2015-04-01, 2017-03-06, 2019-04-08 (selected), and 2020-04-12. Below this is a table with the following data:

Field	Value
date	2019-04-08
version	2.0
operator	jlsolano
modify_date	2021-03-18 10:06:10
id	83
comments	config by JLS on 20210318. calibration data from before Are2019. filter 1 from extended langley

Calibrations and data

To get the data stored in the server, use e.g.

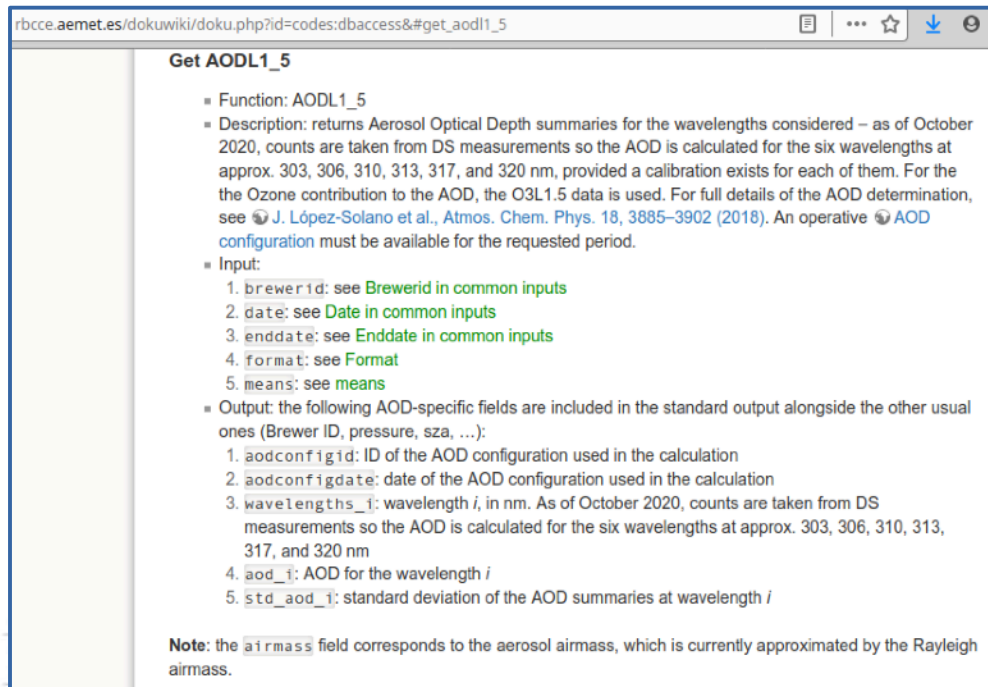
```
http://rbcce.aemet.es/eubrewnet/data/get/AODL1_5?  
brewerid=185&date=2021-04-13&enddate=2021-04-13&format=text
```



```
← → ↻ 🔒 rbcce.aemet.es/eubrewnet/data/get/AODL1_5?brewerid=185&date=2021-04-13&enddate=2021-04-13&format=text  
brewerid,gmt,configid,aodconfigid,date_index,sza,airmass,temperature,filt,press,latitude,longitude,o3,wavelengths_1,wavelengths_2,wavelengths_3,wavelengths_4,wavelengths_5,wavelengths_6,aod_1,aod_2,aod_3,aod_4,aod_5,aod_6,std_aod_1,std_aod_2,std_aod_3,std_aod_4,std_aod_5,std_aod_6,configdate,aodcnfdate,process date  
185,20210413T081334Z,1783,25,738259.342755,70.9526445509,3.04424196434,19,2,770.0,28.3081,16.4992,292.572025716,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.150690331903,0.141061026876,0.144999065455,0.142691603525,0.143174545366,None,0.00392584620601,0.00256463729041,0.00247886652357,0.00177794131459,0.00164476397786,20200814,20200412,20210413T142032Z  
185,20210413T081713Z,1783,25,738259.345289,70.1487186232,2.92720006734,19,2,770.0,28.3081,16.4992,293.55481179,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.150905802537,0.140501356358,0.14430626271,0.141110479111,0.141870350721,None,0.00665769647886,0.00336595184001,0.00310445636071,0.00271399816176,0.00254080035147,20200814,20200412,20210413T142032Z  
185,20210413T082054Z,1783,25,738259.347847,69.3374625743,2.81846549311,19,2,770.0,28.3081,16.4992,292.651059316,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.1645958702,0.156581508157,0.160535860659,0.158218620515,0.159023814902,None,0.00439991800968,0.00460810283953,0.00454222671337,0.0045611995846,0.00455560240111,20200814,20200412,20210413T142032Z  
185,20210413T083206Z,1783,25,738259.355625,66.871221684,2.53496058934,19,2,770.0,28.3081,16.4992,292.28792313,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.162449559409,0.15365581685,0.157765724155,0.154895859848,0.155836061122,None,0.00294661054026,0.00161333973128,0.00154317898101,0.00147927098753,0.00145006373844,20200814,20200412,20210413T142032Z  
185,20210413T085942Z,1783,25,738259.374792,60.8050827116,2.04496656847,19,3,770.0,28.3081,16.4992,293.585591746,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.156042829936,0.147232467934,0.151576421991,0.148380448248,0.149745158032,None,0.0046454042601,0.00359287415,0.00299472291484,0.00315235902649,0.00302828904445,20200814,20200412,20210413T142032Z  
185,20210413T090322Z,1783,25,738259.377338,60.0013123724,1.99539116376,19,3,770.0,28.3081,16.4992,293.653927653,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.157582631995,0.146319468806,0.149602657811,0.146968715476,0.147864792507,None,0.00556973132955,0.00277103900198,0.0027941282198,0.00225485297997,0.00241761177435,20200814,20200412,20210413T142032Z
```


For more information, see EUBREWNET's wiki entry:

http://rbcce.aemet.es/dokuwiki/doku.php?id=codes:dbaccess#get_aodl1_5



rbcce.aemet.es/dokuwiki/doku.php?id=codes:dbaccess#&#get_aodl1_5

Get AODL1_5

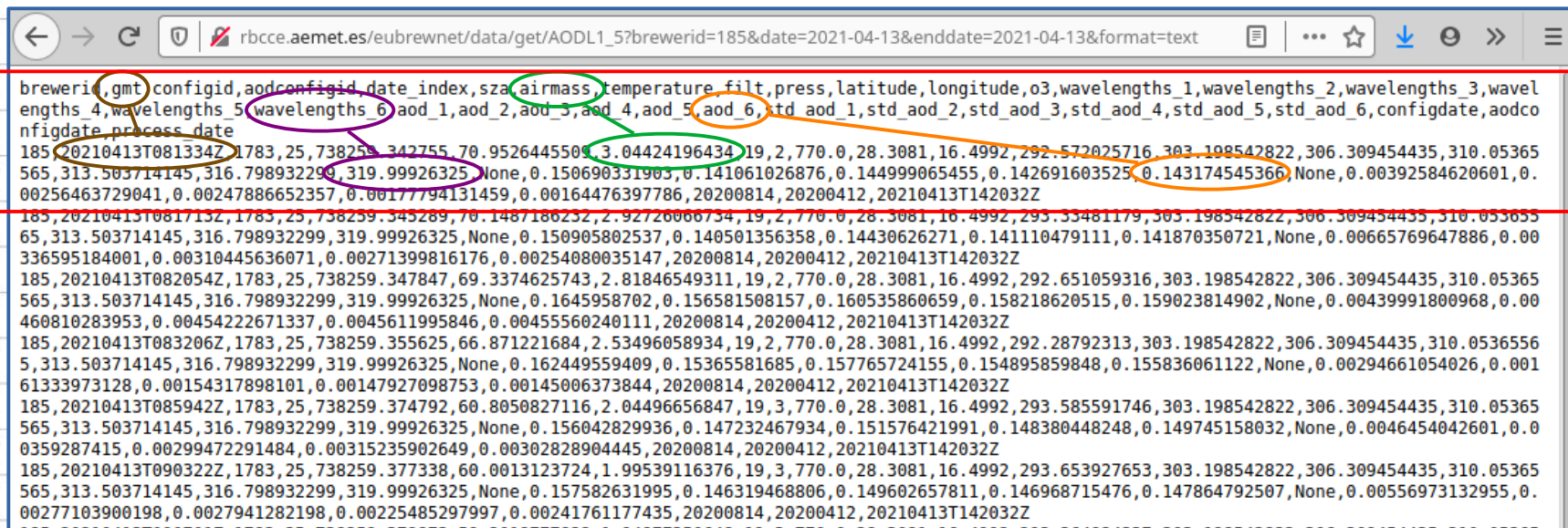
- Function: AODL1_5
- Description: returns Aerosol Optical Depth summaries for the wavelengths considered – as of October 2020, counts are taken from DS measurements so the AOD is calculated for the six wavelengths at approx. 303, 306, 310, 313, 317, and 320 nm, provided a calibration exists for each of them. For the the Ozone contribution to the AOD, the O3L1.5 data is used. For full details of the AOD determination, see J. López-Solano et al., *Atmos. Chem. Phys.* 18, 3885–3902 (2018). An operative AOD configuration must be available for the requested period.
- Input:
 - brewerid: see [Brewerid in common inputs](#)
 - date: see [Date in common inputs](#)
 - enddate: see [Enddate in common inputs](#)
 - format: see [Format](#)
 - means: see [means](#)
- Output: the following AOD-specific fields are included in the standard output alongside the other usual ones (Brewer ID, pressure, sza, ...):
 - aodconfigid: ID of the AOD configuration used in the calculation
 - aodconfigdate: date of the AOD configuration used in the calculation
 - wavelengths_i: wavelength i , in nm. As of October 2020, counts are taken from DS measurements so the AOD is calculated for the six wavelengths at approx. 303, 306, 310, 313, 317, and 320 nm
 - aod_i: AOD for the wavelength i
 - std_aod_i: standard deviation of the AOD summaries at wavelength i

