

Supporting Information for

Field comparison of dual- and single-spot aethalometers: Equivalent black carbon, light absorption, Ångström exponent and secondary brown carbon estimations

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Test S1 AAE calculation examples

Following are the data points used as an example.

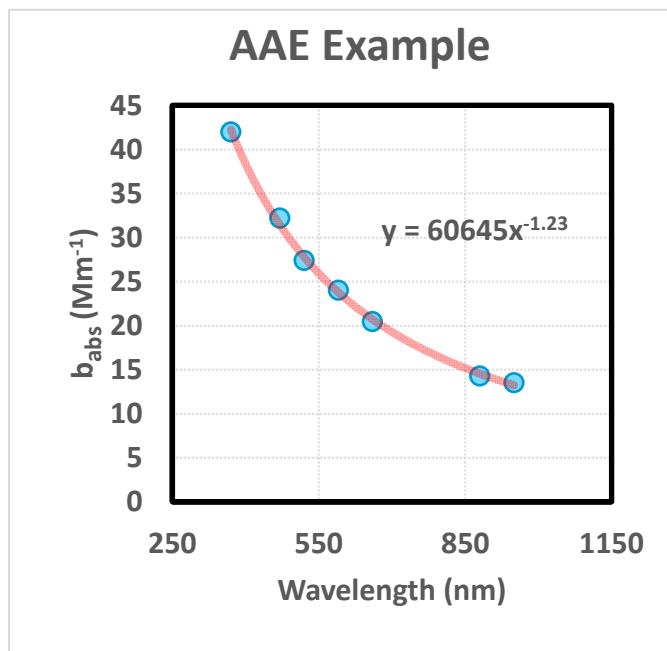
babs370	babs470	babs520	babs590	babs660	babs880	babs950
41.98	32.19	27.40	24.04	20.45	14.27	13.52
$\ln(babs370)$	$\ln(babs470)$	$\ln(babs520)$	$\ln(babs590)$	$\ln(babs660)$	$\ln(babs880)$	$\ln(babs950)$
3.74	3.47	3.31	3.18	3.02	2.66	2.60
λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7
370	470	520	590	660	880	950
$\ln\lambda_{370}$	$\ln\lambda_{470}$	$\ln\lambda_{520}$	$\ln\lambda_{590}$	$\ln\lambda_{660}$	$\ln\lambda_{880}$	$\ln\lambda_{950}$
5.91	6.15	6.25	6.38	6.49	6.78	6.86

Example of approach 1:

$$AAE_{370/950} = \frac{\ln(b_{abs950}/b_{abs370})}{\ln(370/950)}$$

$$AAE_{370/950} = \ln(13.52/41.98)/\ln(370/950) = 1.20$$

Example of approach 2:



AAE wave obtained from the curve fitting of the power function. In this case, $AAE_{370-950} = 1.23$

Table S1. The σ_{air} of AE33 Aethalometer and σ_{ATN} of AE31 Aethalometer.

Wavelength	AE33_ σ_{air} (m^2g^{-1})	AE31_ σ_{ATN} (m^2g^{-1})
370 nm	18.47	39.5
470 nm	14.54	31.1
520 nm	13.14	28.1
590 nm	11.58	24.8
660 nm	10.35	22.2
880 nm	7.77	16.6
950 nm	7.19	15.4

Table S2. Summary of the multiple scattering parameter (C_{ref}) values for Aethamometers reported in the literature.

Reference	Site	Site type	Aethalometer (Filter type)	Reference instrument	Wavelength (nm)						
					370	470	520	590	660	880	950
(Bernardoni et al., 2021)	Milan (Italy)	Urban background station	AE33 (TFE-coated glass fibre tape T60A20)	PP_UniMI	2.91	2.93	2.78	2.78	2.78	2.78	
			AE31 (Pall Q250 quartz)								
(Valentini et al., 2020)	Rome (Italy)	Urban background station	AE33	MAAP					2.66		
(Zhao et al., 2020)	Beijing (China)	Urban	AE33 (Tape 8060)	PASS-3				2.9 ± 0.4			
(Backman et al., 2017)	Arctic	Clean environment	AE31 (Pallflex Q250F)	PSAP/MAAP				3.45			
(Di Biagio et al., 2017)	Laboratory	Mineral dust aerosols	AE31	Extinction minus scattering					1.92		
(Segura et al., 2014)	Granada (Spain)	Urban	AE31	MAAP	3.42	3.87	3.90	3.98	4.19	4.35	4.59
(Arnott et al., 2005)	Las Vegas (USA)	Urban	AE31	PAS				3.69			
(Collaud Coen et al., 2010)	Cabauw, (Netherlands)	Urban	AE31 (Pallflex Q250F)	MAAP					4.26		
(Zhang et al., 2021)	Beijing (China)	Urban	AE31	PAS	5.61	4.98	4.73	4.92	5.19	5.30	5.24
(Weingartner et al., 2003)	Laboratory	Diesel soot with organic coating	AE30 (Pallflex Q250F)	Extinction minus scattering					3.60		
(Schmid et al., 2006)	Amazon (Brazil)	Biomass aerosol	AE30	PAS				5.23			
(Saturno et al., 2017)	Amazon (Brazil)	Urban	AE31	MAPP					4.90		
(Lim et al., 2018)	East Asia	Urban	AE31	PASS-3	3.37	3.80	3.99	4.25	4.49	5.18	5.39
(Ajtai et al., 2019)	Budapest (Hungary)	Urban	AE42 (Quartz)	PAS	2.15	3.52	4.78	4.86	5.21	5.11	5.16
(Laing et al., 2020)	Oregon (USA)	Rural	AE33 (TFE-coated glass filter)	TAP	4.35	4.45			4.24		
(Qin et al., 2018)	Guangzhou (China)	Suburban	AE33 (TFE-coated glass filter)	Extinction minus scattering	$C_{ref} = C_{AE33} \cdot C' = 1.57 \cdot 2.1 = 3.297$						
(Wu et al., 2013)	Guangzhou (China)	Suburban	AE16	PAS				3.48			

Table S3. The monthly eBC mass concentrations ($\mu\text{g m}^{-3}$) of AE31 and AE33 Aethalometers at 5 min and 1 hr time bases. AE31_V and AE31_W are AE31 data corrected by algorithms of Virkkula and Weingartner, respectively. AE33_{2nd_Cor} refers to eBC of AE33 with the second correction.

