

Supplementary Material

Black Carbon and Particulate Matter Concentrations in an Eastern Mediterranean Urban Conditions – An Assessment Based on Integrated Stationary and Mobile Observations

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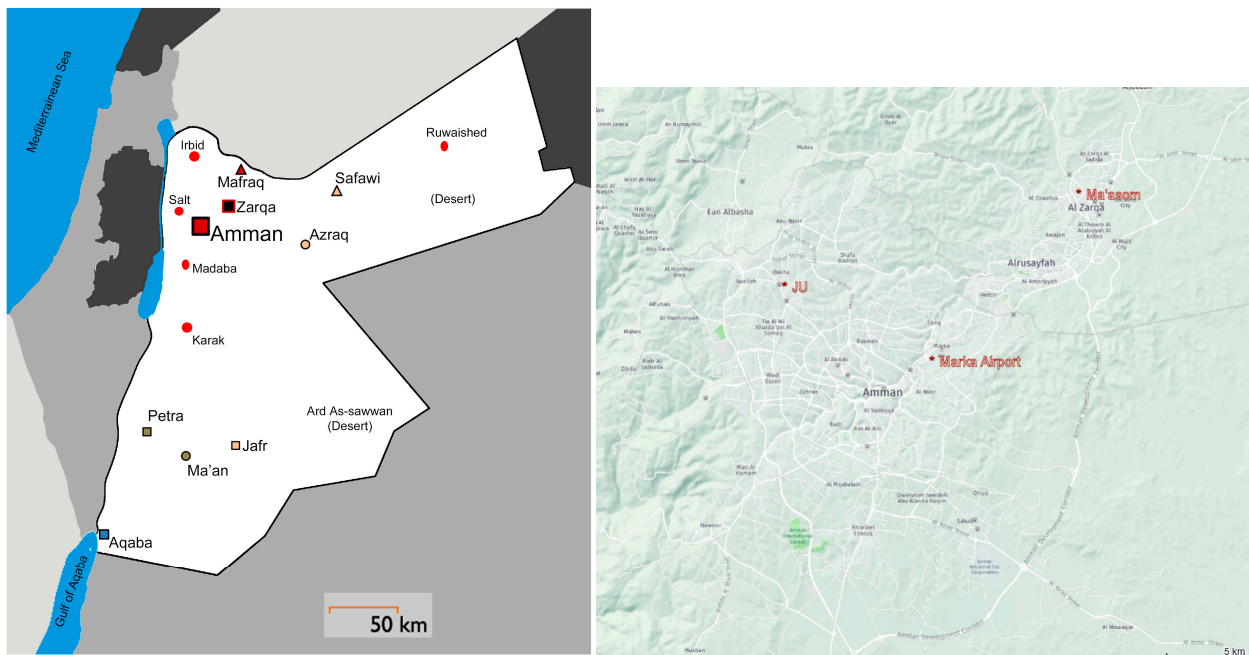


Figure S1: Map of Jordan (left) and map showing Amman and Zarqa city street maps (right).

