

Supplementary Material

Mobile Aerosol Measurement in the Eastern Mediterranean – A Utilization of Portable Instruments

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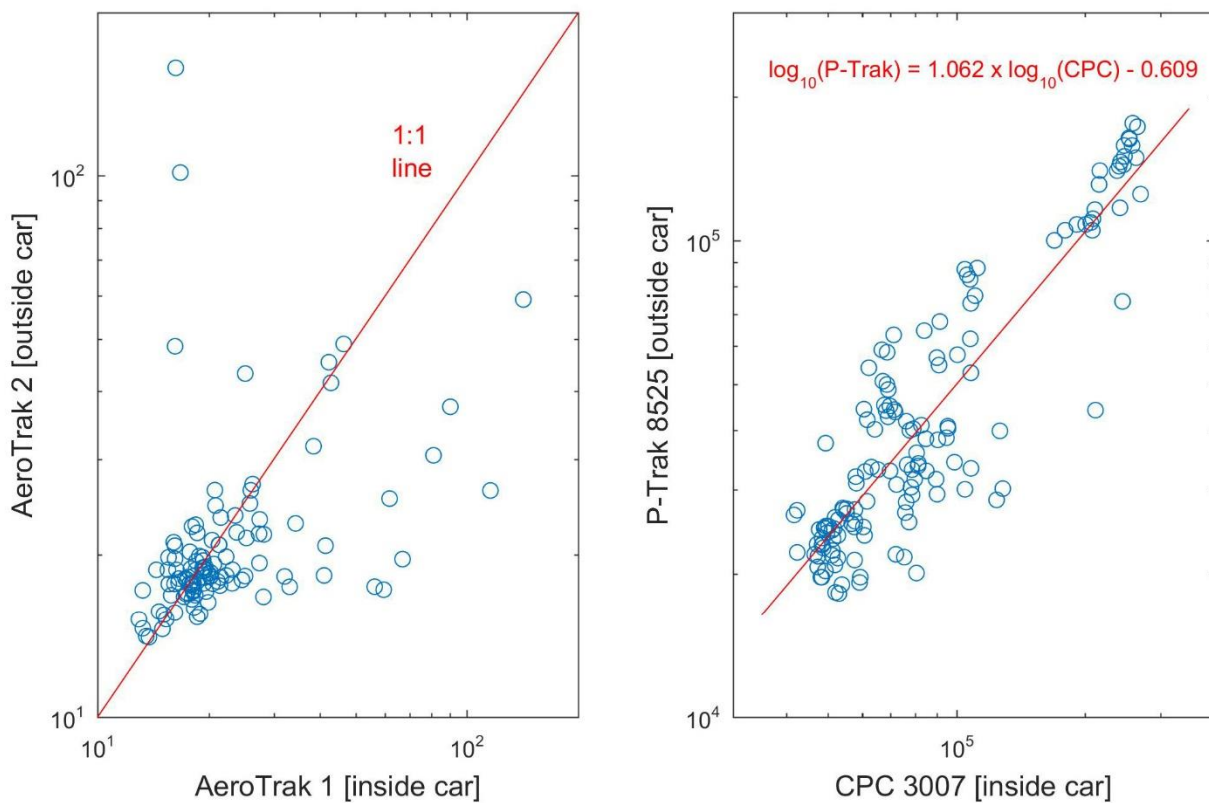


Fig. S1. A comparison between the instruments inside the car (CPC 3007 and AeroTrak 1) and the ones outside the car (P-Trak and AeroTrak 2) during a session performed nearby the campus of the University of Jordan. These plots illustrate the reliability of the simple “mobile setup” representing the “outside car” particle number concentrations

