Source apportionment of fine atmospheric particles using Positive matrix factorization in Pretoria, South Africa

Table S1 Input Data Statistics for positive matrix factorisation modelling

No	Species	Category	Signal-to noise ration
1	$PM_{2.5}$	Weak*	5.7
2	BC	Strong	4.7
3	OC	Strong	4.7
4	Si	Strong	9.0
5	S	Strong	9.0
6	Cl	Strong	8.7
7	K	Strong	9.0
8	Ca	Strong	8.5
9	Ti	Strong	8.8
10	V	Weak#	0.3
11	Fe	Strong	9.0
12	Ni	Strong	7.6
13	Cu	Strong	6.0
14	Zn	Strong	8.9
15	As	Weak	2.1
16	Se	Strong	3.8
17	Br	Strong	8.8
18	Sb	Strong	4.1
19	Ba	Strong	3.4
20	Pb	Weak	2.9
21	U	Strong	3.5

*$PM_{2.5}$ is set to be a "Total Variable" and therefore automatically set to "Weak".

#Vanadium (V) was used in run as test for fuel combustion. This was only observed in the 7 factors profile.

Table S2 Summary of temperature, relative humidity, and wind speed in Pretoria during 18 April 2017 and 17 April 2018.

Variables	**Autumn**	**Winter**	**Spring**	**Summer**	**Full study**
Mean temperature (ºC)	16.2	14.4	19.4	20.4	17.6
Min temperature (ºC)	9.6	11.0	11.5	16.5	9.6
Max temperature (ºC)	21.6	17.6	26.2	24.7	26.2
Mean RH (%)	64.1	49.9	45.1	57.3	54.3
Min RH (%)	37.4	22.7	14.1	30.1	14.1
Max RH (%)	81.9	80.0	73.2	84.1	84.1
Wind direction	ENE,WSW,W	SSE,E,W	ENE,WSW.W	ENE,WSW,W	SSE,WSW,W
Mean wind speed (m/s)	1.2	2.11	1.5	1.6	1.6
Max wind speed (m/s)	2.1	2.3	3.1	2.4	3.1

RH: Relative humidity

Table S3. Trace elemental composition of $PM_{2.5}$ levels in Pretoria during 18 April 2017 to 17 April 2018 (ng m^{-3})

Elements	Average	Mean	SD	median	Range
Si	560 ± 340	565.5	517.1	405.9	4.1 – 2503.8
S	1480 ± 510	1476.2	1302.3	1094.8	8.0 – 6127.5
Cl	70 ± 90	69.5	146.8	17.6	0.4 – 1223.5
K	360 ± 300	357.0	373.7	1176.8	7.7 – 1527.1
Ca	170 ± 120	174.3	168.9	117	3.7 – 834.9
Ti	30 ± 20	31.2	23.7	25.5	1.1 – 129.8
V	2 ± 2	1.5	5.3	0.6	0.6 – 46.8
Fe	370 ± 160	368.1	197.6	335.9	47.9 – 1102.8
Ni	140 ± 80	146.1	90.9	190.4	0.3 – 266.3
Cu	10 ± 4	7.9	8.8	3.8	0.0 – 58.6
Zn	60 ± 60	55.6	83.0	17.6	0.1 – 462.5
As	2 ± 3	1.9	4.1	0.4	0.4 – 23.3
Se	1 ± 1	1.2	2.0	0.4	0.0 – 14.6
Br	20 ± 20	18.1	28.4	8.3	0.4 – 253.7
Sb	10 ± 4	11.1	10.7	5.3	0.6 – 49.5
Ba	12 ± 4	11.9	10.9	5.3	1.0 – 40.8
Pb	10 ± 10	10.3	25.6	2.1	0.1 – 194.9
U	1 ± 1	1.6	1.3	1.1	0.1 – 8.2
$PM_{2.5}$	21100	21.1	15.0	15.6	0.7 – 66.8
BC	3860 ± 2460	3.9	3.0	2.9	0.4 – 11.4

