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Supplement of

Vertical and horizontal variability of PM_{10} source contributions in Barcelona during SAPUSS

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Table S1: Average concentration of PM_{10} analysed species at each site (RS, UB, TM and TC).

	RS	UB	TM	TC
PM_{10} (µgm^{-3})	30.7	25.9	24.8	21.8
OC (µgm^{-3})	3.7	2.5	2.5	2.2
EC (µgm^{-3})	1.4	0.9	0.7	0.5
C_{total} (µgm^{-3})	5.8	3.4	3.1	2.7
EC+OM (µgm^{-3})	7.6	5.2	4.9	5.2
$CO_3^{=}$ (µgm^{-3})	1.1	0.9	0.7	0.6
SiO_2 (µgm^{-3})	1.9	1.3	1.5	1.3
Al_2O_3 (µgm^{-3})	0.6	0. 5	0.5	0.4
Ca (µgm^{-3})	0.7	0.6	0.5	0.4
Fe (µgm^{-3})	0.6	0.4	0.3	0.2
K (µgm^{-3})	0.3	0.2	0.2	0.2
Mg (µgm^{-3})	0.2	0.2	0.2	0.1
Na (µgm^{-3})	1.1	0.9	1.2	0.7
SO_4^{2-} (µgm^{-3})	2.8	2.8	2.7	2.3
NO_3^{-} (µgm^{-3})	2.6	2.2	2.4	1.6
Cl (µgm^{-3})	1.3	1.0	1.2	0.8
NH_4^{+} (µgm^{-3})	0.9	0.7	0.7	0.5
Li (ngm^{-3})	0.2	0.3	0.2	0.2
Be (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Sc (ngm^{-3})	0.1	<0.1	<0.1	<0.1
Ti (ngm^{-3})	20.1	19.9	15.4	13.8
V (ngm^{-3})	6.4	5.9	6.8	4.9
Cr (ngm^{-3})	6.7	4.6	1.9	1.0
Mn (ngm^{-3})	9.3	9.4	6.8	5.3
Co (ngm^{-3})	0.2	0.2	0.2	0.1
Ni (ngm^{-3})	4.8	5.2	2.9	2.5
Cu (ngm^{-3})	23.9	15.9	8.3	5.3
Zn (ngm^{-3})	41.1	61.9	27.9	23.8
Ga (ngm^{-3})	0.1	0.1	<0.1	0.1
Ge (ngm^{-3})	0.2	0.2	<0.1	<0.1
As (ngm^{-3})	0.4	0.4	0.3	0.3
Se (ngm^{-3})	0.5	0.5	0.5	0.4
Rb (ngm^{-3})	0.5	0.5	0.4	0.4
Sr (ngm^{-3})	2.9	2.3	2.2	1.5
Y (ngm^{-3})	0.5	0.3	<0.1	<0.1
Zr (ngm^{-3})	5.8	2.7	5.1	5.3
Nb (ngm^{-3})	<0.1	0.1	<0.1	<0.1
Mo (ngm^{-3})	6.1	4.8	3.8	<0.1
Cd (ngm^{-3})	0.1	0.1	0.1	0.1
Sn (ngm^{-3})	5.8	4.6	2.1	2.9
Sb (ngm^{-3})	2.5	1.8	1.3	0.8
Cs (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Ba (ngm^{-3})	10.9	13.0	5.6	4.1
La (ngm^{-3})	0.3	0.2	0.2	0.2
Ce (ngm^{-3})	0.7	0.5	0.4	0.4
Pr (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Nd (ngm^{-3})	0.2	0.2	<0.1	<0.1

Table S1 (cont.)

	RS	UB	TM	TC
Sm (ngm^{-3})	0.1	0.1	<0.1	<0.1
Eu (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Gd (ngm^{-3})	0.1	0.1	<0.1	<0.1
Tb (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Dy (ngm^{-3})	0.1	0.1	<0.1	<0.1
Ho (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Er (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Tm (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Yb (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Lu (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Hf (ngm^{-3})	0.1	0.1	<0.1	<0.1
Ta (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
W (ngm^{-3})	0.1	0.1	0.1	<0.1
Tl (ngm^{-3})	<0.1	<0.1	<0.1	<0.1
Pb (ngm^{-3})	6.6	6.8	4.9	5.1
Bi (ngm^{-3})	0.3	0.3	0.2	0.1
Th (ngm^{-3})	0.1	0.1	0.1	0.1
U (ngm^{-3})	0.1	0.1	<0.1	0.1

Table S2: Sum of the chemical species contributions to each PMF factor.

