Supplemental Material

Figures

Figure S1: Dylos particle number to $PM_{2.5}$ mass conversion c using reference BAM

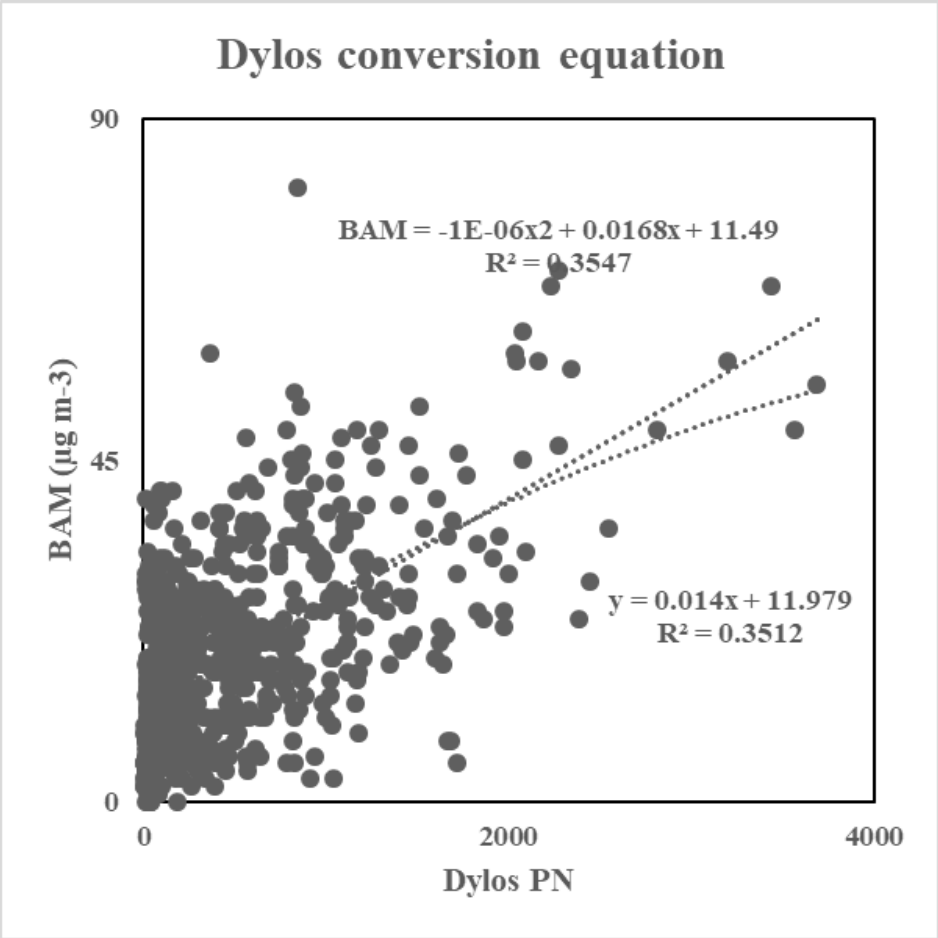


Figure S2. Laboratory test scatter plots showing candidate instrument $PM_{2.5}$ mass concentrations as a function of reference BAM mass concentrations. .