Table S4 Summary of positive matrix factorisation outputs for the different number of factors showing the probable sources and main markers

Factor	Number	Probably sources	Main marker/Analysed chemical
5	1	Diesel/vehicle exhaust	Sb, S, U, Pb
	2	Coal/biomass burning	As, Pb, Br, Cl
	3	Mineral dust Soil, resuspended	Si, K, Ca, Ti
	4	Vehicle exhaust/fossil fuel combustion	Ba, Cu, Ca, Se
	5	Residual/diesel/road traffic	Ni, Fe
6	1	Mineral dust Soil, resuspended dust	Si, K, Ca, Ti
	2	Coal burning/biomass burning	Br, As, K, Cl, BC, S
	3	Residual oil /diesel	S, Sb, U
	4	Residual oil/ domestic heating/industrial	Ni, Fe
	5	Vehicle exhaust/ road traffic	Cu, Zn
	6	Industrial/ road traffic	Cu, Se, Ba, Pb
7	1	Vehicle exhaust/ fossil fuel combustion	Cu, Se, Pb, U
	2	Mineral dust/ soil dust	S, Cl, K, Ca, Ti, Fe
	3	Secondary sulphur/ vehicle exhaust	S, BC
	4	Vehicle exhaust	Zn, Cl, Cu, BC
	5	Road traffic	V, Sb, Ba, Ca, Se
	6	Base metal/Pyrometallurgical	Ni, Fe, V, U
	7	Coal burning	BC, K, As, Pb, Cl

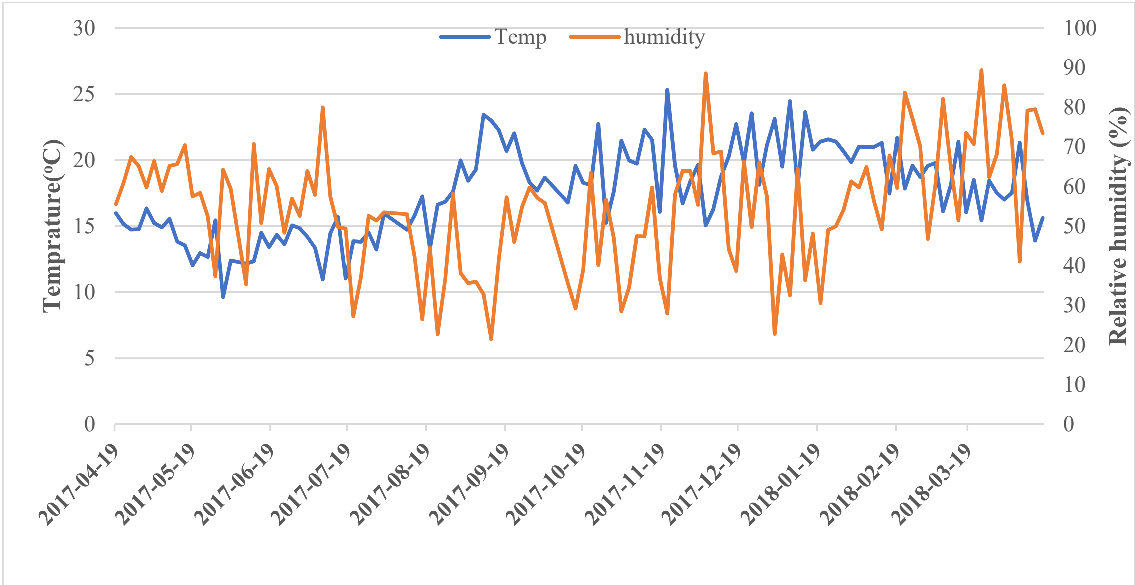

Fig. S1 Time series plot of temperature and relative humidity levels in Pretoria during 18 April 2017 and 17 April 2018 by month.

