

SUPPLEMENTARY

Comparison of PM10 Sources at Traffic and Urban Background Sites Based on Elemental, Chemical and Isotopic Composition: Case Study from Krakow, Southern Poland

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Table S1. PM10 and element concentrations during summer 2018 and inter 2018/2019 season (PM10 concentrations in $\mu\text{g}/\text{m}^3$) recorded at the traffic-dominated monitoring station (AK) and urban background station (ZR). Element concentrations in ng/m^3 . The last column presents winter to summer concentrations ratios.

AK Station							
Element	Summer 2018			Winter 2018/2019			Winter/ Summer Ratio
	Min	Max	Mean \pm St. Dev.	Min	Max	Mean \pm St. Dev.	
PM	17.9	47.1	35 \pm 7	19.7	157	76 \pm 28	2.14
P	61	79	67 \pm 8	62	165	97 \pm 25	1.45
S	139	774	400 \pm 150	251	3300	912 \pm 460	2.29
Cl	16	252	64 \pm 38	117	4125	1632 \pm 890	25.62
K	14	209	101 \pm 50	56	847	260 \pm 140	2.56
Ca	81	955	470 \pm 230	85	2781	757 \pm 520	1.63
Ti	9.4	75	43 \pm 15	14	180	63 \pm 26	1.48
V	2.52	2.52	2.52	2.1	11	5 \pm 3	2.00
Cr	0.9	18	7.3 \pm 3.4	1.8	41	18 \pm 10	2.48
Mn	2.5	30	14 \pm 6	4.3	56	23 \pm 11	1.61
Fe	300	1617	950 \pm 350	500	2925	1365 \pm 570	1.44
Co	1.1	8.9	4.6 \pm 1.8	1.1	16.5	6.4 \pm 3.0	1.40
Ni	1.4	7.09	4.9 \pm 1.5	0.46	9.38	4.4 \pm 1.8	0.90
Cu	10	46	28 \pm 10	13	79	39 \pm 18	1.37
Zn	11	227	62 \pm 30	24	235	104 \pm 47	1.67
As	<LLD	<LLD	<LLD	0.46	4.35	2.03 \pm 0.97	n.d.

Br	0.46	3.43	2.01±0.75	3.7	31	12±6	6.04
Rb	0.23	1.14	0.58±0.22	0.23	2.52	1.04±0.44	1.78
Sr	0.23	4.58	1.81±1.06	0.23	9.84	3.1±2.0	1.70
La	5	23	13.5±3.8	11	44	22±7	1.62
Pb	0.46	14	6.6±3.5	3.9	42	18±9	2.72

ZR Station

Element	Summer 2018			Winter 2018/2019			Winter/ Summer Ratio
	Min	Max	Mean±St. Dev.	Min	Max	Mean±St. Dev.	
PM	10.5	39.7	25.6±5.7	12.1	117	51±25	2.00
P	70	180	130±30	<LLD	<LLD	<LLD	n.d.
S	117	700	343±130	134	1530	585±320	1.70
Cl	16	152	56±30	86	2616	845±610	15.21
K	11	161	95±43	15	437	157±100	1.65
Ca	72	764	375±200	19	1030	318±250	0.85
Ti	8.2	68	34±14	5	55	28±13	0.82
V	2.52	5.95	3.7±1.5	<LLD	<LLD	<LLD	n.d.
Cr	1.8	21	7.8±4.5	1.6	20	8.4±5.7	1.08
Mn	0.5	21	8.1±4.2	1.37	18.5	7.5±5.0	0.93
Fe	45	580	333±150	49	887	367±240	1.10
Co	1.4	2.7	2.0±0.4	1.14	3.43	2.1±0.8	1.04
Ni	1.14	9.38	4.4±2.0	1.6	7.1	3.6±1.3	0.82
Cu	2.3	20.4	7±4	1.14	30	10±8	1.42
Zn	9.4	146	48±26	7	215	69±45	1.44

As	<LLD	<LLD	<LLD	1.37	3.66	2.4±0.9	n.d.
Br	0.92	4.12	2.05±0.70	2.5	25	11±6	5.14
Rb	0.23	1.83	0.62±0.32	0.23	1.83	0.72±0.41	1.16
Sr	0.23	2.97	1.5±1.1	0.23	2.5	1.2±0.7	0.83
La	4.8	44	19±10	3.9	21	11±4	0.60
Pb	0.46	15	7.3±4.4	1.6	33	14±9	1.92

LLD-Lower Limit of Detection; n.d.-not determined

Table S2. Ions and OC/EC concentrations in PM10 samples collected during summer 2018 and winter 2018/2019 at AK monitoring station and urban background station (ZR) (in $\mu\text{g}/\text{m}^3$). The last column presents the ratios of winter to summer concentrations.