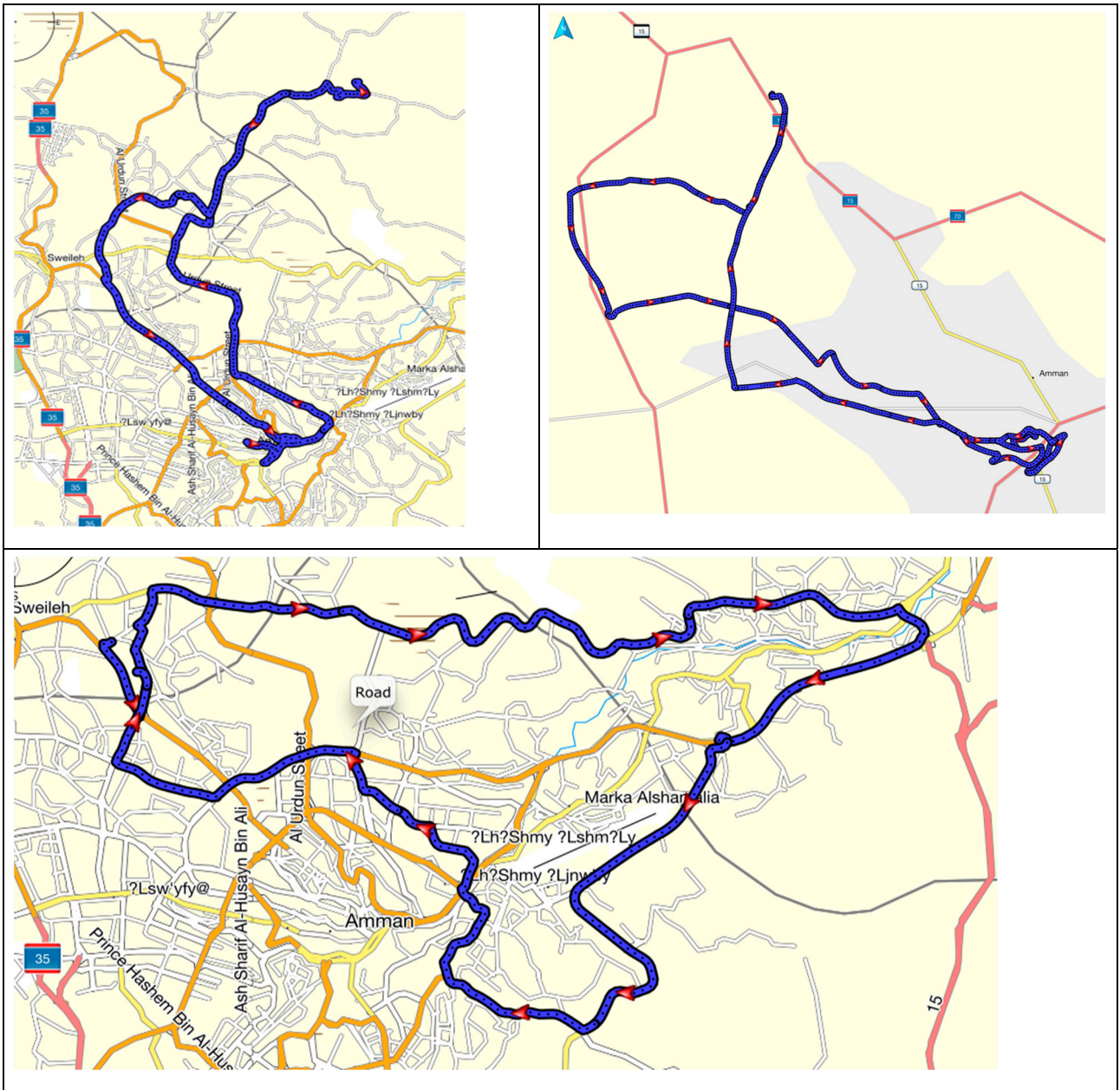


Figure S2: Maps illustrating some of the routes taken during mobile measurements: (a) route made on May 29th driving on Amman main streets, walking in city center, and driving at the background remote location between Amman and Zarqa, (b) route made on June 1st driving on Amman main streets and city center, and (c) route made on June 2nd driving on main roads connecting Amman and Zarqa.