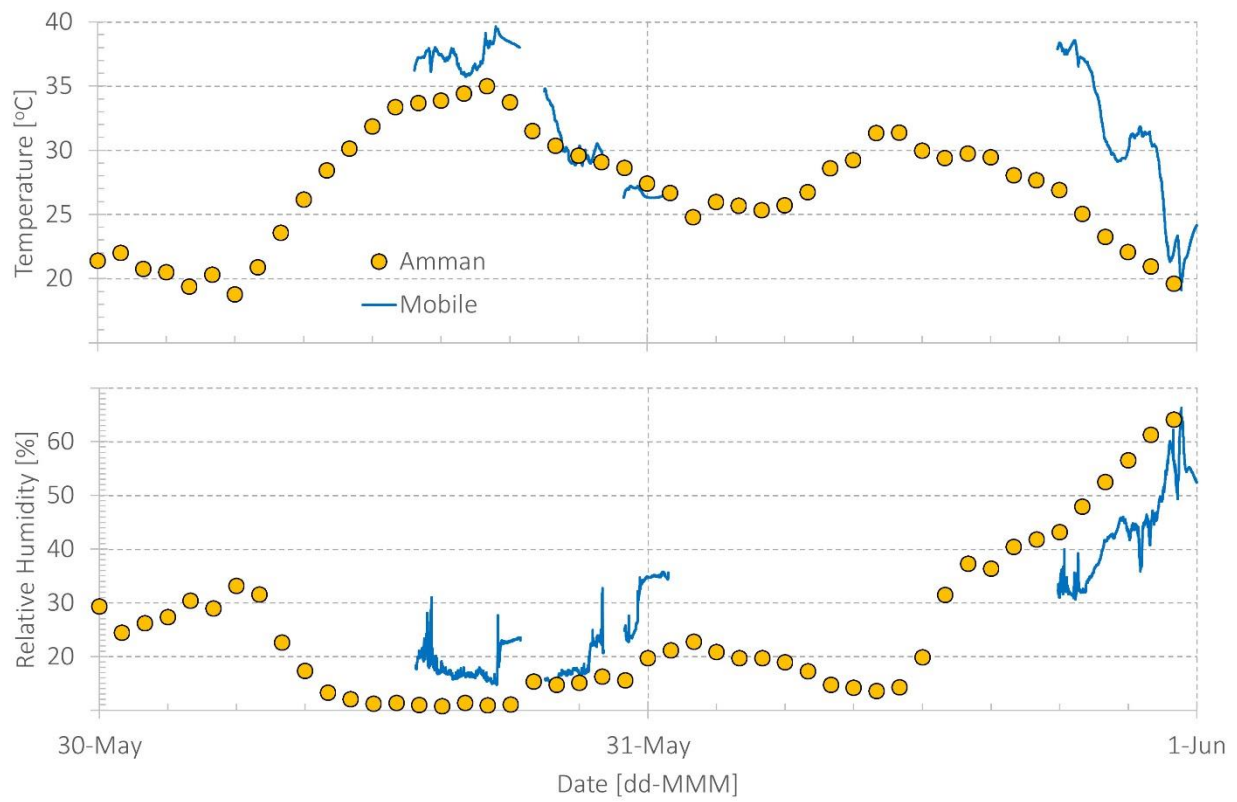


Fig. S2. Ambient conditions (temperature and relative humidity) comparison between the mobile measurement and Amman.

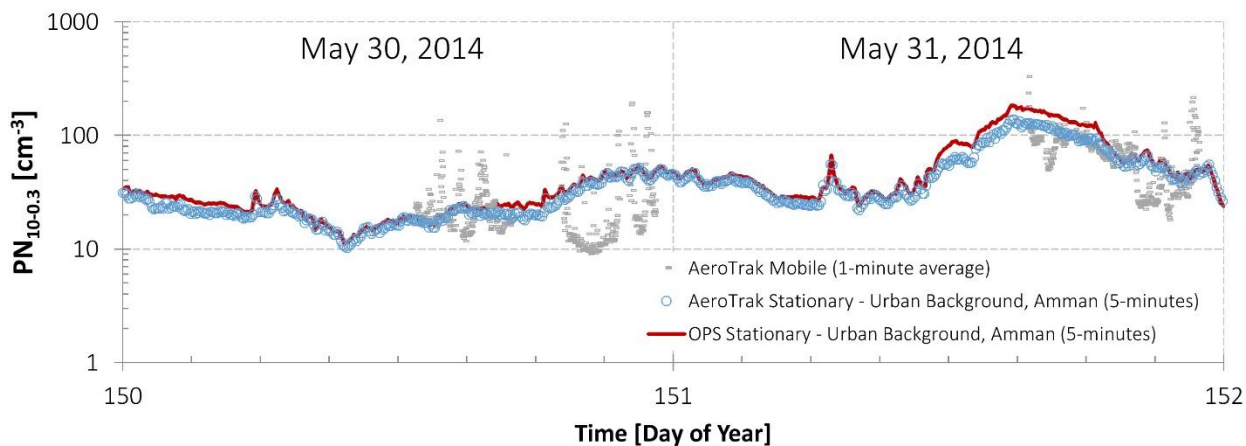


Fig. S3. Particle number concentrations (diameter range 0.3–10 μm) measured with the OPS and the AeroTrak at the stationary site (urban background, Amman) and compared to the measured concentrations with an AeroTrak operated on the mobile setup. *Both AeroTrak concentrations were averaged to 1-minute. The number concentrations were calculated by integrating the measured particle number size distribution over the measured particle size range 0.3–10 μm .*