AK Station							
Chemical Species	Summer 2018			Winter 2018/2019			Winter/Summer Ratio
	Min	Max	Mean ± St Dev.	Min	Max	Mean ± St. Dev.	
Cl⁻	0.33	1.85	0.79±0.44	0.88	8.28	3.7±2.0	4.69
NO₃⁻	0.54	2.38	1.25±0.45	1.85	13.17	5.9±2.92	4.72
PO₄³⁻	0.59	3.50	1.85±0.73	1.74	6.78	3.1±1.4	1.69
SO₄²⁻	1.24	6.82	3.3±1.3	1.98	19.03	5.6±3.5	1.69
Na⁺	0.26	5.70	1.4±1.0	0.73	6.25	2.5±1.5	1.81
NH₄⁺	0.77	2.30	1.27±0.40	0.84	13.56	4.3±3.8	3.35
Mg²⁺	0.48	0.64	0.53±0.04	0.45	0.75	0.57±0.09	1.08
K⁺	0.12	0.77	0.24±0.17	0.11	0.99	0.27±0.17	1.12
Ca²⁺	0.01	1.57	0.29±0.40	0.00	0.80	0.26±0.18	0.87
OC	5.79	13.01	9.4±1.9	7.90	63.54	24±14	2.54

EC	3.38	8.38	6.1±1.5	2.83	14.30	7.3±3.0	1.21
TC	9.36	19.00	15.4±2.9	10.73	72.43	31±16	2.02
ZR Station							
Chemical species	Summer2018			Winter 2018/2019			Winter/Summer Ratio
	Min	Max	Mean±St Dev.	Min	Max	Mean±St Dev.	
Cl⁻	0.33	1.17	0.44±0.22	0.38	7.41	2.7±2.0	6.00
NO₃⁻	0.37	1.80	1.02±0.32	1.29	11.66	6.2±3.0	6.01
PO₄³⁻	0.46	3.53	2.02±0.64	0.45	7.14	3.6±2.4	1.79
SO₄²⁻	1.63	6.89	3.4±1.4	1.52	19.18	5.7±3.9	1.69
Na⁺	0.12	1.43	1.00±0.46	0.11	4.48	1.9±1.3	1.95
NH₄⁺	0.77	4.43	1.6±1.1	0.82	13.24	5.2±3.6	3.21
Mg²⁺	0.44	0.56	0.50±0.03	0.44	0.79	0.54±0.08	1.08
K⁺	0.12	0.78	0.27±0.19	0.14	0.95	0.31±0.19	1.15
Ca²⁺	0.05	0.34	0.13±0.10	0.06	1.19	0.32±0.31	2.47
OC	4.99	12.28	8.3±1.8	6.65	57.15	21±14	2.59
EC	0.59	2.47	1.51±0.44	1.16	11.35	3.7±2.3	2.42
TC	5.58	13.57	9.8±2.0	7.95	61.33	25±15	2.56

NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 17 Jun 18
GDAS Meteorological Data