Note: the `airmass` field corresponds to the aerosol airmass, which is currently approximated by the Rayleigh airmass.

Calibrations and data

To get the data stored in the server, use e.g.

http://rbcce.aemet.es/eubrewnet/data/get/AODL1_5?brewerid=185&date=2021-04-13&enddate=2021-04-13&format=text



```
← → ↻ rbcce.aemet.es/eubrewnet/data/get/AODL1_5?brewerid=185&date=2021-04-13&enddate=2021-04-13&format=text
```

```
brewerid,gmt configid,aodconfigid,date_index, sza,airmass, temperature, filt,press, latitude, longitude,o3,wavelengths_1,wavelengths_2,wavelengths_3,wavelengths_4,wavelengths_5,wavelengths_6,aod_1,aod_2,aod_3,aod_4,aod_5,aod_6,std_aod_1,std_aod_2,std_aod_3,std_aod_4,std_aod_5,std_aod_6,configdate,aodco nfigdate,process_date
```

```
185,20210413T081334Z,1783,25,738259,342755,70.9526445509,3.04424196434,19,2,770.0,28.3081,16.4992,292.572025716,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.150690331903,0.141061026876,0.144999065455,0.142691603525,0.143174545366,None,0.00392584620601,0.00256463729041,0.00247886652357,0.00177794131459,0.00164476397786,20200814,20200412,20210413T142032Z
```

```
185,20210413T081713Z,1783,25,738259,345289,70.1487186232,2.92720000734,19,2,770.0,28.3081,16.4992,293.55481179,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.150905802537,0.140501356358,0.14430626271,0.141110479111,0.141870350721,None,0.00665769647886,0.00336595184001,0.00310445636071,0.00271399816176,0.00254080035147,20200814,20200412,20210413T142032Z
```

```
185,20210413T082054Z,1783,25,738259.347847,69.3374625743,2.81846549311,19,2,770.0,28.3081,16.4992,292.651059316,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.150905802537,0.140501356358,0.14430626271,0.141110479111,0.141870350721,None,0.00665769647886,0.00336595184001,0.00310445636071,0.00271399816176,0.00254080035147,20200814,20200412,20210413T142032Z
```

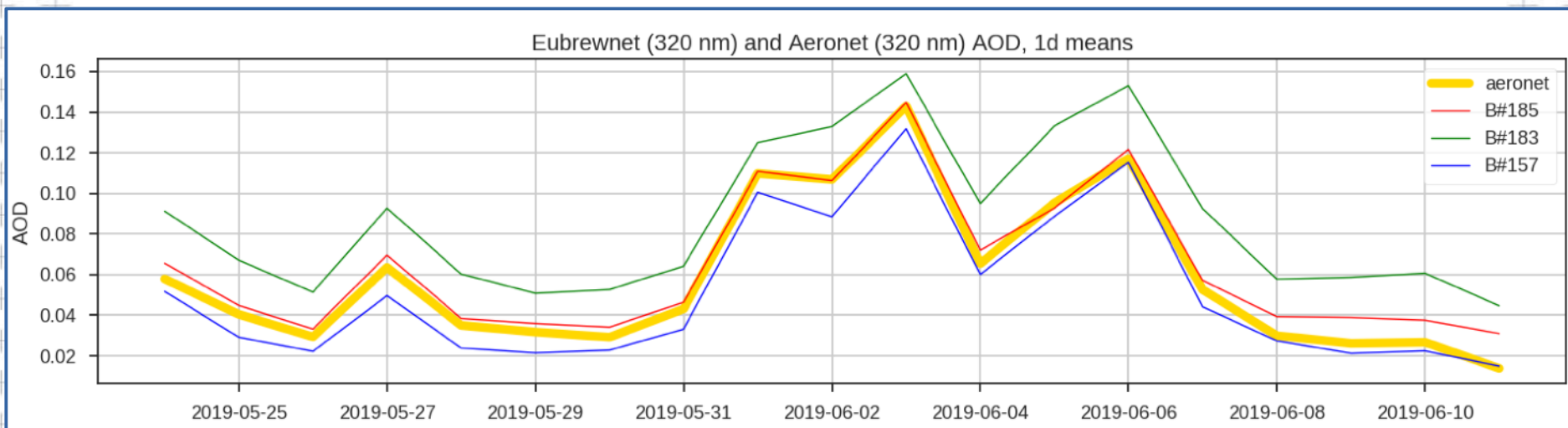
```
185,20210413T08206Z,1783,25,738259.355625,66.871221684,2.53496058934,19,2,770.0,28.3081,16.4992,292.28792313,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.162449559409,0.15365581685,0.157765724155,0.154895859848,0.155836061122,None,0.00294661054026,0.00161333973128,0.00154317898101,0.00147927098753,0.00145006373844,20200814,20200412,20210413T142032Z
```

```
185,20210413T085942Z,1783,25,738259.374792,60.8050827116,2.04496656847,19,3,770.0,28.3081,16.4992,293.585591746,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.156042829936,0.147232467934,0.151576421991,0.148380448248,0.149745158032,None,0.0046454042601,0.00359287415,0.00299472291484,0.00315235902649,0.00302828904445,20200814,20200412,20210413T142032Z
```

```
185,20210413T090322Z,1783,25,738259.377338,60.0013123724,1.99539116376,19,3,770.0,28.3081,16.4992,293.653927653,303.198542822,306.309454435,310.05365565,313.503714145,316.798932299,319.99926325,None,0.157582631995,0.146319468806,0.149602657811,0.146968715476,0.147864792507,None,0.00556973132955,0.00277103900198,0.0027941282198,0.00225485297997,0.00241761177435,20200814,20200412,20210413T142032Z
```

We transfer the calibration of B#185 - the travelling reference of the RBCC-E Triad - at the Intercomparison Campaigns.