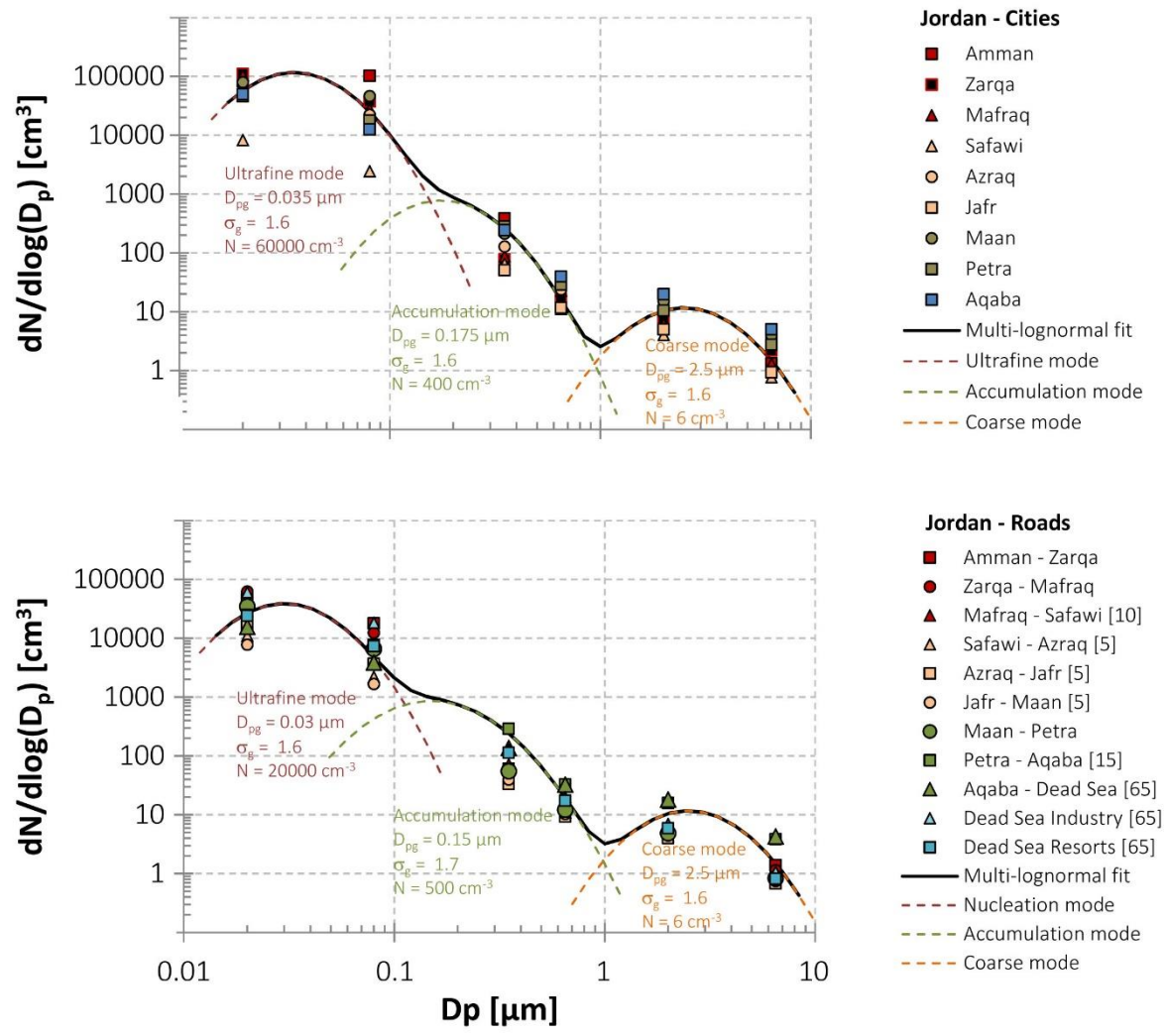


Fig. S4. Average particle number size distributions derived from the merge of the three instruments: CPC, P-Trak and AeroTrak: (a) average across cities and (b) average along main roads.