Time base	Instrument/Algorithm	Annual	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022
1 hr	AE31_V	1.95±1.12	2.44±1.14	1.75±0.91	1.89±0.86	1.66±0.80	1.98±0.90	2.26±1.06	1.39±0.83	1.71±0.92	2.05±1.16	2.63±1.53	1.18±0.90	2.38±1.24
	AE31_W	1.95±1.12	2.44±1.15	1.75±0.91	1.89±0.86	1.66±0.81	1.98±0.90	2.26±1.07	1.38±0.84	1.70±0.92	2.04±1.16	2.62±1.50	1.17±0.90	2.38±1.24
	AE33	2.35±1.37	2.76±1.29	2.06±1.05	2.22±1.05	1.91±0.85	2.36±1.10	2.65±1.24	1.81±1.16	2.21±1.26	2.51±1.39	3.25±1.86	1.46±1.16	2.91±1.65
	AE33 _{2nd_Cor}	1.96±1.14	2.30±1.08	1.71±0.87	1.85±0.87	1.59±0.71	1.97±0.92	2.21±1.04	1.51±0.97	1.84±1.05	2.09±1.16	2.71±1.55	1.22±0.97	2.43±1.38
5 min	AE31_V	1.96±1.18	2.45±1.21	1.75±0.95	1.89±0.93	1.66±0.85	1.97±0.95	2.25±1.10	1.39±0.84	1.71±0.93	2.05±1.23	2.63±1.62	1.18±0.95	2.42±1.31
	AE31_W	1.96±1.18	2.46±1.22	1.75±0.96	1.89±0.94	1.66±0.85	1.98±0.95	2.25±1.12	1.39±0.85	1.71±0.94	2.05±1.23	2.62±1.62	1.17±0.96	2.41±1.31
	AE33	2.35±1.39	2.78±1.37	2.05±1.07	2.22±1.09	1.91±0.89	2.36±1.13	2.64±1.27	1.79±1.14	2.18±1.19	2.52±1.43	3.25±1.87	1.46±1.16	2.91±1.66
	AE33 _{2nd_Cor}	2.02±1.20	2.36±1.16	1.74±0.90	1.88±0.92	1.61±0.75	2.00±0.96	2.24±1.08	1.52±0.97	1.85±1.00	2.13±1.21	2.80±1.61	1.26±1.00	2.51±1.43

Table S4. Annual mean b_{abs} (± 1 S.D.) by AE31_V, AE31_W and AE33 at 7 wavelengths.

Model	Time base	Annual mean b_{abs} with ± 1 S.D. (Mm^{-1})						
		370 nm	470 nm	520 nm	590 nm	660 nm	880 nm	950 nm
AE31_V	1 hr	22.10 \pm 12.78	16.94 \pm 9.84	14.72 \pm 8.58	13.12 \pm 7.70	11.75 \pm 6.94	8.69 \pm 5.20	7.69 \pm 4.63
	5 min	22.16 \pm 13.03	16.98 \pm 10.55	14.76 \pm 8.78	13.15 \pm 7.90	11.78 \pm 7.15	7.81 \pm 5.42	7.71 \pm 4.86
AE31_W	1 hr	20.62 \pm 11.97	16.36 \pm 9.51	14.47 \pm 8.44	12.97 \pm 7.63	11.49 \pm 6.80	8.62 \pm 5.19	7.51 \pm 4.55
	5 min	20.70 \pm 12.22	16.42 \pm 9.73	14.52 \pm 8.65	13.02 \pm 7.84	11.53 \pm 7.01	8.65 \pm 5.41	7.54 \pm 4.79
AE33	1 hr	21.05 \pm 12.48	16.33 \pm 9.59	14.05 \pm 7.90	12.21 \pm 7.19	10.42 \pm 6.15	7.51 \pm 4.48	7.14 \pm 4.27
	5 min	21.04 \pm 12.64	16.32 \pm 9.70	14.02 \pm 8.10	12.20 \pm 7.27	10.41 \pm 6.23	7.50 \pm 4.54	7.14 \pm 4.32

Table S5. Monthly b_{abs} comparisons (370 nm) among AE33_ b_{abs} , AE31_V_ b_{abs} , and AE31_W_ b_{abs} at 5 min and 1 hr time bases. Where the AE31_V_ b_{abs} and AE31_W_ b_{abs} are the light absorption coefficients of AE31 corrected by the procedures of Virkkula and Weingartner, respectively. And the AE33_ b_{abs} is the light absorption coefficient of the AE33 aethalometer.

370 nm	Time base		Annual	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022
AE33_ b_{abs} vs AE31_V_ b_{abs}	5 min	R ²	0.95	0.96	0.97	0.95	0.93	0.95	0.94	0.93	0.93	0.97	0.93	0.94	0.91
		Slope	0.96	0.89	0.91	0.92	0.85	0.95	0.97	0.98	1.03	0.98	0.97	0.98	1.00
	1 hr	R ²	0.96	0.96	0.98	0.98	0.97	0.96	0.96	0.97	0.96	0.98	0.97	0.97	0.96
		Slope	0.97	0.89	0.93	0.93	0.89	0.96	0.99	1.06	1.09	0.99	0.98	0.97	1.08
AE33_ b_{abs} vs AE31_W_ b_{abs}	5 min	R ²	0.94	0.95	0.96	0.94	0.93	0.94	0.93	0.93	0.91	0.96	0.91	0.94	0.89
		Slope	1.03	0.95	0.97	1.00	0.90	1.02	1.04	1.05	1.10	1.05	1.04	1.04	1.07
	1 hr	R ²	0.95	0.95	0.97	0.97	0.96	0.95	0.95	0.96	0.95	0.97	0.96	0.96	0.95
		Slope	1.04	0.96	0.99	1.01	0.95	1.03	1.05	1.14	1.16	1.05	1.06	1.04	1.15
AE31_W_ b_{abs} vs AE31_V_ b_{abs}	5 min	R ²	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
		Slope	0.93	0.94	0.94	0.92	0.94	0.93	0.94	0.93	0.94	0.94	0.93	0.94	0.94
	1 hr	R ²	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
		Slope	0.93	0.93	0.94	0.92	0.94	0.93	0.94	0.93	0.94	0.94	0.93	0.93	0.94

Table S6. Monthly b_{abs} comparisons (880 nm) among AE33_ b_{abs} , AE31_V_ b_{abs} , and AE31_W_ b_{abs} at 5 min and 1 hr time bases. Where the AE31_V_ b_{abs} and AE31_W_ b_{abs} are the light absorption coefficients of AE31 corrected by the procedures of Virkkula and Weingartner, respectively. And the AE33_ b_{abs} is the light absorption coefficient of the AE33 aethalometer.