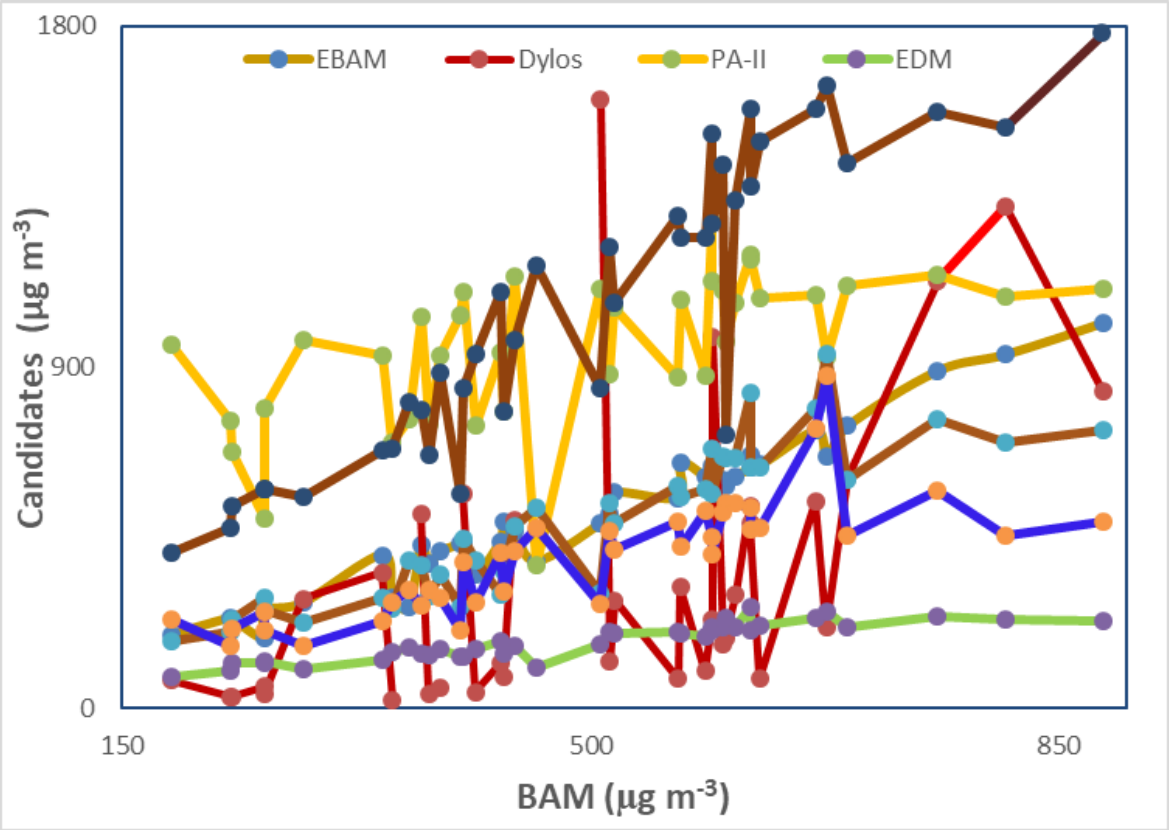
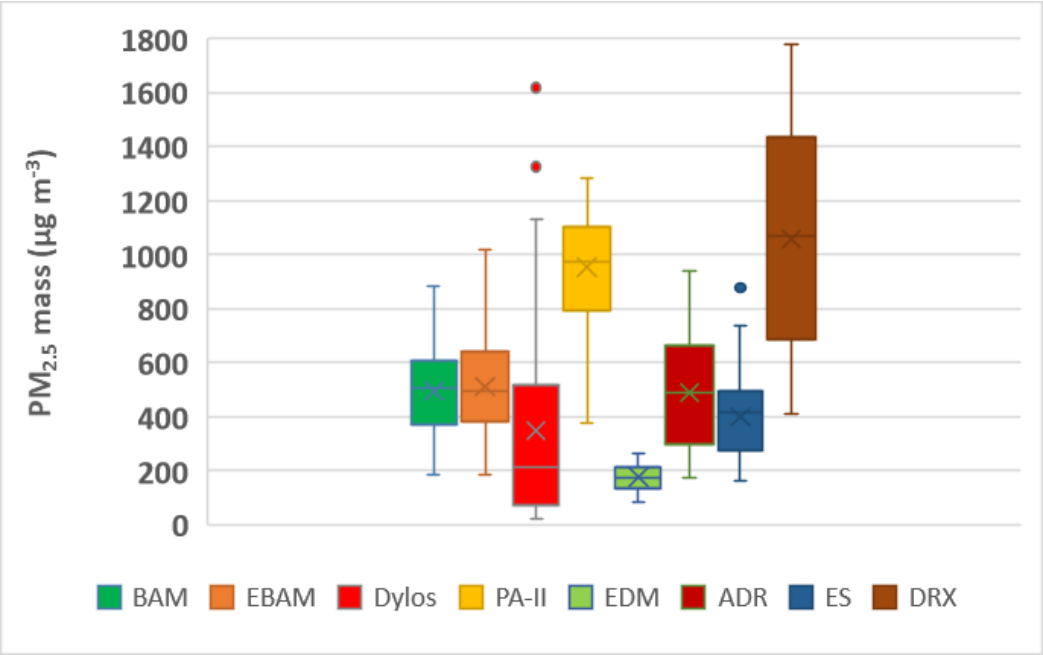


Figure S3. Box plots summarizing the $PM_{2.5}$ mass concentrations measured with the different instruments.



These box plots consist of whiskers (lines) and boxes. The lower end of a whisker represents the minimum value while the upper end represents the highest value. The bottom of the box represents the lower quartile (25%) and the upper end of the box represents the upper quartile (75%). The line in the box represents the median.

Figure S4. Scatter plot of candidates' vs BAM $PM_{2.5}$ mass concentrations for field data