Table S1. Particle number concentrations (cm^{-3}) in different size fractions measured across the cities.

	Time Period	Size fraction	Mean	Std	25%	median	75%	#
Zarqa	13:42–14:51	10–25 nm	43748.8	26078.4	26447.0	38818.9	61866.1	67
	May 30	25–300 nm	40502.7	30597.1	21130.8	31203.2	53021.2	63
		300–1000 nm	22.2	18.4	12.8	15.7	25.8	65
		10–1000 nm	82158.1	51003.1	46943.1	72695.5	108108.7	69
		1–10 μm	4.1	1.4	3.1	3.7	4.6	65
		2.5–10 μm	1.3	0.7	0.9	1.1	1.5	65
Mafraq	15:13–15:29	10–25 nm	41337.5	24451.0	22274.2	32853.0	63869.1	16
	May 30	25–300 nm	29819.8	17566.4	13989.6	27908.9	39326.8	16
		300–1000 nm	26.1	10.2	20.8	23.3	25.7	16
		10–1000 nm	71186.7	41084.7	36501.7	62389.9	104048.6	16
		1–10 μm	3.3	0.4	3.0	3.1	3.4	16
		2.5–10 μm	0.8	0.1	0.7	0.7	0.8	16
Safawi	16:30–16:44	10–25 nm	3304.1	3557.3	1325.2	1863.4	3397.0	15
	May 30	25–300 nm	2626.6	2876.3	1563.5	1793.1	2482.2	15
		300–1000 nm	17.8	12.7	14.4	14.6	14.8	15
		10–1000 nm	5950.6	6256.2	2890.4	3575.2	5945.2	15
		1–10 μm	2.1	0.3	1.9	2.0	2.1	15
		2.5–10 μm	0.5	0.1	0.4	0.4	0.5	15
Azraq	17:16–19:21	10–25 nm	29379.0	23212.8	11731.1	23168.1	37864.1	28
	May 30	25–300 nm	23916.6	19608.0	9086.3	15596.4	41318.2	20
		300–1000 nm	35.6	30.0	13.8	23.6	47.2	21
		10–1000 nm	58108.5	39521.3	23395.0	50140.8	81989.9	29
		1–10 μm	6.5	6.8	2.9	4.0	8.0	21
		2.5–10 μm	2.2	2.9	0.6	0.9	3.3	21
Jafr	20:56–21:16	10–25 nm	18778.6	24935.6	2955.5	12883.0	22471.6	21
	May 30	25–300 nm	13780.2	20958.9	2835.3	7864.4	12878.3	21
		300–1000 nm	14.7	11.0	9.7	10.4	13.6	21
		10–1000 nm	32576.1	44584.4	5857.5	23515.9	31776.6	21
		1–10 μm	2.6	1.0	2.1	2.2	2.6	21
		2.5–10 μm	0.6	0.4	0.4	0.5	0.5	21
Ma'an	21:27–22:12	10–25 nm	31561.0	28369.8	14221.3	16378.6	46350.9	38
	May 30	25–300 nm	50087.3	39426.4	21448.4	42005.8	70777.8	21
		300–1000 nm	57.8	41.0	25.2	40.4	82.4	21
		10–1000 nm	61135.3	57075.5	24810.7	29613.0	95564.6	41
		1–10 μm	8.4	11.6	3.5	4.4	6.6	21
		2.5–10 μm	2.4	3.4	0.9	1.2	2.1	21
Petra	22:35–23:10	10–25 nm	18289.6	15307.3	5226.5	14551.9	25386.9	66
	May 30	25–300 nm	19268.2	19614.5	5039.1	12042.7	26658.8	66
		300–1000 nm	71.3	55.0	22.7	78.3	96.4	66
		10–1000 nm	37845.4	33965.0	10425.9	27806.9	56000.8	66
		1–10 μm	5.8	2.9	3.3	4.8	8.3	66
		2.5–10 μm	1.7	0.9	0.8	1.4	2.5	66
Aqaba	17:43–19:06	10–25 nm	19808.1	17971.7	7235.4	14082.3	28011.4	84
	May 31	25–300 nm	13554.8	12298.7	4866.9	9237.7	20024.6	84
		300–1000 nm	66.3	16.7	55.2	63.2	71.8	84
		10–1000 nm	33440.3	29080.2	11844.8	23847.1	46031.7	84