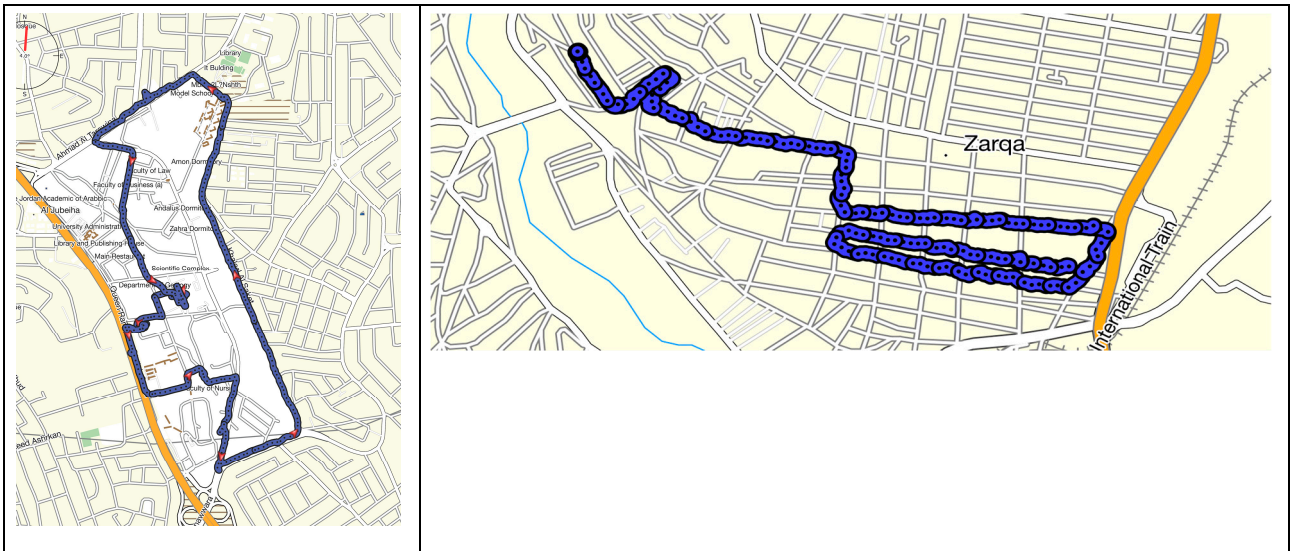


Figure S3: Maps illustrating some walking scenarios: (a) the campus of the University of Jordan on May 29th and June 1st and 2nd and (b) Zarqa streets on June 3rd.

Table S1: Size-fractionated particle number concentrations [cm^{-3}] as measured by the mobile setup during different scenarios.

	Size fraction	Mean	Std	25%	median	75%	#
Remote – Beren (Standing)	10–25 nm	2616.8	1432.4	1965.0	2132.8	2706.5	22
	25–300 nm	4005.0	1048.8	3353.5	3637.9	4382.0	22
	300–1000 nm	18.0	0.7	17.6	17.8	18.7	22
	10–1000 nm	6639.8	2446.9	5354.7	5841.7	7107.8	22
	1–10 μm	5.1	0.6	4.7	4.9	5.5	22
	2.5–10 μm	1.5	0.3	1.2	1.4	1.7	22
Remote – Beren (driving)	10–25 nm	20295.3	16311.1	6378.5	19753.0	27242.6	27
	25–300 nm	30115.7	35467.9	6523.9	16703.3	32799.6	27
	300–1000 nm	22.7	7.0	19.2	20.3	24.0	27
	10–1000 nm	50433.6	49524.6	12511.5	36479.7	63688.6	27
	1–10 μm	5.6	0.7	5.2	5.4	5.8	27
	2.5–10 μm	1.6	0.4	1.4	1.5	1.6	27
JU campus (walking)	10–25 nm	30747.9	19239.2	15941.9	23951.8	39369.8	340
	25–300 nm	48129.5	42282.3	21681.2	31764.1	54820.6	340
	300–1000 nm	45.8	37.2	27.6	35.5	47.9	340
	10–1000 nm	80161.3	54424.5	41274.4	61817.1	99739.8	340
	1–10 μm	2.5	2.1	1.8	2.1	2.8	340
	2.5–10 μm	0.8	0.7	0.5	0.7	0.9	340
Amman city center (walking)	10–25 nm	33000.5	17047.5	19950.5	26816.5	45139.2	156
	25–300 nm	77842.8	73246.2	31454.9	51130.3	102046.2	156
	300–1000 nm	76.0	71.2	33.7	53.9	80.7	156
	10–1000 nm	102768.8	67901.5	55295.3	75291.0	131899.4	156
	1–10 μm	4.7	0.8	4.1	4.6	5.1	156
	2.5–10 μm	1.4	0.2	1.3	1.4	1.6	156
Zarqa city center (walking)	10–25 nm	25803.0	9343.0	19735.8	24238.2	28731.1	94
	25–300 nm	45233.5	32370.6	28613.7	35502.5	49593.3	94
	300–1000 nm	47.6	40.4	28.8	38.1	51.4	94
	10–1000 nm	70179.1	31916.2	48418.2	61248.9	80456.4	94
	1–10 μm	3.8	2.5	2.7	3.5	4.1	94
	2.5–10 μm	1.5	1.2	1.0	1.3	1.6	94
Amman city center (driving)	10–25 nm	28839.0	12927.0	16821.4	28401.5	39237.9	54
	25–300 nm	86300.3	77476.8	26233.2	51056.8	113423.6	54
	300–1000 nm	85.4	58.7	45.7	61.7	101.7	54
	10–1000 nm	113053.4	76835.8	47521.3	88545.0	166028.3	54
	1–10 μm	2.7	0.8	2.1	2.5	3.1	54
	2.5–10 μm	0.7	0.2	0.6	0.6	0.8	54
Amman roads (driving)	10–25 nm	50219.1	21105.5	34447.2	53850.0	66445.5	103
	25–300 nm	123167.0	93903.4	56913.6	100884.0	172458.4	103
	300–1000 nm	52.5	32.6	34.8	44.1	57.9	103
	10–1000 nm	171348.2	80639.5	112016.3	178858.5	234894.2	103
	1–10 μm	3.7	1.5	2.7	3.3	4.4	103
	2.5–10 μm	1.1	0.5	0.7	1.0	1.4	103

