

Calibration Certificate

No. 2023_210401_Cimel#1089_IZO-AEMET

Calibration Item

CIMEL filterradiometer

Manufacturer Cimel
ACTRIS-CARS Station: IZAÑA
AERONET Serial number: #1089

Customer

AEMET
Izaña Atmospheric Research Center
C. la Marina, 20, 38001
Santa Cruz de Tenerife
Spain

Calibration Mark

WORCC-ACTRIS Calibration
CIMEL#1089
01.04.2021/22.02.2023

Calibration period Travelling standard

01.Mar.2021 to 30.Dec.2021
PFR-98-N-010
Calibration : Langley at Izaña/Certificate No.: 2018_1566

Davos Dorf, 22 Feb 2023

Dr. Natalia Kouremeti
WORCC calibrations

Dr. Stelios Kazadzis
Head of WORCC

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Calibration procedure

The aerosol optical depth (AOD) traceability of the Precision Filter Radiometer Reference Group of the World Optical depth Research and Calibration Center of the World radiation Center (WRC-WORCC) maintained and operated at PMOD, is represented by the traveling standard PFR.

The performance of the Device Under Test (DUT) is validated by an outdoor comparison of the AOD values at the wavelengths of DUT to the PFR travelling reference. The interpolation of AOD is performed using the Ångström exponent retrieved from the four PFR wavelengths. To minimize the uncertainty of the calibration the following atmospheric conditions need to be fulfilled:

- Solar zenith angle limit : 75.5° (airmass 4.0)
- Ångström exponent range: 0.9 – 2.1
- Atmospheric variability with respect simulated clear sky irradiance: < 0.5%/min

In addition, the total column of NO₂ is accounted using the AERONET values contained in the Lev15 file of DUT. The comparison and the uncertainty analysis for the traveling standard are done following the process described in QM-PD-WORCC-0050_WORCC_ACTRIS_certificates.docx.

Calibration Information

Location	Izaña Atmospheric Research Center (28.31°N,16.50°E,2401 m)
Device Under Test	Cimel#1089
Cimel temperature (°C) (med,[min,max]):	17.3 [7.1,27.2]
AERONET dataset processing date:	2021-Jul-08 to 2021-Dec-31
Number of comparison days:	198
Number of comparison points:	17405

Comparison of Pressure and Ozone values used in the retrieval of AOD over the calibration period.

	AERONET	WORCC	Difference ± 2σ	Correlation Coefficient
Ozone (DU)	290.2	295.0	-0.1±13.1	0.56
Site Atmospheric Pressure (hPa)	767.8	769.1	-1.2±0.7	0.98

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Calibration Results

AOD Difference (Cimel-PFR)

Wavelength (nm)	Median	Combined expanded uncertainty U (k=2)	Combined expanded uncertainty of PFR AOD (k=2)	Values at 95.45% (k=2) of the distribution	
1020.0	0.000	0.009	0.007	-0.003	0.007
870.0	0.000	0.007	0.006	-0.003	0.004
675.0	0.000	0.009	0.008	-0.005	0.005
500.0	0.002	0.009	0.006	-0.003	0.008
440.0	-0.002	0.009	0.007	-0.007	0.003
380.0	0.003	0.010	0.008	-0.004	0.008
340.0	0.004	0.013	0.009	-0.004	0.014

The reported expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95.45%.

Comments: All observed AOD differences fall within the estimated uncertainty of the traveling standard.