		1–10 μm	10.9	1.9	9.7	10.6	11.7	84
		2.5–10 μm	3.0	0.8	2.5	2.9	3.2	84
Amman	22:24–23:17	10–25 nm	32961.9	32741.1	26956.3	35083.4	51227.5	54
	May 31	25–300 nm	110790.1	63374.2	63735.5	120240.4	143980.4	27
		300–1000 nm	95.5	48.5	59.6	87.2	121.7	27
		10–1000 nm	119728.5	57298.8	64790.5	116380.2	173566.8	54
		1–10 μm	4.1	0.8	3.4	4.1	4.5	27
		2.5–10 μm	0.8	0.2	0.6	0.8	0.9	27

Table S2. Particle number concentrations (cm^{-3}) in different size fractions measured over the main roads.

Road Section	Time Period	Size fraction	Mean	Std	25%	median	75%	#
Amman–Zarqa	13:11–13:40	10–25 nm	18588.0	12824.0	9429.1	15032.3	19131.7	28
		May 30	25–300 nm	19285.4	11701.8	11363.9	16271.4	20832.7
	May 30	300–1000 nm	17.2	4.5	14.3	15.0	18.8	28
		10–1000 nm	37893.5	24185.9	21615.9	32853.3	38819.1	28
		1–10 μm	2.9	0.4	2.6	2.8	3.2	28
		2.5–10 μm	0.8	0.3	0.7	0.7	1.0	28
Zarqa–Mafraq	14:52–15:11	10–25 nm	24734.6	7330.5	20979.2	23133.2	27733.3	20
		May 30	25–300 nm	13381.6	2671.0	12339.2	14019.7	15131.1
	May 30	300–1000 nm	11.5	1.4	10.5	11.0	12.7	20
		10–1000 nm	38130.5	9562.6	32724.1	37350.5	42409.7	20
		1–10 μm	2.7	0.2	2.6	2.7	2.8	20
		2.5–10 μm	0.7	0.1	0.6	0.7	0.7	20
Mafraq–Safawi	15:34–16:29	10–25 nm	11666.3	9606.1	3934.9	7903.6	18012.1	56
		May 30	25–300 nm	7823.5	6669.8	2954.4	5794.6	11253.4
	May 30	300–1000 nm	21.3	10.7	13.0	18.9	25.1	56
		10–1000 nm	19513.9	15426.9	6891.3	14348.1	28826.5	56
		1–10 μm	2.6	0.5	2.2	2.6	3.0	56
		2.5–10 μm	0.6	0.2	0.5	0.6	0.7	56
Safawi–Azraq	16:45–17:15	10–25 nm	4383.4	5244.6	1177.2	1783.8	6225.1	31
		May 30	25–300 nm	2367.3	1671.3	1348.1	1474.4	3562.8
	May 30	300–1000 nm	15.4	1.6	14.6	15.0	15.8	10
		10–1000 nm	7099.7	7502.5	2495.6	3350.6	9293.1	31
		1–10 μm	2.3	0.2	2.1	2.3	2.4	10
		2.5–10 μm	0.6	0.1	0.5	0.6	0.6	10
Azraq–Jafr	19:22–20:55	10–25 nm	6462.2	7319.5	2008.8	3040.7	8233.7	94
		May 30	25–300 nm	4003.6	5103.8	1115.7	2785.7	4667.0
	May 30	300–1000 nm	10.2	6.0	8.1	8.9	9.7	94
		10–1000 nm	10478.0	11823.8	3059.4	5761.4	14908.7	94
		1–10 μm	2.0	0.3	1.8	2.0	2.2	94
		2.5–10 μm	0.4	0.1	0.3	0.4	0.4	94
Jafr–Ma'an	21:17–21:26	10–25 nm	3096.0	3170.6	911.4	1729.8	3938.6	10
		May 30	25–300 nm	1811.1	1579.0	652.5	1247.0	1911.7
	May 30	300–1000 nm	11.9	1.8	10.1	11.7	13.6	10
		10–1000 nm	4921.2	4721.2	1575.7	2968.1	5821.4	10
		1–10 μm	2.2	0.2	2.1	2.3	2.3	10
		2.5–10 μm	0.4	0.0	0.4	0.4	0.5	10
Ma'an–Petra	22:13–22:34	10–25 nm	13823.1	15201.1	2860.8	7453.1	18649.8	22
		May 30	25–300 nm	7158.2	10383.4	2196.4	3724.8	6362.2
	May 30	300–1000 nm	15.9	6.7	12.7	14.5	16.2	22
		10–1000 nm	20999.7	24469.0	5332.2	11337.3	30096.0	22
		1–10 μm	2.4	0.5	2.1	2.3	2.5	22
		2.5–10 μm	0.5	0.1	0.4	0.5	0.6	22
Petra–Aqaba	15:52–17:03	10–25 nm	9885.0	12359.8	1779.9	4394.0	14766.0	66
		May 31	25–300 nm	8307.1	9477.0	2896.1	4118.1	10482.6
	May 31	300–1000 nm	73.9	18.7	57.5	78.2	85.1	62