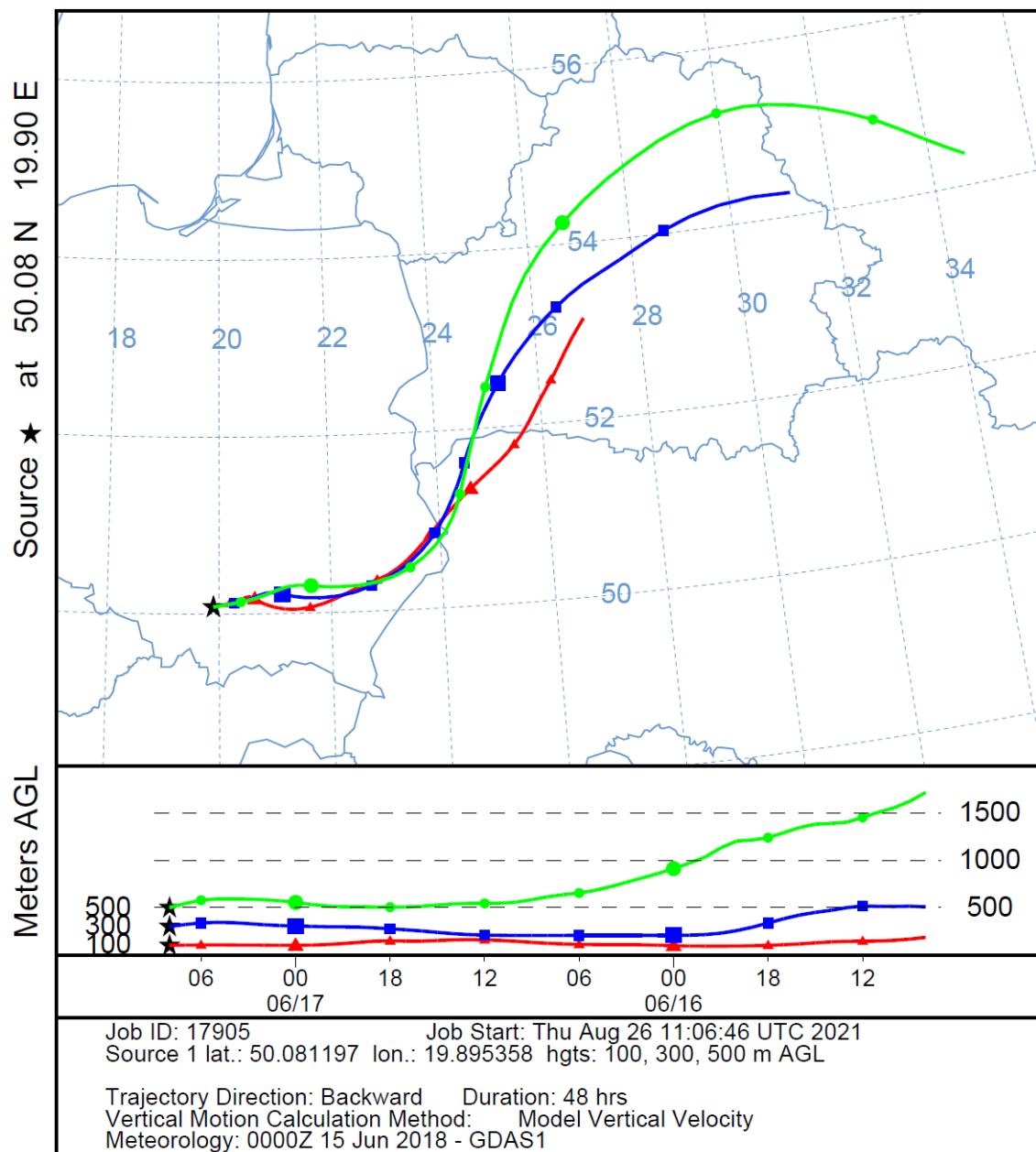


Figure S1. Back trajectories for 17 June 2018 for ZR station.