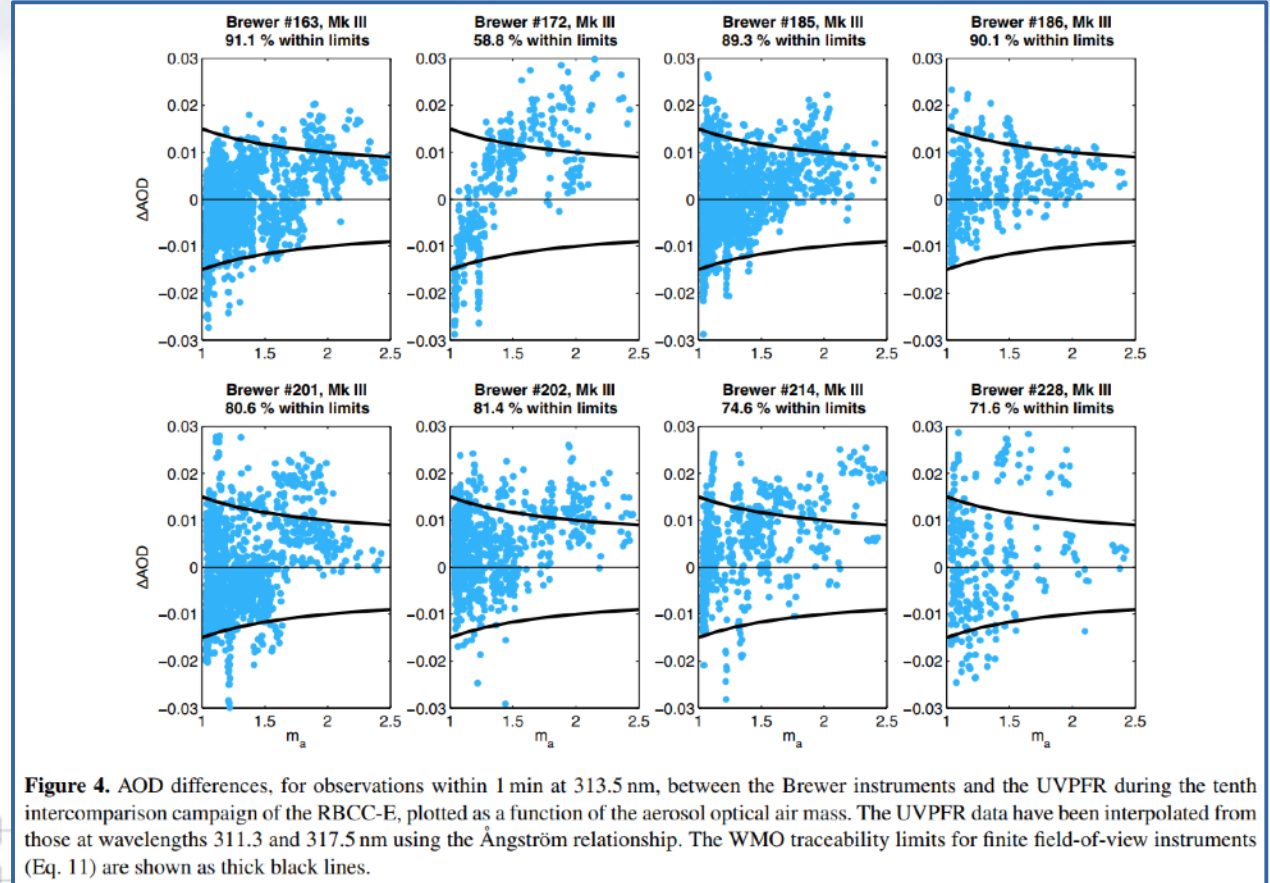
The RBCC-E Triad is calibrated by the Langley-plot method at Izaña, using 1-2 months of data.



El Arenosillo

We have uploaded to EUBREWNET preliminary calibrations for the El Arenosillo 2013 and 2015, 2019, 2021 campaigns.

Some results of these campaigns are discussed in López-Solano *et al.* (2018)

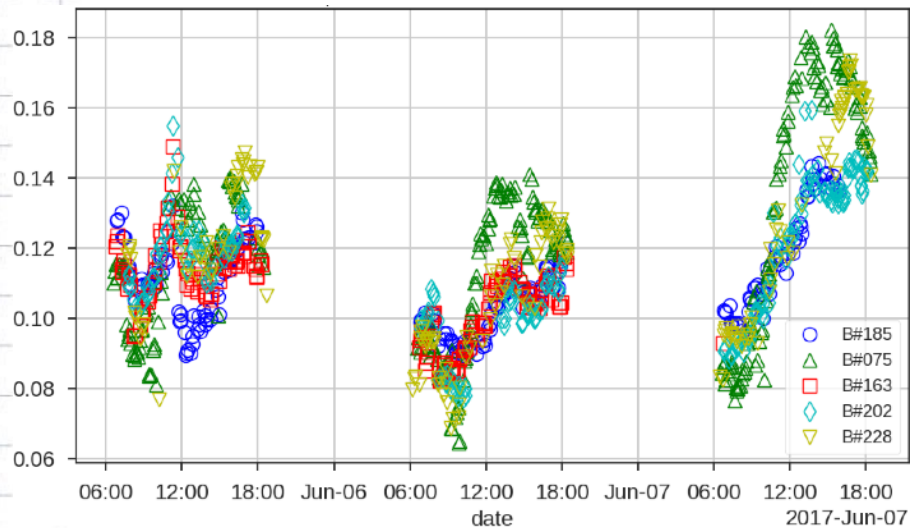


El

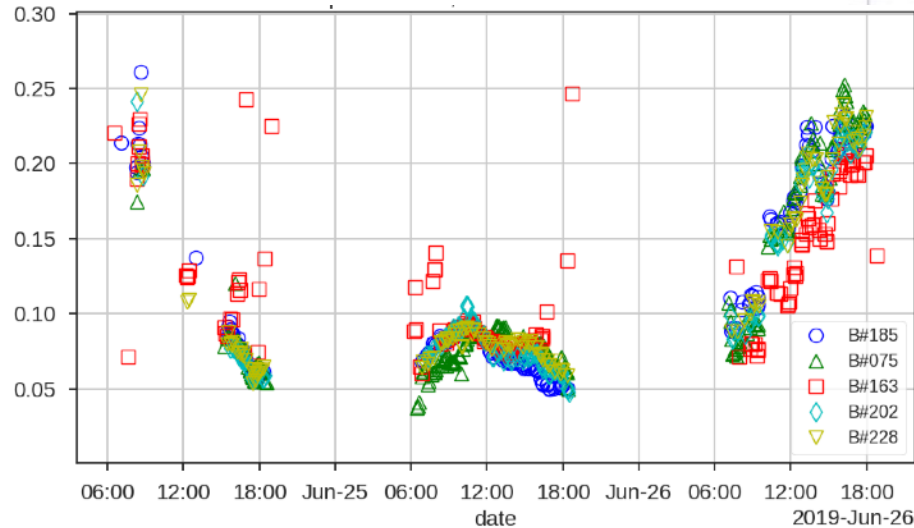
Arenosillo

Calibrations of the 2017 and 2019 campaigns.

AOD 320 nm



El Arenosillo 2017, last three days

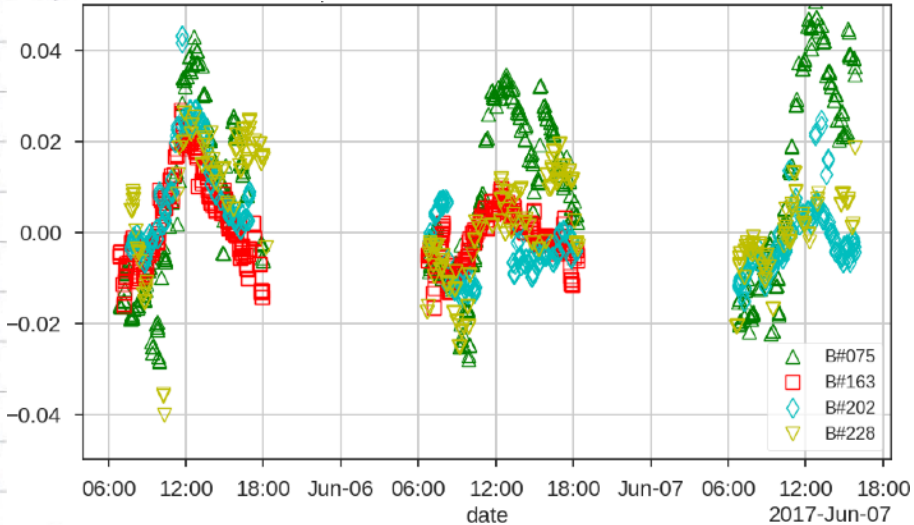


El Arenosillo 2019, last three days

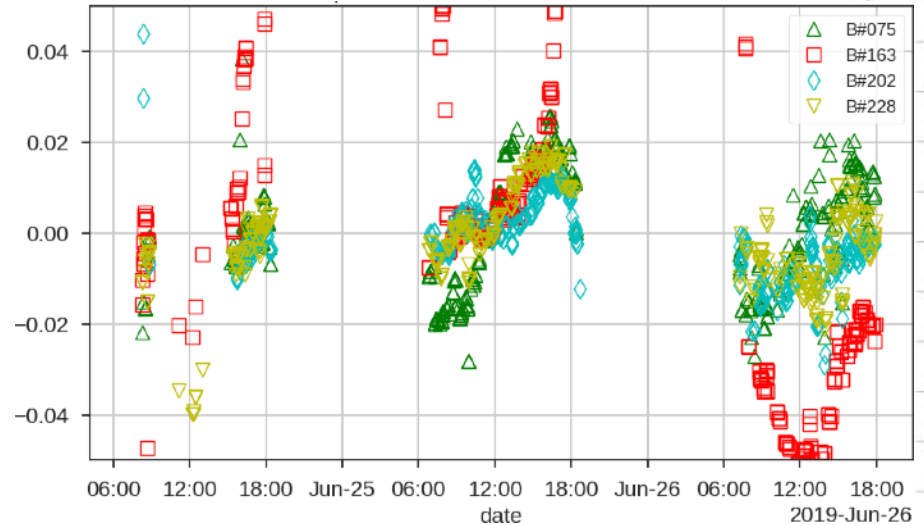
El Arenosillo

We are working on the calibrations of the 2017 and 2019 campaigns.

