Supplement of

Identification of Dust-Dominated Periods and a $PM_{2.5}$ Correction Based Solely on Plantower PMS Sensor Observations

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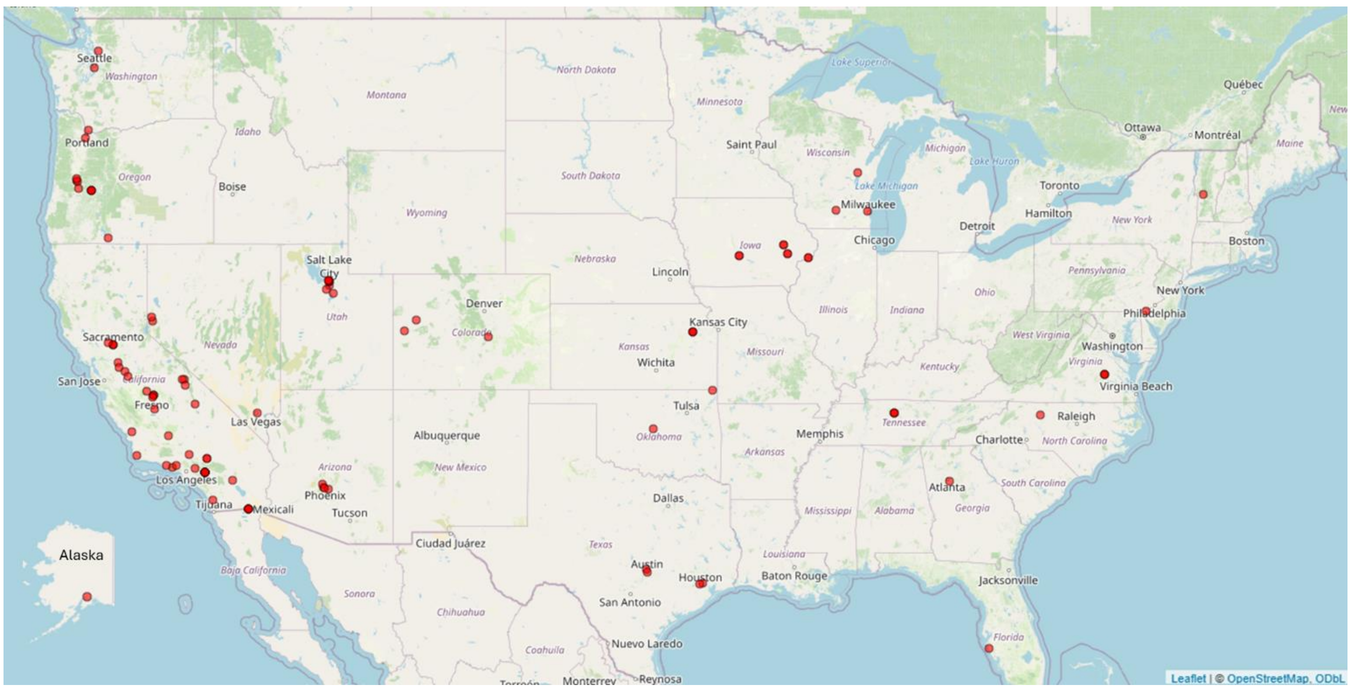

Figure S1: Map showing the EPA sites (marked as red dots) used in this study.

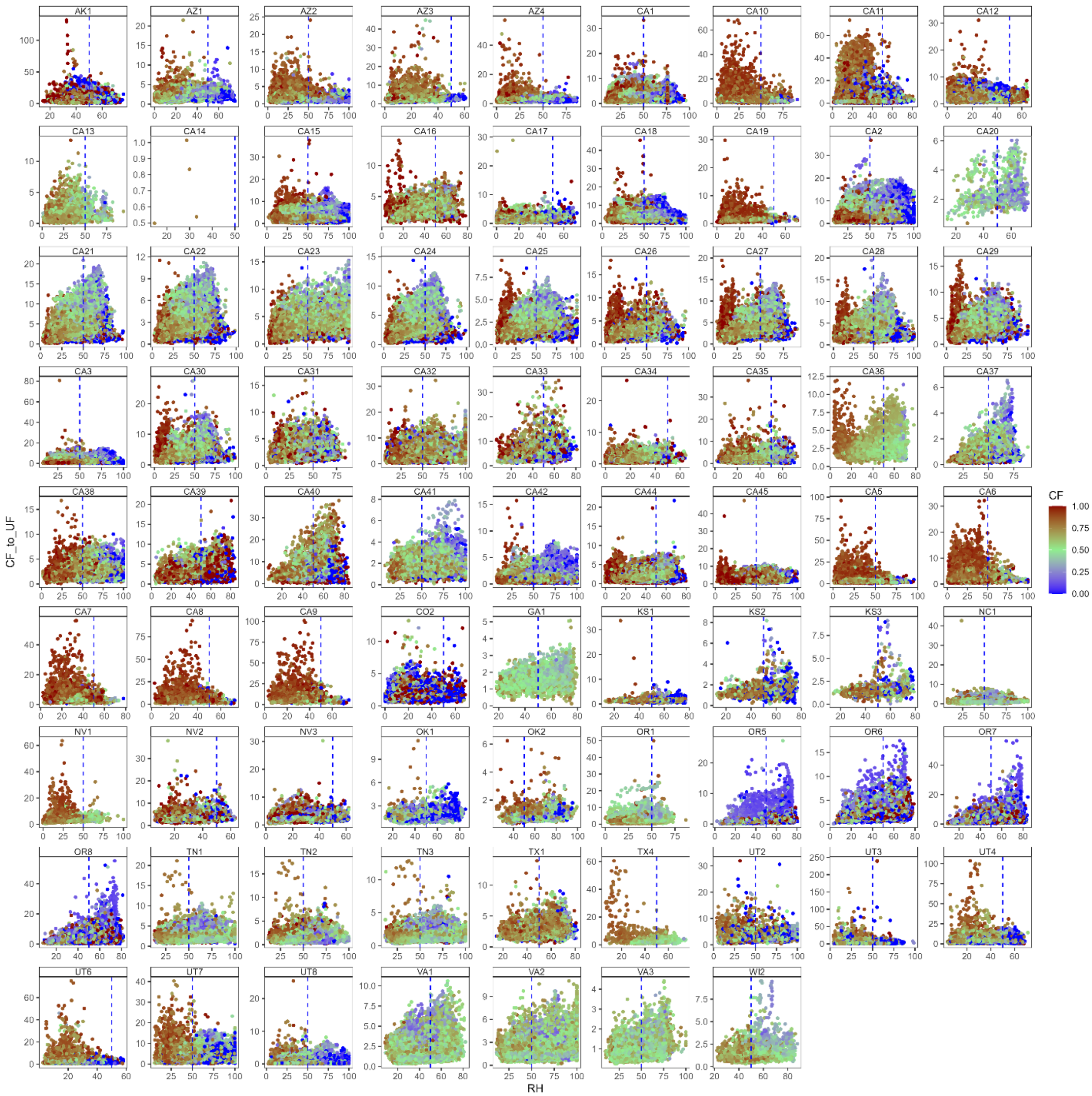

Figure S2: CF_to_UF vs RH. The color of the dots represents the CF. The blue dashed line represents the relative humidity cutoff of 50%.

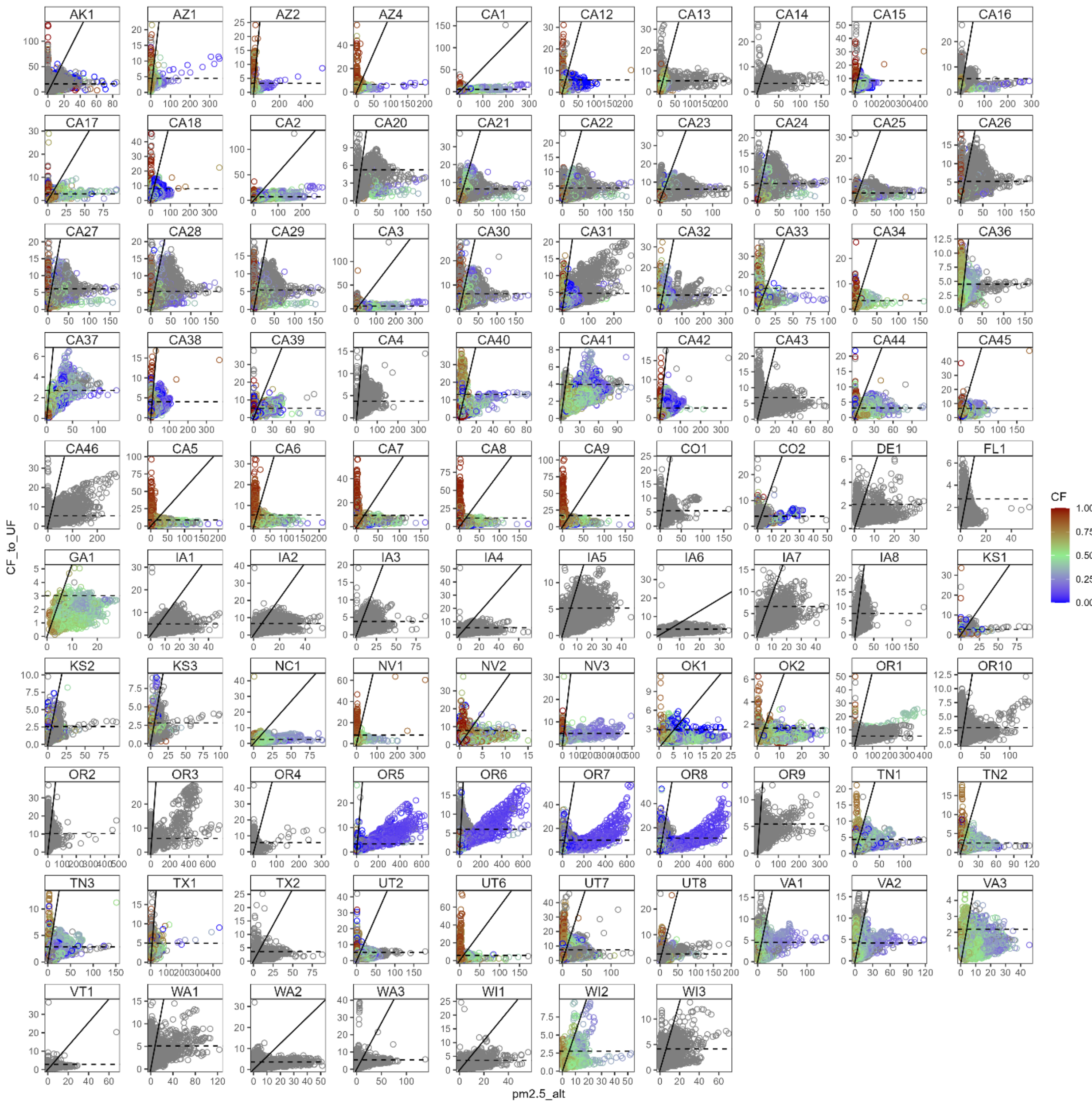

Figure S3: pm2.5_alt vs CF_to_UF. Each point represents hourly-averaged sensor measurement, colored by the FEM calculated CF. The black dashed line represents threshold1, and the black solid line represents threshold2. Grey points represent times when either $PM_{2.5}$ or PM_{10} was unavailable, preventing the calculation of CF.

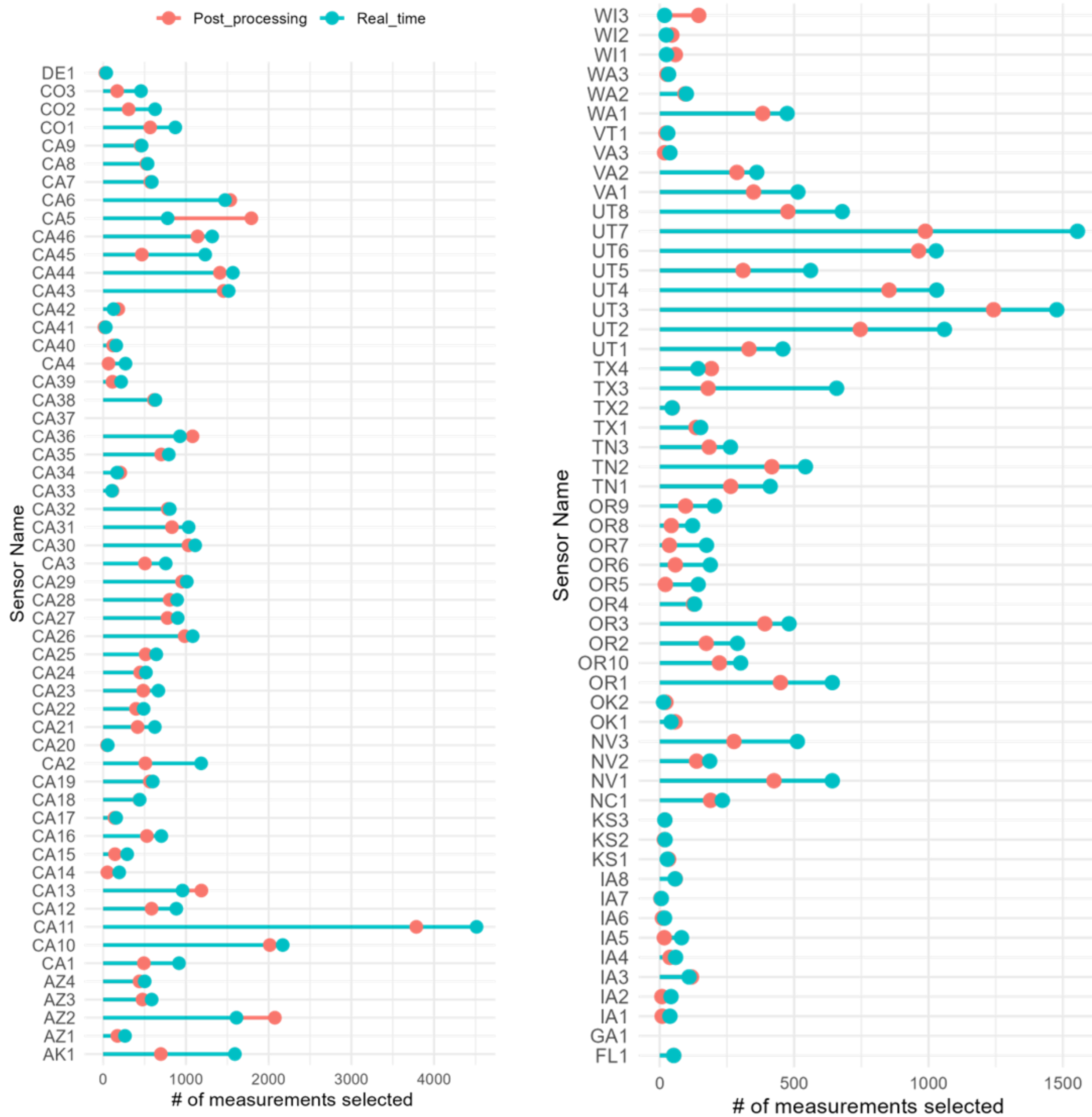

Figure S4: Number of measurements identified per approach for each sensor. For most sensors, the real-time approach (dynamic threshold1) identified more points than the post-processing approach (constant threshold1). The sensor information corresponding to the Sensor Name can be found in Tables S1, S2, and S3.