Exhaust & wear	Road dust	Mineral	Aged marine	Heavy oil	Industrial	Sulfate	Nitrate
0.83	1.17	0.76	0.89	1.00	0.59	0.79	0.89

Table S3: Explained variation for each element and each factor. In bold are the species that most contribute to each factor.

	Exhaust & wear	Road dust	Mineral	Aged marine	Heavy oil	Industrial	Sulfate	Nitrate	
	F1	F2	F3	F4	F5	F6	F7	F8	Residuals
PM_{10}	0.16	0.10	0.16	0.15	0.02	0.05	0.13	0.15	0.08
SiO_2+CO_3	0.02	**0.43**	**0.33**	0.00	0.01	0.00	0.00	0.05	0.16
Al_2O_3	0.00	**0.35**	**0.42**	0.00	0.00	0.00	0.00	0.02	0.20
Ca	0.22	**0.37**	0.07	0.06	0.07	0.00	0.00	0.06	0.15
K	0.09	0.11	0.18	0.10	0.00	0.10	0.08	0.13	0.23
Na	0.01	0.01	0.08	**0.75**	0.09	0.00	0.03	0.00	0.04
Mg	0.00	0.13	0.20	**0.48**	0.06	0.03	0.00	0.03	0.07
Fe	**0.41**	**0.24**	0.19	0.00	0.00	0.06	0.01	0.00	0.09
SO_4^{2-}	0.04	0.01	0.17	**0.22**	0.08	0.00	**0.39**	0.00	0.08
Mn	0.16	0.16	0.10	0.03	0.05	**0.31**	0.00	0.06	0.13
Ti	0.07	**0.29**	**0.45**	0.03	0.03	0.01	0.00	0.00	0.12
V	0.01	0.03	0.04	0.00	**0.71**	0.06	0.00	0.11	0.04
Cr	**0.46**	0.10	0.03	0.02	0.00	0.07	0.01	0.00	0.30
Ni	0.18	0.03	0.00	0.03	**0.45**	0.03	0.04	0.00	0.24
Cu	**0.67**	**0.19**	0.00	0.00	0.00	0.04	0.00	0.00	0.10
Zn	0.14	0.07	0.00	0.00	0.01	**0.44**	0.09	0.03	0.24
As	0.19	0.05	0.06	0.07	0.02	**0.15**	0.21	0.08	0.17
Ga	0.03	0.21	**0.34**	0.00	0.00	0.13	0.07	0.08	0.13
Rb	0.03	**0.26**	**0.36**	0.04	0.03	0.05	0.12	0.03	0.09
Sr	0.13	**0.23**	0.17	0.18	0.06	0.03	0.00	0.06	0.14
Cd	0.13	0.04	0.12	0.00	0.00	**0.19**	0.20	0.10	0.22
Sn	**0.39**	0.07	0.00	0.00	0.00	0.08	0.16	0.00	0.30
Sb	**0.53**	**0.23**	0.00	0.00	0.01	0.01	0.09	0.03	0.11
Pb	0.00	0.08	0.03	0.05	0.00	**0.50**	0.27	0.00	0.08
Li	0.00	**0.30**	**0.26**	0.11	0.08	0.04	0.09	0.01	0.11
Se	0.10	0.01	**0.22**	0.14	0.04	0.03	0.19	0.12	0.15
La	0.13	0.13	**0.27**	0.06	0.12	0.06	0.00	0.05	0.19
Ba	0.26	0.09	0.15	0.00	0.00	0.05	0.00	0.11	0.34
NO_3^-	0.00	0.00	0.00	0.00	0.01	0.00	0.00	**0.97**	0.02
Cl	0.04	0.01	0.07	**0.52**	0.00	0.04	0.00	0.06	0.25
NH_4^+	0.00	0.01	0.00	0.00	0.00	0.03	**0.73**	0.10	0.13
EC	**0.68**	0.07	0.12	0.00	0.02	0.00	0.03	0.00	0.09
OC	0.33	0.07	0.06	0.04	0.00	0.09	0.10	0.11	0.19