AOD 320 nm differences with respect to B#185



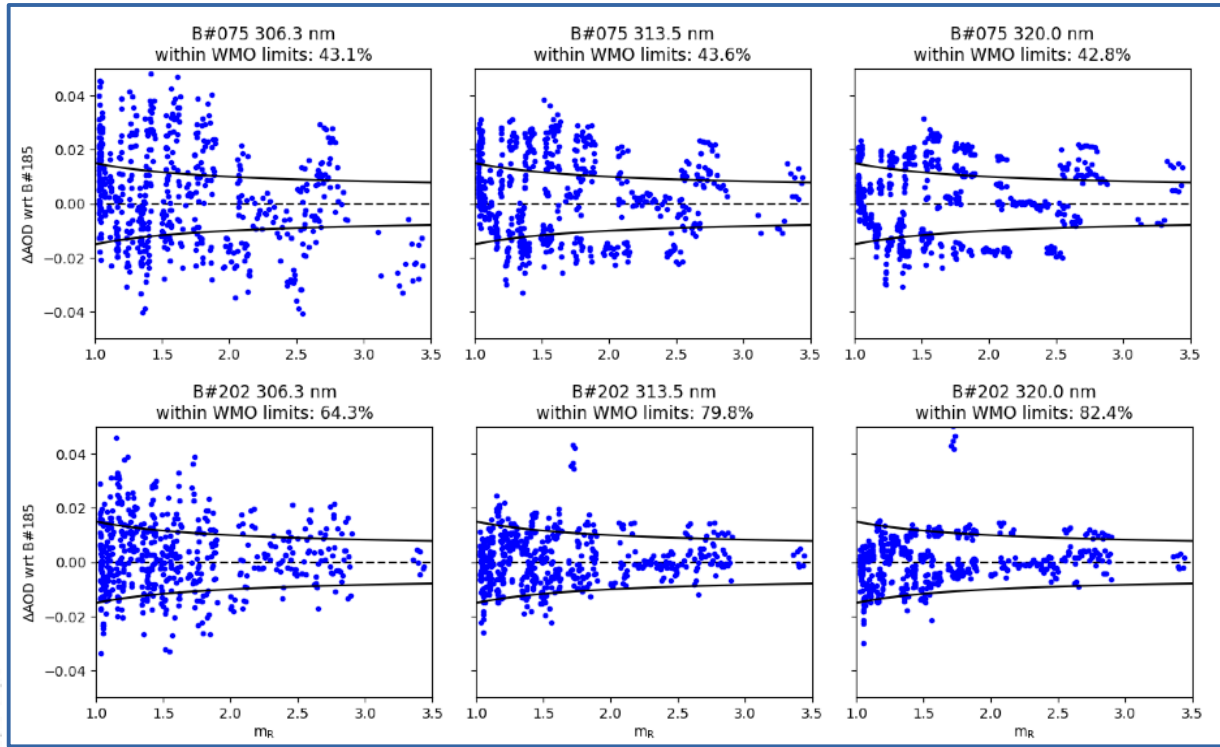
El Arenosillo 2017, last three days



El Arenosillo 2019, last three days

El Arenosillo

Some instruments behave better than others: stray light? Polarization? Temperature? Something else?



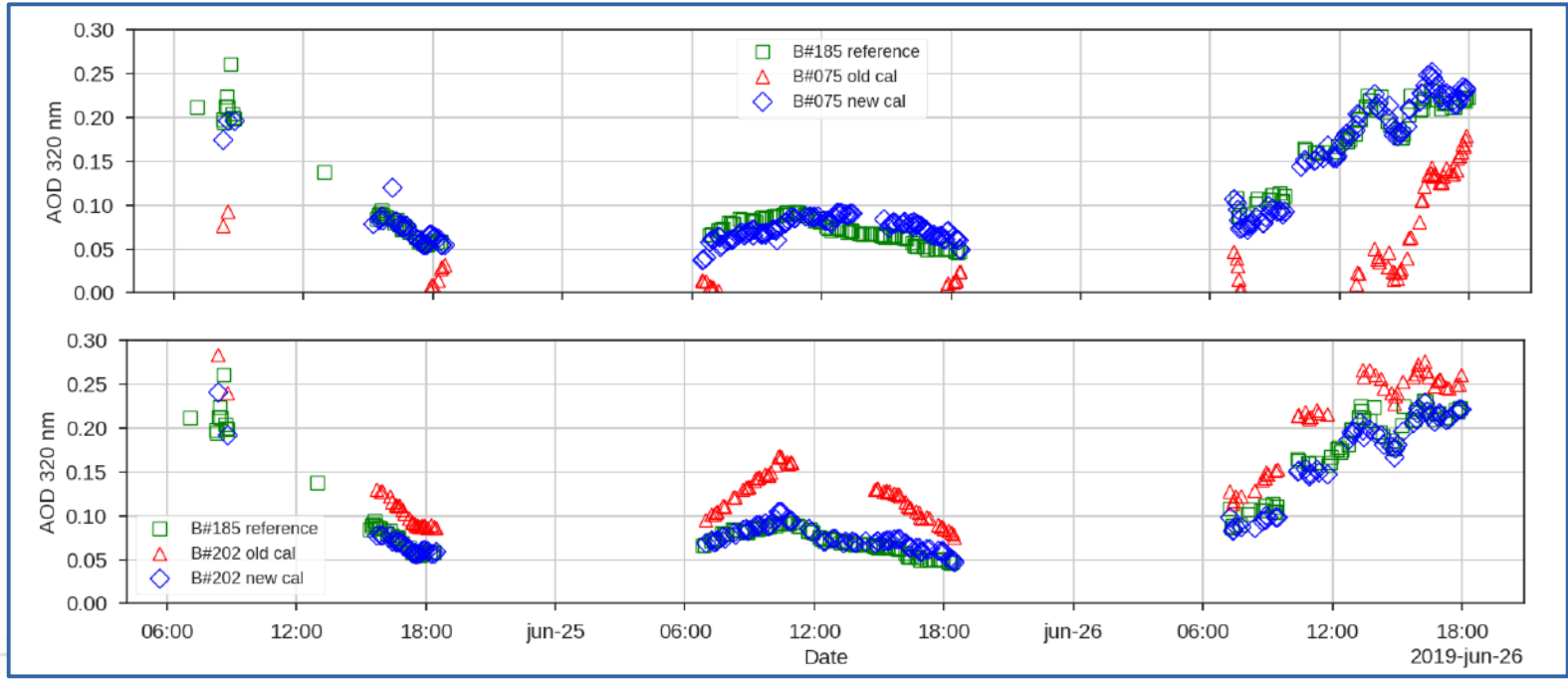
El Arenosillo 2019, last 3 days, final calibrations

WMO traceability criteria: 95% of the differences within the limits

El Arenosillo

We are also working on tracking the changes between campaigns.