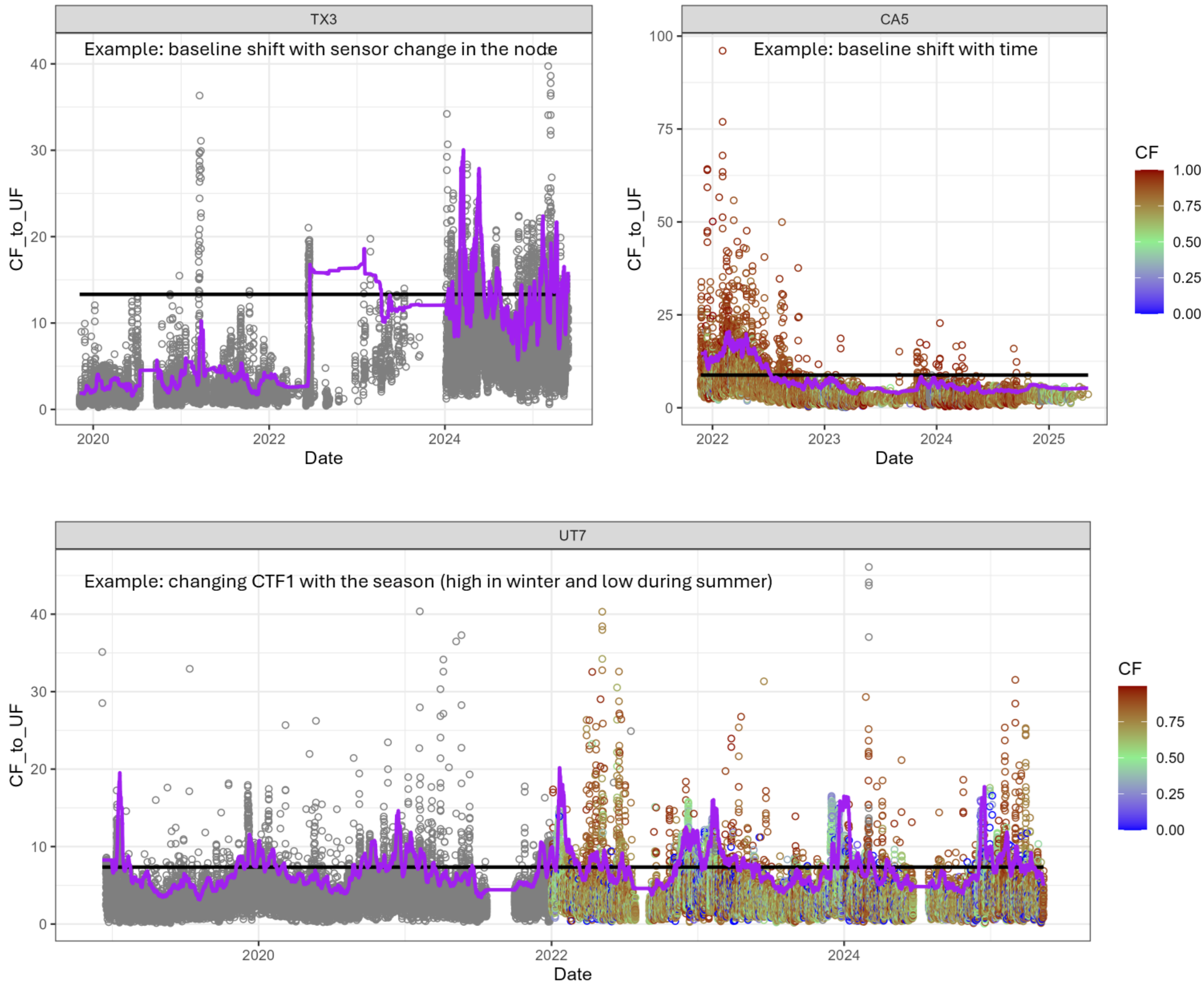

Figure S5: Example showing the time series CF_to_UF for selected locations, illustrating the effect of the long-term use, seasonality, and sensor node change on the shift in the CF_to_UF values, and subsequently on the constant threshold1 and dynamic threshold1. The black line corresponds to the constant threshold1 used for the post-processing approach, while the purple line corresponds to the dynamic threshold1 used for the real-time approach.

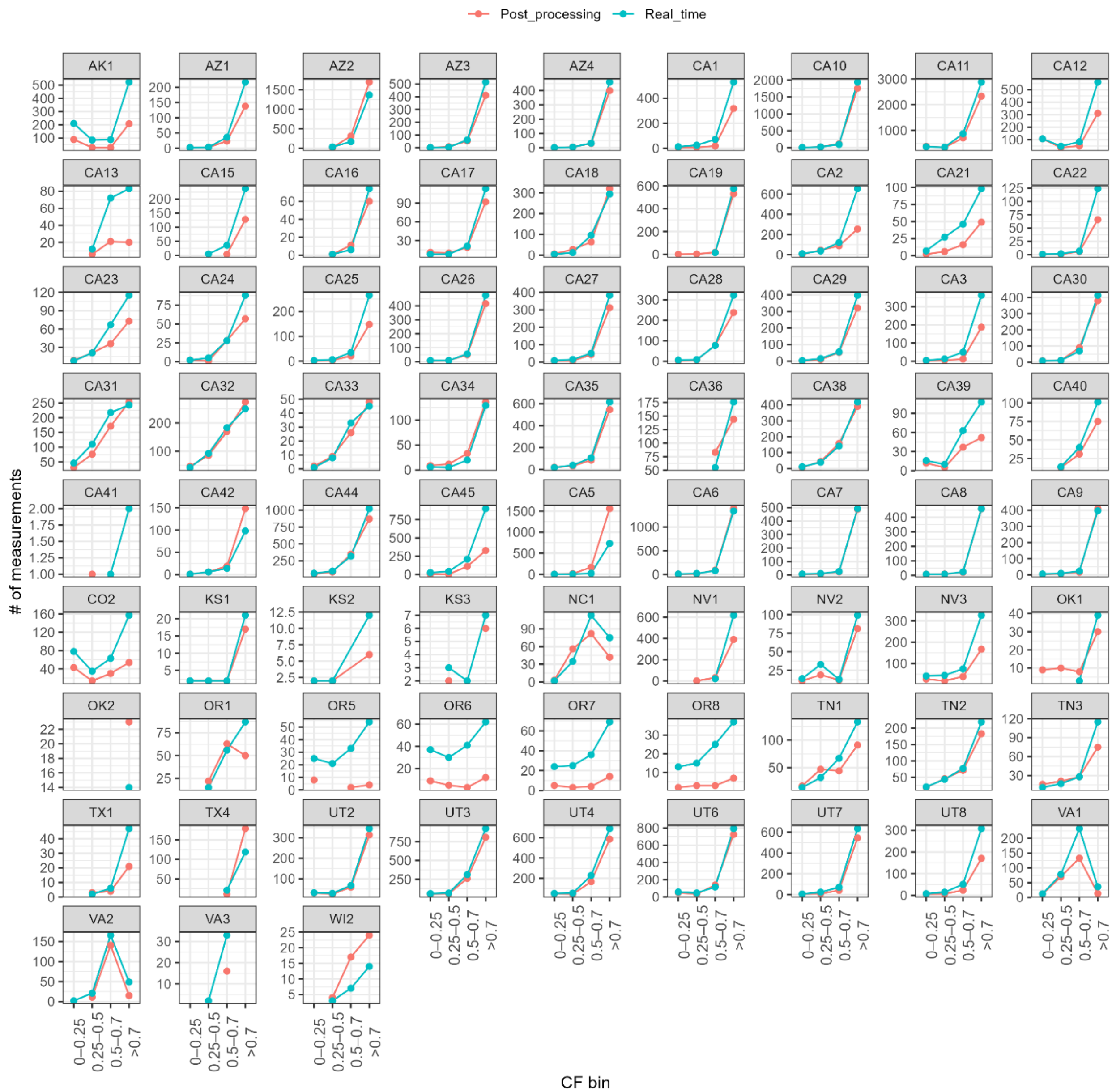

Figure S6: Comparison of the counts of identified measurements vs. corresponding CF (calculated from the FEM $PM_{2.5}$ and PM_{10} measurements and segregated into bins) for post-processing and real-time approach.

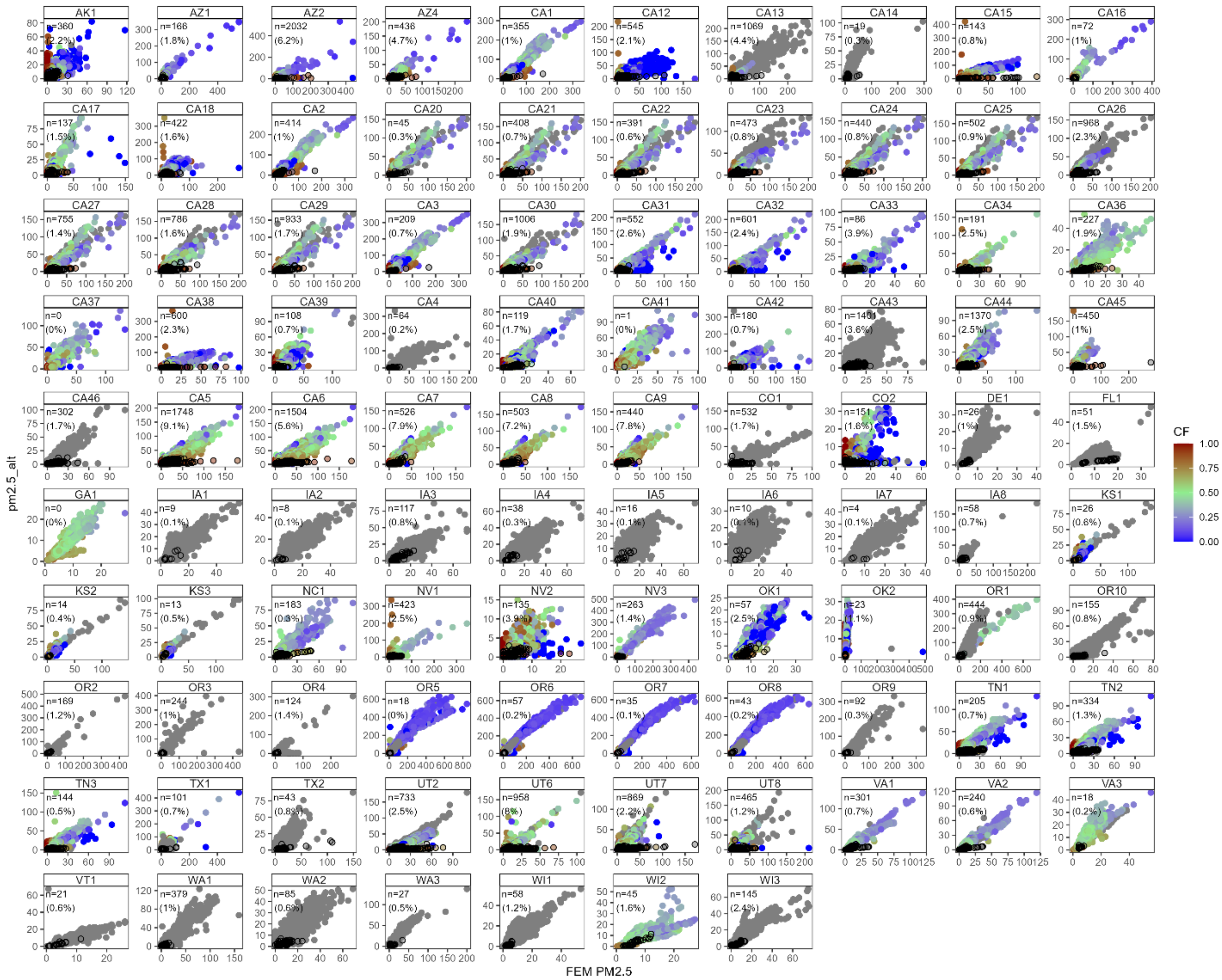

Figure S7: Post-processing approach (identification without correction): Hourly averaged pm2.5_alt compared with FEM $PM_{2.5}$ measurements. Black open circles indicate measurements identified as dust events. The color of the solid circles corresponds to the CF. The grey solid circles represent times when either $PM_{2.5}$ or PM_{10} was unavailable, preventing the calculation of CF. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available. The total number of dust-event measurements, regardless of FEM $PM_{2.5}$ availability, is listed in Table S4.