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Comparison Analysis Figures

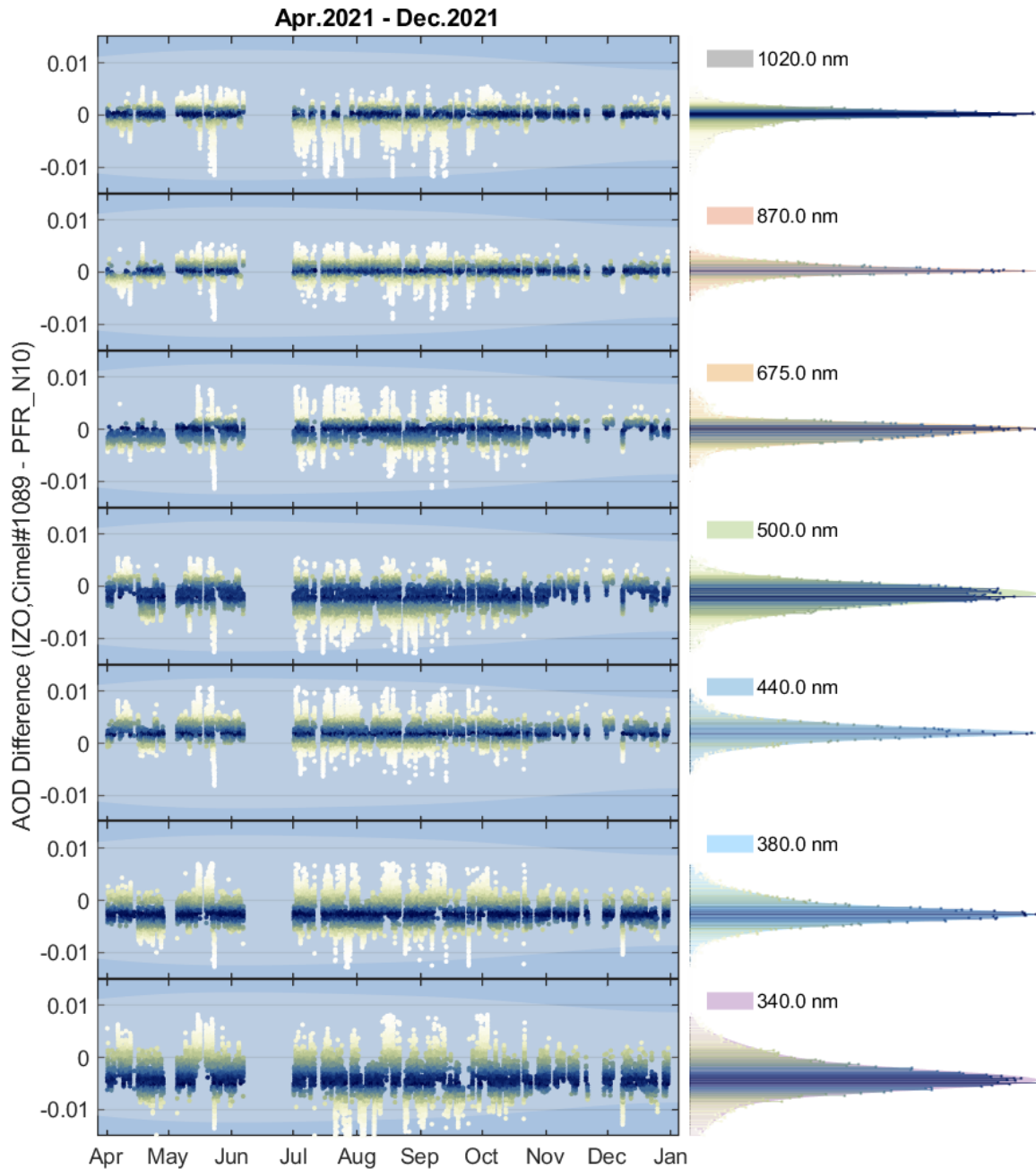


Figure 1: Left panels: Time series of AOD difference PFR-Cimel at 7 Cimel wavelengths over the calibration period. The AOD difference (dots) is colored based on the probability density function shown in the colored bars on the right panels. The highlighted area on the left panels represents the WMO limit for AOD agreement between two instruments with uncertainties of their calibration of better than 1%.