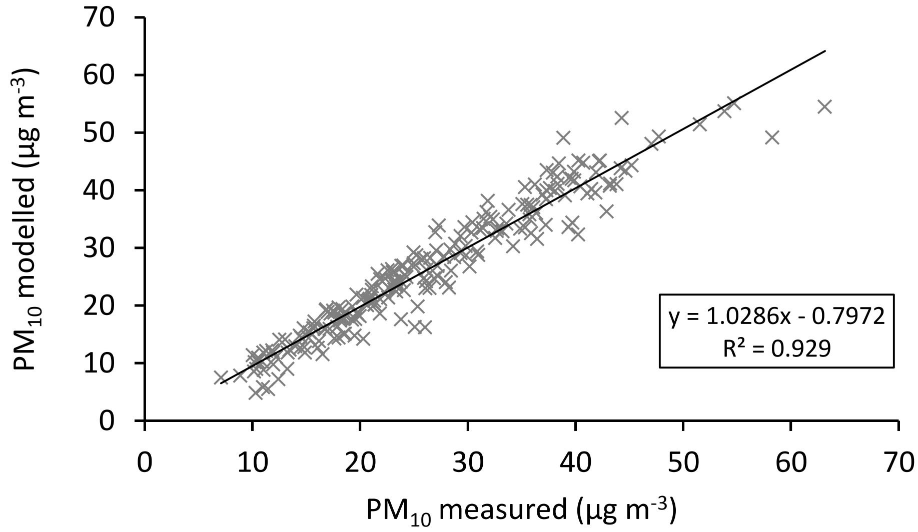

Figure S1: Modelled (by means of PMF) versus measured PM_{10} concentrations.