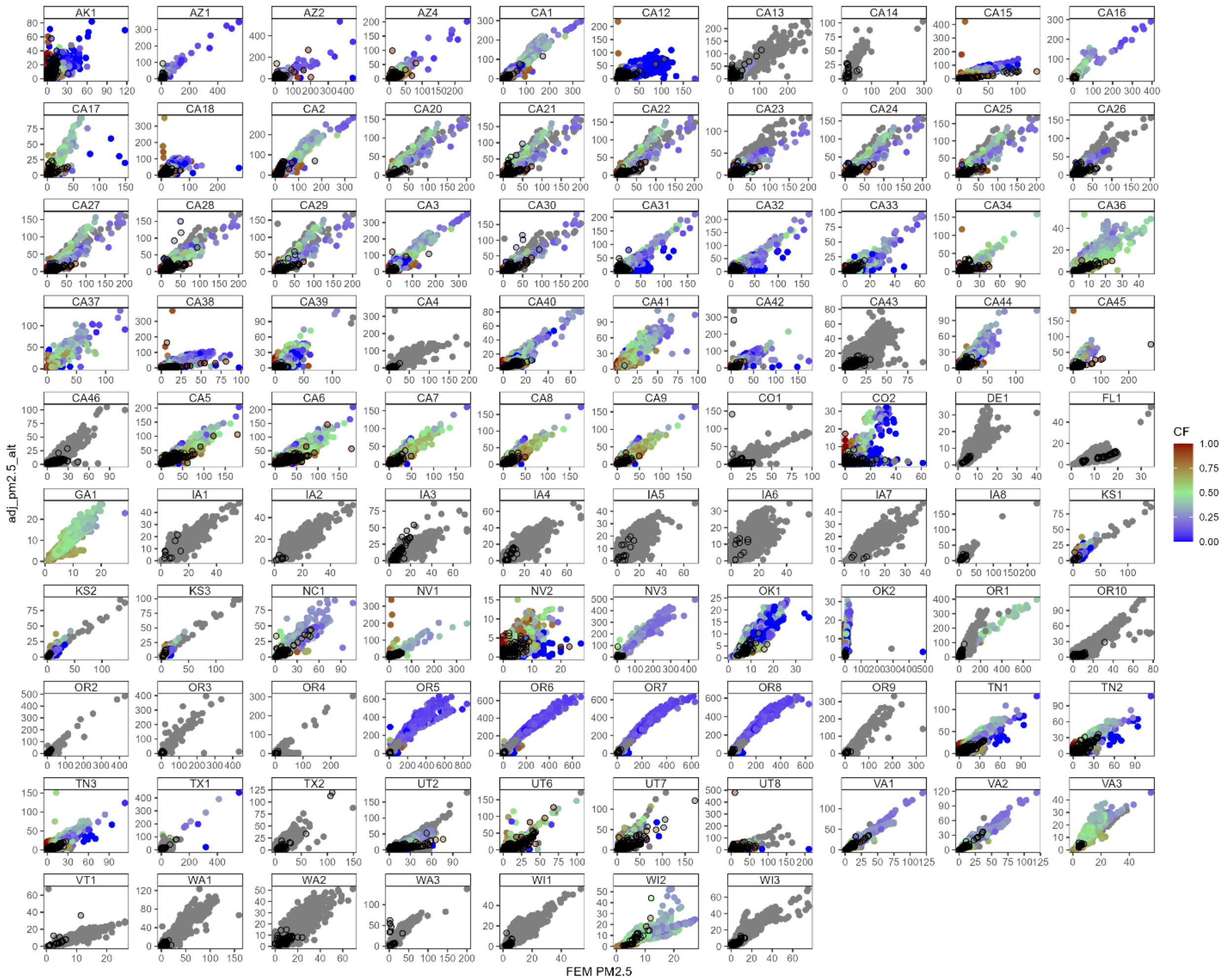

Figure S8: Post-processing approach (identification with correction using A of 0.702): Hourly averaged adj_pm2.5_alt compared with FEM $PM_{2.5}$ measurements. Black open circles indicate measurements identified as dust events. The color of the solid circles corresponds to the CF. The solid grey circles represent times when either $PM_{2.5}$ or PM_{10} was unavailable, preventing the calculation of CF.

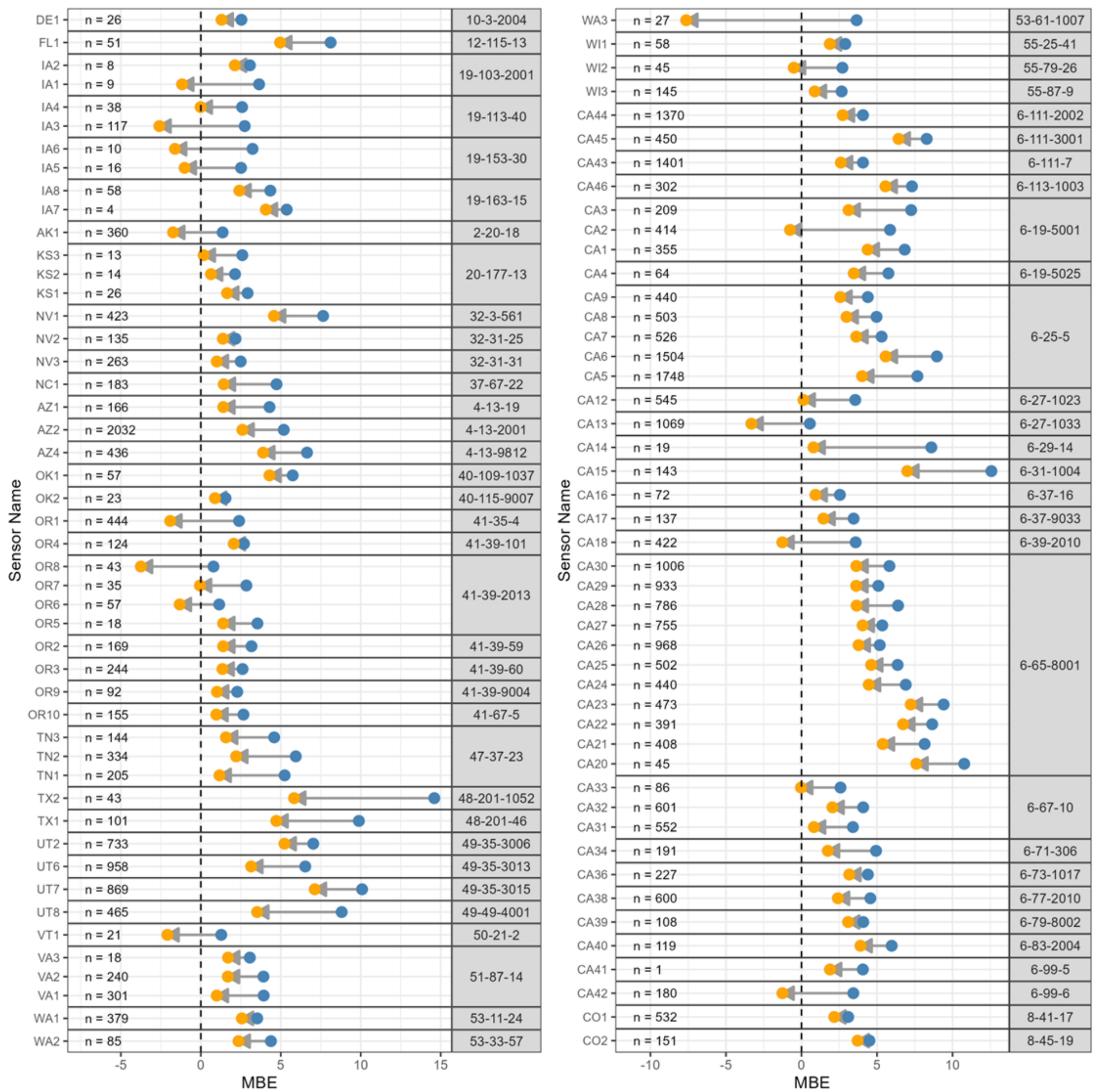

Figure S9: Post-processing approach: MBE (blue) and MBE_adj (orange, using A of 0.702) for all sensors except the 12 sensors discussed in the main manuscript. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available. The left y-axis corresponds to the Sensor Name, while the right y-axis corresponds to the site where these sensors were located.

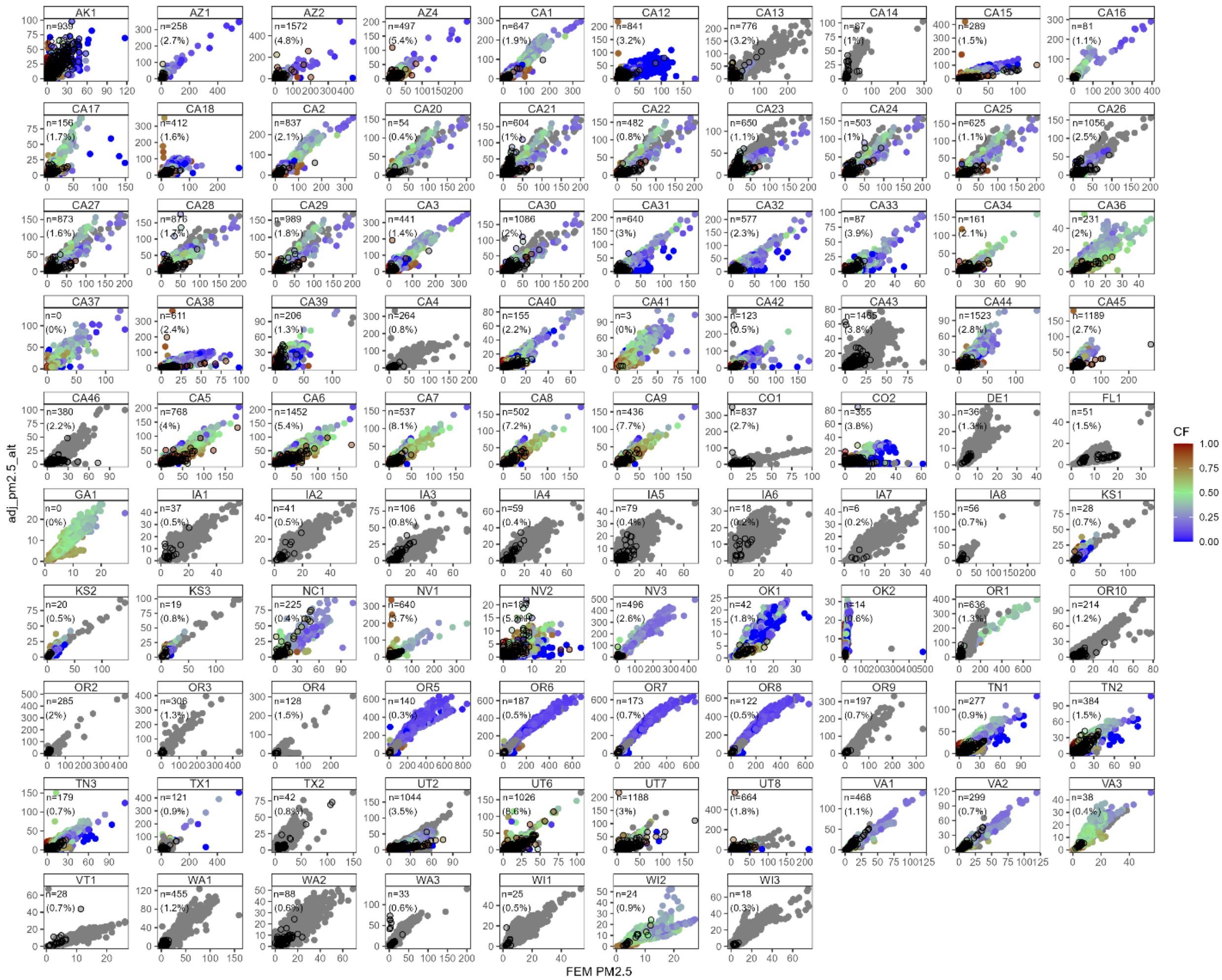

Figure S10: Real-time approach (identification with correction using A of 0.702): Hourly averaged adj_pm2.5_alt compared with FEM $PM_{2.5}$ measurements. Black open circles indicate measurements identified as dust events. The color of the solid circles corresponds to the CF. The grey circles represent times when either $PM_{2.5}$ or PM_{10} was unavailable, preventing the calculation of CF. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available. The total number of dust-event measurements, regardless of FEM $PM_{2.5}$ availability, is listed in Table S4.

