



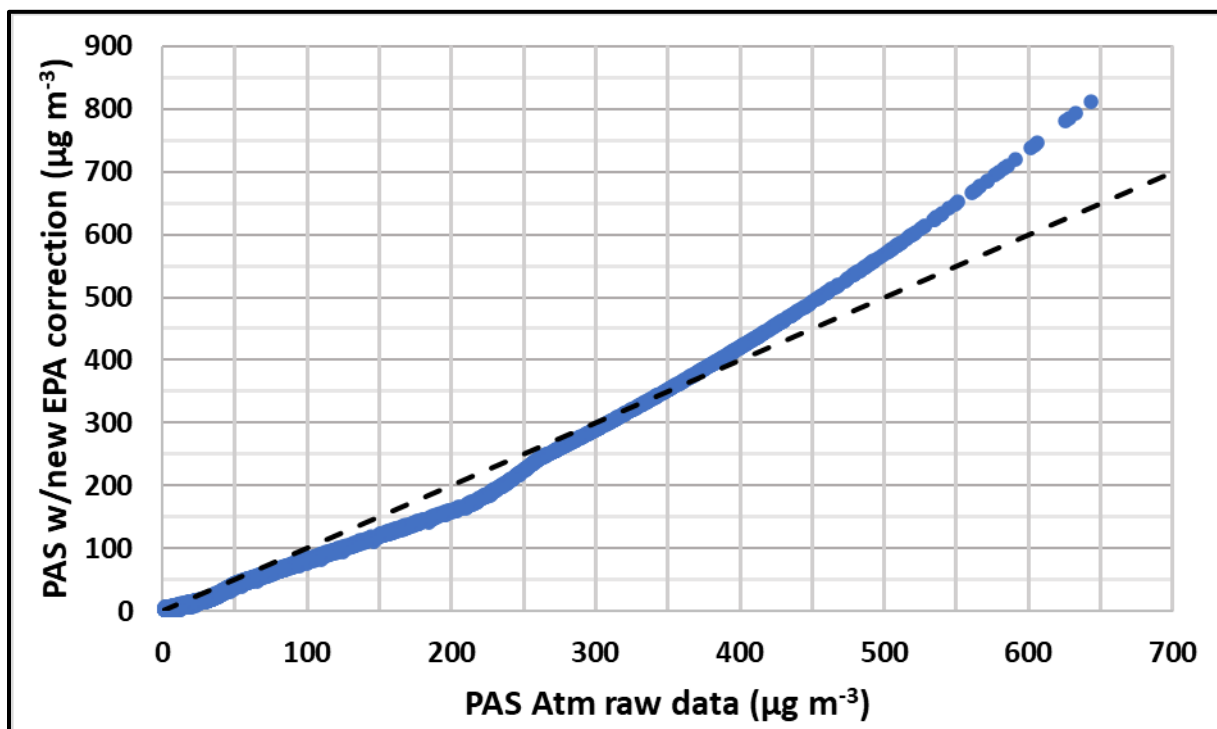
*Supplement of*

## **An evaluation of the U.S. EPA’s correction equation for PurpleAir sensor data in smoke, dust, and wintertime urban pollution events**

**Daniel A. Jaffe et al.**

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**Figure S1:** Comparison of the PAS data corrected with the new EPA correction and the raw PAS ATM data, both in  $\mu\text{g m}^{-3}$ . At each value of PA Atm, there are small variations in the corrected values due to variations in the relative humidity. The dashed line shows a 1:1 relationship.