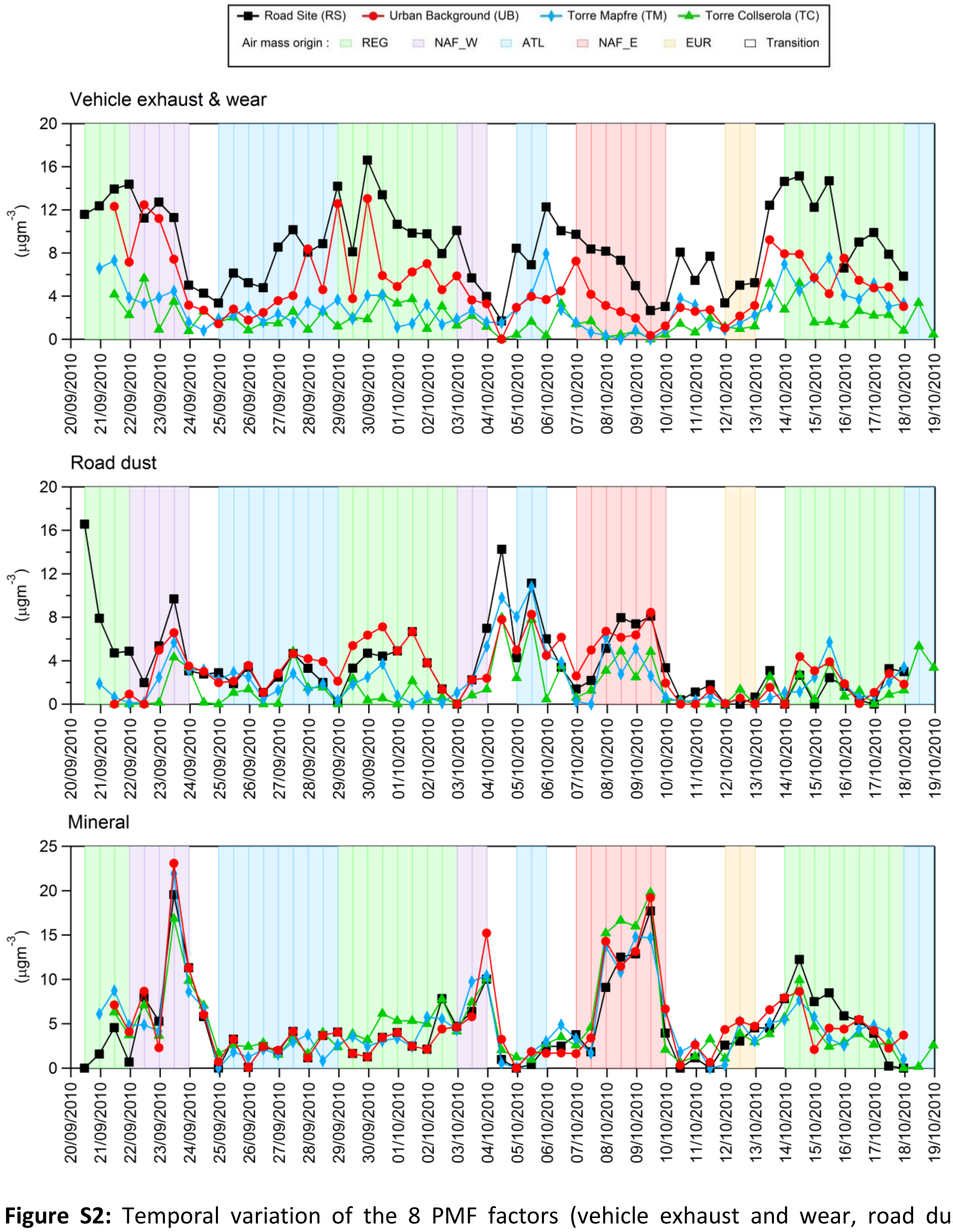

Figure S2: Temporal variation of the 8 PMF factors (vehicle exhaust and wear, road dust, mineral, marine, heavy oil, industrial, sulfate and nitrate) and the calculated contributions of Saharan dust, background mineral dust and anthropogenic marine sulfate during the study period.

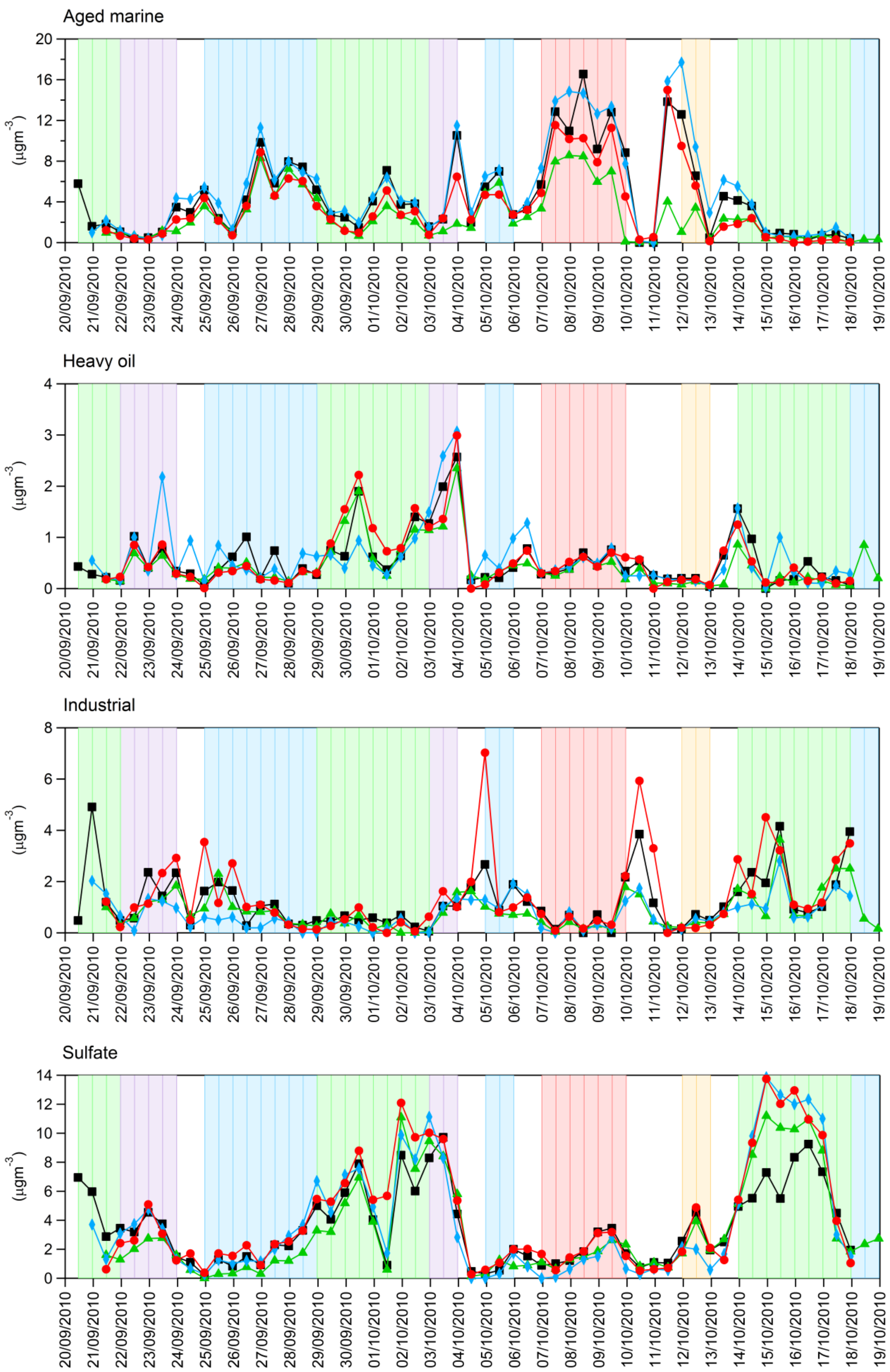

Figure S2 (cont.)