Amman car repair shops	10–25 nm	42127.9	11636.3	32813.1	41627.9	49547.9	52
(driving)	25–300 nm	60139.3	28820.6	35575.6	56059.6	76799.3	52
	300–1000 nm	68.1	31.5	47.5	59.1	79.0	52
	10–1000 nm	102335.3	37634.7	71686.7	100087.2	126661.6	52
	1–10 μm	13.5	1.9	12.2	13.3	14.3	52
	2.5–10 μm	3.8	0.6	3.3	3.6	4.0	52
Amman-Zarqa roads	10–25 nm	51824.2	22316.6	37264.7	57217.7	67799.1	190
(driving)	25–300 nm	127332.0	92940.3	65149.3	102509.8	169098.6	190
	300–1000 nm	66.1	41.2	39.4	53.8	80.1	190
	10–1000 nm	169010.0	72185.5	119376.8	171198.0	222196.5	190
	1–10 μm	3.6	2.6	2.4	3.0	4.2	190
	2.5–10 μm	1.1	1.3	0.6	0.8	1.2	190

Table S2: Size-fractionated PM and black carbon mass concentrations [$\mu\text{g}/\text{m}^3$] as measured by the mobile setup during different scenarios.

	Size fraction	Mean	Std	25%	median	75%	#
Remote – Beren (Standing)	PM ₁	30.1	6.4	25.3	28.9	32.3	22
	PM _{2.5}	33.9	6.9	28.5	32.6	36.2	22
	PM ₁₀	65.5	22.1	47.3	61.2	79.0	22
	PM ₁₀₋₁	35.4	15.9	22.0	32.6	47.5	22
	PM _{10-2.5}	31.6	15.4	18.8	28.6	43.3	22
	BC	0.5	0.9	0.3	0.3	0.4	22
Remote – Beren (driving)	PM ₁	32.3	8.1	27.3	30.7	32.5	27
	PM _{2.5}	36.6	8.6	31.5	34.8	36.6	27
	PM ₁₀	65.8	21.2	54.9	59.0	68.1	27
	PM ₁₀₋₁	33.5	13.9	26.8	29.8	36.0	27
	PM _{10-2.5}	29.2	13.3	22.7	25.2	31.0	27
	BC	1.6	1.9	0.5	0.9	1.4	27
JU campus (walking)	PM ₁	60.1	51.0	25.5	53.5	71.8	340
	PM _{2.5}	62.4	52.1	26.9	55.8	74.9	340
	PM ₁₀	86.6	72.3	38.0	75.8	105.8	340
	PM ₁₀₋₁	26.5	32.2	11.7	21.2	30.5	340
	PM _{10-2.5}	24.3	30.9	10.2	18.9	27.6	340
	BC	7.7	12.6	1.8	2.9	6.7	340
Amman city center (walking)	PM ₁	79.7	56.6	48.8	62.8	86.6	156
	PM _{2.5}	84.7	56.7	53.7	68.1	92.3	156
	PM ₁₀	119.7	56.5	85.8	102.6	133.8	156
	PM ₁₀₋₁	40.0	9.7	32.7	39.2	44.8	156
	PM _{10-2.5}	35.0	9.3	27.8	34.3	39.8	156
	BC	8.1	10.0	2.3	3.8	8.7	156
Zarqa city center (walking)	PM ₁	58.7	43.0	41.2	48.2	61.8	94
	PM _{2.5}	61.6	44.4	43.8	50.8	65.2	94
	PM ₁₀	113.4	79.8	76.8	95.8	119.2	94
	PM ₁₀₋₁	54.7	41.0	35.3	45.4	59.3	94
	PM _{10-2.5}	51.8	39.5	32.8	42.3	56.3	94
	BC	5.3	5.4	2.5	3.8	5.8	94
Amman city center (driving)	PM ₁	49.7	32.4	28.2	38.3	59.8	54
	PM _{2.5}	51.4	32.7	29.5	39.8	62.7	54
	PM ₁₀	70.7	37.9	45.2	57.1	85.2	54
	PM ₁₀₋₁	21.0	9.5	14.8	17.8	24.5	54
	PM _{10-2.5}	19.3	9.2	13.2	16.3	22.8	54
	BC	8.2	14.2	1.5	3.3	8.2	54
Amman roads (driving)	PM ₁	56.2	37.2	33.6	44.7	63.4	103
	PM _{2.5}	59.6	38.3	36.0	48.3	68.0	103
	PM ₁₀	89.2	48.2	53.5	77.3	106.3	103
	PM ₁₀₋₁	33.0	17.1	21.3	32.2	38.3	103
	PM _{10-2.5}	29.6	15.9	19.8	28.2	34.9	103
	BC	15.9	21.8	3.1	7.8	21.5	103