El Arenosillo 2019, last 3 days. Old cal = Arenosillo 2017, new cal= Arenosillo 2019



Parsing at Eubrewnet with *get/JG*

← → ↻ rbce.aemet.es/eubrewnet/data/get/JG?brewerid=185&date=2022-07-15&format=text&fields=gmt,steps,raw_counts*

20220715T081101Z	,4178	171776	,177804	,229877	,268754	,245924	,276185
20220715T081114Z	,4178	172182	,178881	,230274	,269650	,246511	,276867
20220715T081128Z	,4178	173425	,179904	,232185	,270898	,248103	,278192
20220715T081143Z	,4178	173718	,180769	,232614	,271780	,248622	,279252
20220715T081158Z	,4178	174373	,181177	,233474	,272752	,249536	,279836
20220715T081237Z	,6205	265912	,323503	,321180	,334966	,343698	,411486
20220715T081250Z	,6205	265345	,323130	,321106	,335018	,343176	,410834
20220715T081304Z	,6205	266271	,323912	,321135	,335053	,343230	,410744
20220715T081318Z	,6205	268395	,327003	,324351	,338462	,346928	,415620
20220715T081333Z	,6205	271044	,330194	,328213	,341522	,349523	,419118
20220715T081410Z	,7678	336157	,357683	,440070	,394253	,427587	,465038
20220715T081424Z	,7678	337937	,359173	,442582	,397092	,429595	,466895
20220715T081438Z	,7678	337946	,359215	,442377	,396063	,428292	,466808
20220715T081452Z	,7678	338205	,358971	,442329	,396822	,429688	,466432
20220715T081507Z	,7678	337551	,358562	,442686	,396086	,429142	,466123
20220715T085920Z	,2090	84888	,122857	,176112	,228198	,300241	,388081
20220715T085933Z	,2090	85021	,122553	,176022	,228484	,299372	,387043
20220715T085947Z	,2090	85977	,123725	,177623	,230344	,302582	,390579
20220715T090002Z	,2090	86718	,124600	,178453	,231259	,303776	,392374
20220715T090016Z	,2090	86706	,125344	,179612	,232219	,305271	,393953

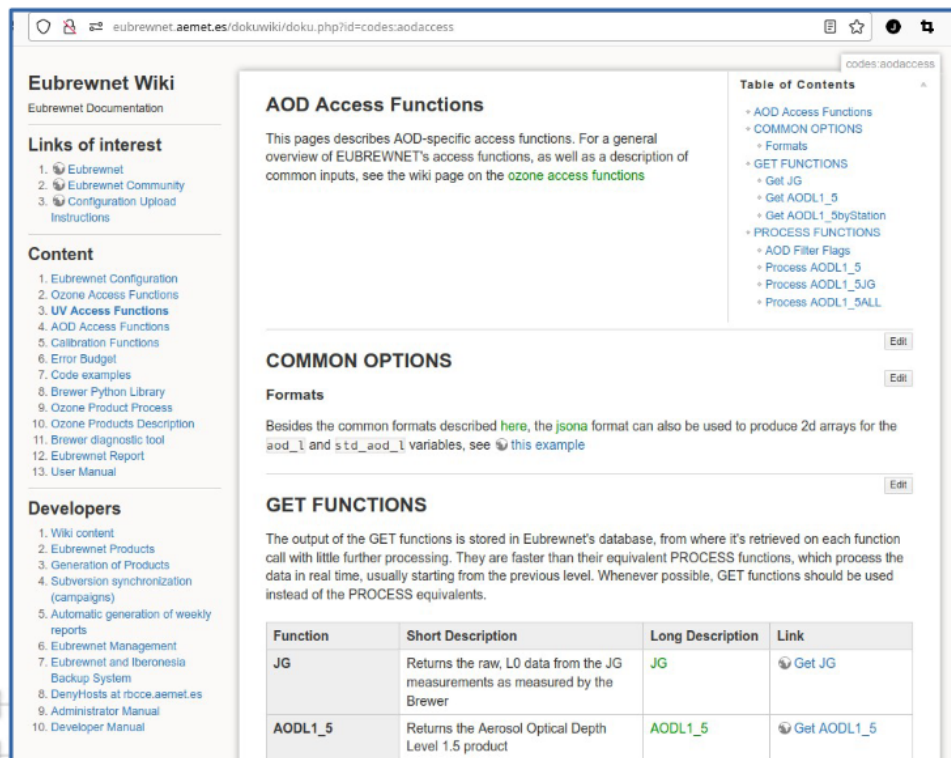
Each JG makes 5 measurements at 4 different steps. And for every step, we have data at each of the 6 slits. So we have $4 \times 6 = 24$ wavelengths

Processing at Eubrewnet with *process/AODL1_5JG*

← → ↻ https://rbce-test.aemet.es/eubrewnet/data/process/AODL1_5JG?brewerid=185&date=2022-07-15&format=text&fields=gmt,wavel*

gmt,wavelengths	1_wavelengths	2_wavelengths	3_wavelengths	4_wavelengths	5_wavelengths	6
20220715T081128Z	3256.14	3285.1	3319.71	3351.49	3381.91	3410.46
20220715T081304Z	3392.08	3419.49	3452.16	3482.17	3510.93	3536.78
20220715T081438Z	3486.96	3513.16	3544.37	3573.06	3600.64	3624.27
20220715T085947Z	3109.65	3139.99	3176.58	3210.07	3242.2	3273.17

For more information on these functions, see the wiki page at <https://eubrewnet.aemet.es/dokuwiki/doku.php?id=codes:aodaccess>



The screenshot shows a web browser displaying the Eubrewnet Wiki page for "AOD Access Functions". The page is titled "AOD Access Functions" and contains a table of contents, a description of the functions, and a table of common options and get functions.

Eubrewnet Wiki
Eubrewnet Documentation

Links of interest

1. Eubrewnet
2. Eubrewnet Community
3. Configuration Upload Instructions

Content

1. Eubrewnet Configuration
2. Ozone Access Functions
3. UV Access Functions
4. AOD Access Functions
5. Calibration Functions
6. Error Budget
7. Code examples
8. Brewer Python Library
9. Ozone Product Process
10. Ozone Products Description
11. Brewer diagnostic tool
12. Eubrewnet Report
13. User Manual

Developers

1. Wiki content
2. Eubrewnet Products
3. Generation of Products
4. Subversion synchronization (campaigns)
5. Automatic generation of weekly reports
6. Eubrewnet Management
7. Eubrewnet and Iberonesia Backup System
8. DenyHosts at rbcoe.aemet.es
9. Administrator Manual
10. Developer Manual

AOD Access Functions

This page describes AOD-specific access functions. For a general overview of EUBREWNET's access functions, as well as a description of common inputs, see the wiki page on the [ozone access functions](#)

Table of Contents

- + AOD Access Functions
- + COMMON OPTIONS
- + Formats
- + GET FUNCTIONS
 - + Get JG
 - + Get AODL1_5
 - + Get AODL1_5byStation
- + PROCESS FUNCTIONS
 - + AOD Filter Flags
 - + Process AODL1_5
 - + Process AODL1_5JG
 - + Process AODL1_5ALL

COMMON OPTIONS

Formats

Besides the common formats described [here](#), the [json](#) format can also be used to produce 2d arrays for the `aod_l` and `std_aod_l` variables, see [this example](#)

GET FUNCTIONS

The output of the GET functions is stored in Eubrewnet's database, from where it's retrieved on each function call with little further processing. They are faster than their equivalent PROCESS functions, which process the data in real time, usually starting from the previous level. Whenever possible, GET functions should be used instead of the PROCESS equivalents.

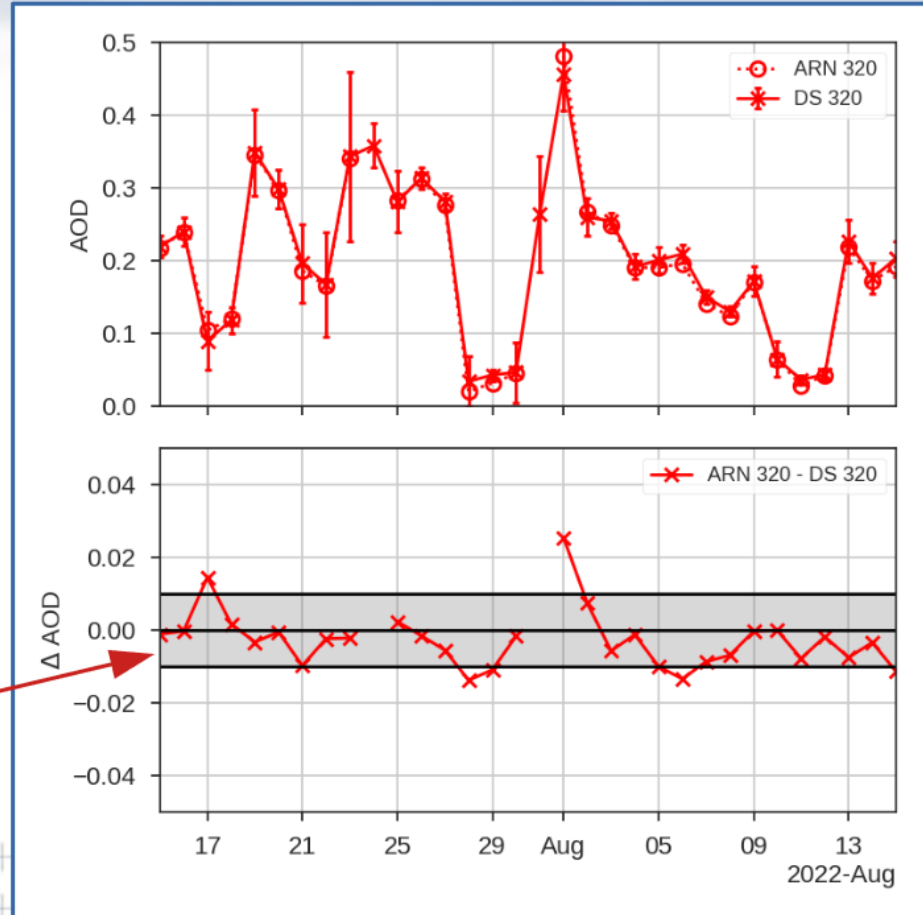
Function	Short Description	Long Description	Link
JG	Returns the raw, L0 data from the JG measurements as measured by the Brewer	JG	Get JG
AODL1_5	Returns the Aerosol Optical Depth Level 1.5 product	AODL1_5	Get AODL1_5