		10–1000 nm	17963.1	20053.0	4594.3	9671.7	26007.6	66
		1–10 μm	8.7	1.0	7.9	8.8	9.1	62
		2.5–10 μm	2.3	0.4	2.1	2.2	2.4	62
Aqaba–Dead Sea	19:07–20:58	10–25 nm	6195.2	9862.8	1562.4	2176.8	5822.5	110
	May 31	25–300 nm	4163.0	5007.8	2080.9	2419.1	3855.7	110
		300–1000 nm	39.9	17.3	22.9	39.5	54.3	110
		10–1000 nm	10408.0	14462.2	3756.8	4652.0	9577.7	110
		1–10 μm	9.8	8.5	3.2	8.5	12.4	110
		2.5–10 μm	2.6	2.6	0.6	2.1	3.6	110
Dead Sea Industry	20:59 -21:54	10–25 nm	23987.9	22303.5	7170.9	17342.5	30133.4	56
	May 31	25–300 nm	19745.8	24243.5	5092.5	9642.6	22249.6	56
		300–1000 nm	34.2	19.5	23.2	27.2	39.2	56
		10–1000 nm	43771.3	44023.9	12292.1	28427.1	55247.1	56
		1–10 μm	3.4	0.9	2.9	3.2	3.8	56
		2.5–10 μm	0.6	0.3	0.5	0.6	0.7	56
Dead Sea Resorts	21:55–22:23	10–25 nm	9596.3	11208.5	3565.3	5834.1	11521.1	29
	May 31	25–300 nm	7941.2	7863.9	4001.9	5017.7	7357.9	29
		300–1000 nm	30.5	4.5	27.2	28.9	32.9	29
		10–1000 nm	17570.9	18591.3	7459.1	11976.1	17148.5	29
		1–10 μm	2.8	0.3	2.6	2.7	3.0	29
		2.5–10 μm	0.5	0.1	0.4	0.5	0.5	29

Table S3. Particulate mass and black carbon concentrations ($\mu\text{g}/\text{m}^3$) in different size fractions measured across the cities.