Amman car repair shops	PM ₁	115.4	35.4	92.2	105.0	125.3	52
(driving)	PM _{2.5}	126.3	35.9	102.7	115.8	136.4	52
	PM ₁₀	238.2	53.6	199.7	230.8	261.0	52
	PM ₁₀₋₁	122.7	29.9	100.3	113.5	139.3	52
	PM _{10-2.5}	111.8	29.0	89.8	102.5	128.4	52
	BC	11.8	11.0	5.9	8.1	13.4	52
Amman-Zarqa roads	PM ₁	67.7	47.1	38.3	51.7	79.7	190
(driving)	PM _{2.5}	70.5	48.9	39.6	54.5	82.5	190
	PM ₁₀	108.3	104.4	61.3	86.3	129.5	190
	PM ₁₀₋₁	40.6	69.2	18.7	27.0	41.7	190
	PM _{10-2.5}	37.8	66.7	16.6	24.7	37.5	190
	BC	22.4	24.1	5.9	15.8	28.5	190

Table S3: Size-fractionated particle number concentration ratios between the mobile scenarios and corresponding measurements at the reference urban background sites.

	Size fraction	Mean	Std	25%	median	75%	#
Remote – Beren / JU (Standing)	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	0.8	0.0	0.8	0.8	0.9	22
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	1.0	0.1	0.9	1.0	1.1	22
	2.5–10 μm	1.3	0.3	1.1	1.3	1.5	22
Remote – Beren / JU (driving)	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	1.0	0.2	0.8	1.1	1.2	27
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	0.9	0.0	0.9	1.0	1.0	27
	2.5–10 μm	1.0	0.1	1.0	1.0	1.1	27
JU campus / JU	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	1.2	0.9	0.5	1.0	1.6	340
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	1.3	0.7	0.9	1.2	1.5	340
	2.5–10 μm	2.3	2.3	1.4	1.9	2.6	340
Amman city center / JU	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	2.7	2.4	1.2	1.9	3.0	156
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	0.9	0.2	0.7	0.9	1.0	156
	2.5–10 μm	1.1	0.3	0.9	1.2	1.3	156
Zarqa city center / Ma'asom	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	2.5	3.6	1.1	1.7	2.1	94
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	2.2	0.6	1.8	2.0	2.4	94
	2.5–10 μm	3.8	1.3	3.1	3.5	4.4	94
Amman city center / JU (driving)	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	5.2	3.9	2.3	3.5	8.6	54
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	2.2	0.8	1.5	2.1	2.5	54
	2.5–10 μm	3.7	1.1	2.6	3.6	4.5	54
Amman roads / JU (driving)	10–25 nm	--	--	--	--	--	--
	25–300 nm	--	--	--	--	--	--
	300–1000 nm	1.9	0.8	1.0	1.8	2.6	103
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	1.6	0.8	1.0	1.5	2.2	103
	2.5–10 μm	2.6	1.5	1.3	2.4	4.1	103

Amman car repair shops / JU	10–25 nm	--	--	--	--	--	--
(driving)	25–300 nm	--	--	--	--	--	--
	300–1000 nm	1.9	0.8	1.4	1.9	2.2	52
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	1.2	0.3	1.0	1.2	1.4	52
	2.5–10 μm	1.4	0.3	1.1	1.3	1.7	52
Amman-Zarqa roads / JU	10–25 nm	--	--	--	--	--	--
(driving)	25–300 nm	--	--	--	--	--	--
	300–1000 nm	4.2	2.8	2.3	3.1	6.1	190
	10–1000 nm	--	--	--	--	--	--
	1–10 μm	3.5	3.8	2.0	2.6	3.7	190
	2.5–10 μm	7.2	11.6	2.7	4.1	7.4	190