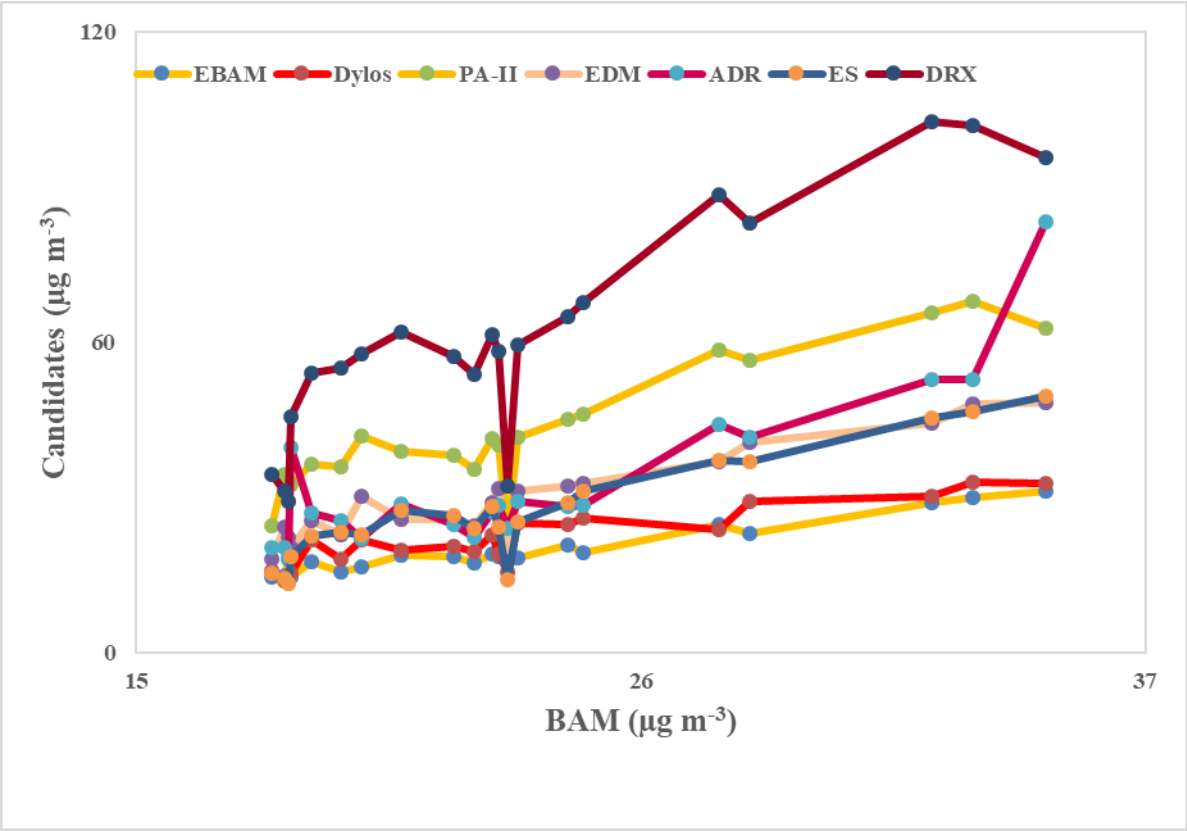


Figure S5. Box plots of $PM_{2.5}$ mass concentrations of field data

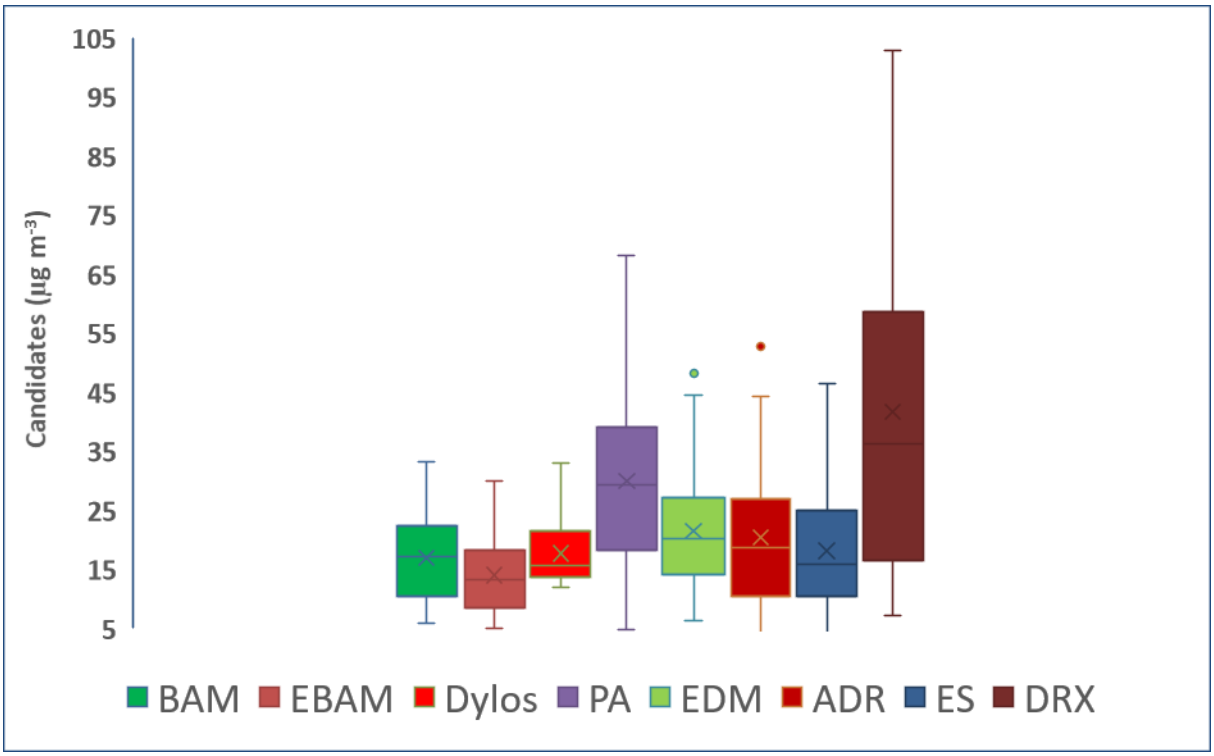


Figure S6. Time-series plots of $PM_{2.5}$ mass concentrations of field data

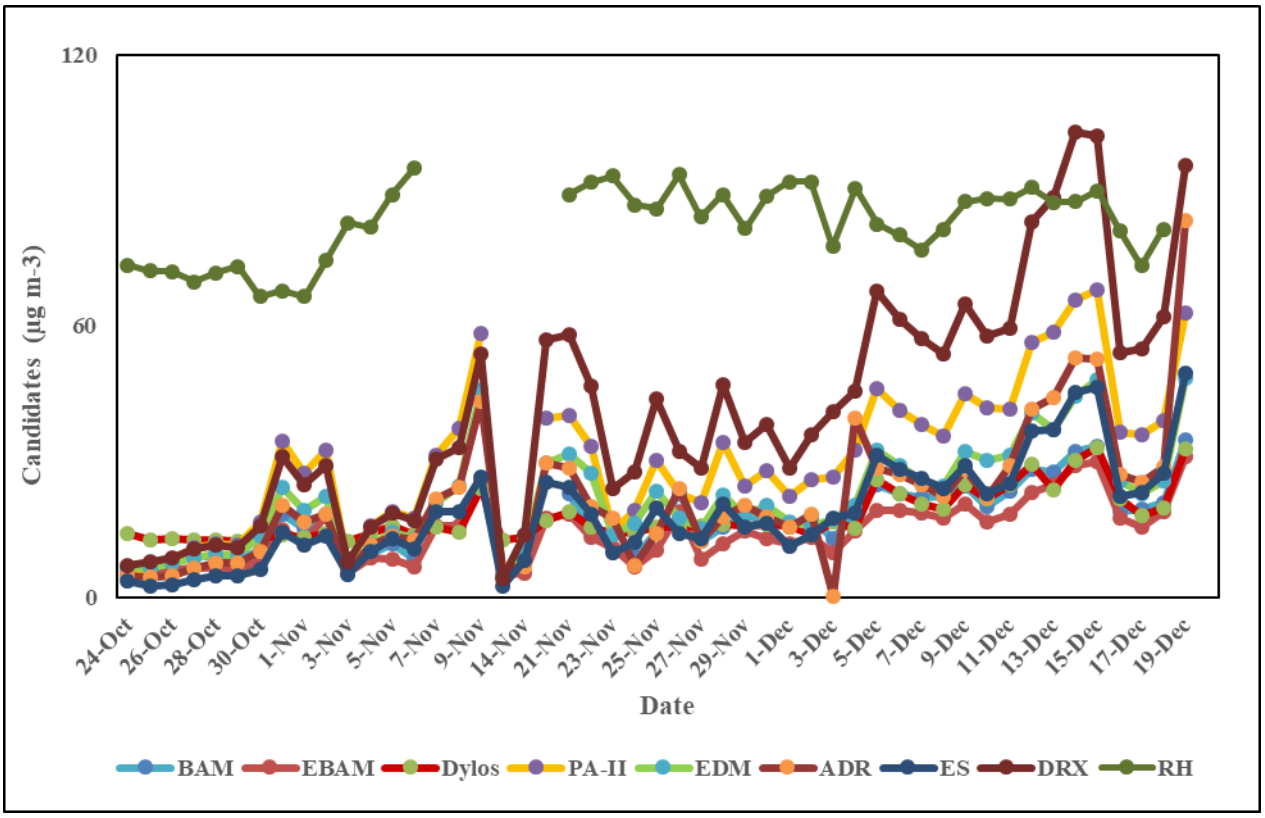