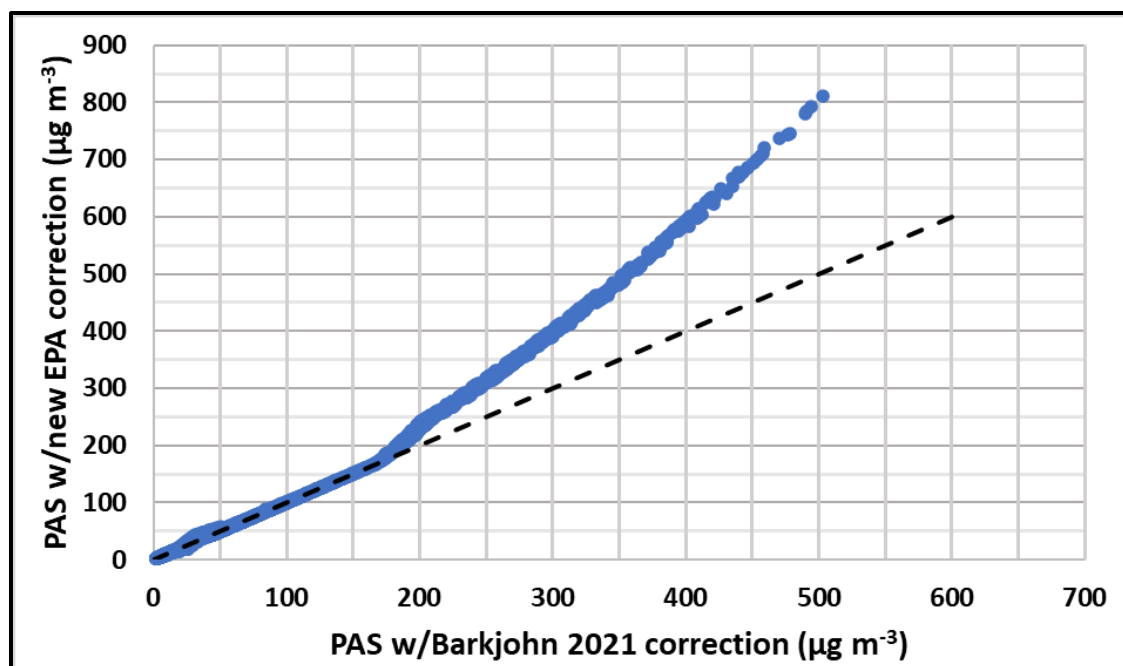
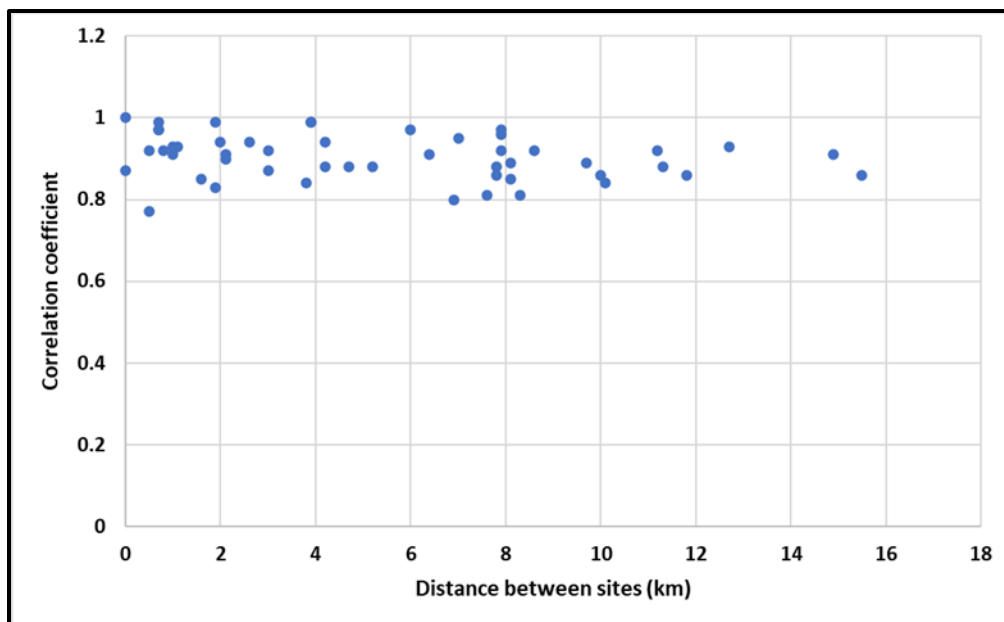
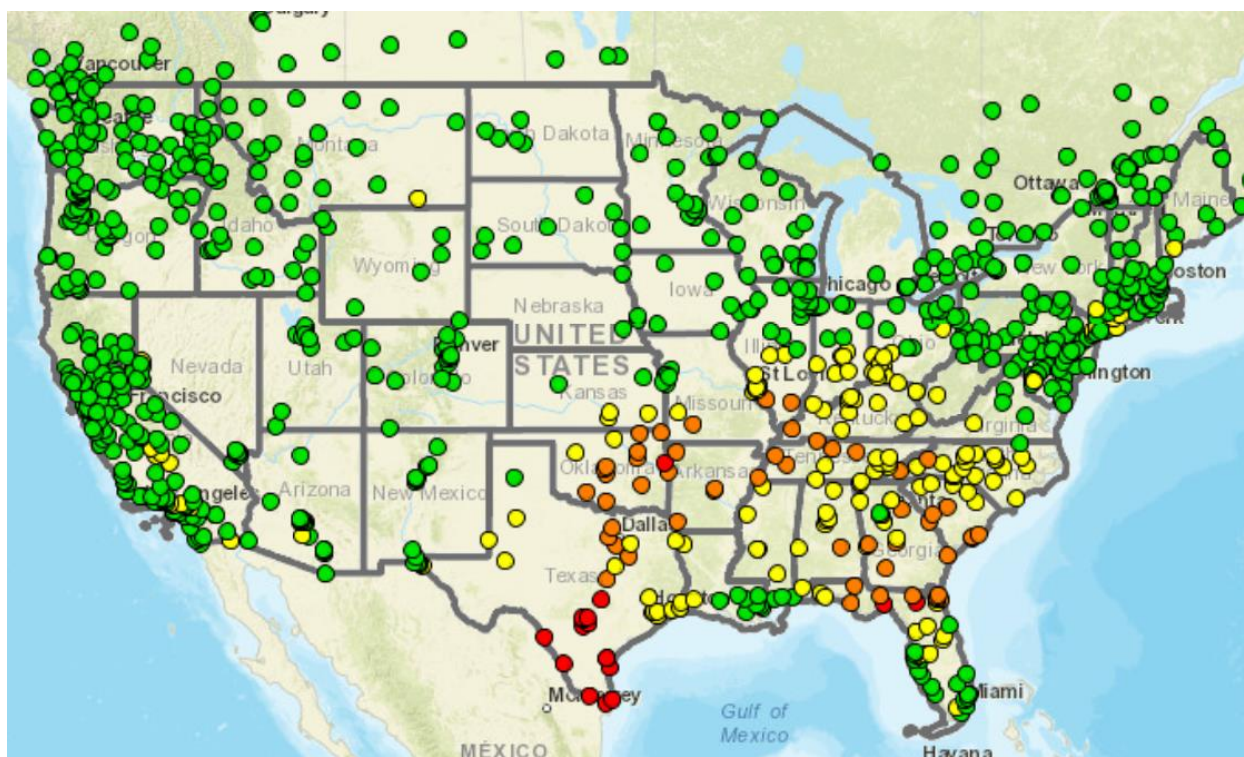