	Time Period	Size fraction	Mean	Std	25%	median	75%	#
Zarqa	13:42–14:51	PM ₁	46.1	27.1	31.5	36.7	53.3	67
		PM _{2.5}	49.8	27.9	34.4	40.3	57.3	67
	May 30	PM ₁₀	94.3	53.7	60.9	77.0	108.9	67
		PM _{10-2.5}	44.5	32.1	27.7	35.8	50.8	67
		PM ₁₀₋₁	48.1	33.2	31.5	39.7	54.2	67
		BC	12.3	27.1	1.1	2.3	9.3	69
Mafraq	15:13–15:29	PM ₁	34.7	13.7	27.0	29.8	34.9	16
		PM _{2.5}	37.9	14.3	30.0	32.9	38.1	16
	May 30	PM ₁₀	57.9	19.6	45.9	51.3	63.2	16
		PM _{10-2.5}	20.1	6.3	15.8	17.5	23.3	16
		PM ₁₀₋₁	23.2	6.9	18.5	20.6	27.0	16
		BC	6.2	13.7	1.9	3.2	8.4	15
Safawi	16:30–16:44	PM ₁	18.2	8.1	15.7	16.0	16.5	15
		PM _{2.5}	20.0	8.5	17.3	17.7	18.4	15
	May 30	PM ₁₀	29.3	10.7	24.2	26.5	28.4	15
		PM _{10-2.5}	9.3	2.7	7.2	8.8	10.1	15
		PM ₁₀₋₁	11.2	3.0	8.9	10.3	12.0	15
		BC	3.4	8.1	0.2	0.3	1.0	10
Azraq	17:16–19:21	PM ₁	83.8	83.4	18.1	56.7	104.9	31
		PM _{2.5}	88.9	85.9	20.8	60.7	112.4	31
	May 30	PM ₁₀	145.0	131.3	36.3	106.7	197.7	31
		PM _{10-2.5}	56.2	68.1	13.2	21.7	80.9	31
		PM ₁₀₋₁	61.2	71.7	15.4	25.0	87.5	31
		BC	31.4	83.4	0.6	8.9	50.6	39
Jafr	20:56–21:16	PM ₁	8.4	7.7	4.6	5.7	8.8	21
		PM _{2.5}	10.3	8.4	6.5	7.0	10.3	21
	May 30	PM ₁₀	18.8	16.6	11.6	13.5	16.6	21
		PM _{10-2.5}	8.5	8.4	5.5	6.0	7.0	21
		PM ₁₀₋₁	10.4	9.0	7.2	7.5	8.8	21
		BC	1.9	7.7	0.3	0.5	4.6	10
Ma'an	21:27–22:12	PM ₁	51.1	81.1	23.3	30.7	50.2	46
		PM _{2.5}	55.8	88.7	26.0	33.7	53.2	46
	May 30	PM ₁₀	111.7	169.8	52.2	74.9	93.8	46
		PM _{10-2.5}	55.9	82.1	26.7	35.4	49.5	46
		PM ₁₀₋₁	60.6	89.6	29.3	38.8	52.5	46
		BC	11.7	81.1	1.5	1.9	7.8	46
Petra	22:35–23:10	PM ₁	52.5	52.8	17.2	57.3	68.2	66
		PM _{2.5}	57.1	54.2	19.5	63.4	75.3	66
	May 30	PM ₁₀	97.8	74.8	40.0	101.7	138.0	66
		PM _{10-2.5}	40.7	26.1	18.8	35.8	60.3	66
		PM ₁₀₋₁	45.3	28.4	21.0	39.0	67.2	66
		BC	4.3	52.8	1.2	1.7	4.2	64
Aqaba	17:43–19:06	PM1	86.7	22.2	74.5	84.0	93.9	84
		PM2.5	96.4	23.7	83.8	93.9	103.9	84
	May 31	PM10	177.9	64.9	141.3	173.0	191.2	84

		PM10-2.5	81.5	42.4	55.7	78.7	89.8	84
		PM10-1	91.2	44.0	64.6	88.5	100.1	84
		BC	4.8	22.2	1.7	2.4	3.8	82
Amman	22:24-23:17	PM ₁	65.5	43.1	40.0	50.7	74.2	54
	May 31	PM _{2.5}	68.8	43.2	43.2	54.5	78.2	54
		PM ₁₀	87.3	42.7	60.7	76.3	95.5	54
		PM _{10-2.5}	18.5	8.3	12.3	16.9	24.0	54
		PM ₁₀₋₁	21.8	8.7	15.3	20.2	27.5	54
		BC	21.3	43.1	2.6	9.8	26.2	54

Table S4. Particulate mass and black carbon concentrations ($\mu\text{g}/\text{m}^3$) in different size fractions measured over the main roads.