Figure S7. Regression analysis of BAM vs candidate instruments $PM_{2.5}$ mass concentrations for hourly average field data

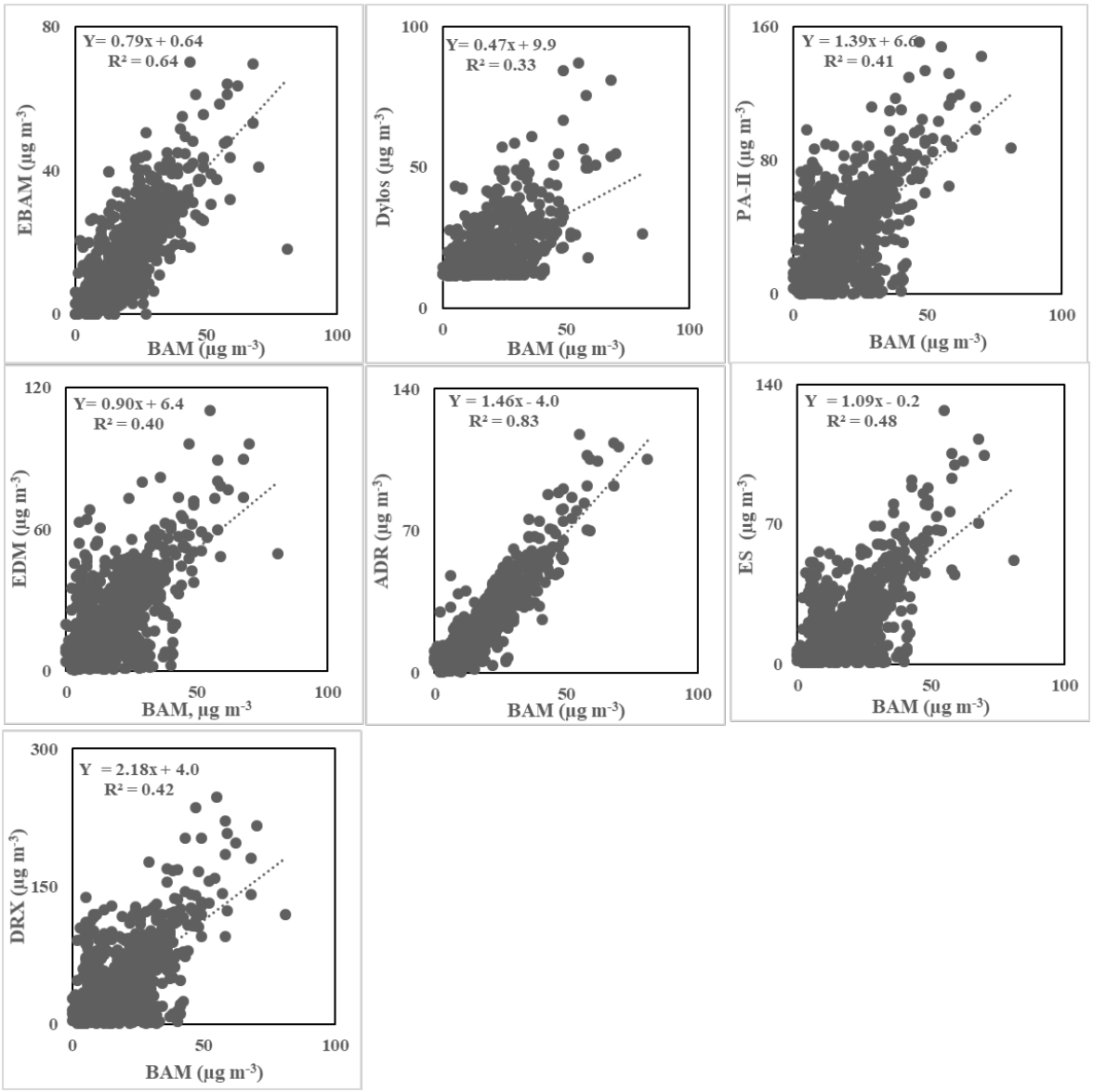


Figure S8 Regression analysis of candidate/BAM ratios of daily average $PM_{2.5}$ mass concentrations as function of temperature (T)