AOD: preliminary results

Comparison with AERONET (ARN) data (extrapolated from 340 nm using the 340-440 nm Ångström exponent where necessary), daily medians over July-August 2022 for B#185 at Izaña

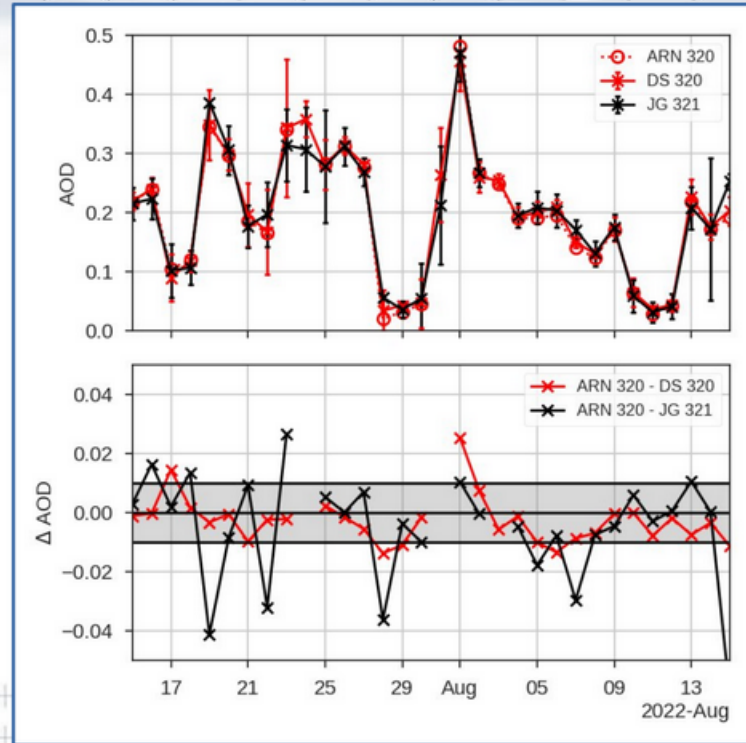
320 nm from DS looks OK, as usual

Approx. area within the WMO traceability limits





321 nm from JG is worse than the DS, but it's quite close



AOD: preliminary results



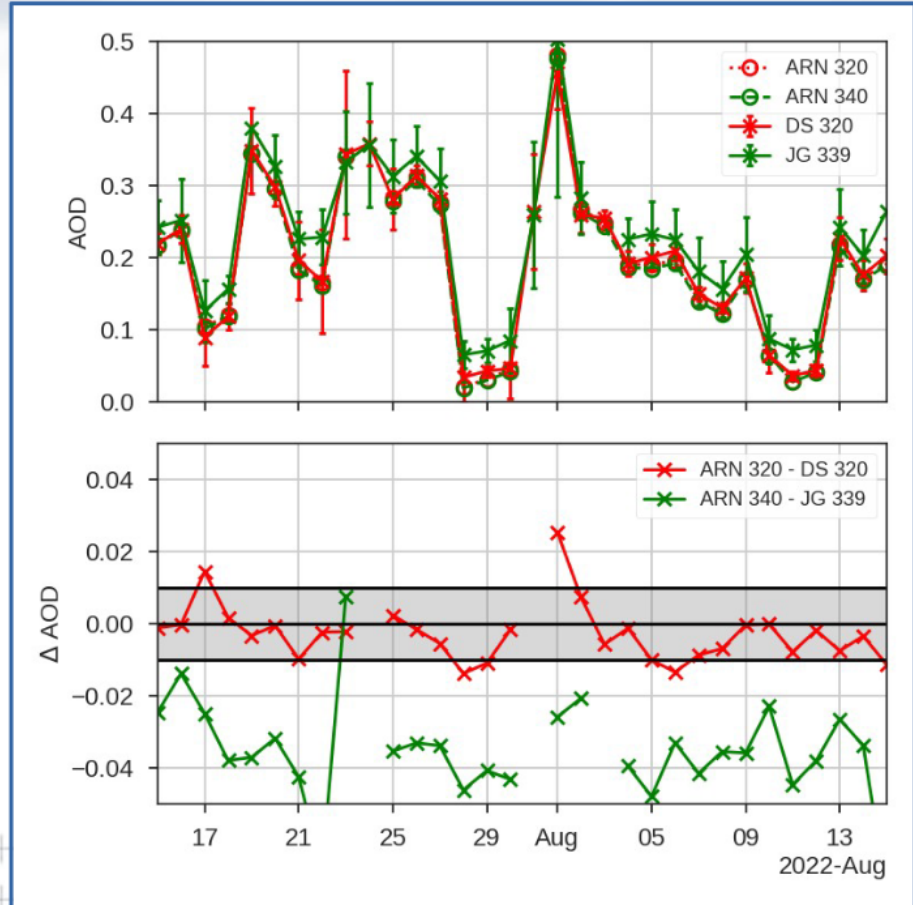
GOBIERNO DE ESPAÑA

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339 nm looks quite bad...



AOD: preliminary results

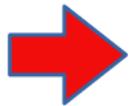


GOBIERNO DE ESPAÑA

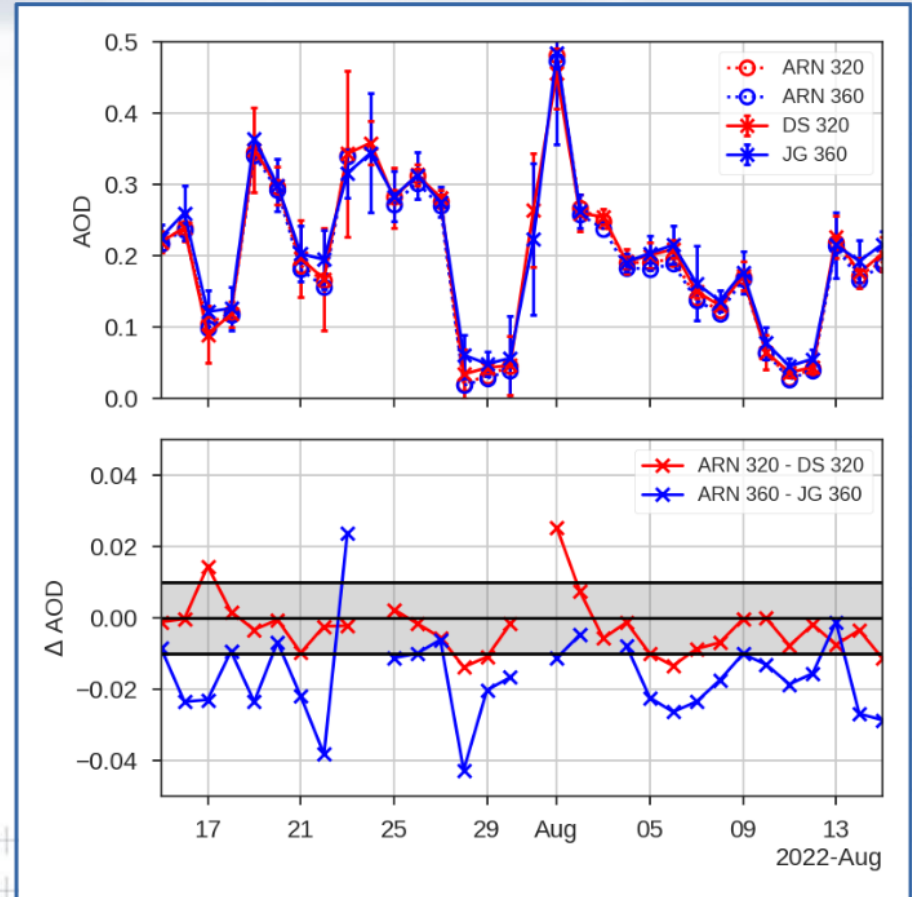
VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

AEmet
Agencia Estatal de Meteorología

... but 360 nm gets better!