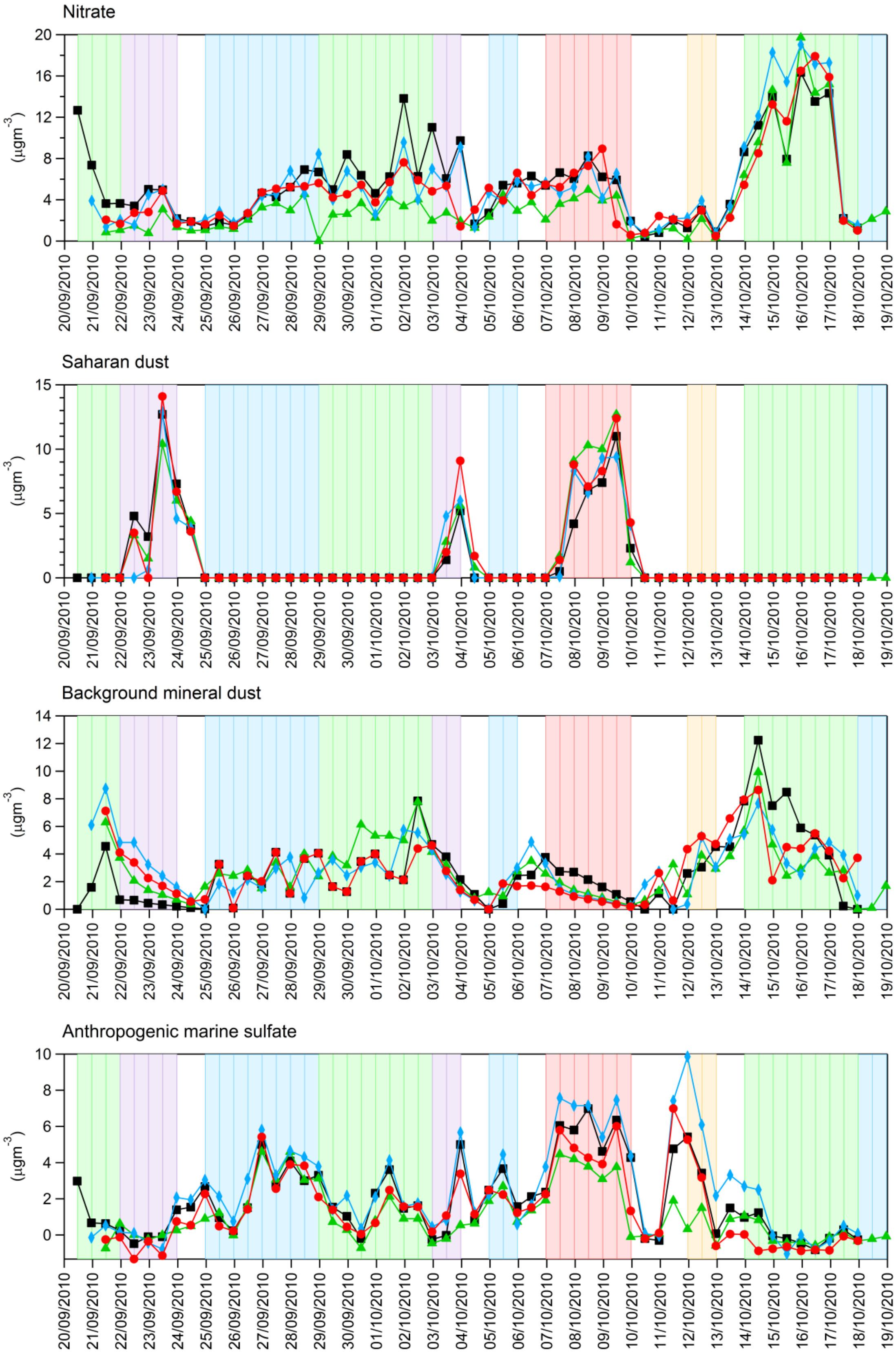

Figure S2 (cont.)