Figure S2: Comparison of the PAS data corrected with the new EPA correction and PAS data corrected with the Barkjohn 2021 equation, both in  $\mu\text{g m}^{-3}$ . At each value of both corrected datasets, there are small variations due to how relative humidity is incorporated.



**Figure S3: Correlation coefficient for the correlation of corrected PAS data versus distance between the PAS and regulatory site.**



**Figure S4.** Daily mean  $\text{PM}_{2.5}$  values for June 27, 2020, at U.S. monitoring sites. The  $\text{PM}_{2.5}$  values use the EPA AQI color scale: green ( $0$  to  $<12.1 \mu\text{g m}^{-3}$ ); yellow ( $12.2$  to  $<35.5 \mu\text{g m}^{-3}$ ); orange ( $35.5$  to  $<55.5 \mu\text{g m}^{-3}$ ); red ( $55.5$  to  $<150 \mu\text{g m}^{-3}$ ). Figure is from the AirNow-Tech website ([airnowtech.org](http://airnowtech.org)). The high values in the southeast U.S. reflect the impact of the “Godzilla” Saharan dust event.

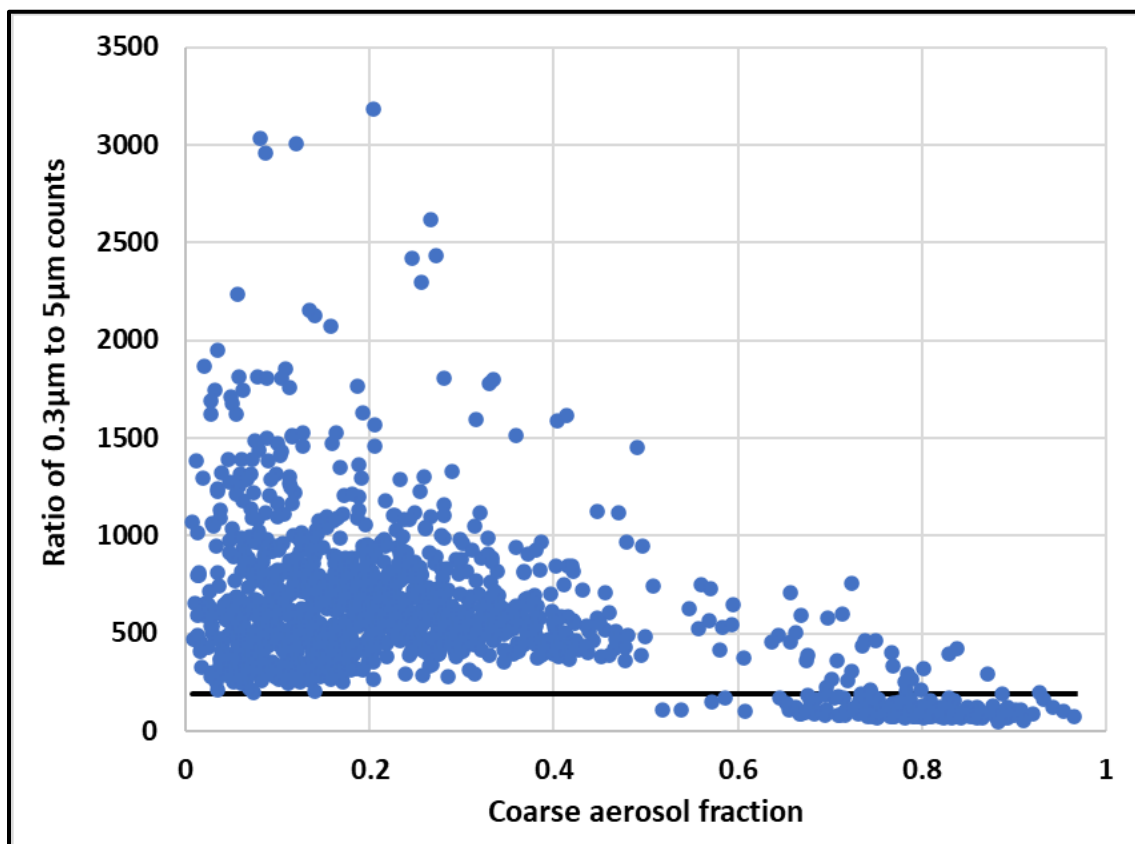
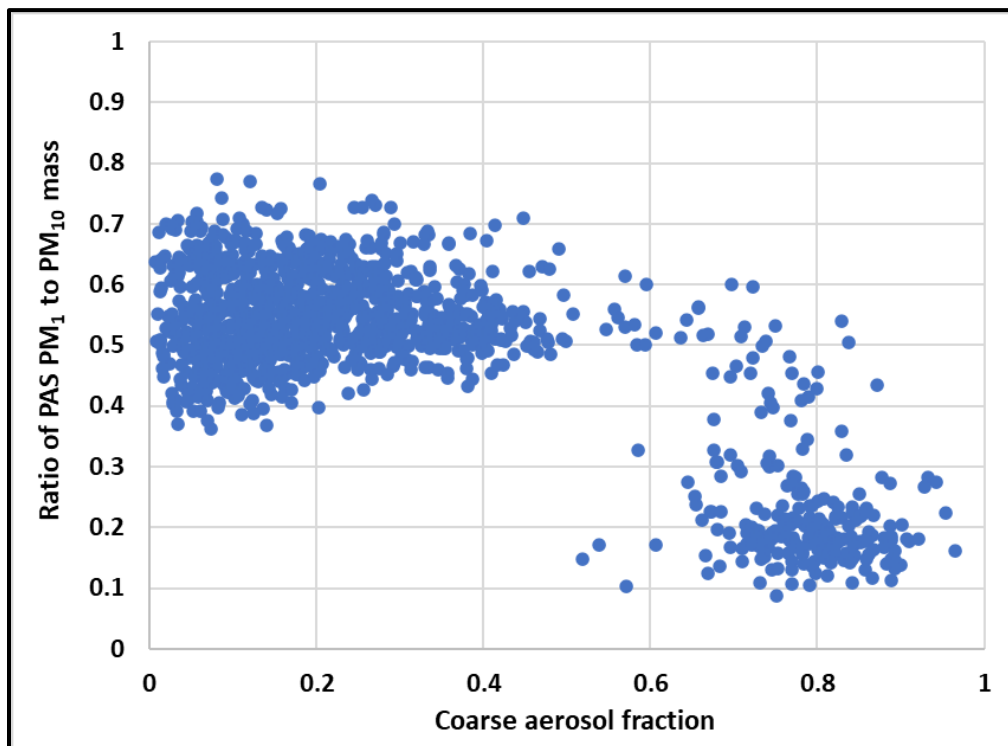