880 nm	Time base		Annual	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022
AE33_ b_{abs}	5 min	R ²	0.91	0.94	0.90	0.88	0.89	0.91	0.92	0.93	0.86	0.92	0.84	0.87	0.84
vs		Slope	0.85	0.77	0.72	0.74	0.74	0.80	0.80	0.88	0.91	0.83	0.84	0.86	0.86
AE31_V_ b_{abs}	1 hr	R ²	0.97	0.97	0.97	0.97	0.96	0.97	0.96	0.97	0.96	0.98	0.98	0.98	0.97
		Slope	0.87	0.81	0.85	0.86	0.79	0.88	0.85	0.95	0.96	0.87	0.89	0.87	0.99
AE33_ b_{abs}	5 min	R ²	0.91	0.93	0.89	0.86	0.88	0.90	0.90	0.92	0.86	0.92	0.84	0.87	0.84
vs		Slope	0.86	0.77	0.72	0.75	0.75	0.80	0.80	0.89	0.92	0.83	0.85	0.87	0.87
AE31_W_ b_{abs}	1 hr	R ²	0.96	0.96	0.96	0.96	0.94	0.96	0.95	0.96	0.95	0.98	0.98	0.97	0.97
		Slope	0.95	0.81	0.85	0.86	0.80	0.88	0.85	0.96	0.97	0.88	0.91	0.88	1.01
AE31_W_ b_{abs}	5 min	R ²	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	0.99
vs		Slope	0.99	1.00	0.99	0.99	0.99	1.00	1.00	0.99	0.99	0.99	0.99	0.98	0.99
AE31_V_ b_{abs}	1 hr	R ²	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	0.99
		Slope	0.98	1.00	1.00	1.00	0.99	1.00	1.00	0.98	0.99	0.99	0.99	1.00	0.99

Table S7. Relative deviation of slope between monthly and annual data among AE33_b_{abs}, AE31_V_b_{abs}, and AE31_W_b_{abs} at 5 min and 1 hr time bases. The month with maximum deviation was shown in bold. Where the AE31_V_b_{abs} and AE31_W_b_{abs} are the light absorption coefficients of AE31 corrected by the procedures of Virkkula and Weingartner, respectively. And the AE33_b_{abs} is the light absorption coefficient of the AE33 aethalometer.

Relative deviation of slope	Instrument/Algorithm	Time base	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022
370 nm	AE33_b _{abs} vs AE31_V_b _{abs}	5 min	7.29%	5.21%	4.17%	11.46%	1.04%	1.04%	2.08%	7.29%	2.08%	1.04%	2.08%	4.17%
	AE33_b _{abs} vs AE31_W_b _{abs}	1 hr	8.25%	4.12%	4.12%	8.25%	1.03%	2.06%	9.28%	12.37%	2.06%	1.03%	0.00%	11.34%
	AE33_b _{abs} vs AE31_V_b _{abs}	5 min	7.77%	5.83%	2.91%	12.62%	0.97%	0.97%	1.94%	6.80%	1.94%	0.97%	0.97%	3.88%
	AE33_b _{abs} vs AE31_W_b _{abs}	1 hr	7.69%	4.81%	2.88%	8.65%	0.96%	0.96%	9.62%	11.54%	0.96%	1.92%	0.00%	10.58%
	AE31_W_b _{abs} vs AE31_V_b _{abs}	5 min	1.08%	1.08%	1.08%	1.08%	0.00%	1.08%	0.00%	1.08%	1.08%	0.00%	1.08%	1.08%
	AE31_W_b _{abs} vs AE31_V_b _{abs}	1 hr	0.00%	1.08%	1.08%	1.08%	0.00%	1.08%	0.00%	1.08%	1.08%	0.00%	0.00%	1.08%
	AE33_b _{abs} vs AE31_V_b _{abs}	5 min	9.41%	15.29%	12.94%	12.94%	5.88%	5.88%	3.53%	7.06%	2.35%	1.18%	1.18%	1.18%
	AE33_b _{abs} vs AE31_W_b _{abs}	1 hr	6.90%	2.30%	1.15%	9.20%	1.15%	2.30%	9.20%	10.34%	0.00%	2.30%	0.00%	13.79%
880 nm	AE33_b _{abs} vs AE31_W_b _{abs}	5 min	10.47%	16.28%	12.79%	12.79%	6.98%	6.98%	3.49%	6.98%	3.49%	1.16%	1.16%	1.16%
	AE33_b _{abs} vs AE31_V_b _{abs}	1 hr	6.90%	2.30%	1.15%	8.05%	1.15%	2.30%	10.34%	11.49%	1.15%	4.60%	1.15%	16.09%
	AE31_W_b _{abs} vs AE31_V_b _{abs}	5 min	1.01%	0.00%	0.00%	0.00%	1.01%	1.01%	0.00%	0.00%	0.00%	0.00%	1.01%	0.00%
	AE31_W_b _{abs} vs AE31_V_b _{abs}	1 hr	1.01%	1.01%	1.01%	0.00%	1.01%	1.01%	1.01%	0.00%	0.00%	0.00%	1.01%	0.00%

Table S8. Monthly average (± 1 S.D.) of AAE values (AAE_{470/660}, AAE_{370/880}, AAE_{880/950}, AAE_{370/950} and AAE₃₇₀₋₉₅₀) calculated by 1 hr data.