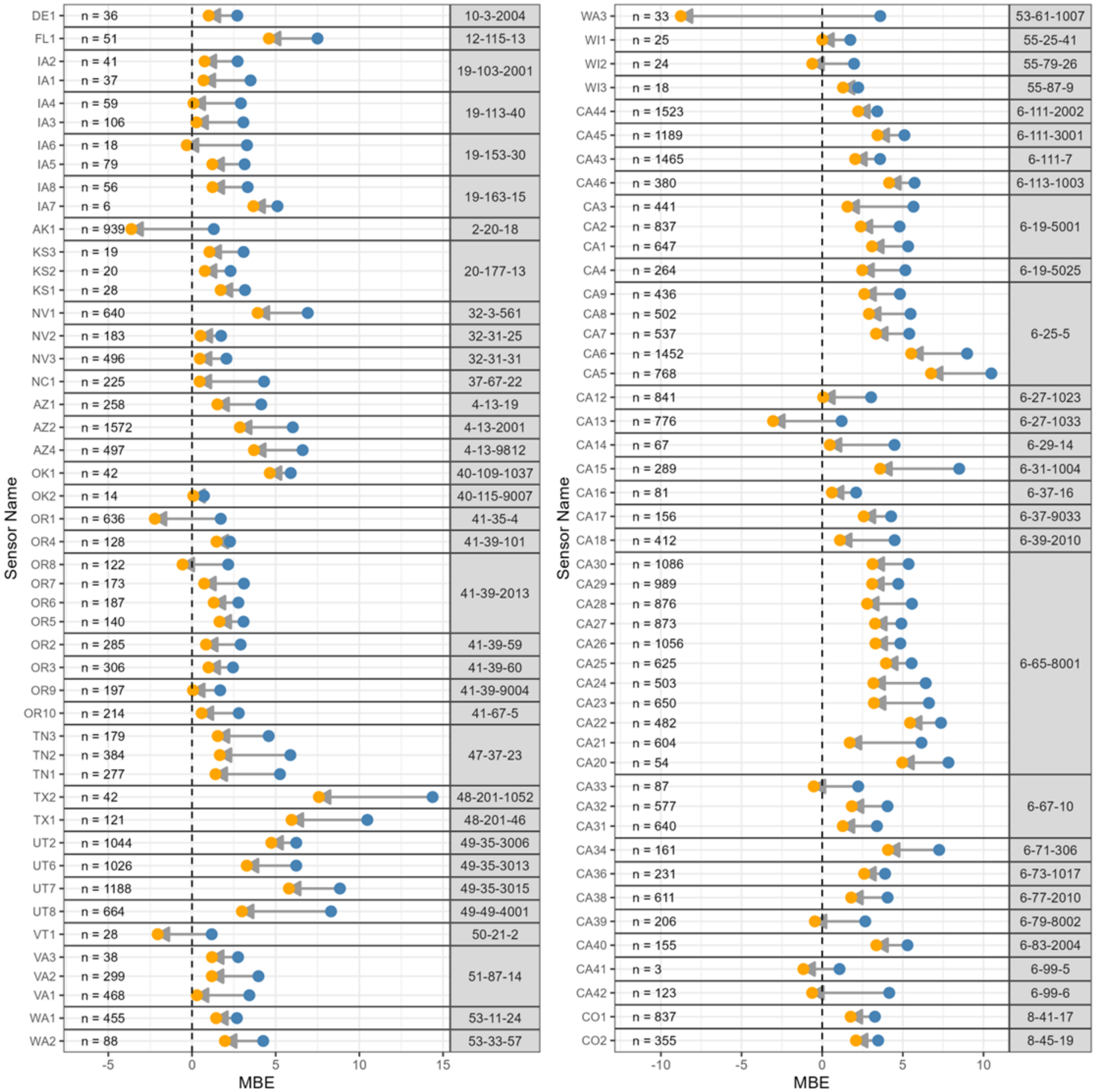

Figure S11: Real-time approach: MBE (blue) and MBE_adj (orange), using A of 0.702, for all sensors except the 12 sensors discussed in the main manuscript. All available data with FEM $PM_{2.5}$ measurements were included in the comparison, regardless of CF availability. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available. The left y-axis corresponds to the Sensor Name, while the right y-axis corresponds to the site where these sensors were located.

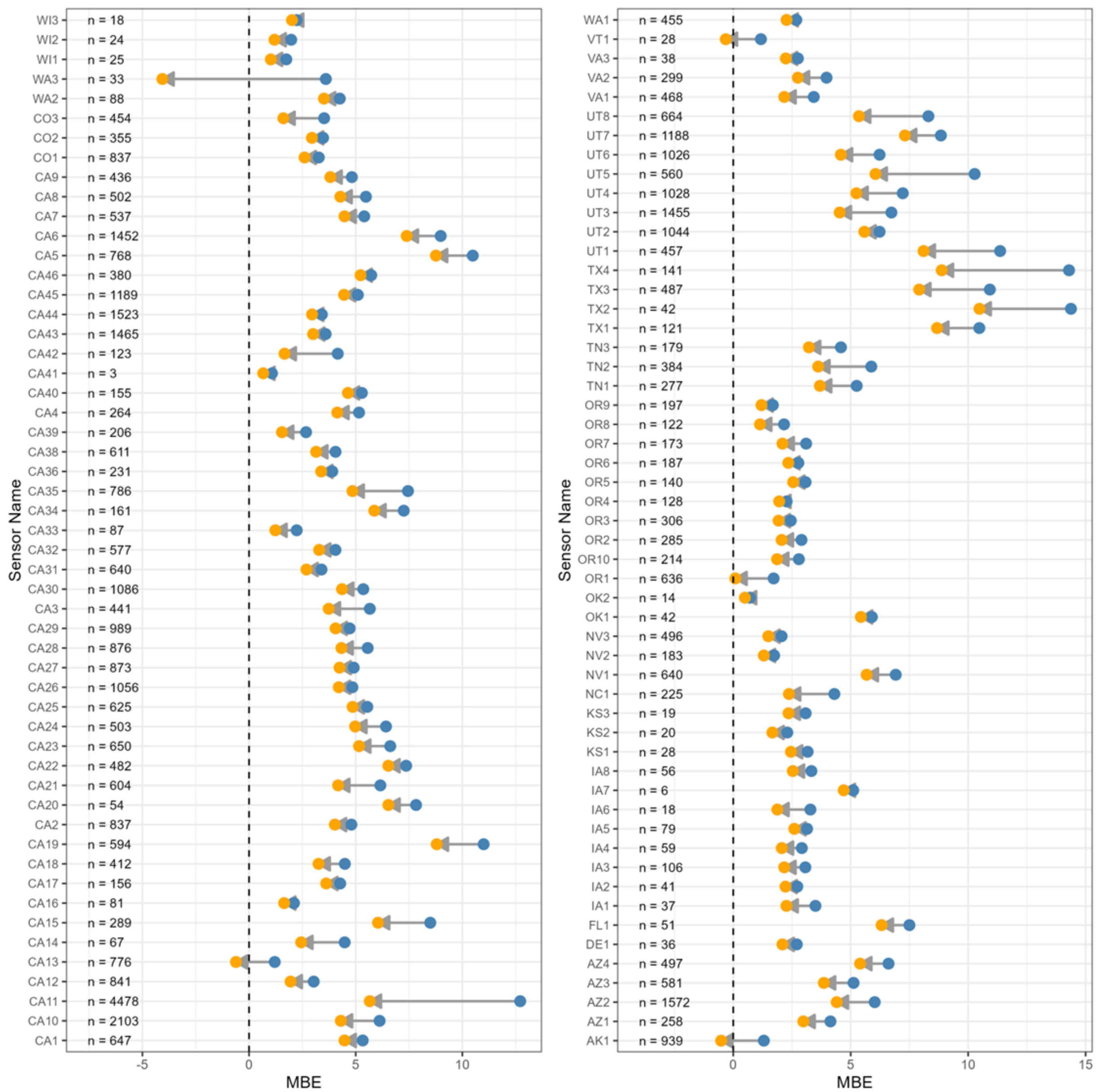

Figure S12: Real-time approach: MBE (blue) and MBE_adj (orange), using A of 0.998 for all. All available data with FEM $PM_{2.5}$ measurements were included in the comparison, regardless of CF availability. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available.

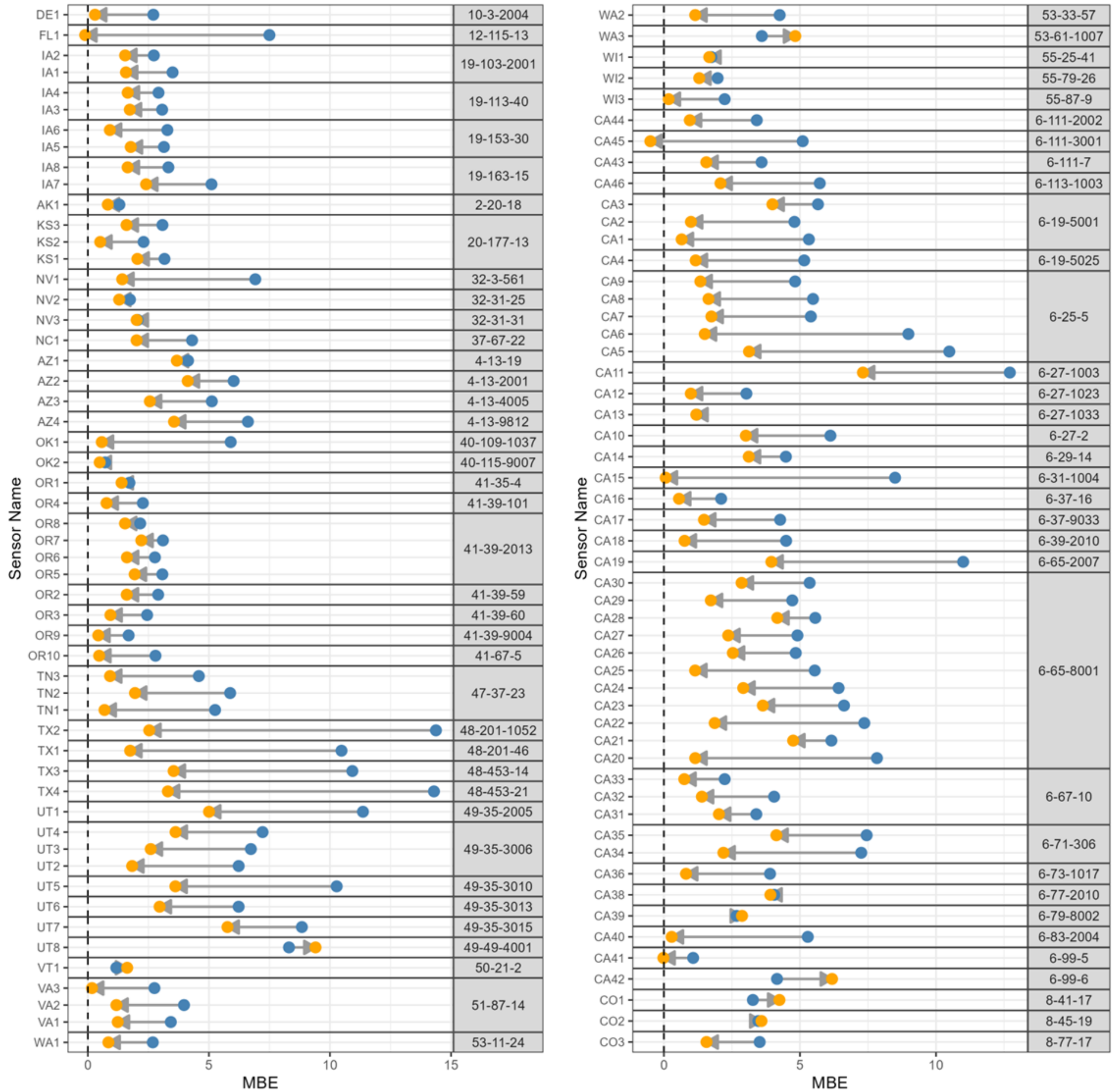

Figure S13: Real-time approach: MBE (blue) and MBE_adj (orange) using sensor-specific factor A for all the sensors. The grey arrow indicates the direction of the change after the adjustment of pm2.5_alt. All available data with FEM $PM_{2.5}$ measurements were included in the comparison, regardless of CF availability. The left y-axis corresponds to the Sensor Name, while the right y-axis corresponds to the site where these sensors were located.

Table S1: Details about the EPA monitoring sites providing the FEM $PM_{2.5}$, FEM PM_{10}, and corresponding collocated PMS sensors. The BA, BS, FDMS, TEOM, and Laser LS acronyms refer to beta attenuation, broadband spectroscopy, filter dynamic measurement system, tapered element oscillating microbalance, and laser light scattering, respectively. The # PM2.5, # PM10, and # sensor represent the number of hourly measurements available for FEM $PM_{2.5}$, FEM PM_{10}, and PMS sensor, respectively.