Figure S5. Ratio of 0.3 to 5  $\mu\text{m}$  counts measured by the PAS versus coarse aerosol fraction (CAF) from the Keeler regulatory data. The black line shows a ratio of 190, which is used in Eq. (4). More information on this ratio as a function of the CAF is shown in Table 5 in the main manuscript.



**Figure S6.** Ratio of PAS PM<sub>1</sub> to PM<sub>10</sub> mass versus coarse aerosol fraction (CAF) from the Keeler regulatory data. The PAS PM<sub>1</sub> and PM<sub>10</sub> are raw data with CF=1. A statistical comparison is shown in Table 5 in the main manuscript. More information on this ratio as a function of the CAF is shown in Table 5 in the main manuscript.

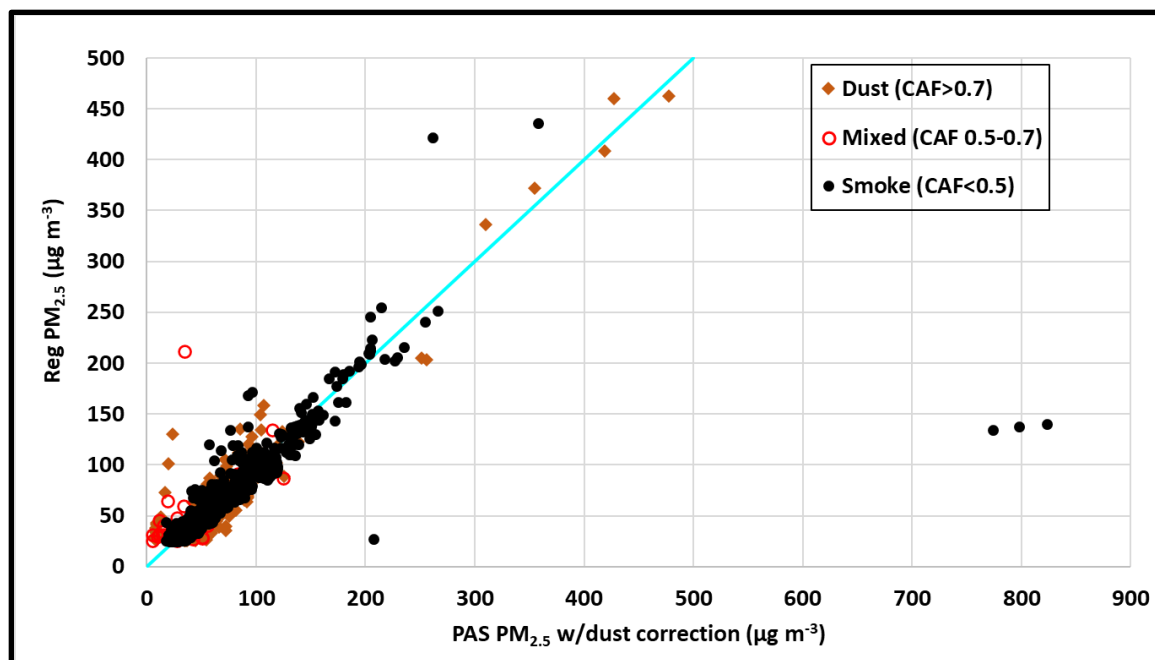


Figure S7. Regulatory PM<sub>2.5</sub> versus PAS PM<sub>2.5</sub> with new dust correction at Keeler, CA, for hours with regulatory PM<sub>2.5</sub> > 25 μg m<sup>-3</sup>. The data are separated by the CAF, as measured by the regulatory data. The correction is applied to all data with PAS measured 0.3 μm / 5 μm counts < 220. The light blue line shows a 1:1 relationship.