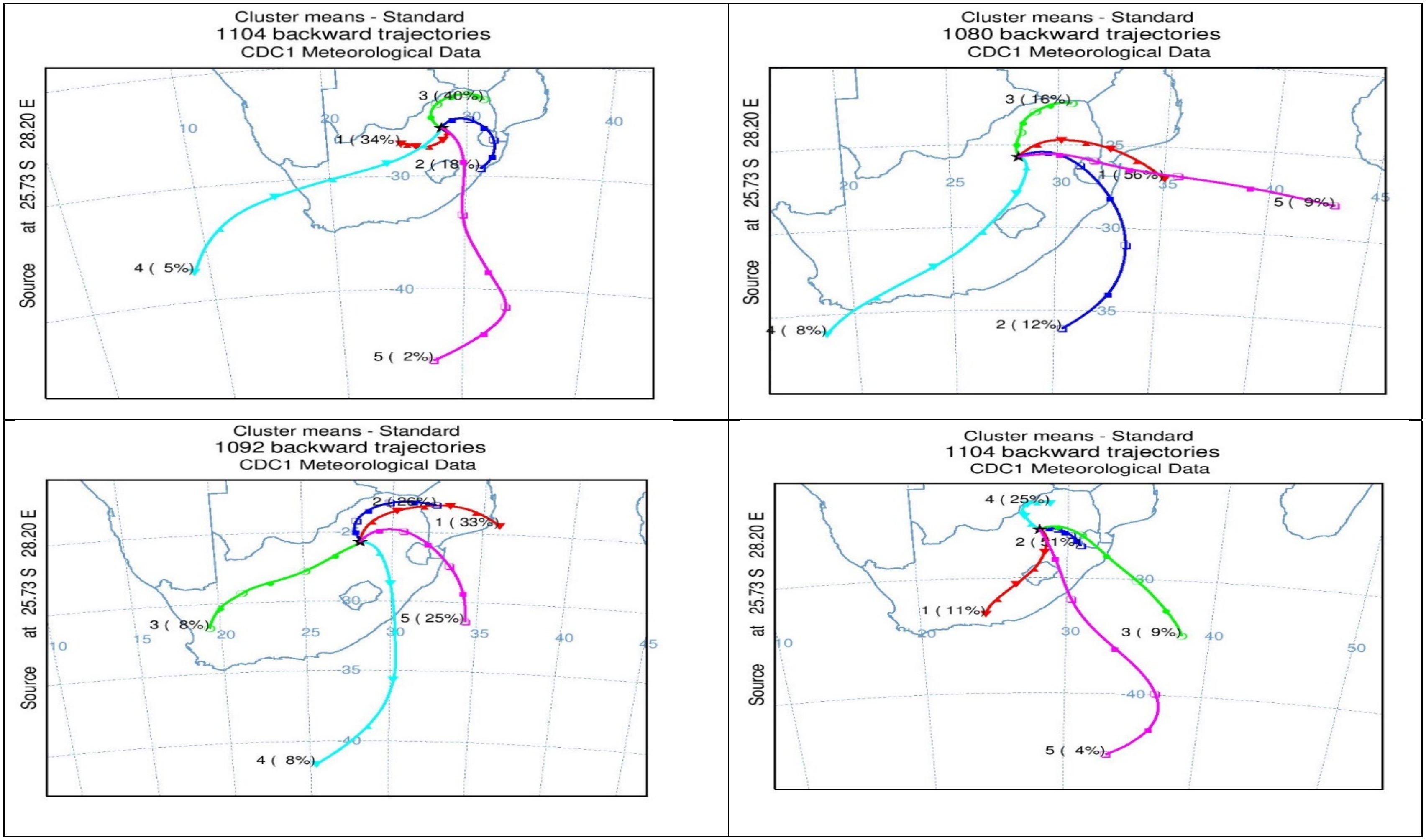

Fig. S2 Five transport pathways (cluster plots) arriving at the sampling site during 18 April 2017 and 18 April 2018 by seasons, clockwise from top left, winter, autumn, spring and summer.