Supplementary material for:
Long-range transport clusters and Positive Matrix Factorization source apportionment for investigating trans-boundary $PM_{2.5}$ in Gothenburg, Sweden

Table S1. Descriptive statistics of chemical species of $PM_{2.5}$ (μg m^{-3}) during 22 September 2008 to 24 September 2009 in Gothenburg, Sweden.

Species	Full study		Autumn		Winter		Spring		Summer	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
BC	0.245	0.001-1.03	0.202	0.001-0.669	0.342	0.003-1.030	0.254	0.006-0.830	0.187	0.013-0.545
UVPM	0.047	<0.001-0.195	0.041	<0.001-0.137	0.065	0.001-0.195	0.045	<0.001-0.174	0.037	0.002-0.135
S	1.280	0.14-5.604	0.795	0.140-3.330	1.208	0.183-4.177	1.586	0.181-5.604	1.518	0.142-4.159
Cl	0.189	0.016-1.912	0.230	0.039-1.378	0.186	0.016-1.912	0.188	0.020-1.062	0.152	0.042-1.265
K	0.087	0.004-3.78	0.066	0.008-0.162	0.146	0.004-0.521	0.090	0.024-0.203	0.049	0.016-0.241
Ca	0.063	0.011-0.149	0.057	0.017-0.117	0.050	0.011-0.122	0.077	0.029-0.149	0.067	0.038-0.135
Ti	0.008	0.001-0.036	0.007	0.002-0.021	0.008	0.001-0.031	0.009	0.002-0.025	0.009	0.001-0.027
V	0.005	0.001-0.017	0.004	0.001-0.014	0.004	0.001-0.011	0.005	0.001-0.017	0.005	0.001-0.017
Mn	0.003	<0.001-0.018	0.003	0.001-0.018	0.003	<0.001-0.007	0.004	0.001-0.007	0.003	0.001-0.006
Fe	0.057	0.005-0.217	0.051	0.012-0.217	0.049	0.005-0.134	0.080	0.020-0.194	0.048	0.012-0.167
Ni	0.003	0.001-0.033	0.003	0.001-0.014	0.003	0.001-0.033	0.003	0.001-0.016	0.003	0.001-0.010
Cu	0.006	0.001-0.162	0.005	0.002-0.025	0.009	0.001-0.097	0.005	0.002-0.010	0.004	0.002-0.019
Zn	0.013	0.001-0.077	0.011	0.002-0.036	0.017	0.001-0.045	0.015	0.003-0.048	0.009	0.002-0.071
Br	0.002	<0.001-0.005	0.001	<0.001-0.005	0.002	<0.001-0.005	0.002	<0.001-0.004	0.001	<0.001-0.003
Rb	0.001	<0.001-0.002	0.001	<0.001-0.002	0.001	<0.001-0.002	0.001	<0.001-0.002	0.001	<0.001-0.002
Sr	0.001	<0.001-0.106	0.001	<0.001-0.001	0.002	<0.001-0.008	0.001	<0.001-0.003	0.001	<0.001-0.019
Pb	0.003	<0.001-0.036	0.003	<0.001-0.009	0.004	<0.001-0.015	0.003	<0.001-0.010	0.003	<0.001-0.020

Some comments regarding the seasonal variations of the chemical species

The high frequency of sulfur containing transport clusters (i.e. UK-NorthS-DK) in spring and summer with substantial contribution from the sources LRT and Shipping (see table S2) is the cause of the elevated mean concentrations.

The most likely cause for the elevated Fe concentrations during springtime is the combined effect of sanding streets in wintertime combined with studded tires. In spring when the temperature rise and on days with dry streets surfaces, the combination of brittle asphalt and sand generates an increased resuspension. (We have written a section on page 4, lines46 – 54, and referring to similar results seen in Stockholm, Sweden). Additionally, street sweeping of excess sand can create vast amount of resuspension on single days. (This occurs during April and May within the city.)

The mean concentration of Zn is higher in winter (and spring) than in summer and autumn. One factor behind this is likely biomass burning for domestic heating, but other factors such as industrial sources in continental Europe might also influence.

Table S2. Mean $PM_{2.5}$ levels of the six estimated sources (μg m^{-3}) by transport cluster and season during 22 September 2008 to 24 September 2009 in Gothenburg, Sweden.

Transport cluster	No. days	$PM_{2.5}$	LRT	LRT-Pb	Marine	Shipping	Resuspension	Combustion
S-Scandic								
76 days								
Autumn	17	5.00	1.85	0.10	0.18	0.92	0.28	1.09
Winter	25	7.05	3.49	0.11	0.12	0.77	0.26	1.58
Spring	20	11.62	6.29	0.11	0.15	1.12	0.44	1.96
Summer	14	6.03	2.72	0.08	0.17	2.03	0.21	1.31
N-Scandic								
38 days								
Autumn	8	2.60	0.96	0.09	0.38	0.46	0.28	0.28
Winter	14	5.36	2.24	0.13	0.21	0.48	0.50	1.91
Spring	7	4.39	2.03	0.11	0.19	0.80	0.46	0.56
Summer	9	3.10	1.92	0.08	0.34	1.28	0.17	0.19
BalticS								
28 days								
Autumn	7	5.67	2.06	0.02	0.01	0.49	0.47	2.26
Winter	4	4.10	1.90	0.12	0.11	0.42	0.47	1.05
Spring	6	6.98	3.30	0.10	0.21	1.32	0.40	0.56
Summer	11	6.39	2.60	0.11	0.12	1.68	0.30	1.07
E-Eur								
21 days								
Autumn	3	10.45	5.75	0.17	0.09	0.41	0.48	2.15
Winter	11	9.88	5.49	0.17	0.04	0.21	0.22	2.95
Spring	2	16.33	12.41	0.17	0.00	0.40	0.43	2.95
Summer	5	6.12	3.18	0.20	0.08	1.18	0.12	1.33
UK-NorthS-DK								
91 days								
Autumn	10	8.95	3.90	0.13	0.20	0.97	0.19	1.57
Winter	15	7.59	3.33	0.17	0.32	0.63	0.10	1.23
Spring	33	7.75	3.51	0.09	0.48	1.85	0.18	0.69
Summer	33	5.08	2.53	0.08	0.36	1.78	0.09	0.72
N-Atlantic								
107 days								
Autumn	45	4.56	0.96	0.09	0.75	0.98	0.22	0.63
Winter	18	5.12	1.77	0.15	0.81	1.02	0.14	1.09
Spring	24	4.63	2.05	0.09	0.61	1.03	0.37	0.56
Summer	20	4.33	1.66	0.09	0.47	1.62	0.08	0.41