Site	State	Method PM2.5	PM2.5_Date range		# PM2.5	Method PM10	PM10 Date range		# PM10	Sensor Index	Sensor Name	Sensor type	Firmware	Sensor Date range		# sensor	# sensor Rh available
2-20-18	Alaska	BA	2019-01-01	2024-07-01	46332	BA	2019-01-01	2024-07-01	45537	151768	AK1	PA-II-FLEX	7.04	7/8/2022	5/26/2025	25110	25109
4-13-2001	Arizona	FDMSG	2019-01-01	2025-05-31	54368	FDMS	2019-01-01	2025-05-31	54251	98793	AZ2	PA-II SD	7.02	3/3/2021	5/26/2025	33823	33214
4-13-4005	Arizona	FDMSG	2019-01-01	2025-05-31	54250	FDMS	2019-01-01	2025-05-31	54254	220839	AZ3	PA-II	7.02	8/12/2024	5/26/2025	6792	6791
6-19-5001	California	BA	2019-01-01	2025-05-31	48127	BA	2019-01-01	2025-05-31	48091	18625	CA1	PA-II-SD	7.02	3/4/2019	5/26/2025	51358	40001
										18645	CA2	PA-II-SD	7.02	3/4/2019	5/26/2025	50797	47730
										18647	CA3	PA-II-SD	7.02	3/4/2019	5/26/2025	38758	36624
6-19-5025	California	BA	2021-01-08	2025-05-31	37741					104230	CA4	PA-II-SD	7.02	4/15/2021	5/26/2025	31799	31797
6-25-5	California	BA	2020-12-10	2025-05-31	37987	BA	2019-01-01	2025-05-31	55353	53189	CA5	PA-II-SD	7.02	11/24/2021	5/8/2025	19900	19899
										56291	CA6	PA-II-SD	7.02	11/24/2021	5/26/2025	27817	27816
										184989	CA7	PA-II-FLEX	7.04	10/28/2023	1/10/2025	7204	7204
										184995	CA8	PA-II-FLEX	7.04	10/28/2023	10/2/2024	7359	7359
										185023	CA9	PA-II-FLEX	7.04	10/28/2023	8/9/2024	6016	6016
6-27-2	California	BS	2019-01-01	2025-05-31	54523	TEOM	2024-01-01	2025-05-31	12118	36591	CA10	PA-II-SD	7.02	8/7/2019	5/26/2025	36026	35960
						BS	2019-01-01	2024-01-01	42170								
6-27-1003	California	FDMSG	2019-01-01	2025-05-31	55430	TEOM	2019-01-01	2025-05-31	55449	13469	CA11	PA-II	7.02	2/12/2019	5/26/2025	48297	46904
6-27-1023	California	BS	2020-07-17	2025-05-31	41271	TEOM	2019-01-01	2025-05-31	51851	95961	CA12	PA-II-SD	7.02	12/22/2020	5/26/2025	27429	27266
6-29-14	California		2024-07-01	2025-05-31	7857	BA	2021-02-01	2024-07-01	29328	13473	CA14	PA-II	7.02	5/25/2021	5/26/2025	20779	20720
6-39-2010	California	BA	2019-01-01	2025-05-31	53944	BA	2019-01-01	2025-05-31	52708	104254	CA18	PA-II-SD	7.02	4/16/2021	5/19/2025	27149	27137
6-65-2007	California	BA	2024-01-01	2025-05-31	11975	BA	2024-01-01	2025-05-31	12044	92527	CA19	PA-II	7.02	4/5/2024	5/26/2025	9949	9949
6-65-8001	California	BA	2017-01-01	2025-05-31	71241	BA	2022-01-01	2025-05-31	29220	1854	CA20	PA-II	6.06b	1/2/2019	4/27/2025	13421	13418
										2325	CA21	PA-II	6.06b	8/29/2017	5/21/2025	64472	64231
										2612	CA22	PA-II	6.06b	8/29/2017	5/21/2025	65821	65534
										3537	CA23	PA-II	6.06b	9/22/2017	5/26/2025	60170	59847
										4748	CA24	PA-II	7.02	1/27/2019	5/21/2025	54439	54379
										5280	CA25	PA-II	7.02	12/12/2017	5/26/2025	60947	60714
										5284	CA26	PA-II	7.02	12/12/2017	5/26/2025	44496	44234
										6806	CA27	PA-II	7.02	1/30/2018	5/21/2025	57384	57237
										6912	CA28	PA-II-SD	7.02	4/25/2018	11/25/2024	52186	52111
										9226	CA29	PA-II	7.02	3/24/2018	5/26/2025	57780	57428
										9358	CA30	PA-II-SD	7.02	3/25/2018	5/26/2025	55622	55480
6-67-10	California	BA	2020-12-11	2025-05-31	37264	BA	2017-01-01	2025-05-31	70574	8408	CA31	PA-II	7.02	3/9/2018	1/23/2024	43363	42911
										38831	CA32	PA-II	7.02	9/25/2019	5/26/2025	36114	35931
										185043	CA33	PA-II-FLEX	7.04	6/28/2023	6/14/2024	2396	2396
6-71-306	California	BA	2019-01-01	2025-05-31	55066	BA	2019-01-01	2025-05-31	55009	97965	CA35	PA-II	7.02	9/6/2022	5/26/2025	28550	28550
6-73-1017	California	BS	2023-06-30	2025-05-31	11900	BS	2023-06-30	2025-05-31	11930	60561	CA36	PA-II-SD	7.02	7/31/2020	5/26/2025	36352	36340
6-77-1003	California	BA	2021-11-08	2025-05-31	28922	BA	2021-11-10	2025-05-31	28752	163235	CA37	PA-II-SD	7.02	11/23/2024	5/27/2025	4342	4342
6-77-2010	California	BA	2019-01-01	2025-05-31	52091	BA	2019-01-01	2025-05-31	53045	104108	CA38	PA-II-SD	7.02	4/14/2021	5/27/2025	27992	27049
6-99-5	California	BA	2019-01-07	2025-05-31	52779	BA	2019-01-01	2025-05-31	53447	57865	CA41	PA-II-SD	7.02	8/23/2023	5/27/2025	8032	8031
6-99-6	California	BA	2019-01-01	2025-05-31	54622	BA	2022-02-15	2025-05-31	28377	104096	CA42	PA-II-SD	7.02	4/14/2021	5/27/2025	26248	25318
6-111-2002	California	BA	2017-01-01	2025-05-31	72257	BA	2017-01-01	2025-05-31	72569	12743	CA44	PA-II	7.02	7/10/2018	5/26/2025	55783	54764
6-111-3001	California	BA	2017-01-01	2025-05-31	71005	BA	2017-01-01	2025-05-31	72403	9594	CA45	PA-II-SD	7.02	4/7/2018	5/26/2025	56109	45702
6-113-1003	California	BA	2021-01-01	2024-10-01	18071					11424	CA46	PA-II	7.02	6/1/2018	5/27/2025	59920	54780
8-41-17	Colorado	Laser LS	2019-01-01	2025-05-31	54803					21043	CO1	PA-II	7.02	2/4/2019	5/26/2025	33667	31577
8-77-17	Colorado	Laser LS	2019-01-04	2025-05-31	55746					150132	CO3	PA-II-FLEX	7.04	7/2/2022	5/26/2025	22342	7831
32-3-561	Nevada	BS	2019-01-01	2025-05-31	55676	BS	2019-01-01	2025-05-31	55704	159667	NV1	PA-II-SD	7.02	5/16/2023	5/5/2025	17220	17220
37-67-22	North Caroli	BS	2018-01-01	2025-05-31	61566	BS	2018-01-01	2025-05-31	61566	6008	NC1	PA-II	7.02	3/23/2018	5/26/2025	61657	61225
						TEOM	2017-01-01	2018-01-01	8615								
41-35-4	Oregon	BA	2021-07-16	2025-05-31	33137	BS	2019-01-01	2021-01-01	17124	9810	OR1	PA-II-SD	7.02	4/11/2018	5/26/2025	53271	52882
		BS	2019-01-01	2021-07-01	21416												
41-39-59	Oregon	BA	2021-01-01	2025-05-31	38187	BA	2019-01-01	2023-06-18	38274	165481	OR2	PA-II-FLEX	7.04	8/8/2023	5/26/2025	14659	14658
41-39-60	Oregon	BA	2022-01-01	2025-05-31	29423					56971	OR3	PA-II	7.02	6/3/2020	5/1/2025	36609	36598
41-39-101	Oregon	BA	2023-01-01	2025-05-31	20864					137756	OR4	PA-II	7.02	10/7/2022	12/26/2024	17602	8978
41-39-2013	Oregon	BA	2020-01-14	2025-05-31	46170	BA	2019-01-01	2024-10-01	48675	38631	OR5	PA-II	7.02	8/29/2019	5/26/2025	47868	47863
										56793	OR6	PA-II	7.02	6/1/2020	5/26/2025	36453	36181
										146162	OR7	PA-II-FLEX	7.04	4/13/2022	5/26/2025	26914	26899
										146498	OR8	PA-II-FLEX	7.04	4/13/2022	5/26/2025	23723	23702
41-39-9004	Oregon	BA	2021-01-01	2025-05-31	37956					80381	OR9	PA-II	7.02	4/20/2022	5/26/2025	26902	26901
41-67-5	Oregon	BA	2022-11-21	2025-05-31	21911					103166	OR10	PA-II-SD	7.02	4/2/2021	5/26/2025	28878	28876
47-37-23	Tennessee	BA	2019-07-01	2025-05-31	40159	TEOM	2019-01-01	2020-03-03	9412	51873	TN1	PA-II-SD	7.02	4/8/2020	5/26/2025	39168	37575
						BS	2020-09-01	2025-05-31	39968	51921	TN2	PA-II-SD	7.02	4/9/2020	3/12/2025	33379	33288
										93645	TN3	PA-II-SD	7.02	12/11/2020	5/26/2025	35762	34505
48-201-1052	Texas	BA	2021-05-12	2025-05-31	33939					246011	TX2	PA-II-SD	7.02	10/3/2024	5/26/2025	5304	5304
49-35-3006	Utah	BA	2019-01-01	2025-05-31	55344	BA	2022-01-01	2025-05-31	29742	39263*	*UT2	PA-II	7.02	9/23/2019	8/21/2024	38084	30169
										53611*	*UT3	PA-II	7.02	8/5/2021	5/27/2025	29902	29901
										176791*	*UT4	PA-II-FLEX	7.04	3/14/2023	5/27/2025	16929	16916
49-35-3010	Utah	BA	2019-01-01	2025-05-31	55721					143078*	*UT5			1/21/2022	5/27/2025	20778	19918
49-49-4001	Utah	BA	2019-01-01	2025-05-31	55320	BA	2022-01-01	2025-05-31	29217	31003	UT8	PA-II	7.02	4/25/2019	5/26/2025	39829	38471
51-87-14	Virginia	BS	2020-01-01	2025-05-31	46616	BS	2021-01-01	2025-05-31	36051	10264	VA1	PA-II-SD	7.02	10/10/2019	5/26/2025	48367	46734
										21109	VA2	PA-II	7.02	2/7/2019	5/26/2025	50154	49026
										178289	VA3	PA-II	7.02	8/4/2023	10/8/2024	9250	8672
53-11-24	Washington	BA	2017-01-01	2025-05-30	71640					12917	WA1	PA-II	7.02	7/11/2018	5/20/2025	43532	39172

*sensor managed by this group

Table S2: Details about the EPA monitoring sites providing the FEM $PM_{2.5}$, FEM PM_{10}, and corresponding 13 nearby PMS sensors. The BA, BS, FDMS, TEOM, and Laser LS acronyms refer to beta attenuation, broadband spectroscopy, filter dynamic measurement system, tapered element oscillating microbalance, and laser light scattering, respectively. The # PM2.5, # PM10, # sensor represent the number of hourly measurements available for FEM $PM_{2.5}$, FEM PM_{10}, and PMS sensor, respectively.

Site	State	Method PM2.5	PM2.5_Date range		#_PM2.5	Method PM10	PM10 Date range		# PM10	Sensor Index		Sensor type	Firmware	Sensor Date range		# sensor	# sensor Rh available
6-27-1033	California	BS	2021-01-01	2025-05-31	29857	BS	2020-07-01	2025-05-31	10247	94941	CA13	PA-II	7.02	2020-12-16	2025-05-26	31201	31199
6-31-1004	California	BA	2019-01-01	2025-05-31	54684	BA	2019-01-01	2025-05-31	55034	104246	CA15	PA-II-SD	7.02	2021-04-15	2025-05-21	29413	19184
6-37-16	California		2024-07-01	2025-05-31	7695	BA	2019-01-01	2025-05-31	53075	69201	CA16	PA-II	7.02	2020-10-12	2025-05-26	37068	37059
6-111-7	California	BA	2019-01-01	2025-05-31	55260					51681	CA43	PA-II	7.02	2020-04-06	2025-05-26	39571	39390
8-45-19	Colorado	BA	2019-01-01	2024-10-01	39037	BA	2019-01-01	2024-10-01	34862	38727	CO2	PA-II	7.02	2023-06-29	2025-05-26	15475	15458
32-31-25	Nevada	BA	2019-01-01	2025-05-31	55228	BA	2019-01-01	2025-05-31	55251	250981	NV2	PA-II-FLEX	7.04	2024-12-28	2025-05-26	3554	3553
32-31-31	Nevada	BA	2020-01-01	2025-05-31	46070	BA	2020-01-01	2025-05-31	46304	118493	NV3	PA-II	7.02	2021-08-06	2025-05-26	19749	19746
48-201-46	Texas	BA	2021-05-04	2025-05-31	33194	TEOM	2021-09-01	2024-07-01	20453	166421	TX1	PA-II	7.02	2023-08-02	2025-05-26	15463	15462
48-453-14	Texas	BA	2020-10-15	2025-05-31	38310					2862	TX3	PA-II	6.06b	2019-11-05	2025-05-26	22076	22070
48-453-21	Texas	BA	2019-01-01	2023-11-09	40837	BS	2023-11-09	2025-05-31	12677	229899	TX4	PA-II	7.02	2025-02-26	2025-05-26	2142	2142
		BS	2023-11-09	2024-04-01	11285												
49-35-2005	Utah	BA	2019-01-01	2025-05-31	55787					204009	UT1	PA-II	7.02	2024-01-04	2025-05-26	12039	12036
49-35-3013	Utah	BA	2019-01-01	2025-05-31	55161	BA	2021-12-22	2025-05-31	29151	206185	UT6	PA-II-FLEX	7.04	2024-01-07	2025-05-26	12028	12025
49-35-3015	Utah	BA	2019-10-01	2025-05-31	45161	BA	2022-01-01	2025-05-31	29577	20897	UT7	PA-II	7.02	2018-12-06	2025-05-26	54819	50914

Table S3: Details about the EPA monitoring sites, list shared by the EPA, providing the FEM $PM_{2.5}$, FEM PM_{10}, and corresponding collocated sensor. The collocated sensors were PMS5003. The BA, BS, FDMS, TEOM, and Laser LS acronyms refer to beta attenuation, broadband spectroscopy, filter dynamic measurement system, tapered element oscillating microbalance, and laser light scattering, respectively. The # PM2.5, # PM10, # sensor represent the number of hourly measurements available for FEM $PM_{2.5}$, FEM PM_{10}, and PMS sensor, respectively.