AAE		Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022	Annual
470/660	AE31_V	1.04 \pm 0.09	1.03 \pm 0.08	1.04 \pm 0.08	1.03 \pm 0.08	1.03 \pm 0.08	1.01 \pm 0.08	1.09 \pm 0.14	1.20 \pm 0.18	1.22 \pm 0.11	1.23 \pm 0.09	1.30 \pm 0.18	1.17 \pm 0.11	1.12 \pm 0.15
	AE31_W	1.00 \pm 0.13	1.00 \pm 0.12	1.00 \pm 0.13	1.00 \pm 0.13	0.99 \pm 0.12	0.98 \pm 0.12	1.06 \pm 0.17	1.17 \pm 0.19	1.18 \pm 0.14	1.19 \pm 0.12	1.28 \pm 0.19	1.13 \pm 0.14	1.08 \pm 0.17
	AE33	1.28 \pm 0.08	1.25 \pm 0.05	1.27 \pm 0.07	1.28 \pm 0.06	1.27 \pm 0.06	1.27 \pm 0.06	1.33 \pm 0.09	1.40 \pm 0.12	1.43 \pm 0.09	1.45 \pm 0.09	1.46 \pm 0.14	1.34 \pm 0.14	1.33 \pm 0.12
370/880	AE31_V	1.04 \pm 0.15	1.03 \pm 0.26	1.03 \pm 0.23	1.03 \pm 0.17	1.02 \pm 0.20	1.01 \pm 0.15	1.09 \pm 0.24	1.21 \pm 0.29	1.23 \pm 0.20	1.25 \pm 0.22	1.28 \pm 0.27	1.16 \pm 0.23	1.11 \pm 0.14
	AE31_W	0.97 \pm 0.18	0.96 \pm 0.28	0.96 \pm 0.25	0.96 \pm 0.20	0.95 \pm 0.22	0.94 \pm 0.18	1.02 \pm 0.26	1.15 \pm 0.31	1.16 \pm 0.22	1.18 \pm 0.23	1.23 \pm 0.28	1.09 \pm 0.25	1.05 \pm 0.17
	AE33	1.12 \pm 0.11	1.11 \pm 0.06	1.12 \pm 0.08	1.14 \pm 0.07	1.12 \pm 0.07	1.13 \pm 0.07	1.21 \pm 0.10	1.27 \pm 0.12	1.31 \pm 0.09	1.32 \pm 0.10	1.30 \pm 0.20	1.21 \pm 0.15	1.20 \pm 0.13
880/950	AE31_V	1.59 \pm 0.32	1.72 \pm 0.41	1.74 \pm 0.39	1.65 \pm 0.34	1.69 \pm 0.38	1.67 \pm 0.38	1.85 \pm 0.49	1.74 \pm 0.56	1.77 \pm 0.38	1.98 \pm 0.57	1.82 \pm 0.61	1.78 \pm 0.57	1.75 \pm 0.47
	AE31_W	1.78 \pm 0.31	1.91 \pm 0.40	1.94 \pm 0.38	1.84 \pm 0.34	1.89 \pm 0.37	1.86 \pm 0.37	2.04 \pm 0.49	1.92 \pm 0.52	1.95 \pm 0.38	2.17 \pm 0.57	1.99 \pm 0.60	1.96 \pm 0.57	1.94 \pm 0.46
	AE33	0.66 \pm 0.06	0.62 \pm 0.06	0.62 \pm 0.06	0.62 \pm 0.06	0.60 \pm 0.05	0.62 \pm 0.06	0.65 \pm 0.09	0.69 \pm 0.10	0.72 \pm 0.07	0.76 \pm 0.11	0.76 \pm 0.28	0.67 \pm 0.13	0.67 \pm 0.12
370/950	AE31_V	1.05 \pm 0.07	1.02 \pm 0.06	1.03 \pm 0.07	1.04 \pm 0.06	1.03 \pm 0.06	1.03 \pm 0.06	1.10 \pm 0.09	1.18 \pm 0.14	1.22 \pm 0.10	1.23 \pm 0.09	1.26 \pm 0.11	1.14 \pm 0.10	1.16 \pm 0.14
	AE31_W	1.01 \pm 0.11	0.98 \pm 0.10	0.99 \pm 0.11	1.00 \pm 0.11	0.98 \pm 0.10	0.98 \pm 0.11	1.06 \pm 0.13	1.15 \pm 0.16	1.18 \pm 0.13	1.19 \pm 0.11	1.23 \pm 0.14	1.09 \pm 0.13	1.12 \pm 0.17
	AE33	1.12 \pm 0.08	1.10 \pm 0.05	1.11 \pm 0.06	1.12 \pm 0.06	1.11 \pm 0.05	1.12 \pm 0.06	1.20 \pm 0.09	1.25 \pm 0.10	1.29 \pm 0.08	1.32 \pm 0.09	1.35 \pm 0.14	1.20 \pm 0.13	1.15 \pm 0.12
370-950	AE31_V	1.06 \pm 0.16	1.06 \pm 0.29	1.06 \pm 0.28	1.05 \pm 0.19	1.05 \pm 0.23	1.04 \pm 0.18	1.12 \pm 0.26	1.22 \pm 0.31	1.24 \pm 0.22	1.28 \pm 0.29	1.30 \pm 0.26	1.19 \pm 0.26	1.11 \pm 0.12
	AE31_W	1.02 \pm 0.19	1.02 \pm 0.31	1.02 \pm 0.29	1.01 \pm 0.21	1.01 \pm 0.25	1.00 \pm 0.20	1.08 \pm 0.27	1.18 \pm 0.32	1.20 \pm 0.23	1.24 \pm 0.30	1.27 \pm 0.27	1.14 \pm 0.27	1.07 \pm 0.15
	AE33	1.12 \pm 0.08	1.10 \pm 0.05	1.11 \pm 0.06	1.12 \pm 0.06	1.11 \pm 0.06	1.12 \pm 0.06	1.19 \pm 0.10	1.25 \pm 0.11	1.29 \pm 0.09	1.31 \pm 0.10	1.35 \pm 0.17	1.20 \pm 0.15	1.19 \pm 0.12

Table S9. Secondary brown carbon light absorption of AE31 and AE33 aethalometers at hourly time resolution.

b_{abs370_BrCsec} (Mm⁻¹)	AE31_V	AE31_W	AE33
Full-year	2.16 ± 2.02	2.61 ± 2.35	1.99 ± 1.97
Dry season	2.68 ± 2.15	2.91 ± 2.54	2.34 ± 2.08
Wet season	1.12 ± 1.15	2.07 ± 1.85	0.99 ± 1.15
Apr-2021	1.85 ± 1.51	2.80 ± 2.42	1.55 ± 1.65
May-2021	0.71 ± 0.62	1.58 ± 1.41	0.43 ± 0.44
Jun-2021	0.96 ± 1.14	1.89 ± 1.72	0.82 ± 1.03
Jul-2021	0.98 ± 1.07	1.87 ± 1.63	0.87 ± 0.91
Aug-2021	0.92 ± 0.87	2.05 ± 1.73	0.86 ± 0.79
Sep-2021	1.08 ± 0.99	2.11 ± 1.71	1.05 ± 1.06
Oct-2021	1.44 ± 1.58	1.94 ± 1.80	1.58 ± 1.82
Nov-2021	3.46 ± 2.39	3.66 ± 2.90	2.95 ± 2.37
Dec-2021	4.22 ± 2.40	4.51 ± 3.06	3.38 ± 2.38
Jan-2022	3.02 ± 1.78	3.08 ± 2.19	2.38 ± 1.77
Feb-2022	1.64 ± 1.28	1.67 ± 1.40	1.45 ± 1.32
Mar-2022	1.92 ± 1.56	2.27 ± 2.01	1.75 ± 1.62