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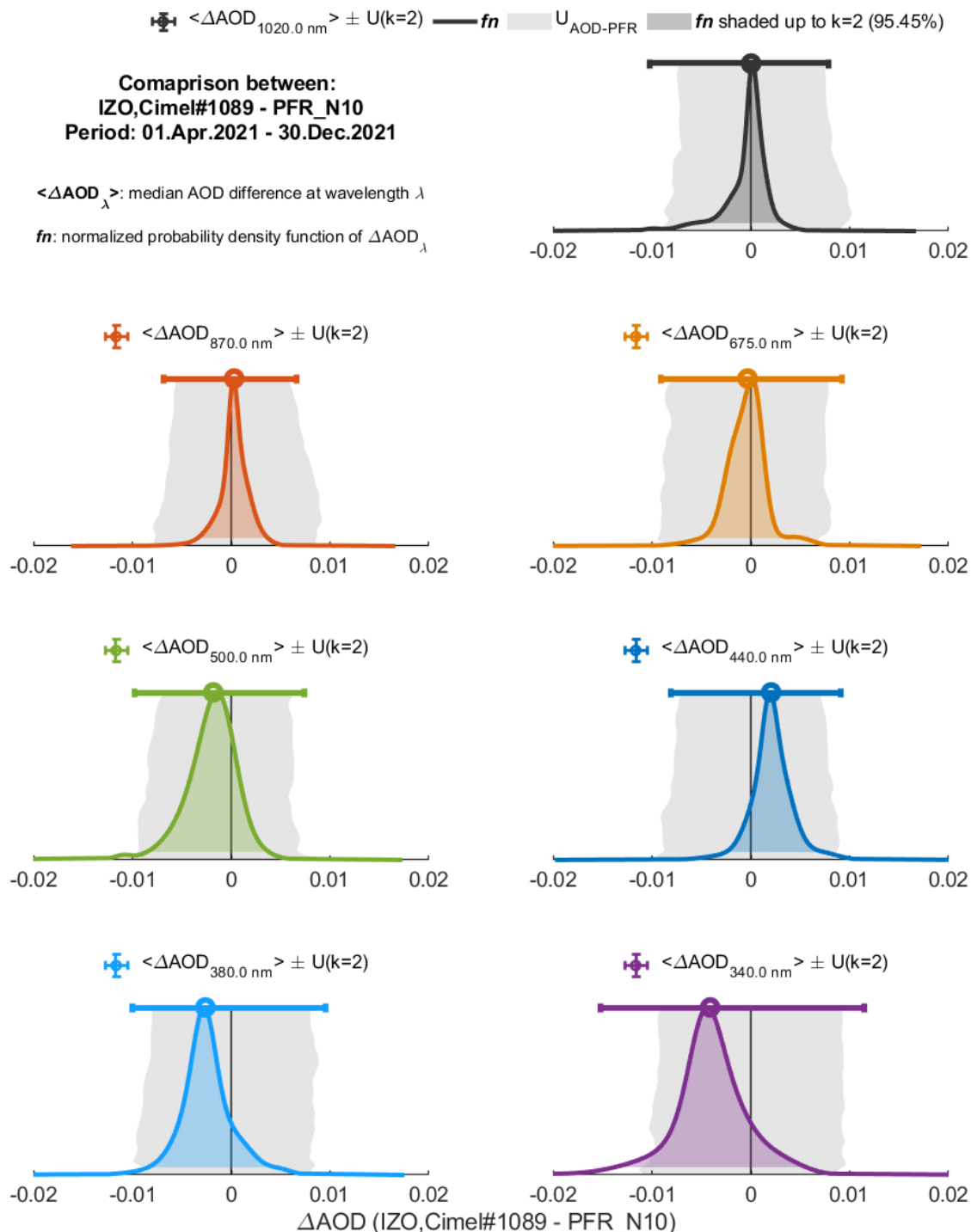


Figure 2: Normalized probability density functions of the AOD differences at 7 wavelengths, approximated by high order (4 to 8) gaussian distribution functions (colored thick lines), the shaded colored area represents a coverage factor of 2. The light gray area represents the combined expanded uncertainty of the travelling standard. The circle and errorbar represent the median AOD difference and the combined expanded uncertainty of the PFR AOD.