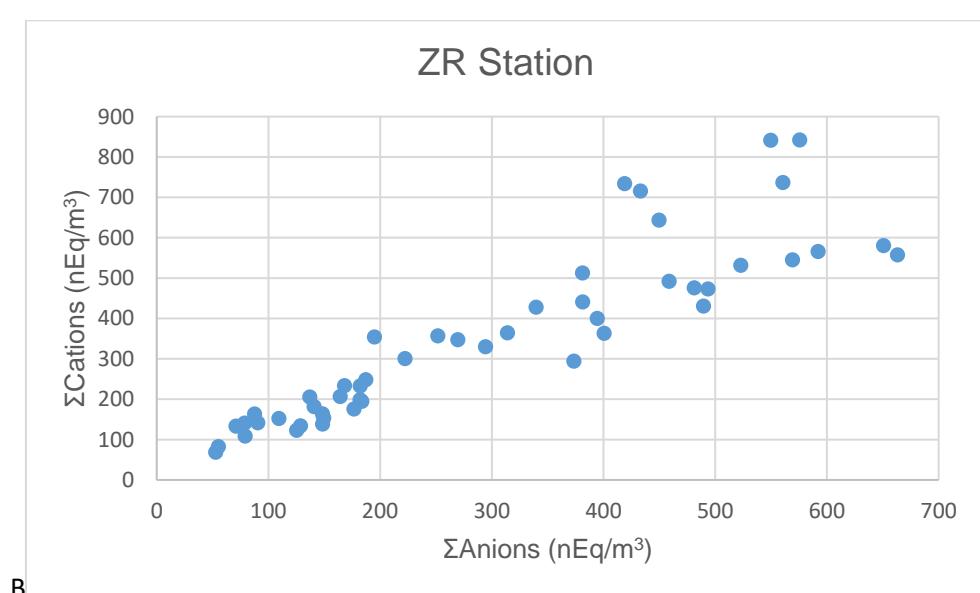
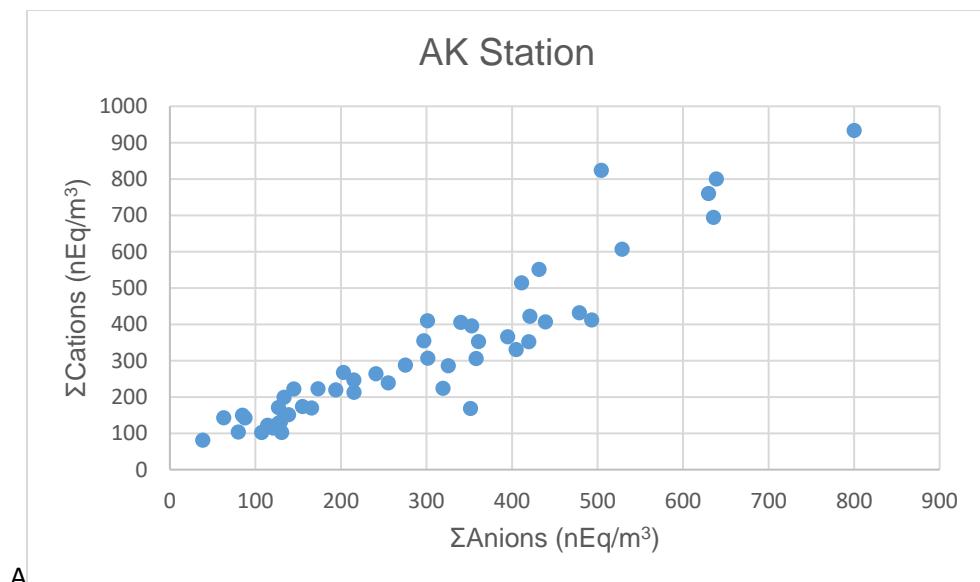
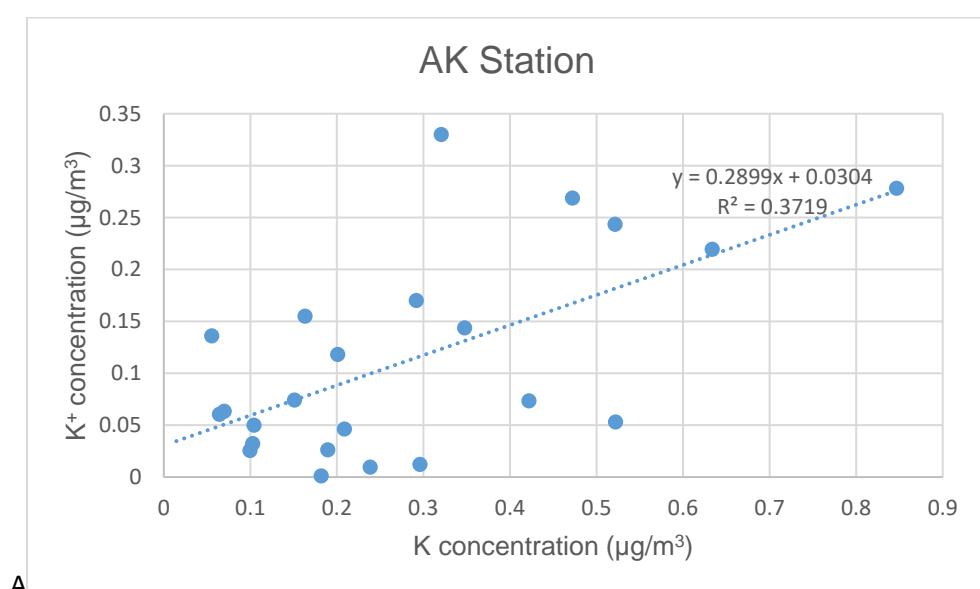
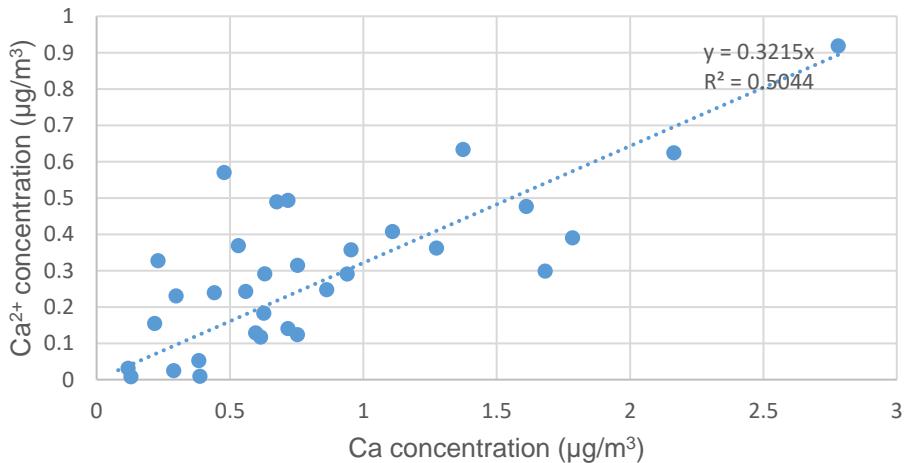