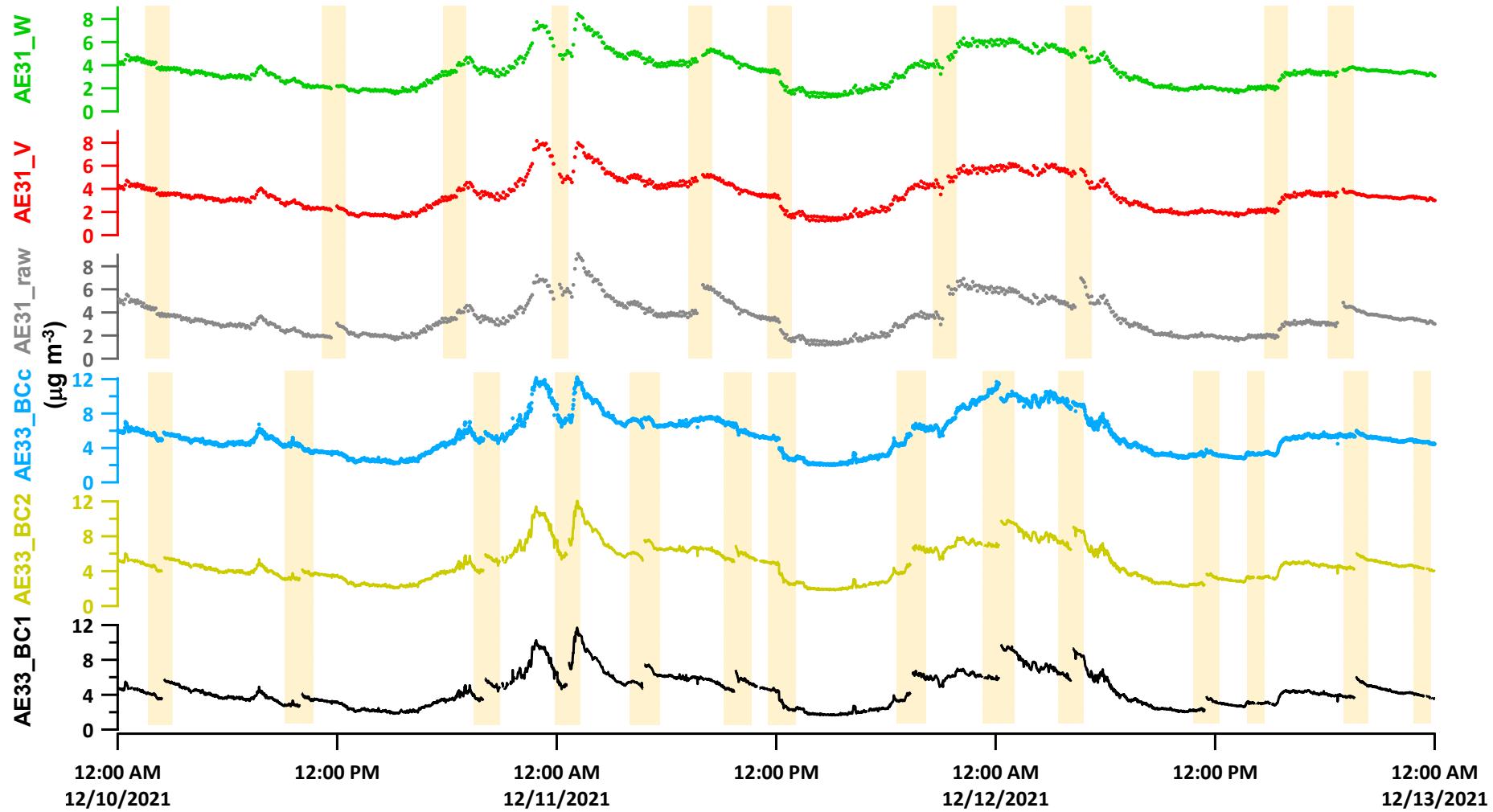


Figure S1. Example of Aethalometer eBC data before and after correction. The shaded areas indicate change of of sampling spot to a new position. AE31_V and AE31_W represent AE31 data corrected by Virkkula and Weingartner algorithms, respectively.

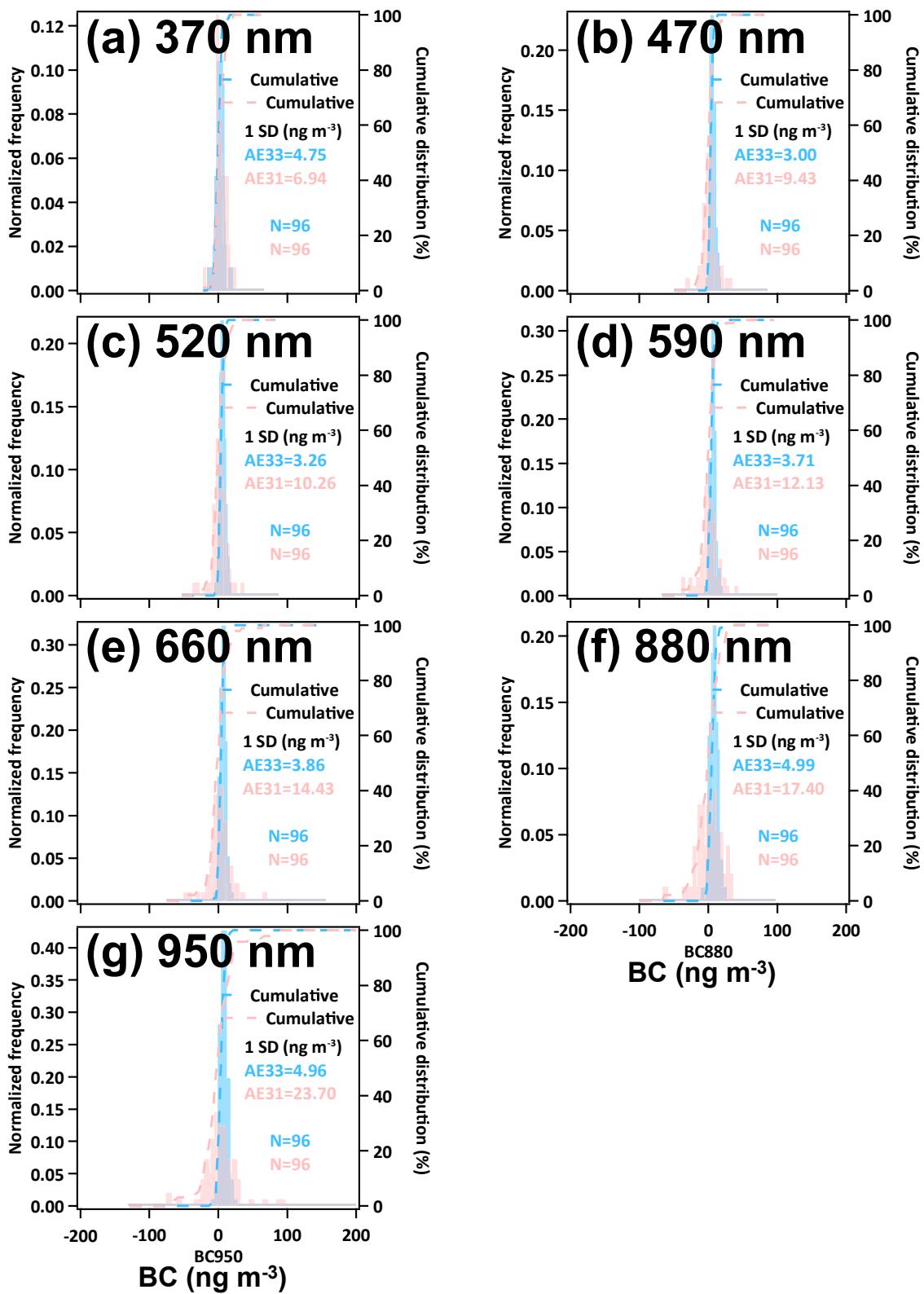


Figure S2. The frequency histograms of the blank measurements of AE31 and AE33 at the time base of 60 min. The red histograms represents AE31 and AE33 results are shown in blue histograms. Figures a-g correspond to 370, 470, 520, 590, 660, 880 and 950 nm, respectively.