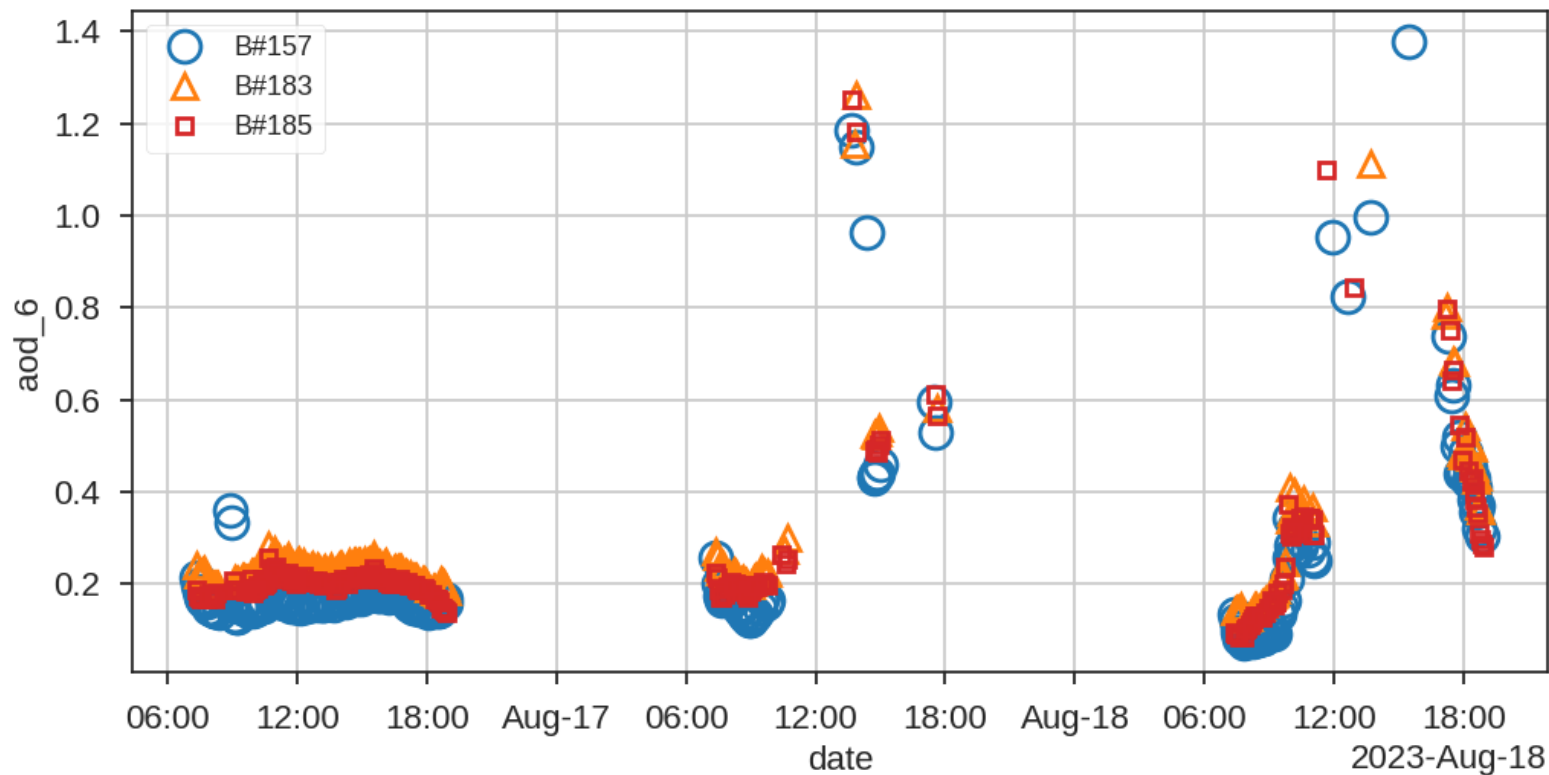


Lots of work pending in the AOD calibrations!





EUBREWNET get data, downloaded on 2023-09-19 at 7:38





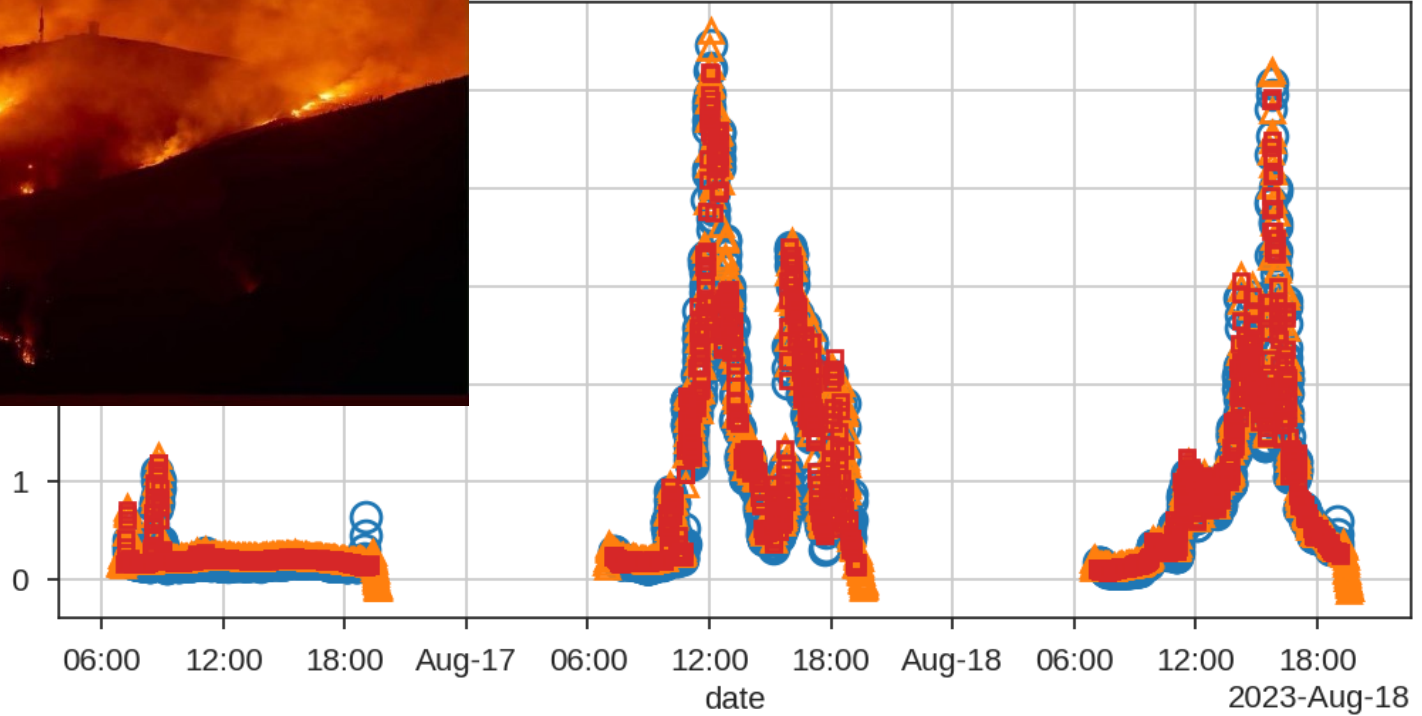
GOBIERNO DE ESPAÑA

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MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

AEMet
Agencia Estatal de Meteorología



s data (inc. rejected), downloaded on 2023-09-19 at 7:40



RBCC-E 20 years 2003-2023



naturenews
nature news home | news archive | specials | opinion | features | news blog | nat

Published online 12 September 2011 | Nature 477, 257-258 (2011) | doi:10.1038/477257a
Corrected online: 15 September 2011

Canadian ozone network faces axe

Arctic monitoring stations hit by budget constraints.