The polar plots were obtained with the OPENAIR package of R. These plots represent the concentration (in our case of certain PMF factors extracted from PM_{10} filters) depending on the wind direction and speed. Note that for the sites located in the city (RS, UB and TM) the wind data used is that measured at the Faculty of Physics as it is representative of the city conditions. The wind components applied to the TC site are those measured at the nearby Fabra Observatory.

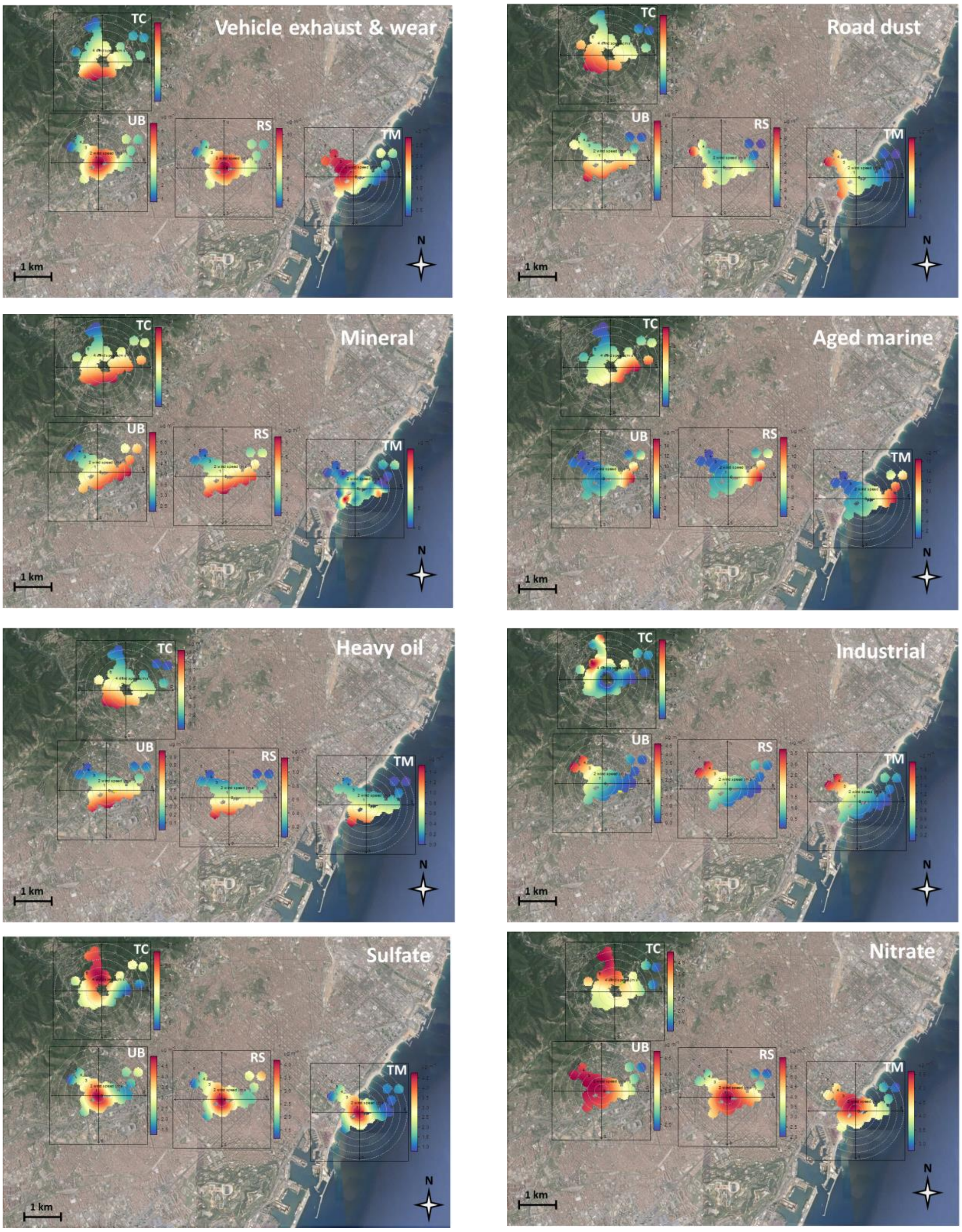

Figure S3: Polar plots representations of the eight PMF factor at each site, calculated sea salt and anthropogenic marine sulfate contributions. Note the different concentration scales.