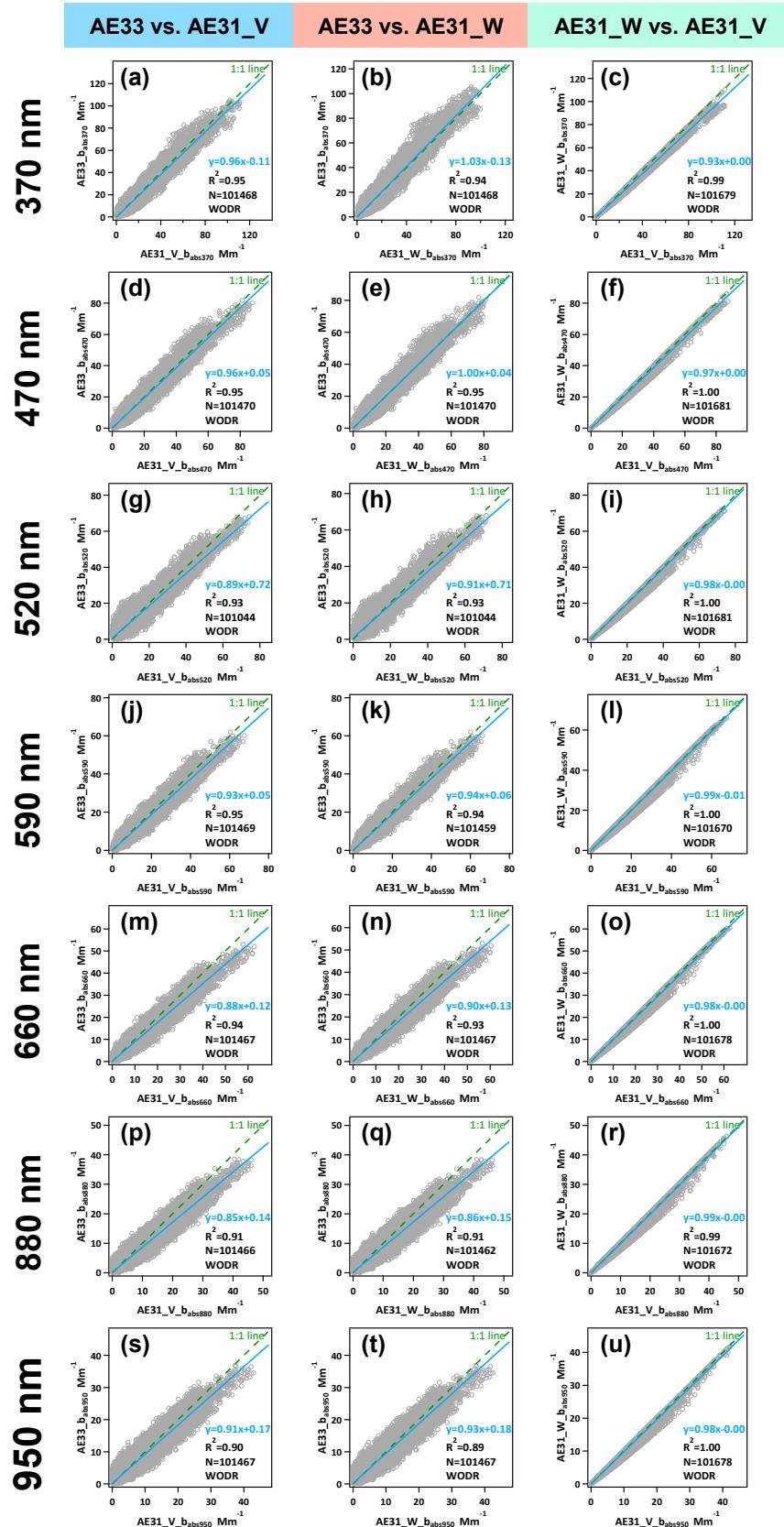


Figure S3. Comparisons of 5 min light absorption coefficient between AE33 and AE31 at 370, 470, 520, 590, 660, 880 and 950 nm. AE31_V_b_{abs} and AE31_W_b_{abs} represent the light absorption coefficients of AE31 corrected by the algorithms of Virkkula and Weingartner, respectively.