Figure S2. Balance Σ Cations versus Σ Anions for AK and ZR stations

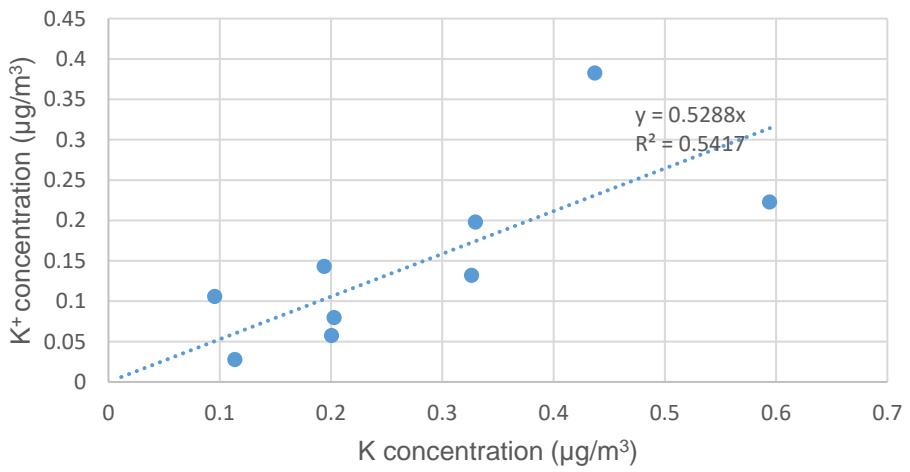


AK Station



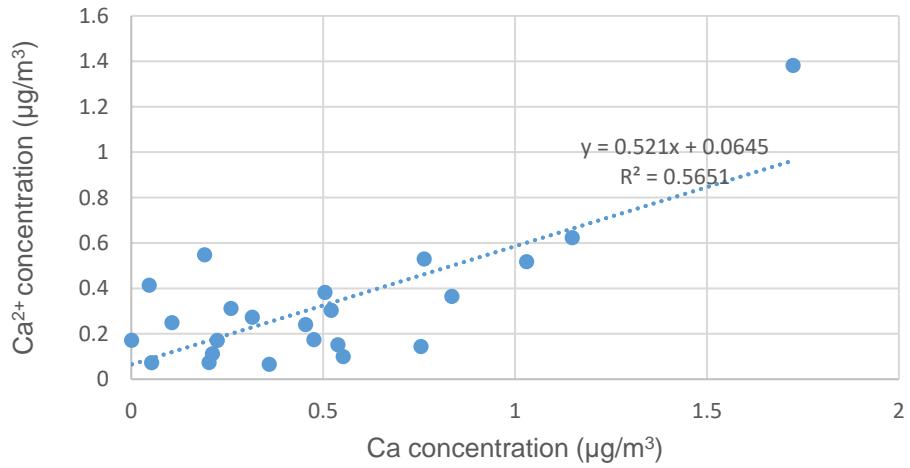
B

ZR Station



C

ZR Station



D

Figure S3. Cations K^+ and Ca^{2+} concentration versus elements K and Ca concentrations at AK and ZR stations.