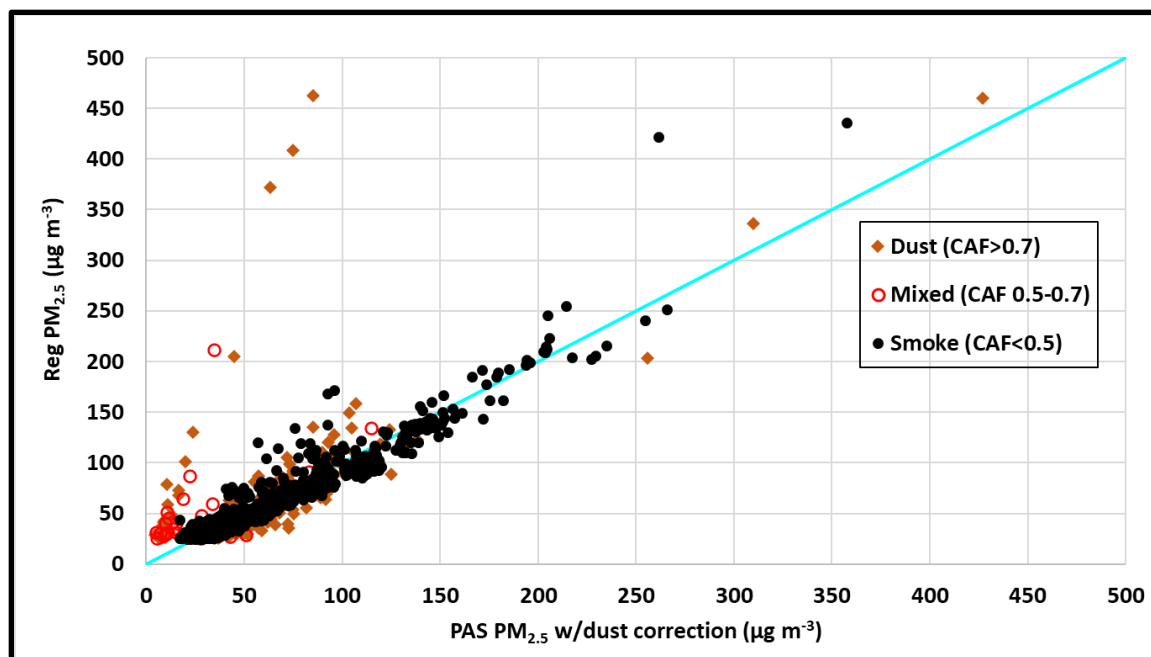
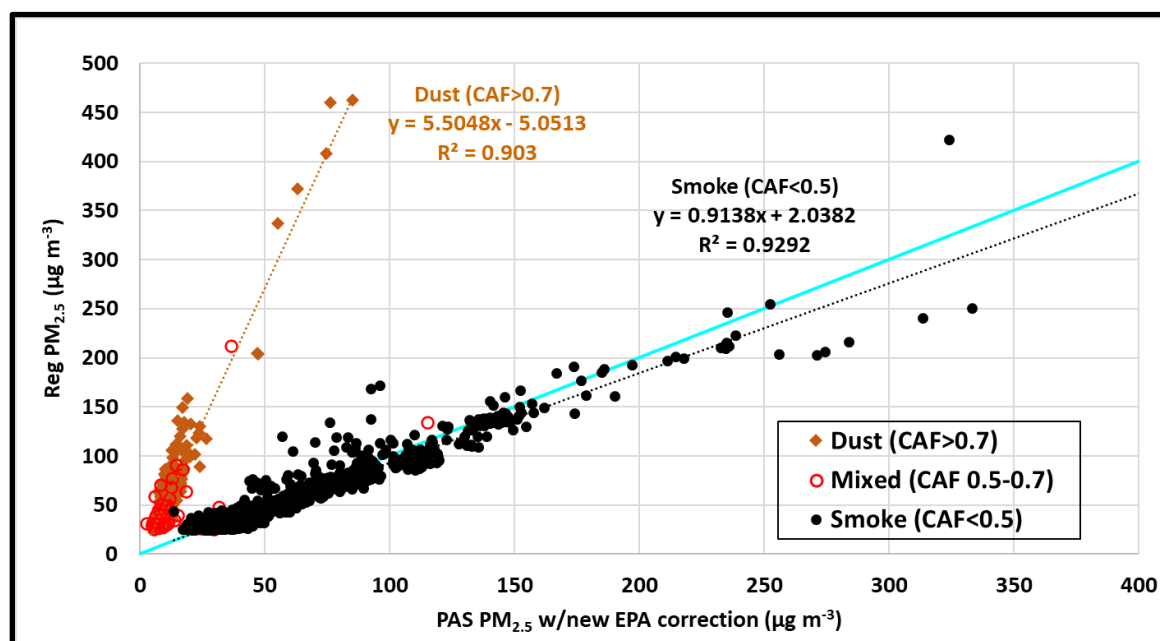


Figure S8. Regulatory PM<sub>2.5</sub> versus PAS PM<sub>2.5</sub> with dust correction at Keeler, CA, for hours with regulatory PM<sub>2.5</sub> > 25 μg m<sup>-3</sup>. The data are separated by the coarse aerosol fraction (CAF), as measured by the regulatory data. The correction is applied to all data with PAS measured 0.3 μm / 5 μm counts < 160. The light blue line shows a 1:1 relationship.