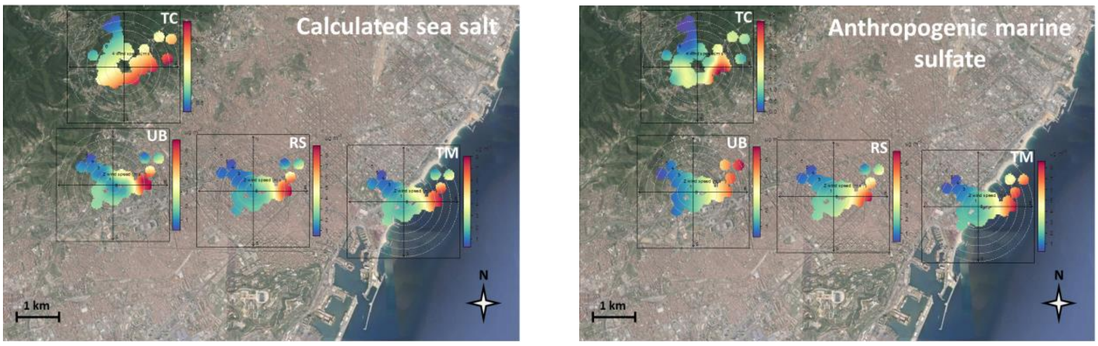

Figure S3 (cont.)

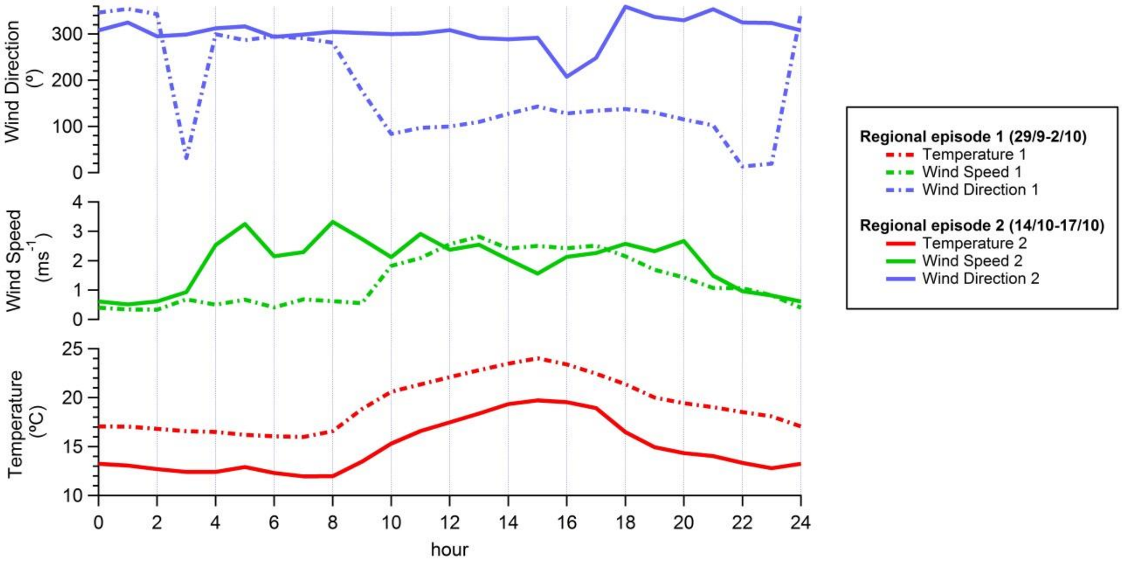

Figure S4: Average diurnal trends of temperature, wind speed and wind direction during two different regional episodes (REG_1: 29/9-2/10 and REG_2: 14/10-17/10).

PMF 9 factors solution

The PMF solutions with nine factors showed the same factors shown with the eight solution, with an additional nine one called "Se-SUL", composed mainly of Selenium and Sulfate (see Figure S5) and lacking of any clear temporal trends.