Site	State	Method PM2.5	PM2.5_Date range		# PM2.5	Method PM10	PM10 Date range		# PM10	Sensor Name	Sensor Date range		# sensor	# sensor Rh available
4-13-0019	Arizona	FDMS	2017-01-01	2022-01-01	42557	FDMS	2017-01-01	2022-01-01	42559	AZ1	11/8/2018 20:00	1/3/2020 20:00	9814	9632
										AZ4	11/8/2018 16:00	1/3/2020 15:00	9690	9461
6-37-9033	California	BA	2017-01-01	2022-01-01	43043	BA	2017-01-01	2022-01-01	42911	CA17	3/8/2018 22:00	7/25/2019 17:00	10295	9495
6-71-306	California	BA	2017-01-01	2022-01-01	42940	BA	2017-01-01	2022-01-01	42929	CA34	3/21/2018 18:00	7/25/2019 21:00	9427	7717
6-79-8002	California	BA	2017-01-01	2022-01-01	42116	BA	2017-01-01	1/1/2022	42557	CA39	8/8/2017 20:00	10/24/2019 20:00	16173	15804
6-83-2004	California	BA	2017-01-01	2022-01-01	41685	BA	2017-01-01	2022-01-01	42770	CA40	11/14/2018 19:00	10/30/2019 15:00	7361	7131
10-003-2004	Delaware	BA	2017-01-01	2018-04-12	10187					DE1	7/27/2019 7:00	11/19/2019 13:00	2706	2704
		BS	2018-01-01	2022-01-01	32980									
12-115-13	Florida	BS	2018-01-03	2022-01-01	33799					FL1	5/30/2019 8:00	10/25/2019 8:00	3485	3459
13-89-2	Georgia	BS	2017-06-14	2021-12-28	38677	BA	2017-01-01	2017-06-12	3410	GA1	8/1/2019 17:00	11/19/2019 15:00	2292	2290
						BS	2017-06-16	2021-12-28	37727					
19-103-2001	Iowa	BS	1/1/2019	2021-01-01	15830					IA1	1/1/2019 6:00	1/15/2020	8786	8655
										IA2	1/1/2019 6:00	1/15/2020 1:00	8769	8364
19-113-40	Iowa	BA	2017-01-01	2019-08-30	22176					IA3	4/27/2018 6:00	1/14/2020 21:00	14897	14566
		BS	2019-09-01	2021-01-01	11357					IA4	5/5/2018 6:00	1/14/2020 21:00	14714	14236
19-153-30	Iowa	BA	2017-03-24	2022-01-01	39994					IA5	9/26/2017 6:00	1/14/2020 22:00	20123	19779
										IA6	2/1/2019 16:00	1/14/2020 18:00	8168	7948
19-163-15	Iowa	BS	2019-01-03	2022-01-01	24643					IA7	1/1/2019 6:00	6/19/2019 4:00	4009	3528
										IA8	1/1/2019 6:00	1/15/2020 2:00	8167	7932
20-177-13	Kansas	BS	6/15/2017	12/20/2021	37657	TEOM	2017-01-01	2020-09-15	28782	KS1	3/1/2019 20:00	10/29/2019 18:00	4701	4616
						BS	2020-09-16	2021-12-20	10995	KS2	3/1/2019 20:00	10/29/2019 20:00	4370	4244
										KS3	3/1/2019 20:00	10/29/2019 22:00	3072	3002
40-109-1037	Oklahoma	BS	2017-03-04	2022-01-01	40807	TEOM	2017-01-01	2019-12-31	24695	OK1	8/2/2019 11:00	11/19/2019 17:00	2352	2348
						BS	2020-01-03	2022-01-01	17246					
40-115-9007	Oklahoma	BS	2018-11-03	2022-01-01	23517	BA	2017-01-01	2021-07-01	36007	OK2	7/10/2019 6:00	10/24/2019 19:00	2527	2522
						BS	2021-07-01	2022-01-01	3815					
50-21-2	Vermont	BS	2017-07-28	2022-01-01	38425					VT1	9/25/2018 20:00	10/25/2019 10:00	4698	3835
53-33-57	Washingtom	FDMS	2017-01-01	2019-01-01	15848					WA2	10/16/2017 8:00	10/30/2019 3:00	15236	15005
		BA	2019-01-01	2022-01-01	25593									
53-61-1007	Washingtom	FDMS	2017-01-01	2019-01-01	16439					WA3	10/25/2018 8:00	9/26/2019 14:00	6142	6086
		BA	2019-01-01	2022-01-01	25749									
55-25-41	Wisconsin	BA	2017-01-01	2018-06-13	12091					WI1	1/1/2019 8:00	10/25/2019 13:00	4788	4760
		BS	2018-06-13	2022-01-01	30999									
55-79-26	Wisconsin	BA	2017-01-01	2018-07-20	13206	BS	2018-07-20	2021-04-05	23593	WI2	7/24/2019 7:00	11/19/2019 19:00	2798	2795
		BS	2018-07-20	2021-04-05	23656									
55-87-9	Wisconsin	BA	2017-01-01	2019-01-25	17519					WI3	1/1/2019 6:00	10/25/2019 11:00	6258	6068
		BS	2019-01-25	2022-01-01	25633									

Table S4: Counts of measurements identified per sensor, MBE (μg/m^3), and MBE_adj (μg/m^3) after adjusting pm2.5_alt for identified measurements for the post-processing and real-time approach. The % refers to the change in the MBE before and after correction.

Sensor name	Total			FEM PM2.5 available											
	Total # measurement	# measurements selected		Total # measurement	# measurements selected		MBE	MBE_adj	%	MBE	MBE_adj	%	MBE	MBE_adj	%
		post-processing approach	real-time approach		post-processing approach	real-time approach	post-processing approach			real-time approach (A= 0.702)			real-time approach (A=0.998)		
AK1	25109	697	1592	16576	360	939	1.36	-1.74	227.3	1.30	-3.63	378.5	1.30	-0.52	139.6
AZ1	9632	172	264	9418	166	258	4.30	1.40	67.4	4.14	1.52	63.4	4.14	2.98	27.9
AZ2	33214	2075	1611	32666	2032	1572	5.19	2.60	49.9	6.02	2.86	52.5	6.02	4.40	26.9
AZ3	6791	475	586	6736	472	581	5.53	3.05	44.9	5.12	2.50	51.2	5.12	3.86	24.7
AZ4	9461	439	502	9213	436	497	6.64	3.89	41.4	6.61	3.70	44.0	6.61	5.40	18.3
CA1	40001	492	917	33998	355	647	6.83	4.37	36.0	5.33	3.09	42.0	5.33	4.47	16.0
CA10	35960	2014	2170	35147	1924	2103	6.66	2.78	58.2	6.12	2.86	53.2	6.12	4.30	29.7
CA11	46904	3785	4513	46264	3764	4478	14.06	4.17	70.4	12.71	1.39	89.1	12.71	5.66	55.5
CA12	27266	585	884	26277	545	841	3.56	0.13	96.5	3.03	0.06	98.0	3.03	1.95	35.8
CA13	31199	1187	959	24036	1069	776	0.55	-3.32	699.9	1.20	-3.04	352.8	1.20	-0.61	151.0
CA14	20720	51	194	6502	19	67	8.60	0.79	90.8	4.48	0.47	89.5	4.48	2.44	45.5
CA15	19184	143	290	18711	143	289	12.57	7.00	44.3	8.49	3.59	57.7	8.49	6.05	28.8
CA16	37059	528	703	7405	72	81	2.54	0.92	63.7	2.10	0.60	71.4	2.10	1.65	21.8
CA17	9495	137	157	9385	137	156	3.45	1.45	58.1	4.27	2.57	39.8	4.27	3.62	15.3
CA18	27137	438	441	26282	422	412	3.59	-1.27	135.5	4.49	1.10	75.4	4.49	3.26	27.5
CA19	9949	563	600	9704	556	594	11.46	7.21	37.0	11.00	6.76	38.5	11.00	8.80	20.0
CA2	47730	510	1184	40789	414	837	5.86	-0.76	113.0	4.80	2.39	50.2	4.80	4.02	16.1
CA20	13418	47	56	12973	45	54	10.77	7.60	29.4	7.83	4.96	36.6	7.83	6.53	16.6
CA21	64231	416	624	61928	408	604	8.15	5.37	34.1	6.16	1.71	72.3	6.16	4.17	32.2
CA22	65534	397	489	63273	391	482	8.65	6.72	22.3	7.36	5.45	26.1	7.36	6.53	11.3
CA23	59847	484	667	57644	473	650	9.41	7.23	23.1	6.62	3.21	51.6	6.62	5.16	22.1
CA24	54379	447	517	52686	440	503	6.90	4.45	35.5	6.42	3.18	50.5	6.42	4.97	22.5
CA25	60714	513	642	58456	502	625	6.36	4.61	27.6	5.54	3.95	28.7	5.54	4.85	12.4
CA26	44234	985	1082	42440	968	1056	5.18	3.78	27.1	4.84	3.30	31.8	4.84	4.21	13.1
CA27	57237	778	901	55269	755	873	5.35	4.04	24.4	4.91	3.28	33.2	4.91	4.24	13.5
CA28	52111	804	894	50198	786	876	6.39	3.65	42.9	5.56	2.78	50.0	5.56	4.33	22.2
CA29	57428	953	1011	55474	933	989	5.09	3.62	28.9	4.72	3.10	34.4	4.72	4.06	14.0
CA3	36624	505	756	30657	209	441	7.26	3.11	57.2	5.66	1.57	72.4	5.66	3.73	34.1
CA30	55480	1031	1112	53612	1006	1086	5.82	3.63	37.7	5.36	3.12	41.7	5.36	4.36	18.6
CA31	42911	831	1033	21452	552	640	3.40	0.82	76.0	3.40	1.28	62.4	3.40	2.69	20.8
CA32	35931	781	805	25416	601	577	4.08	2.04	50.0	4.05	1.84	54.7	4.05	3.28	18.9
CA33	2396	112	106	2204	86	87	2.58	-0.04	101.4	2.23	-0.52	123.4	2.23	1.23	44.9
CA34	7717	207	168	7655	191	161	4.93	1.74	64.7	7.25	4.08	43.7	7.25	5.87	19.0
CA35	28550	702	793	28034	690	786	6.03	2.19	63.7	7.45	2.51	66.3	7.45	4.85	34.9
CA36	36340	1080	928	11682	227	231	4.39	3.16	28.1	3.90	2.61	33.2	3.90	3.38	13.3
CA37	4342			4102											
CA38	27049	614	631	25556	600	611	4.56	2.40	47.3	4.05	1.80	55.6	4.05	3.14	22.4
CA39	15804	112	217	15370	108	206	4.09	3.08	24.6	2.67	-0.45	117.0	2.67	1.54	42.2
CA4	31797	65	270	31082	64	264	5.75	3.46	39.9	5.16	2.48	51.8	5.16	4.14	19.8
CA40	7131	120	158	6918	119	155	5.97	3.90	34.7	5.29	3.36	36.5	5.29	4.64	12.3
CA41	8031	15	32	6868	1	3	4.06	1.88	53.7	1.07	-1.17	208.6	1.07	0.67	38.1
CA42	25318	183	125	24552	180	123	3.43	-1.26	136.8	4.16	-0.62	115.0	4.16	1.66	60.0
CA43	39390	1455	1517	38726	1401	1465	4.07	2.60	36.0	3.59	2.04	43.0	3.59	3.00	16.3
CA44	54764	1411	1568	53914	1370	1523	4.07	2.73	33.0	3.41	2.23	34.7	3.41	2.96	13.4
CA45	45702	468	1233	44059	450	1189	8.29	6.42	22.5	5.10	3.43	32.8	5.10	4.45	12.7
CA46	54780	1141	1317	17271	302	380	7.31	5.56	24.0	5.73	4.15	27.5	5.73	5.23	8.7
CA5	19899	1791	779	19195	1748	768	7.67	4.01	47.7	10.49	6.75	35.7	10.49	8.76	16.4
CA6	27816	1536	1473	26915	1504	1452	8.96	5.57	37.9	8.98	5.52	38.6	8.98	7.39	17.7
CA7	7204	570	588	6626	526	537	5.30	3.62	31.7	5.40	3.34	38.2	5.40	4.48	17.1
CA8	7359	524	537	6972	503	502	4.97	2.98	40.1	5.48	2.90	47.1	5.48	4.28	21.8
CA9	6016	454	465	5647	440	436	4.39	2.57	41.5	4.82	2.61	45.8	4.82	3.81	20.9
CO1	31577	568	872	30688	532	837	3.09	2.17	29.8	3.27	1.76	46.0	3.27	2.60	20.4
CO2	15458	308	627	9320	151	355	4.50	3.71	17.5	3.47	2.09	39.7	3.47	2.95	15.1
CO3	7831	169	457	7776	168	454	4.71	2.63	44.2	3.52	-1.44	140.9	3.52	1.61	54.3
DE1	2704	26	37	2684	26	36	2.54	1.30	48.9	2.70	0.99	63.2	2.70	2.09	22.5
FL1	3459	52	52	3449	51	51	8.12	4.96	38.9	7.50	4.60	38.7	7.50	6.32	15.8