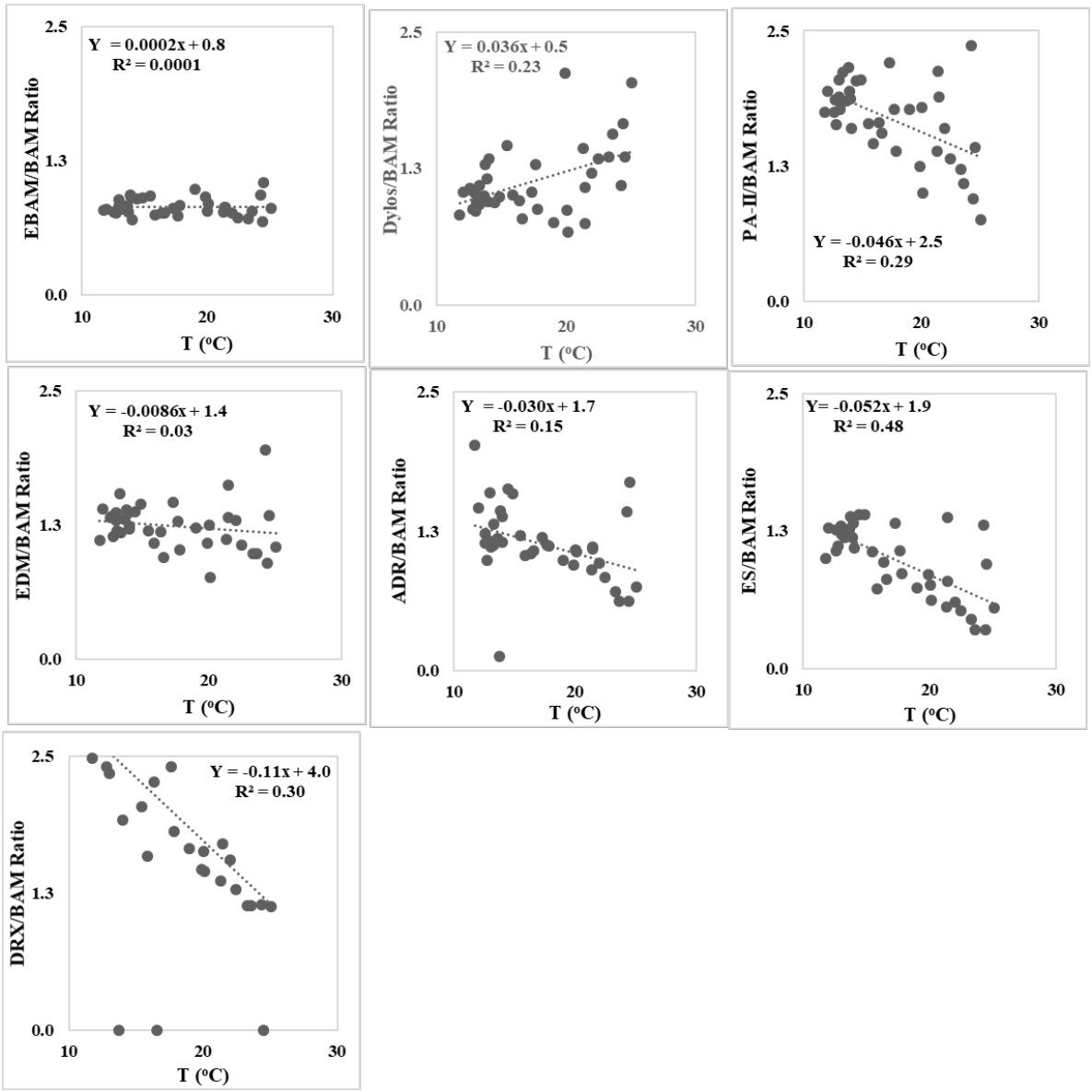


Figure S9(a) Regression analysis of candidate/BAM ratios of daily average $PM_{2.5}$ mass concentrations as function of relative humidity (RH)