**New Figure S9: Regulatory PM<sub>2.5</sub> versus PAS PM<sub>2.5</sub> with new EPA correction at Keeler, CA, for hours with regulatory PM<sub>2.5</sub> > 25 μg m<sup>-3</sup>. The data are separated by the course aerosol fraction (CAF), as measured by the regulatory data. Linear regression relationships are shown with dotted lines and the light blue line shows a 1:1 relationship.**

**Table S1. Details on each of the 50 pollution events used in Part I of this analysis.**

Case #	Aerosol type	PAS site name	PAS site latitude	PAS site longitude	AQS site ID	Distance between sites (km)	Start time (UTC)	End time (UTC)	Available regulatory data
1	Urban	North Berkeley	37.88	-122.27	60010012, 06001001 3	3.0	1/4/18 12:00	1/5/18 12:00	PM <sub>2.5</sub>
2	Urban	Berkeley Park and Coventry, Kensington, CA, USA	37.90	-122.29	60010012, 06001001 3	4.7	2/8/18 12:00	2/10/18 12:00	PM <sub>2.5</sub>
3	Urban	El Cerrito - Rust - Ohlone Greenway	37.91	-122.30	60010012, 06001001 3	5.2	2/8/18 12:00	2/10/18 12:00	PM <sub>2.5</sub>
4	Urban	North Berkeley	37.88	-122.27	60010012, 06001001 3	3.0	2/8/18 12:00	2/10/18 12:00	PM <sub>2.5</sub>
5	Urban	Alamo-Erselia Trail	37.86	-122.02	60130002	8.1	1/2/18 12:00	1/5/18 12:00	PM <sub>2.5</sub>
6	Urban	Concord	37.97	-122.02	60130002	3.8	1/2/18 12:00	1/5/18 12:00	PM <sub>2.5</sub>
7	Urban	Alamo-Erselia Trail	37.86	-122.02	60130002	8.1	12/13/17 12:00	12/16/17 12:00	PM <sub>2.5</sub>
8	Urban	AQMD_NASA_16 (outside)	33.76	-118.15	60374008	11.8	1/2/18 0:00	1/3/18 12:00	PM <sub>2.5</sub> , PM <sub>10</sub>
9	Urban	BikeSGV - Alhambra	34.07	-118.14	60371103	7.8	12/30/17 12:00	1/3/18 12:00	PM <sub>2.5</sub> , PM <sub>10</sub>
10	Urban	003 FK Parking Lot	34.11	-117.63	60711004	1.1	1/25/20 0:00	1/28/20 23:00	PM <sub>2.5</sub>
11	Urban	BikeSGV - Alhambra	34.07	-118.14	60371103	7.8	2/1/18 0:00	2/5/18 10:00	PM <sub>2.5</sub> , PM <sub>10</sub>
12	Urban	AQMD_NASA_16 (outside)	33.76	-118.15	60374004	4.2	12/24/17 16:00	12/25/17 23:00	PM <sub>2.5</sub>
13	Urban	AQMD_NASA_16 (outside)	33.76	-118.15	60374004	4.2	12/30/17 8:00	1/2/18 8:00	PM <sub>2.5</sub>
14	Urban	90.9fm KRCL 2	40.77	-111.95	49035301 0	2.1	12/31/17 12:00	1/1/18 23:00	PM <sub>2.5</sub>
15	Urban	KSL Mike Hale Acura Murray	40.65	-111.89	49035301 0	15.5	12/31/17 12:00	1/1/18 23:00	PM <sub>2.5</sub>
16	Urban	90.9fm KRCL 2	40.77	-111.95	49035301 0	2.1	1/3/18 12:00	1/7/18 23:00	PM <sub>2.5</sub>
17	Smoke	Enatai	47.59	-122.20	53033003 1	3.9	8/8/17 0:00	8/18/17 23:00	PM <sub>2.5</sub>
18	Smoke	Seattle	47.62	-122.34	53033008 0	6.0	8/9/18 0:00	8/27/18 23:00	PM <sub>2.5</sub>
19	Smoke	Enatai	47.59	-122.20	53033003 1	3.9	8/9/18 0:00	8/27/18 23:00	PM <sub>2.5</sub>
20	Smoke	LRAPA-Emerald Park	44.08	-123.14	41039005 9	1.9	8/9/18 0:00	8/30/18 23:00	PM <sub>2.5</sub>
21	Smoke	LRAPA-Bethel	44.07	-123.14	41039005 9	0.0	8/9/18 0:00	8/30/18 23:00	PM <sub>2.5</sub>