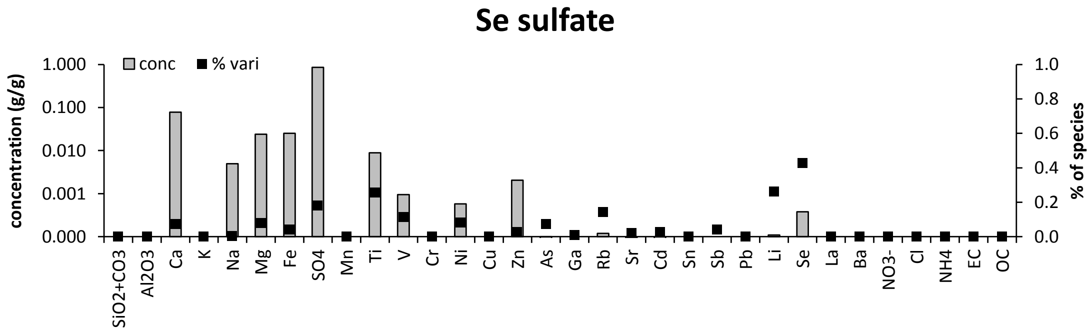

Figure S5: PMF profile of the Se sulfate factor.

Table S4 shows that most of the factors were broadly conservative. In some stations (TM, TC) the road traffic, mineral and vehicle exhaust and wear are mixed up. The eight factor solution was found more appropriate.

Table S4: Temporal correlation coefficients for the factors found in the 8 and 9 factor solution.

8 factor PMF solution	RS	UB	TM	TC
	Correlation with same factor found in the 9 factor solution			
1 Vehicle exhaust and wear	0.9	0.6	0.6	0.4
2 Road dust	0.9	0.5	0.5	0.4
3 Mineral	0.7	0.8	0.6	0.6
4 Aged marine	0.9	0.8	0.9	0.7
5 Heavy Oil	0.9	0.8	0.6	0.7
6 Industrial	0.9	0.6	0.7	0.7
7 Sulfate	0.9	0.8	0.8	0.9
8 Nitrate	0.9	0.8	0.8	0.7

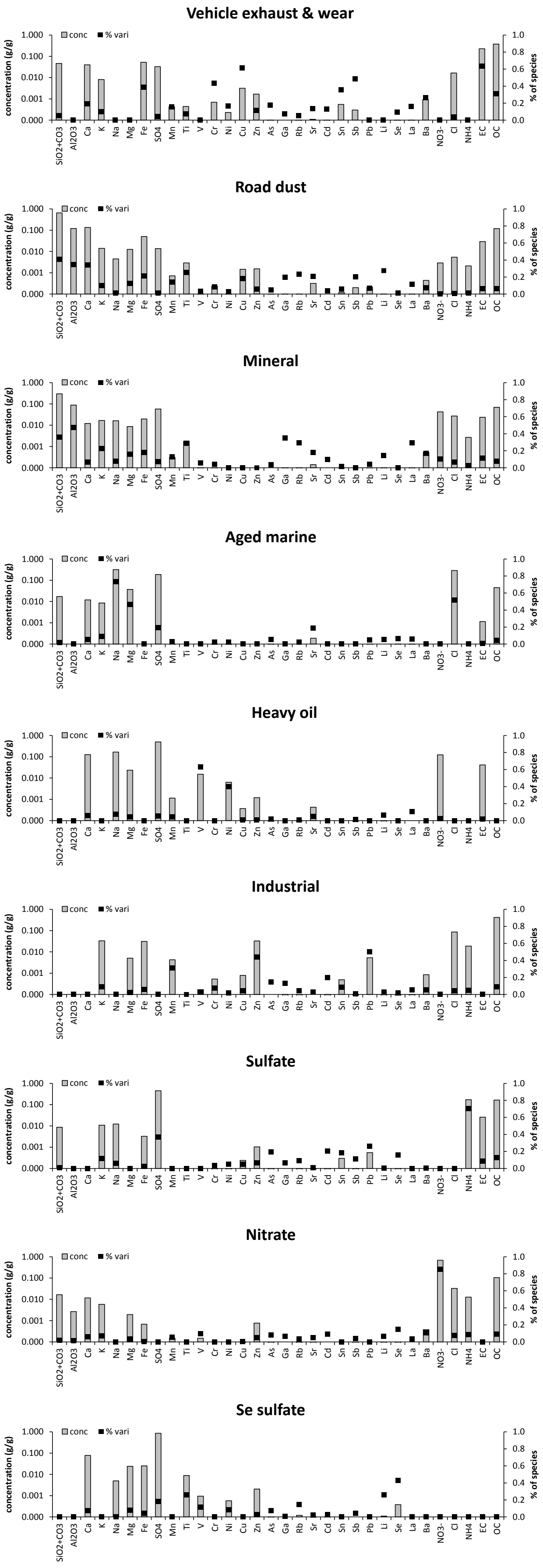

Figure S6: Profiles of the each PMF 9 factors solution.