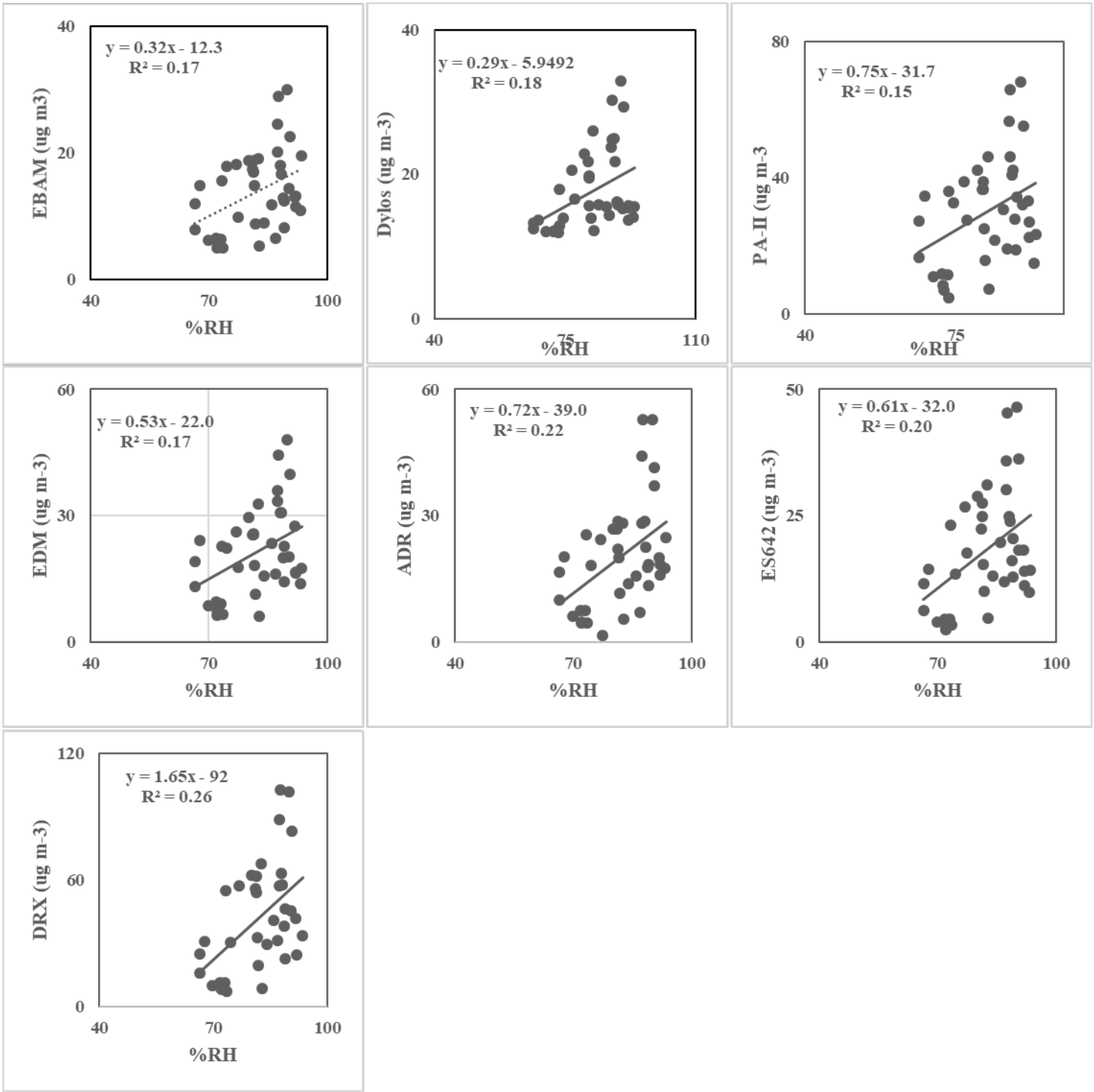
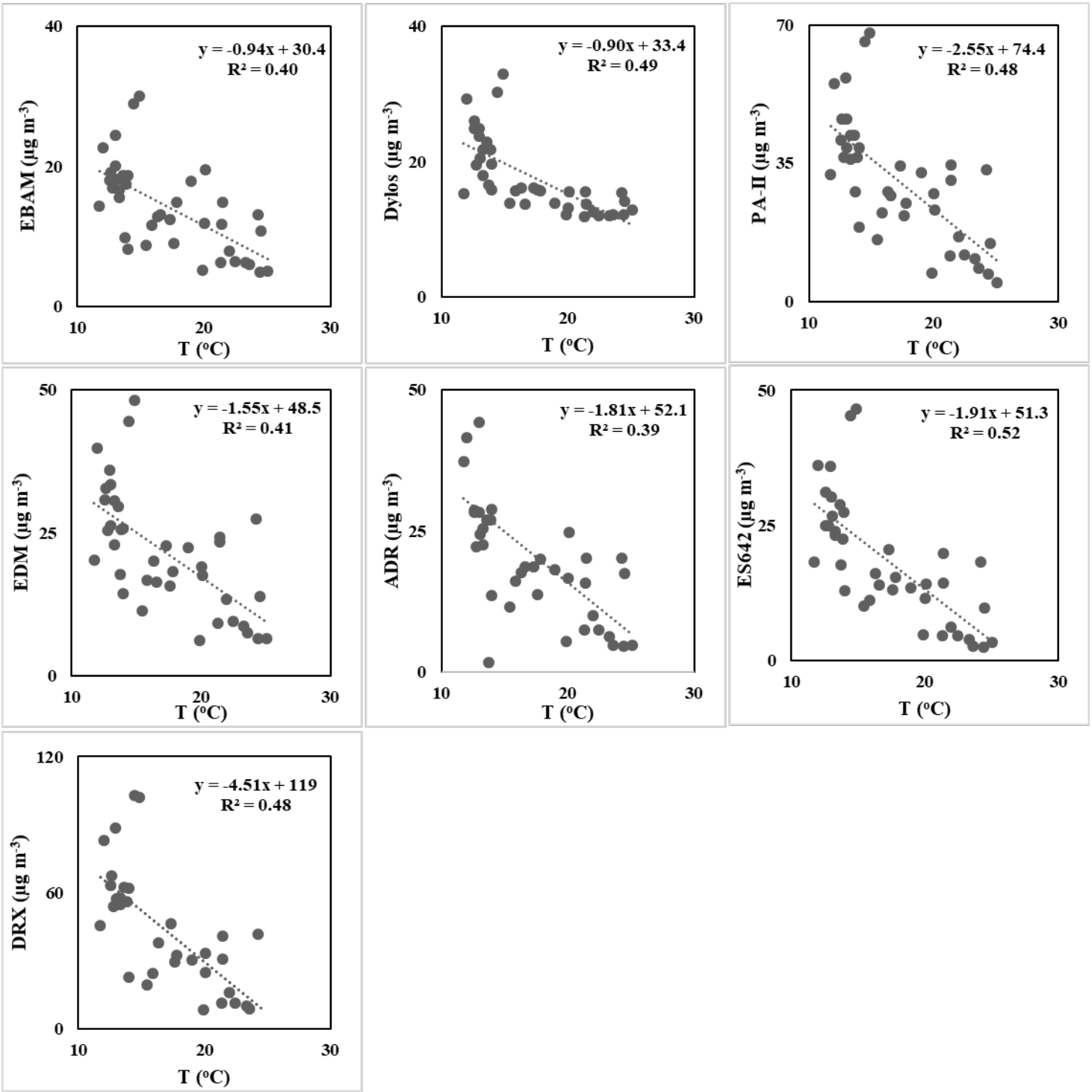