Road Section	Time Period	Size fraction	Mean	Std	25%	median	75%	#
Amman–Zarqa	13:11–13:40	PM ₁	24.5	7.8	18.3	23.1	28.2	28
		PM _{2.5}	27.2	8.1	20.8	25.7	31.6	28
	May 30	PM ₁₀	51.3	22.6	35.8	44.1	59.4	28
		PM _{10-2.5}	24.1	15.0	14.0	18.9	28.3	28
		PM ₁₀₋₁	26.8	15.4	16.5	21.3	31.4	28
		BC	2.3	7.8	0.7	0.9	3.0	28
Zarqa–Mafraq	14:52–15:11	PM ₁	22.9	2.4	21.4	21.9	25.0	20
		PM _{2.5}	25.5	2.5	23.8	24.6	27.7	20
	May 30	PM ₁₀	41.9	6.2	37.3	40.2	44.2	20
		PM _{10-2.5}	16.4	4.0	13.8	15.4	17.3	20
		PM ₁₀₋₁	19.0	4.0	16.3	18.0	20.1	20
		BC	1.6	2.4	0.7	0.9	1.7	20
Mafraq–Safawi	15:34–16:29	PM ₁	24.8	8.9	17.6	22.1	29.8	56
		PM _{2.5}	27.3	9.3	19.8	24.4	33.1	56
	May 30	PM ₁₀	42.6	14.6	29.8	39.0	52.7	56
		PM _{10-2.5}	15.3	6.3	10.3	14.7	18.8	56
		PM ₁₀₋₁	17.8	6.7	12.3	17.1	21.4	56
		BC	1.7	8.9	0.4	0.8	1.8	56
Safawi–Azraq	16:45–17:15	PM ₁	18.1	4.3	14.6	16.3	21.0	31
		PM _{2.5}	20.1	4.5	16.6	18.2	23.3	31
	May 30	PM ₁₀	31.0	10.8	23.0	28.0	35.8	31
		PM _{10-2.5}	10.9	6.6	6.4	8.3	14.4	31
		PM ₁₀₋₁	12.9	6.8	8.2	10.2	16.4	31
		BC	2.2	4.3	0.8	1.4	2.5	23
Azraq–Jafr	19:22–20:55	PM ₁	7.4	7.1	4.7	5.6	8.2	94
		PM _{2.5}	9.0	7.2	6.2	7.0	10.0	94
	May 30	PM ₁₀	16.2	10.1	11.5	13.5	17.2	94
		PM _{10-2.5}	7.3	4.7	5.3	6.3	7.2	94
		PM ₁₀₋₁	8.9	4.9	6.7	7.7	9.0	94
		BC	1.7	7.1	0.4	0.5	0.9	78
Jafr–Ma’an	21:17–21:26	PM ₁	5.7	1.0	4.5	6.2	6.3	10
		PM _{2.5}	7.4	1.0	6.3	7.9	8.2	10
	May 30	PM ₁₀	13.4	2.0	11.0	14.2	15.2	10
		PM _{10-2.5}	6.0	1.1	5.2	6.1	6.8	10
		PM ₁₀₋₁	7.7	1.2	6.7	7.8	8.7	10
		BC	0.5	1.0	0.3	0.3	0.5	5
Ma’an–Petra	22:13–22:34	PM ₁	9.0	5.9	5.8	7.4	9.0	22
		PM _{2.5}	10.9	6.2	7.7	9.2	11.0	22
	May 30	PM ₁₀	20.3	10.0	14.7	17.1	20.2	22
		PM _{10-2.5}	9.4	4.3	6.8	8.2	9.2	22
		PM ₁₀₋₁	11.3	4.7	8.5	10.2	11.2	22
		BC	2.0	5.9	0.2	0.4	1.2	19
Petra–Aqaba	15:52–17:03	PM ₁	54.1	15.5	44.5	53.6	58.3	66
		PM _{2.5}	60.5	16.4	50.5	60.1	65.2	66
	May 31	PM ₁₀	97.7	34.9	78.8	91.3	103.5	66

		PM _{10-2.5}	37.2	20.3	25.2	33.1	39.8	66
		PM ₁₀₋₁	43.6	21.2	31.2	39.7	46.5	66
		BC	2.9	15.5	1.3	1.7	2.5	63
Aqaba–Dead Sea	19:07–20:58	PM ₁	54.0	38.2	19.7	53.9	78.0	110
	May 31	PM _{2.5}	61.9	45.2	21.8	61.2	86.7	110
		PM ₁₀	113.4	101.1	29.3	97.4	163.7	110
		PM _{10-2.5}	51.4	56.5	7.0	36.6	75.5	110
		PM ₁₀₋₁	59.4	63.6	9.3	43.6	84.3	110
		BC	1.0	38.2	0.3	0.7	1.0	108
Dead Sea Industry	20:59 -21:54	PM ₁	29.4	16.3	21.4	24.6	30.3	56
	May 31	PM _{2.5}	31.8	16.9	23.3	26.8	33.0	56
		PM ₁₀	42.6	24.7	28.7	35.8	44.2	56
		PM _{10-2.5}	10.8	10.9	5.5	8.8	12.4	56
		PM ₁₀₋₁	13.2	11.6	7.4	11.0	15.1	56
		BC	5.4	16.3	0.3	0.6	1.8	50
Dead Sea Resorts	21:55–22:23	PM ₁	24.5	3.9	21.8	23.8	26.0	29
	May 31	PM _{2.5}	26.5	4.0	23.6	26.2	28.0	29
		PM ₁₀	32.7	6.6	28.3	31.7	34.7	29
		PM _{10-2.5}	6.3	2.9	4.3	5.0	7.2	29
		PM ₁₀₋₁	8.3	3.1	6.2	7.0	9.1	29
		BC	1.3	3.9	0.6	0.7	1.4	29