AAE comparison: 5 min data

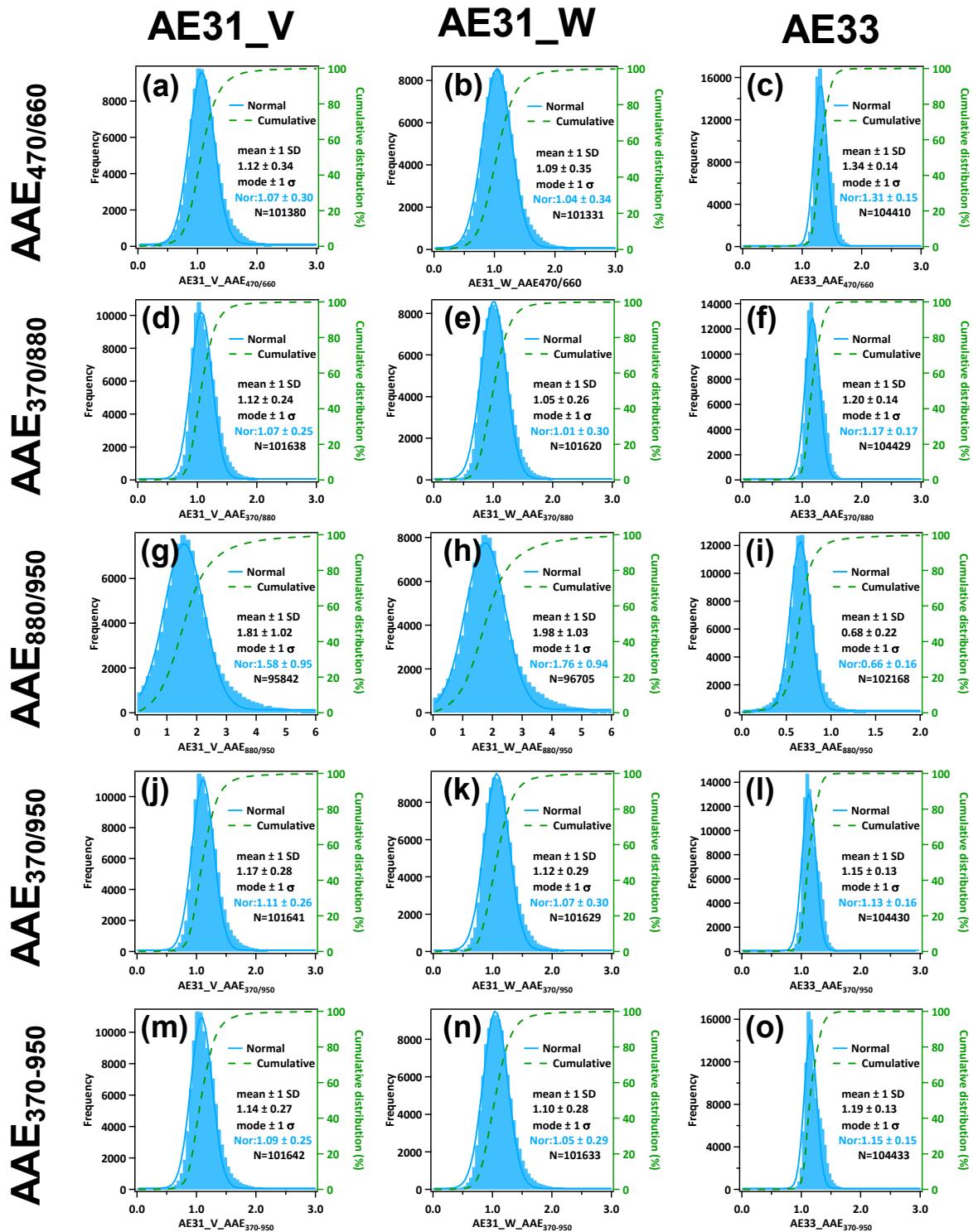


Figure S4. Frequency distributions of AAE values of AE33, AE31_V (AE31 data corrected by Virkkula algorithms), and AE31_W (AE31 data corrected by Weingartner algorithms) at 5 min time base. Here "://" denotes the AAE value calculated by the light absorption coefficients of two wavelengths (approach 1) and "-" denotes the AAE value obtained by curve fitting of seven wavelengths (approach 2).

AAE comparison: 1 hr data

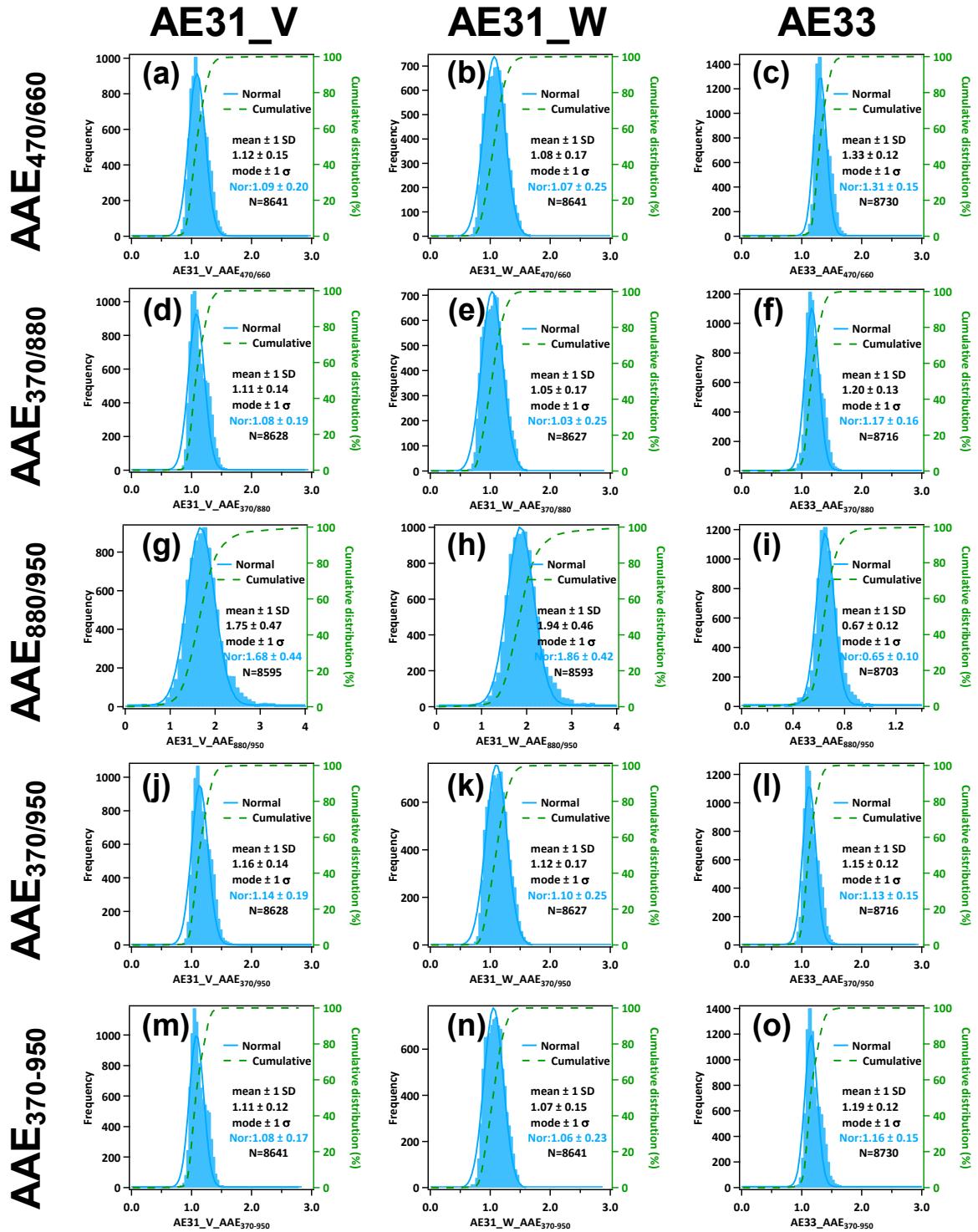


Figure S5. Frequency distributions of AAE values of AE33, AE31_V (AE31 corrected by the algorithms of Virkkula), and AE31_W (AE31 corrected by the algorithms of Weingartner) at 1 hr time base. Here "://" denotes the AAE value calculated by the light absorption coefficients of two wavelengths (approach 1) and "-" denotes the AAE value obtained by curve fitting of seven wavelengths (approach 2).