Figure S9(b) Regression analysis of candidate/BAM ratios of daily average $PM_{2.5}$ mass concentrations as function of temperature (T)



Tables

Table S1. Regression analysis of candidate/BAM ratios of hourly $PM_{2.5}$ mass concentrations as function of RH for chamber study

	Slope	Slope/error	Intercept	R^2
RH vs EBAM Ratio	0.005 ± 0.001	4.00	0.82± 0.05	0.335
RH vs Dylos Ratio	0.035 ± 0.004	8.75	-0.82 ± 0.17	0.681
RH vs PA-II Ratio	-0.006 ± 0.010	-0.60	2.36 ± 0.41	0.010
RH vs EDM Ratio	-0.0012 ± 0.001	-1.20	0.47 ± 0.03	0.301
RH vs ADR Ratio	-0.004 ± 0.002	-2.00	1.14 ± .0.09	0.091
RH vs ES642 Ratio	-0.006 ± 0.002	-3.00	108 ± 0.08	0.220
RH vs DRX Ratio	-0.010 ± 0.003	-3.33	2.53 ± 0.14	0.178

Table S2. Effect of PM mass concentrations on candidate instruments performances for chamber study

	Slope	Slope/error	Intercept	R^2
BAM vs EBAM Ratio	2.58E-04 ± 9.69E-05	2.66	0.89 ± 0.06	0.16
BAM vs Dylos Ratio	0.0011 ± 0.0007	1.57	0.10 ± 0.35	0.08
BAM vs PA-II Ratio	-0.0027 ± 0.0004	-6.75	3.37 ± 0.21	0.55
BAM vs EDM Ratio	-0.00022 ± 4E-05	-5.50	0.48 ± 0.02	0.43
BAM vs ADR Ratio	0.00023 ± 0.00016	1.44	0.86 ± 0.84	0.05
BAM vs ES642 Ratio	-0.0015 ± 0.00017	-8.82	0.89 ± 0.09	0.02
BAM vs DRX Ratio	7.87E-05 ± 2.85E-04	0.28	2.10 ± 0.15	0.002

Table S3. Hourly accuracy of candidate instruments using regression analysis for chamber study

	Slope	Intercept	R^2
		μg m^{-3}	
BAM vs EBAM	1.17 ± 0.04	-67.2 ± 21.9	0.95
BAM vs Dylos	1.22± 0.33	-252± 174	0.29
BAM vs PA-II	0.67± 0.16	622 ± 81.8	0.33
BAM vs EDM	0.26 ± 0.02	47.5 ± 10.7	0.82
BAM vs ADR	1.07 ± 0.09	-40.3 ± 45.6	0.80
BAM vs ES642	0.73 ± 0.09	39.6 ± 48.4	0.62
BAM vs DRX	2.16 ± 0.15	-7.0 ± 79.2	0.84

Table S4. Regression analysis of EC/OC vs candidate/BAM ratio using hourly average chamber study

	Slope ± std. error	Slope/std. error	Intercept ± std. error	R^2
EC/OC vs EBAM/BAM	0.0046 ± 0.0023	2.0	0.939 ± 0.036	0.10
EC/OC vs Dylos/BAM	0.018 ± 0.018	1.0	0.436 ± 0.276	0.03
EC/OC vs Purple Air/BAM	-0.029 ± 0.016	-1.8	2.475 ± 0.240	0.09
EC/OC vs EDM/BAM	-0.0042 ± 0.0011	-3.7	0.419 ± 0.017	0.28
EC/OC vs ADR/BAM	-0.0072 ± 0.0034	-2.1	1.05 ± 0.05	0.11
EC/OC vs ES-642ES/BAM	-0.0095 ± 0.0033	-2.9	0.922 ± 0.050	0.20
EC/OC vs DRX/BAM	-0.018 ± 0.006	-3.0	2.33 ± 0.09	0.21

Table S5. Regression analysis of replicate candidate instruments at different averaging time for field data