Quinn Schiermeier

A key source of information about the health of the ozone layer above the Arctic looks set to be choked off.

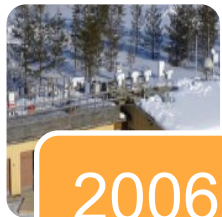
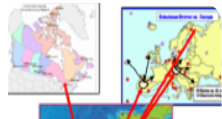
In a year that saw the first "ozone hole" appear in the Northern Hemisphere, arctic scientists say Arctic ozone levels hit a record low this year (blue area, right), compared

- Environmental Science
- Policy

Stories by keywords

- Canada
- Arctic
- Environment
- Ozone
- Funding

Buy one - year get two



2003

2005

2006

2011

2022
CCI

2021- Summer Europe intercomparisons

5-15 July 2021: Davos intercomparison (PMOD)

5-15 September 2021: Huelva intercomparison

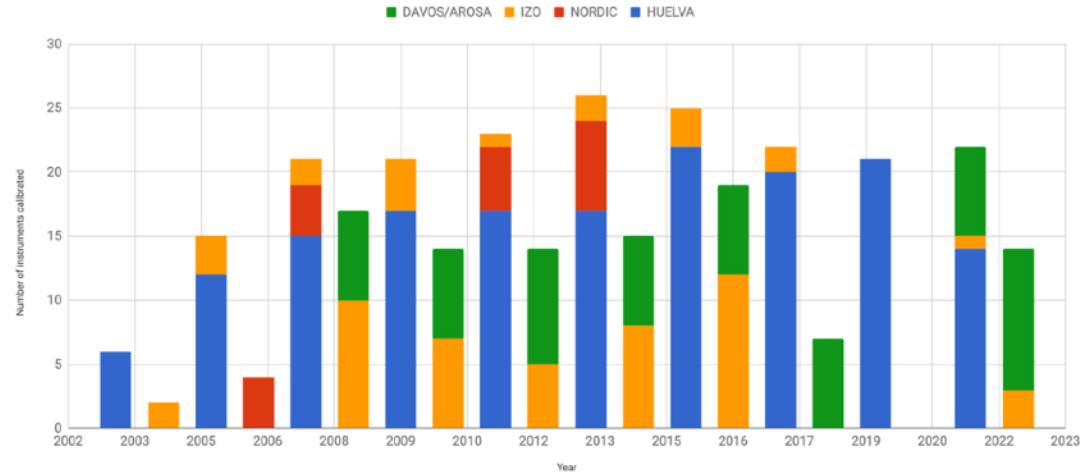
2022 - Chile – Chajnantor setup

Davos July 2022

2023 – September 2023

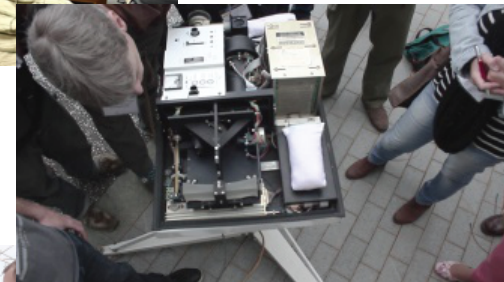
2024 - WMO Brasil January 2024

RBCC-E calibrated Brewers



• Operator training Courses.

- Tenerife, March 2014
- Huelva , June 2015
- Edinburgh, Sept 2016
- Sydney, Sept 2017
- Huelva, June 2019
- Huelva, Sep 2023 ?
- South America 2024?



Thanks for your attention!
Questions and suggestions are always welcome!
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The RBCC-E Team



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



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



GOBIERNO
DE ESPAÑA

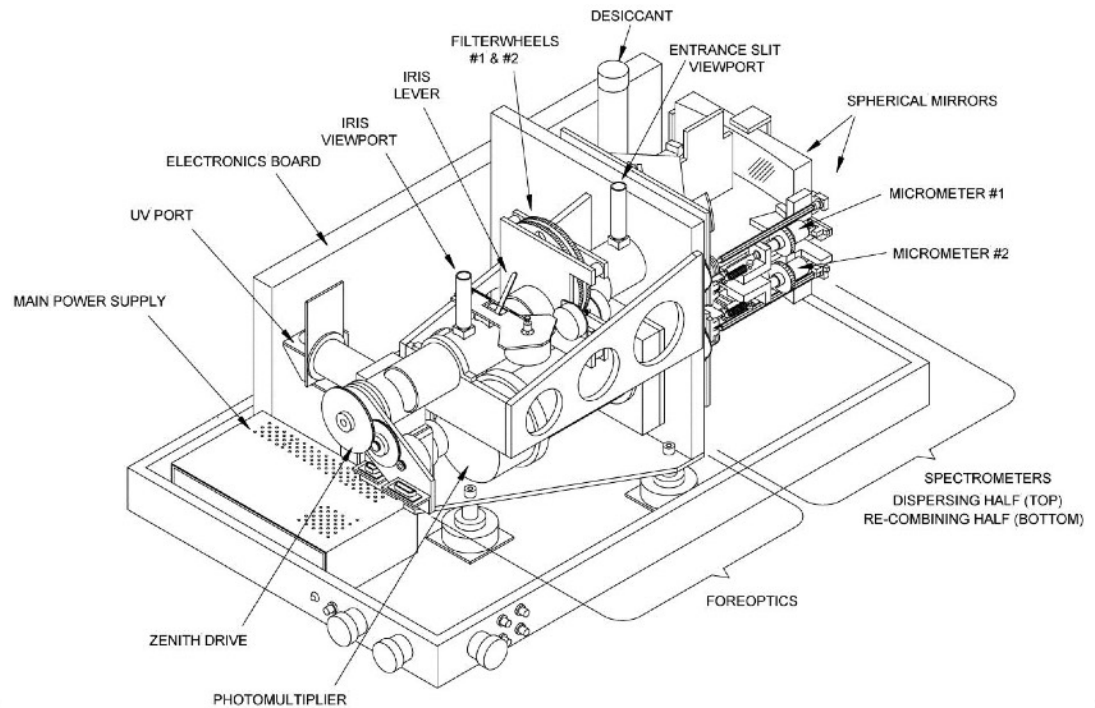
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Summary

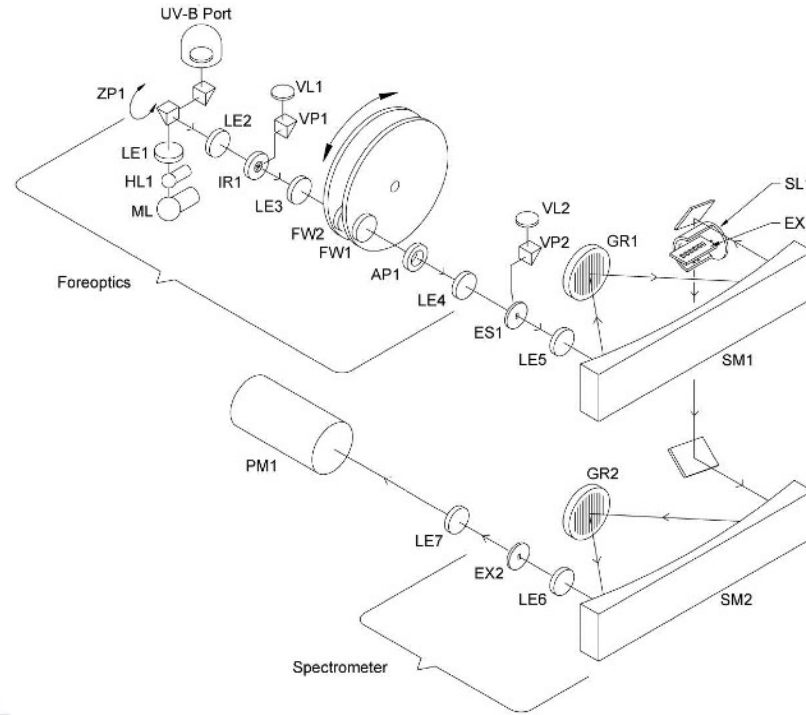
Inside a Brewer



Picture: Kipp & Zonen



Simpler view



Picture: Kipp & Zonen