Sensor name	Total			FEM PM2.5 available											
	Total # measurement	# measurements selected		Total # measurement	# measurements selected		MBE	MBE_adj	%Change	MBE	MBE_adj	%Change	MBE	MBE_adj	%Change
		post-processing approach	real-time approach		post-processing approach	real-time approach	post-processing approach			real-time approach (A= 0.702)			real-time approach (A=0.998)		
GA1	2290			2279											
IA1	8655	9	38	7857	9	37	3.65	-1.17	132.1	3.50	0.69	80.3	3.50	2.26	35.3
IA2	8364	8	42	7710	8	41	3.07	2.13	30.8	2.73	0.75	72.3	2.73	2.22	18.4
IA3	14566	118	109	14006	117	106	2.74	-2.59	194.5	3.07	0.26	91.5	3.07	2.17	29.3
IA4	14236	38	59	13682	38	59	2.58	-0.01	100.6	2.92	0.09	96.9	2.92	2.07	29.2
IA5	19779	17	81	18906	16	79	2.52	-1.02	140.4	3.14	1.22	61.3	3.14	2.60	17.3
IA6	7948	10	18	7564	10	18	3.24	-1.62	150.0	3.28	-0.31	109.5	3.28	1.88	42.9
IA7	3528	4	6	3453	4	6	5.37	4.06	24.3	5.11	3.67	28.2	5.11	4.70	7.9
IA8	7932	58	57	7837	58	56	4.35	2.41	44.6	3.33	1.23	63.1	3.33	2.53	23.8
KS1	4616	33	28	4056	26	28	2.92	1.64	43.9	3.17	1.71	45.9	3.17	2.45	22.5
KS2	4244	17	20	3769	14	20	2.14	0.63	70.5	2.30	0.77	66.7	2.30	1.67	27.6
KS3	3002	19	19	2455	13	19	2.59	0.18	93.2	3.08	1.04	66.2	3.08	2.35	23.6
NC1	61225	189	233	57880	183	225	4.74	1.43	69.8	4.30	0.46	89.4	4.30	2.37	44.9
NV1	17220	425	642	17125	423	640	7.65	4.57	40.2	6.92	3.92	43.3	6.92	5.68	17.9
NV2	3553	137	186	3469	135	183	2.17	1.38	36.6	1.74	0.51	70.6	1.74	1.30	25.2
NV3	19746	276	512	19341	263	496	2.49	1.00	60.1	2.06	0.47	77.2	2.06	1.49	27.4
OK1	2348	57	42	2324	57	42	5.75	4.29	25.3	5.90	4.65	21.2	5.90	5.43	7.9
OK2	2522	23	14	2158	23	14	1.54	0.89	42.6	0.71	0.08	88.9	0.71	0.50	30.3
OR1	52882	449	642	50389	444	636	2.39	-1.91	180.0	1.72	-2.22	229.4	1.72	0.09	94.8
OR10	28876	222	301	18248	155	214	2.67	0.97	63.6	2.79	0.58	79.4	2.79	1.87	33.2
OR2	14658	173	289	14476	169	285	3.17	1.39	56.0	2.90	0.84	71.2	2.90	2.06	29.0
OR3	36598	391	481	24157	244	306	2.61	1.35	48.2	2.45	0.98	59.8	2.45	1.93	21.1
OR4	8978	126	130	8785	124	128	2.70	2.06	23.8	2.27	1.47	35.5	2.27	1.96	13.9
OR5	47863	21	143	44794	18	140	3.54	1.39	60.7	3.08	1.64	46.6	3.08	2.55	17.2
OR6	36181	58	188	35424	57	187	1.15	-1.32	214.8	2.77	1.30	53.1	2.77	2.34	15.4
OR7	26899	36	174	26330	35	173	2.85	-0.06	102.0	3.10	0.73	76.5	3.10	2.09	32.5
OR8	23702	43	122	23206	43	122	0.79	-3.75	573.3	2.16	-0.57	126.1	2.16	1.14	47.4
OR9	26901	96	204	26511	92	197	2.28	1.01	55.6	1.68	0.06	96.5	1.68	1.20	28.7
TN1	37575	264	411	30360	205	277	5.24	1.17	77.7	5.26	1.40	73.3	5.26	3.69	29.8
TN2	33288	417	542	26252	334	384	5.94	2.21	62.8	5.88	1.66	71.8	5.88	3.62	38.4
TN3	34505	184	263	26862	144	179	4.59	1.57	65.8	4.58	1.54	66.5	4.58	3.22	29.7
TX1	15462	135	152	13826	101	121	9.88	4.72	52.2	10.48	5.95	43.2	10.48	8.68	17.2
TX2	5304	47	46	5141	43	42	14.60	5.83	60.1	14.38	7.58	47.3	14.38	10.48	27.1
TX3	22070	180	658	17084	171	487	20.81	16.66	19.9	10.92	4.70	57.0	10.92	7.91	27.6
TX4	2142	192	142	2133	191	141	11.87	2.07	82.5	14.29	5.32	62.8	14.29	8.88	37.9
UT1	12036	332	458	11956	331	457	13.43	7.43	44.6	11.36	5.41	52.4	11.36	8.10	28.7
UT2	30169	746	1059	29444	733	1044	7.03	5.23	25.6	6.23	4.74	23.9	6.23	5.58	10.4
UT3	29901	1242	1477	29301	1220	1455	7.21	2.44	66.2	6.73	2.49	63.0	6.73	4.53	32.7
UT4	16916	853	1030	16870	853	1028	7.62	3.40	55.3	7.22	3.53	51.1	7.22	5.24	27.4
UT5	19918	310	561	19835	310	560	12.97	7.52	42.0	10.28	1.85	82.0	10.28	6.06	41.1
UT6	12025	963	1028	11981	958	1026	6.53	3.15	51.8	6.23	3.27	47.5	6.23	4.58	26.5
UT7	50914	988	1554	40034	869	1188	10.08	7.12	29.4	8.84	5.79	34.5	8.84	7.31	17.3
UT8	38471	477	679	37716	465	664	8.81	3.52	60.0	8.31	2.98	64.1	8.31	5.35	35.6
VA1	46734	349	514	44044	301	468	3.93	0.99	74.7	3.43	0.29	91.6	3.43	2.17	36.6
VA2	49026	287	361	40611	240	299	3.92	1.69	56.9	3.97	1.18	70.2	3.97	2.75	30.8
VA3	8672	18	38	8577	18	38	3.07	1.70	44.6	2.75	1.19	56.6	2.75	2.24	18.6
VT1	3835	23	30	3798	21	28	1.28	-2.09	263.7	1.18	-2.05	274.3	1.18	-0.32	127.0
WA1	39172	383	474	38110	379	455	3.53	2.57	27.3	2.68	1.44	46.3	2.68	2.27	15.4
WA2	15005	94	99	13626	85	88	4.38	2.36	46.2	4.25	1.97	53.8	4.25	3.51	17.5
WA3	6086	27	33	5948	27	33	3.65	-7.63	309.2	3.60	-8.77	343.5	3.60	-4.06	212.9
WI1	4760	58	25	4741	58	25	2.90	1.87	35.4	1.74	0.00	99.8	1.74	1.02	41.6
WI2	2795	45	24	2786	45	24	2.71	-0.51	118.9	1.98	-0.61	131.1	1.98	1.19	39.7
WI3	6068	145	18	6051	145	18	2.66	0.87	67.1	2.23	1.29	42.3	2.23	2.01	9.9

Section S1: Dust-event selection without using relative humidity (RH) cutoff

This section discusses the effect of including RH on the selection of potential dust events using the real-time approach, the correction factor A, the distribution of identified measurements vs. CF, and the change in mean bias error (MBE).

From Figure S14, the number of measurements identified as potential dust events was higher for the no-RH cutoff scenario. The most noticeable difference in measurements was for the sensors located at sites with higher RH, including those in Oregon, Iowa, Washington, Virginia, Florida, Kansas, Georgia, and Alaska.

The inclusion of a larger number of measurements does not necessarily improve the criteria for identifying dust events. For example, Figure S15 shows that the number of measurements increased in the CF bins of 0–0.25, 0.25–0.5, and 0.5–0.7 for sensors deployed in Oregon, Wisconsin, Kansas, Georgia, Tennessee, Virginia, North Carolina, and Oklahoma. In contrast, sensors in dust-dominant states such as Utah, Arizona, Nevada, and Texas were less affected by the RH cutoff, both in terms of the count of identified measurements and their CF distributions. This underscores the importance of applying an RH cutoff when including sensors located in high-humidity sites.

Using non-linear regression, factor A was estimated as 1.00 for the post-processing approach and 1.12 for the real-time approach. Figure S15 illustrates the corrected pm2.5_alt (i.e., adj_pm2.5_alt) for the real-time approach using A = 1.00. The inclusion of RH increased A from 0.702 to 1.00, which determined the extent of correction applied to pm2.5_alt. A higher value of A minimizes the corrections, leading to an adjusted pm2.5_alt that underestimates $PM_{2.5}$ concentrations compared to reference measurements.

Figure S16 presents the MBE and MBE_adj results for the real-time approach with A = 1.00. This correction led to an overestimation of $PM_{2.5}$ compared to reference measurements (negative MBE_adj < –0.5 µg/m³ for 11 sensors and between 0 and –0.5 µg/m³ for 9 sensors). Most sensors with negative MBE_adj were located at high-humidity sites. For the remaining 88 sensors, the MBE declined by 38.3 ± 21.2%. This ~38% reduction was smaller than the ~60% reduction observed when applying an RH cutoff of 50%. The primary reason was the higher value of A: while decreasing A improves estimates for sensors in dust-dominant regions, it worsens pm2.5_alt estimates at non-dust sites (Figure S18).

Figure S14: The number of measurements identified as potential dust events for the real-time approach when using a RH cutoff of 50% vs. no RH cutoff. For all sensors, using no RH cutoff resulted in the selection of more measurements. The sensor information corresponding to the Sensor Name can be found in Tables S1, S2, and S3.

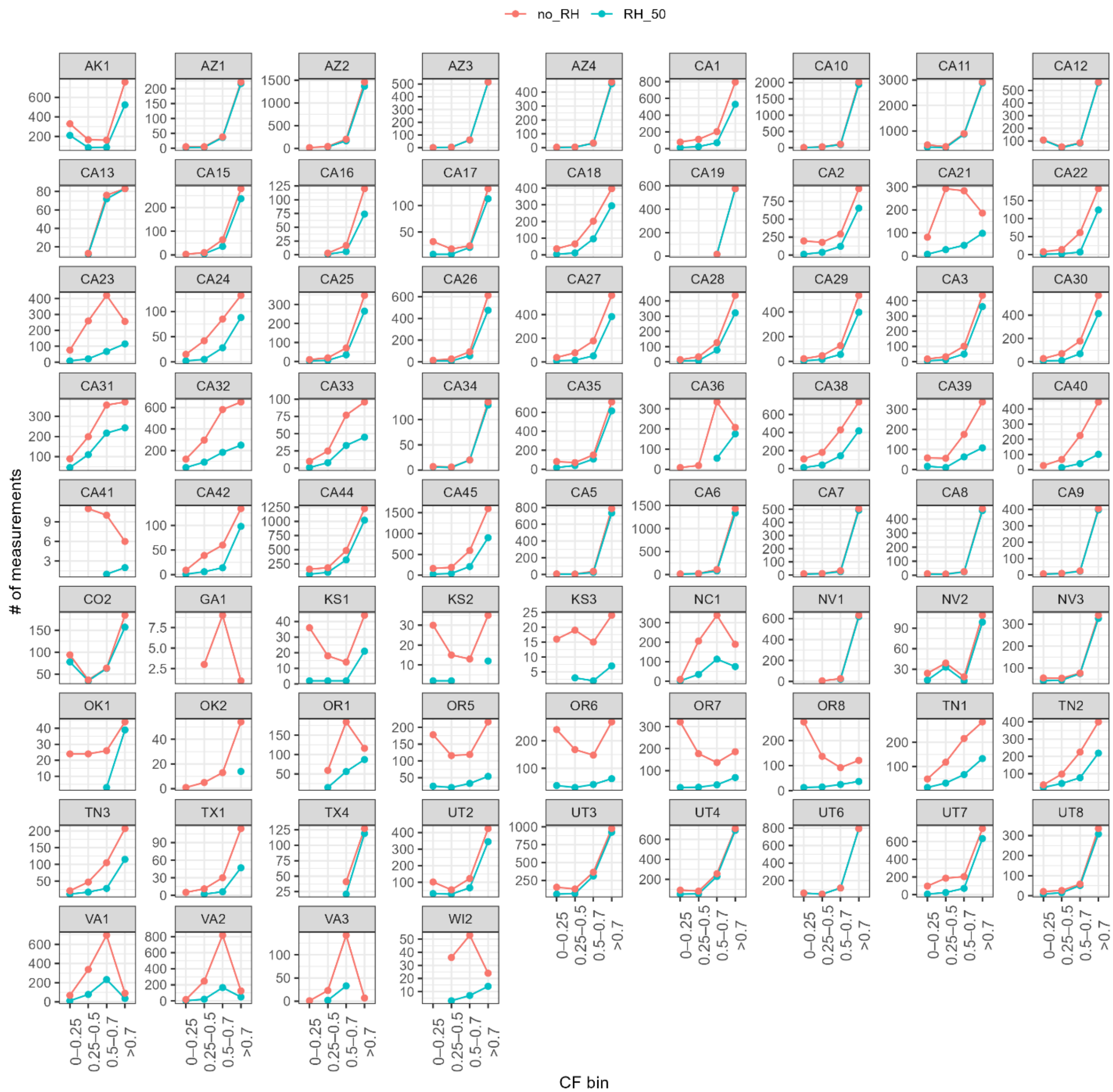

Figure S15: Comparison between the counts of potential dust event measurements and the corresponding coarse fraction (CF), derived from FEM $PM_{2.5}$ and PM_{10} measurements and categorized into bins. Results are shown for the real-time approach with a 50% RH cutoff and without any RH cutoff.