Case #	Aerosol type	PAS site name	PAS site latitude	PAS site longitude	AQS site ID	Distance between sites (km)	Start time (UTC)	End time (UTC)	Available regulatory data
22	Smoke	Miller	45.52	-122.76	410512011	12.7	8/13/18 0:00	8/24/18 23:00	PM <sub>2.5</sub>
23	Smoke	PSU_GBRL_Home	45.50	-122.65	410512011	7.0	8/13/18 0:00	8/24/18 23:00	PM <sub>2.5</sub>
24	Smoke	PSU STAR Lab Lost Park	45.54	-122.79	410512011	14.9	8/13/18 0:00	8/23/18 23:00	PM <sub>2.5</sub>
25	Smoke	PSU STAR Lab Rose City Park	45.54	-122.60	410512011	0.7	8/13/18 0:00	8/24/18 23:00	PM <sub>2.5</sub>
26	Smoke	Bonny Slope	45.54	-122.79	410670111	7.9	8/13/18 0:00	8/23/18 22:00	PM <sub>2.5</sub>
27	Smoke	Woods Park	45.46	-122.72	410670111	7.9	8/13/18 0:00	8/23/18 23:00	PM <sub>2.5</sub>
28	Smoke	MesaVista	43.60	-116.21	160010010	11.3	8/17/18 0:00	8/24/18 23:00	PM <sub>2.5</sub>
29	Smoke	352 Saint Augustine Drive	39.73	-121.78	60070008	6.4	7/27/18 0:00	8/12/18 7:00	PM <sub>2.5</sub> , PM <sub>10</sub>
30	Smoke	CARB_SMOKE_BCAQMD_NORD	39.78	-121.96	60070008	10.1	7/27/18 0:00	8/3/18 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
31	Smoke	Phoenix	42.28	-122.81	410292129	8.6	7/23/19 0:00	8/2/19 23:00	PM <sub>2.5</sub>
32	Smoke	Fairbanks Ballaine & Lynx	64.90	-147.83	20900034	7.9	7/10/19 0:00	7/15/19 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
33	Smoke	CTC Building	64.84	-147.73	20900034	0.5	7/10/19 0:00	7/15/19 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
34	Smoke	Inclination Dr.	64.92	-147.88	20900034	11.2	7/10/19 0:00	7/15/19 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
35	Smoke	Kellum	64.84	-147.74	20900034	1.0	7/10/19 0:00	7/15/19 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
36	Smoke	Line Dr.	64.88	-147.91	20900034	9.7	7/10/19 0:00	7/15/19 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
37	Smoke	Haines St.	64.84	-147.68	20900040	0.7	7/7/19 0:00	7/11/19 0:57	PM <sub>2.5</sub>
38	Smoke	LRAPA-Emerald Park	44.08	-123.14	410390059	1.9	9/6/20 0:00	9/18/20 22:00	PM <sub>2.5</sub>
39	Smoke	LRAPA-Bethel	44.07	-123.14	410390059	0.0	9/6/20 0:00	9/18/20 22:00	PM <sub>2.5</sub>
40	Smoke	PSU STAR Lab Rose City Park	45.54	-122.60	410512011	0.7	9/9/20 0:00	9/18/20 23:00	PM <sub>2.5</sub>
41	Smoke	Wildwood	45.01	-123.04	410470041	7.6	9/6/20 8:00	9/19/20 23:00	PM <sub>2.5</sub>
42	Smoke	Willamette University - Sparks Center	44.93	-123.03	410470041	1.6	9/6/20 8:00	9/19/20 23:00	PM <sub>2.5</sub>
43	Smoke	Hopfer Road	48.42	-119.52	530470013	2.6	8/1/21 0:00	8/3/21 23:00	PM <sub>2.5</sub>
44	Smoke	Colville High School-	48.55	-117.88	530650005	2.0	7/31/21 0:00	8/1/21 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>

Case #	Aerosol type	PAS site name	PAS site latitude	PAS site longitude	AQS site ID	Distance between sites (km)	Start time (UTC)	End time (UTC)	Available regulatory data
45	Dust	Creative Montessori School	33.48	-86.79	10730023	8.3	6/26/20 0:00	6/27/20 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
46	Dust	Ruffner Mountain	33.56	-86.71	10730023	10.0	6/26/20 1:00	6/27/20 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
47	Dust	Hudson Hill	32.09	-81.12	13051100 2	0.8	6/26/20 12:00	6/28/20 12:00	PM <sub>2.5</sub> , PM <sub>10</sub>
48	Dust	TracMyAir2	35.88	-78.87	37063009 9	1.0	6/28/20 0:00	6/29/20 12:00	PM <sub>2.5</sub> , PM <sub>10</sub>
49	Dust	Gina Ward	32.61	-83.60	13153000 1	0.5	6/25/20 12:00	6/27/20 23:00	PM <sub>2.5</sub> , PM <sub>10</sub>
50	Dust	MLK+Peeples	35.04	-85.30	13295000 2	6.9	6/26/20 12:00	6/27/20 18:00	PM <sub>2.5</sub> , PM <sub>10</sub>