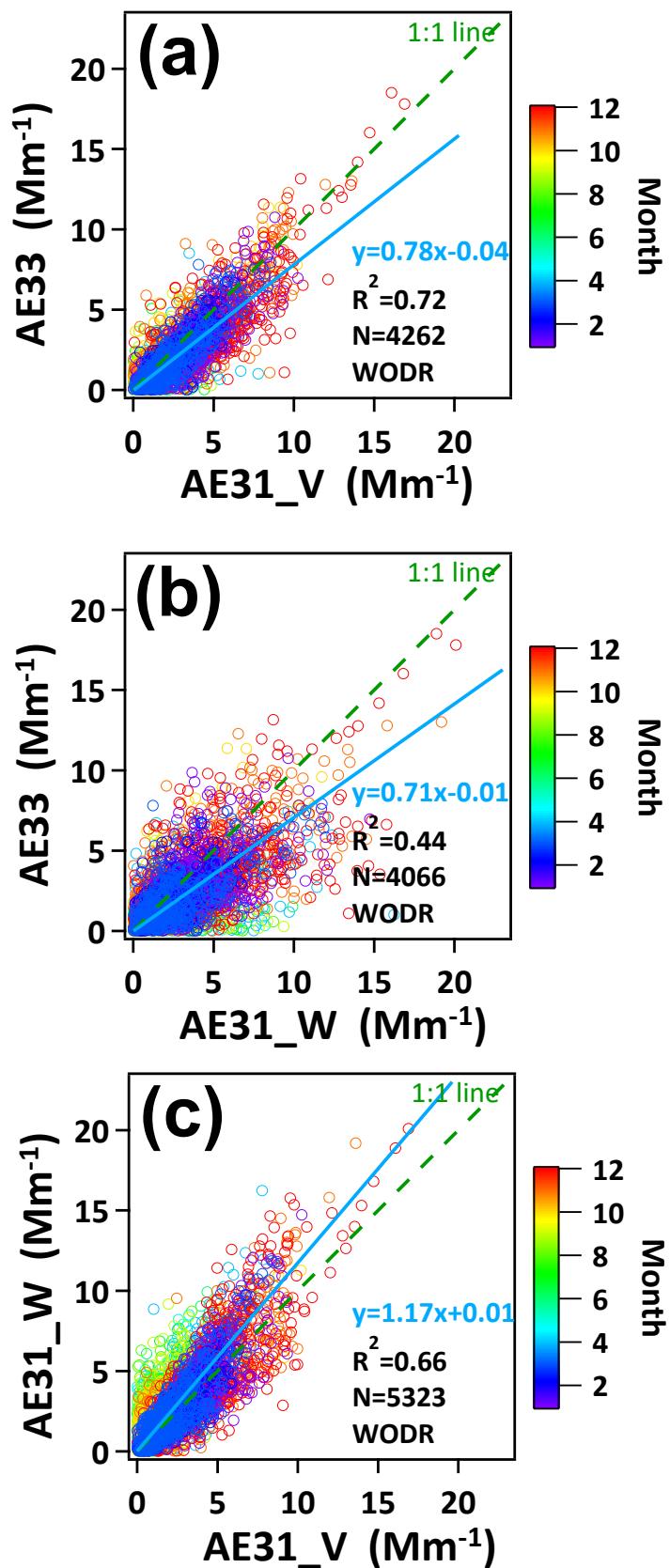


Figure S6. Scatter plot of $b_{\text{abs370_BrCsec}}$ between AE31_V, AE31_W and AE33.

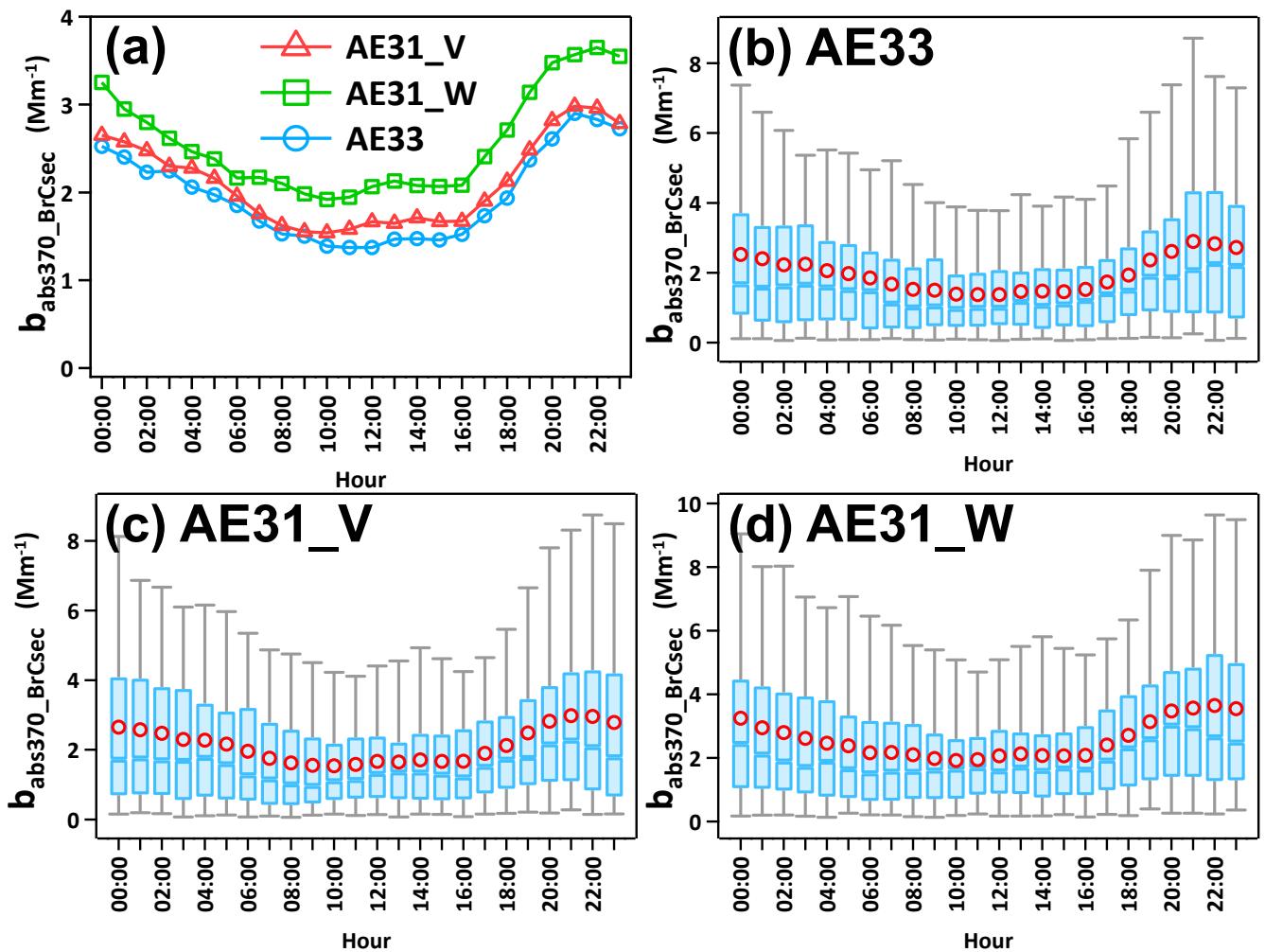


Figure S7. Diurnal variation of $b_{\text{abs}370\text{-Brcsec}}$ with hourly time base. AE31_V and AE31_W represent the AE31 data corrected with algorithms of d and Weingartner, respectively.

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