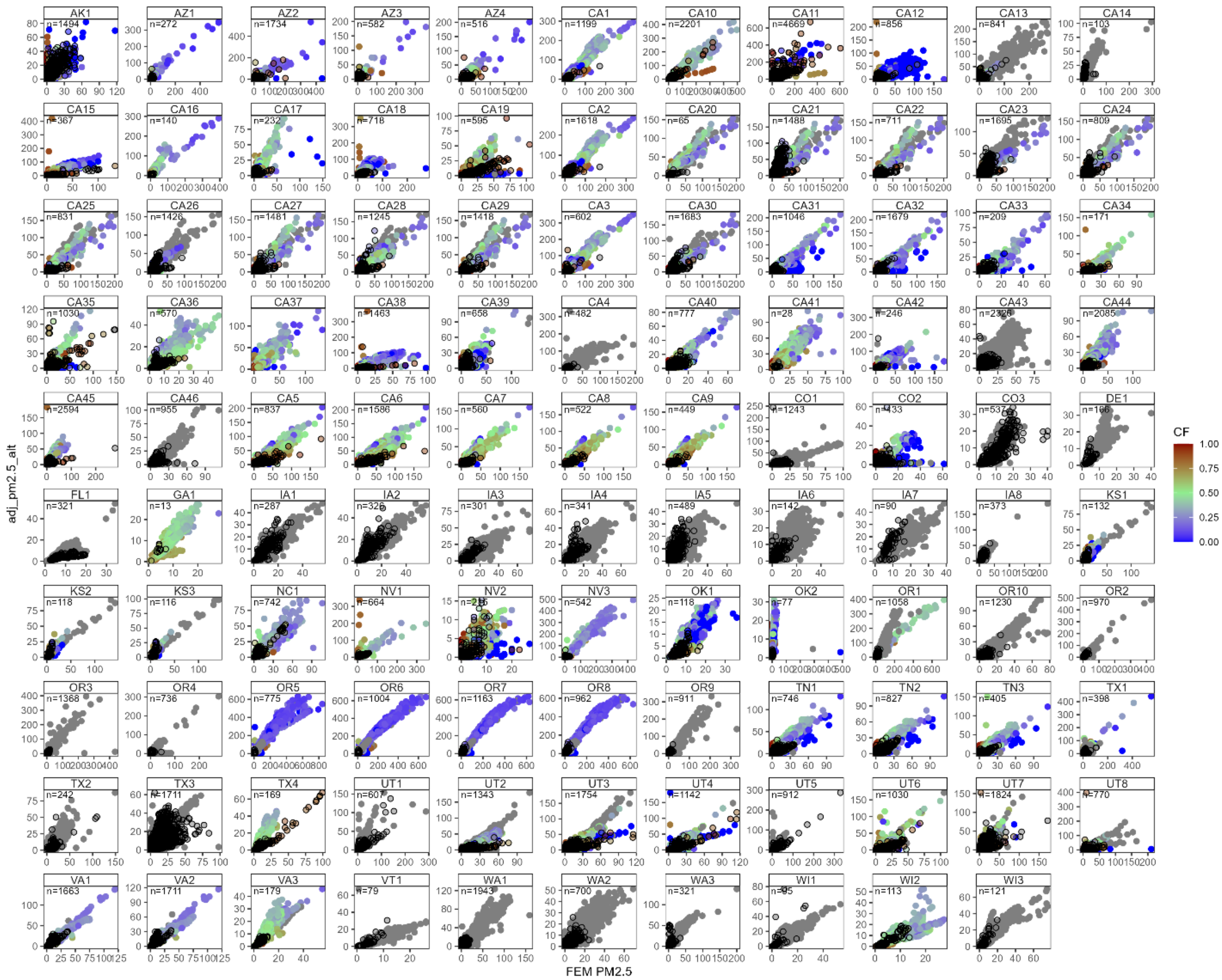

Figure S16: Real-time approach (corrected using an A of 1.00): Hourly averaged adj_pm2.5_alt compared with FEM $PM_{2.5}$ measurements. Black open circles indicate measurements identified as potential dust events. The color of the solid circles corresponds to the CF. The grey circles represent times when either $PM_{2.5}$ or PM_{10} was unavailable, preventing CF calculation. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available.

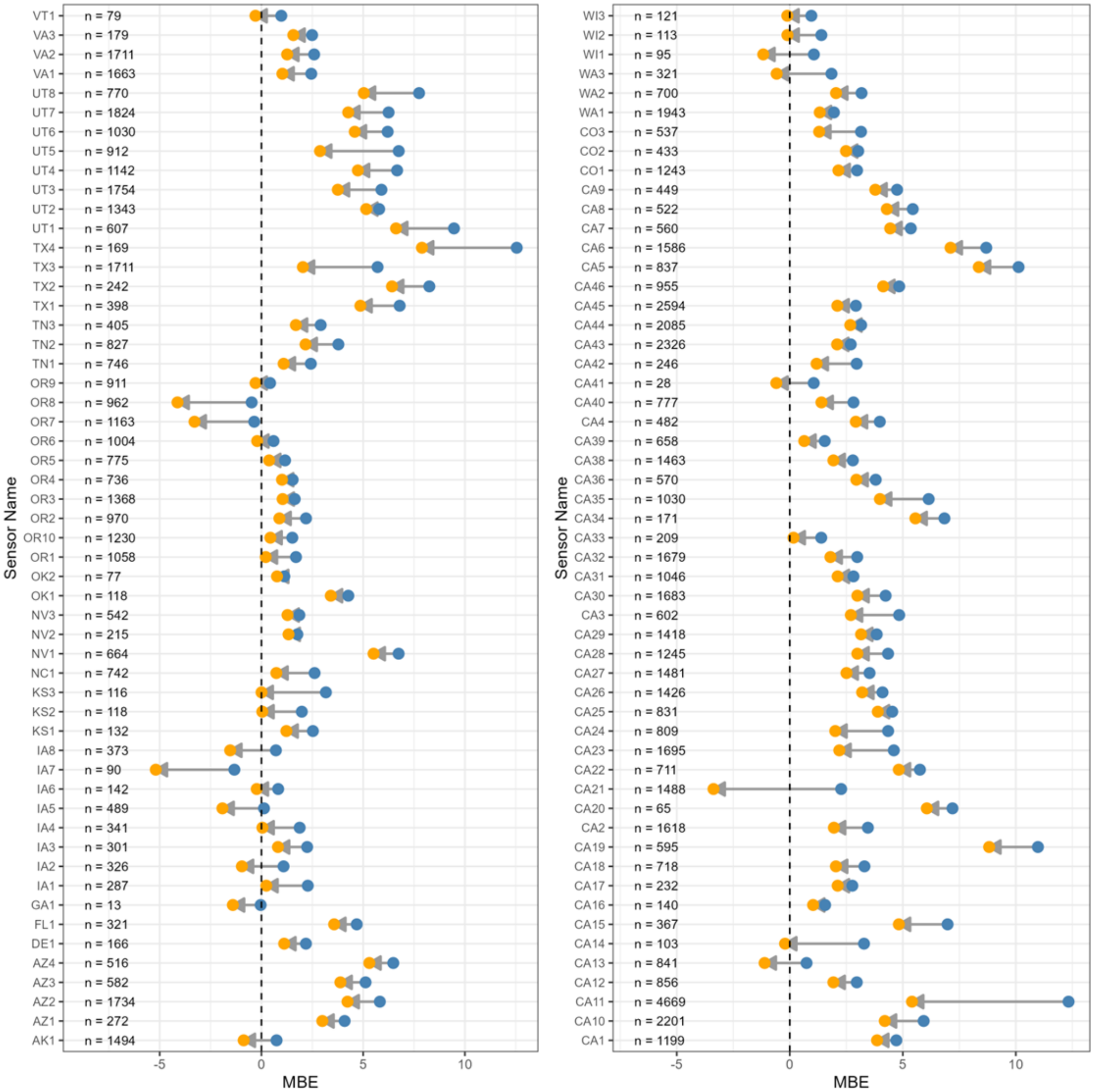

Figure S17: Real-time approach: MBE (blue) and MBE_adj (orange), using A (1.00). All available data with FEM $PM_{2.5}$ measurements were included in the comparison, regardless of CF availability. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available.

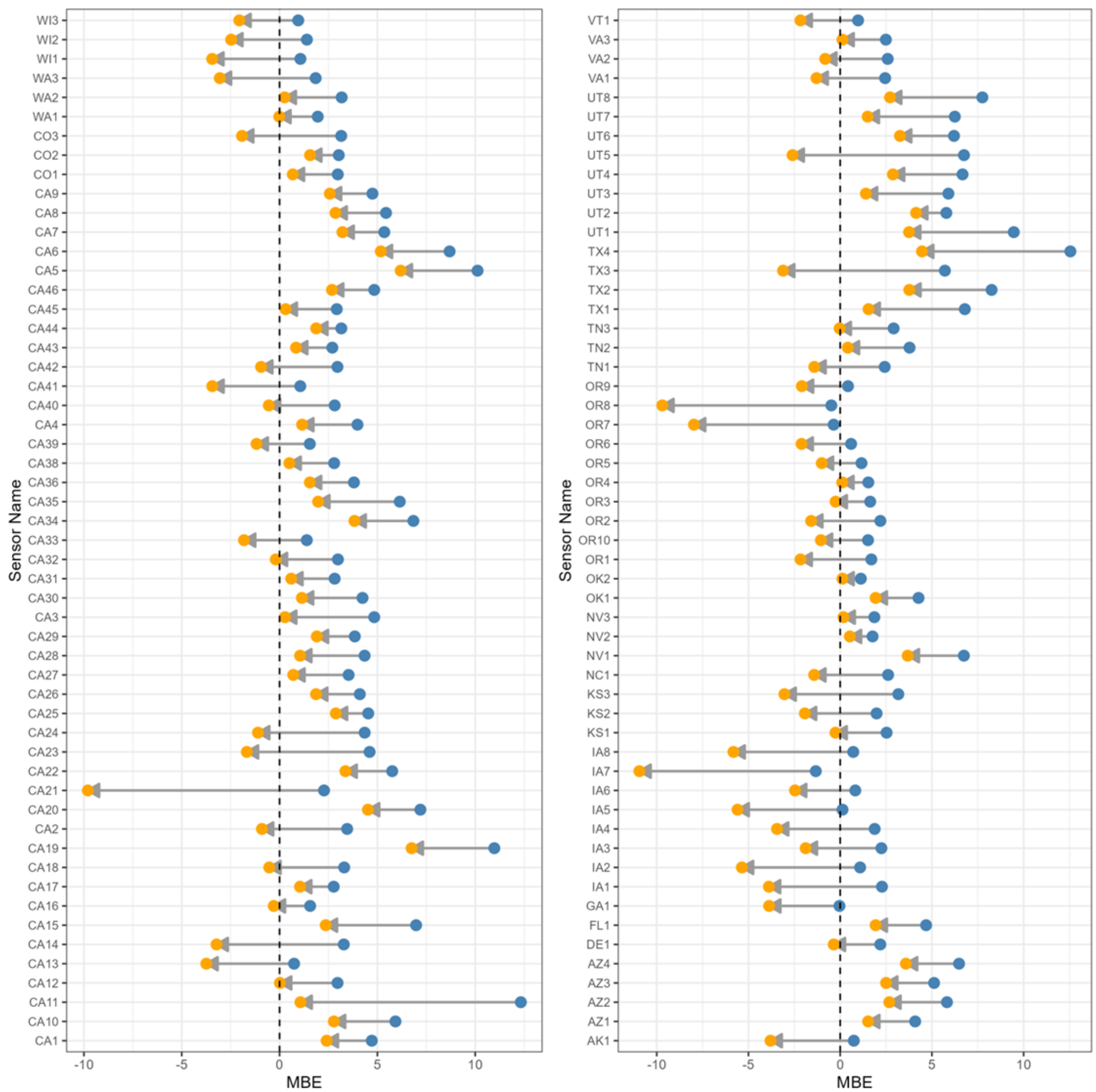

Figure S18: Real-time approach: MBE (blue) and MBE_adj (orange), using A (0.702, obtained using RH cutoff of 50% and post-processing approach identified measurements). All available data with FEM $PM_{2.5}$ measurements were included in the comparison, regardless of CF availability. n denotes the number of measurements identified as dust events, for a subset of data when FEM $PM_{2.5}$ data were available.