	Slope	Intercept	R^2
Minute-Average		μg m^{-3}	
Dylos1 vs Dylos2	0.82 ± 0.00	2.20 ± 0.01	0.93
Purple Air1 vs Purple Air2	0.91 ± 0.00	1.27 ± 0.05	0.92
EDM1 vs EDM2	1.22 ± 0.00	0.08 ± 0.05	0.81
ADR1 vs ADR2	0.82 ± 0.00	3.70 ± 0.09	0.67
ES642-1 vs ES642-2	1.00 ± 0.00	0.32 ± 0.03	0.94
DRX1 vs DRX2	0.28 ± 0.00	1.90 ± 0.01	0.97
Hourly-Average			
EBAM1 vs EBAM2	0.89 ± 0.01	2.08 ± 0.29	0.83
Dylos1 vs Dylos2	0.85± 0.01	2.32 ± 0.13	0.97
Purple Air1 vs Purple Air2	0.94 ± 0.00	0.01 ± 0.09	0.99
EDM1 vs EDM2	1.28 ± 0.01	-1.10 ± 0.29	0.93
ADR1 vs ADR2	0.95 ± 0.02	2.05 ± 0.50	0.88
ES642-1 vs ES642-2	1.04± 0.00	-0.03 ± 0.06	0.996
DRX1 vs DRX2	0.29± 0.00	2.18 ± 0.09	0.99
Daily-Average			
EBAM1 vs EBAM2	0.95 ± 0.03	0.81 ± 0.42	0.97
Dylos1 vs Dylos2	0.88 ± 0.02	1.34 ± 0.4	0.97
Purple Air1 vs Purple Air2	0.95 ± 0.01	-0.26 ± 0.13	0.999
EDM1 vs EDM2	1.29 ± 0.03	-1.33± 0.73	0.97
ADR1 vs ADR2	0.98 ± 0.02	1.03 ± 0.57	0.98
ES642-1 vs ES642-2	1.04 ± 0.01	-0.13 ± 0.21	0.997
DRX1 vs DRX2	0.31 ± 0.00	1.47 ± 0.12	0.998

Table S6. Regression analysis of BAM vs candidate instruments for field study

Averaging Time	Slope	Intercept	R^2
Hourly Average		μg m^{-3}	
BAM vs EBAM	0.79 ± 0.02	0.7 ± 0.4	0.64
BAM vs Dylos	0.47 ± 0.02	9.9 ± 0.5	0.33
BAM vs Purple Air	1.39 ± 0.06	6.6 ± 1.2	0.41
BAM vs EDM	0.90 ± 0.04	6.4 ± 0.8	0.40
BAM vs ADR	1.46 ± 0.02	-4.0 ± 0.5	0.83
BAM vs ES642	1.09 ± 0.04	-0.2 ± 0.8	0.48
BAM vs DRX	2.18 ± 0.09	4.1 ± 1.9	0.42
Daily Average			
BAM vs EBAM	0.88 ± 0.03	-0.9 ± 0. 5	0.97
BAM vs Dylos	0.69 ± 0.06	6 ± 1	0.80
BAM vs Purple Air	2.1 ± 0.1	-5 ±2	0.91
BAM vs EDM	1.36± 0.08	-1.5 ± 1.5	0.88
BAM vs ADR	1.64 ± 0.1	-7.4 ± 2	0.87
BAM vs ES642	1.48 ± 0.09	-6.8 ± 1.6	0.88
BAM vs DRX	3.4 ± 0.2	-16 ± 4	0.88

Table S7. Effect of $PM_{2.5}$ mass concentrations on candidate instruments performances for field study

	Slope	Slope/error	Intercept	R^2
BAM vs EBAM Ratio	0.0029 ± 0.002	1.5	0.77 ± 0.03	0.07
BAM vs Dylos Ratio	-0.033 ± 0.005	-6.6	1.70 ± 0.09	0.52
BAM vs PA-II Ratio	0.026 ± 0.007	3.7	1.26 ± 0.13	0.24
BAM vs EDM Ratio	0.0036 ± 0.0005	7.2	1.15 ± 0.09	0.04
BAM vs ADR Ratio	0.027 ± 0.006	4.5	0.67 ± 0.11	0.32
BAM vs ES642 Ratio	0.027 ± 0.006	4.5	0.54 ± 0.11	0.35
BAM vs DRX Ratio	0.072 ± 0.017	4.2	0.86 ± 0.32	0.31

Table S8. Regression analysis of candidate/BAM ratios of daily average $PM_{2.5}$ mass concentrations as a function of RH or temperature for field data..

	Slope ± std. error	Slope /error	P-Value	Intercept ± std. error	R^2
RH vs EBAM/BAM	0.0025 ± 0.0015	1.6	0.11	0.61 ± 0.13	0.07
RHin vs EBAM/BAM*	0.0039 ± 0.0059	0.7	0.51	0.72 ± 0.17	0.01
RH vs Dylos/BAM	-0.0095 ± 0.0064	-1.5	0.14	1.9 ± 0.5	0.06
RH vs Purple Air/BAM	0.014 ± 0.007	2.0	0.05	0.51 ± 0.58	0.10
RH vs EDM/BAM	0.0082 ± 0.004	1.8	0.07	0.58 ± 0.36	0.08
RH vs ADR/BAM	0.022 ± 0.006	4.8	0.00	-0.62 ± 0.47	0.27
RH vs ES/BAM	0.021 ± 0.005	3.8	0.00	-0.70 ± 0.45	0.28
RH vs DRX/BAM	0.036 ± 0.017	2.1	0.07	-0.6 ± 1.4	0.08
T vs EBAM/BAM	0.0002 ± 0.003	0.1	0.95	0.82 ± 0.05	0.0001
T vs Dylos/BAM	0.036 ± 0.011	3.2	0.00	0.5 ± 0.2	0.23
T vs Purple Air/BAM	-0.046 ± 0.012	-3.9	0.00	2.5 ± 0.2	0.29
T vs EDM/BAM	-0.0085 ± 0.0081	-1.1	0.30	1.39 ± 0.14	0.03
T vs ADR/BAM	-0.030 ± 0.012	-2.5	0.02	1.7 ± 0.2	0.15
T vs ES/BAM	-0.052 ± 0.009	-5.9	0.00	1.88 ± 0.16	0.48
T vs DRX/BAM	-0.11 ± 0.03	-4.0	0.00	4.0 ± 0.5	0.3

*Calculated using Internal EBAM RH