**Table S2. Details on the Keeler, CA, site used in Part II of this analysis.**

<b>Case #</b>	<b>Aerosol type</b>	<b>PAS site name</b>	<b>PAS site latitude</b>	<b>PAS site longitude</b>	<b>AQS site ID</b>	<b>Distance between sites (km)</b>	<b>Start time (UTC)</b>	<b>End time (UTC)</b>
1	Dust	CARB_S_GPU APCD_Keeler	36.48	-117.87	060271003	30 meters	2/12/2019 17:00	5/29/2022 21:00

**Table S3. Average regulatory PM<sub>2.5</sub>, mean bias (PAS-regulatory), and slopes for each event using three different correction schemes. Slopes are given per Eq. (2), so that a slope less than 1 indicates a positive bias in the PAS-corrected data (i.e., PAS data are higher than regulatory data) and a slope greater than 1 indicates a negative bias in the PAS-corrected data (i.e., PAS data are lower than regulatory data). Events 1–16, 17–44, and 45–50 are dominated by urban, smoke, and dust aerosol, respectively.**

Case #	Average regulatory PM <sub>2.5</sub> (µg m <sup>-3</sup> )	Mean bias w/Barkjohn 2021 correction (µg m <sup>-3</sup> )	Mean bias w/new EPA correction (µg m <sup>-3</sup> )	Mean bias w/dust correction (µg m <sup>-3</sup> )	Slope using Barkjohn 2021 correction	Slope using new EPA correction	Slope using dust correction
1	24.4	-4.5	-3.7	-4.5	0.92	0.85	0.92
2	21.3	-9.1	-8.8	-9.2	1.07	1.00	1.07
3	21.3	-8.3	-7.8	-8.3	0.94	0.86	0.94
4	21.3	-6.8	-6.5	-6.8	0.99	0.95	0.99
5	47.5	-13.2	-12.4	-13.2	0.85	0.85	0.85
6	46.1	-14.5	-12.5	-14.5	0.98	0.95	0.98
7	29.0	-4.7	-2.9	-4.7	0.95	0.81	0.95
8	44.1	-4.9	-1.4	-5.3	1.15	1.18	1.14
9	49.1	-6.3	-5.8	-6.5	0.95	0.96	0.95
10	22.3	1.4	2.0	8.6	1.15	1.12	0.22
11	29.8	-7.0	-6.4	-6.9	0.94	0.88	0.95
12	36.3	-1.3	1.3	-1.2	1.04	1.04	1.06
13	52.5	-5.1	-2.7	-5.4	1.27	1.31	1.28
14	18.8	-2.4	0.2	-2.4	1.05	0.82	1.05
15	19.4	-1.1	1.9	-1.3	0.93	0.73	0.91
16	33.4	3.4	10.3	3.4	0.85	0.83	0.85
17	20.1	3.9	3.9	3.9	0.85	0.85	0.85
18	35.1	2.8	3.0	2.9	0.96	0.96	0.96
19	28.9	6.0	6.2	5.4	0.81	0.81	0.84
20	14.6	2.7	3.0	2.7	0.7	0.68	0.70
21	14.7	1.9	2.4	1.9	0.75	0.72	0.75
22	35.9	-2.1	-1.8	-2.1	1.02	1.02	1.02
23	35.9	-1.1	-0.8	-1.1	1.05	1.05	1.05
24	38.8	-1.6	-1.3	-1.6	0.98	0.98	0.98
25	35.9	0.8	1.1	0.80	1.00	1.00	1.00
26	34.1	4.1	4.4	4.1	0.92	0.92	0.92
27	34.0	2.4	2.7	2.4	0.95	0.95	0.95
28	35.2	3.0	3.7	3.0	0.93	0.94	0.93
29	44.6	5.4	5.8	5.5	0.82	0.83	0.80
30	37.7	3.1	3.7	3.1	0.6	0.61	0.60
31	42.7	4.9	6.7	4.9	0.84	0.75	0.84

32	102.2	-1.8	9.4	-1.8	1.13	0.92	1.13
33	102.2	-10.1	-3.0	-10.1	1.22	1.04	1.22
34	102.2	-0.6	11.9	-0.6	1.07	0.84	1.07
35	102.2	-10.1	-3.8	-10.1	1.24	1.05	1.24
36	102.2	-5.0	3.2	-5.0	1.15	0.95	1.15
37	140.6	20.0	41.8	20.0	1.07	0.78	1.07
38	189.3	-42.3	-4.3	463.9	1.3	0.98	0.26
39	210.9	-8.9	49.3	693.8	1.08	0.75	0.19
40	204.8	-3.3	53.1	798.8	1.14	0.76	0.17
41	68.2	-20.6	-17.5	-28.8	1.29	1.06	1.26
42	196.7	-6.8	51.8	No data*	1.06	0.73	No data*
43	148.3	-15.4	-10.0	-15.4	1	0.9	1.00
44	67.4	7.7	10.9	7.7	0.81	0.70	0.81
45	31.3	-25.5	-25.5	-15.9	6.76	6.70	0.72
46	33.1	-26.8	-26.8	-26.8	7.03	6.98	7.03
47	34.1	-25.9	-25.9	-0.6	4.55	4.69	0.46
48	28.3	-21.5	-21.5	-21.5	5.67	5.64	5.67
49	28.5	-22.6	-22.6	-7.7	4.69	4.64	0.63
50	27.9	-22.4	-22.4	-21.4	4.55	4.51	0.67

**\*For event 42, no channel B counts were available, so this calculation is considered less reliable.**