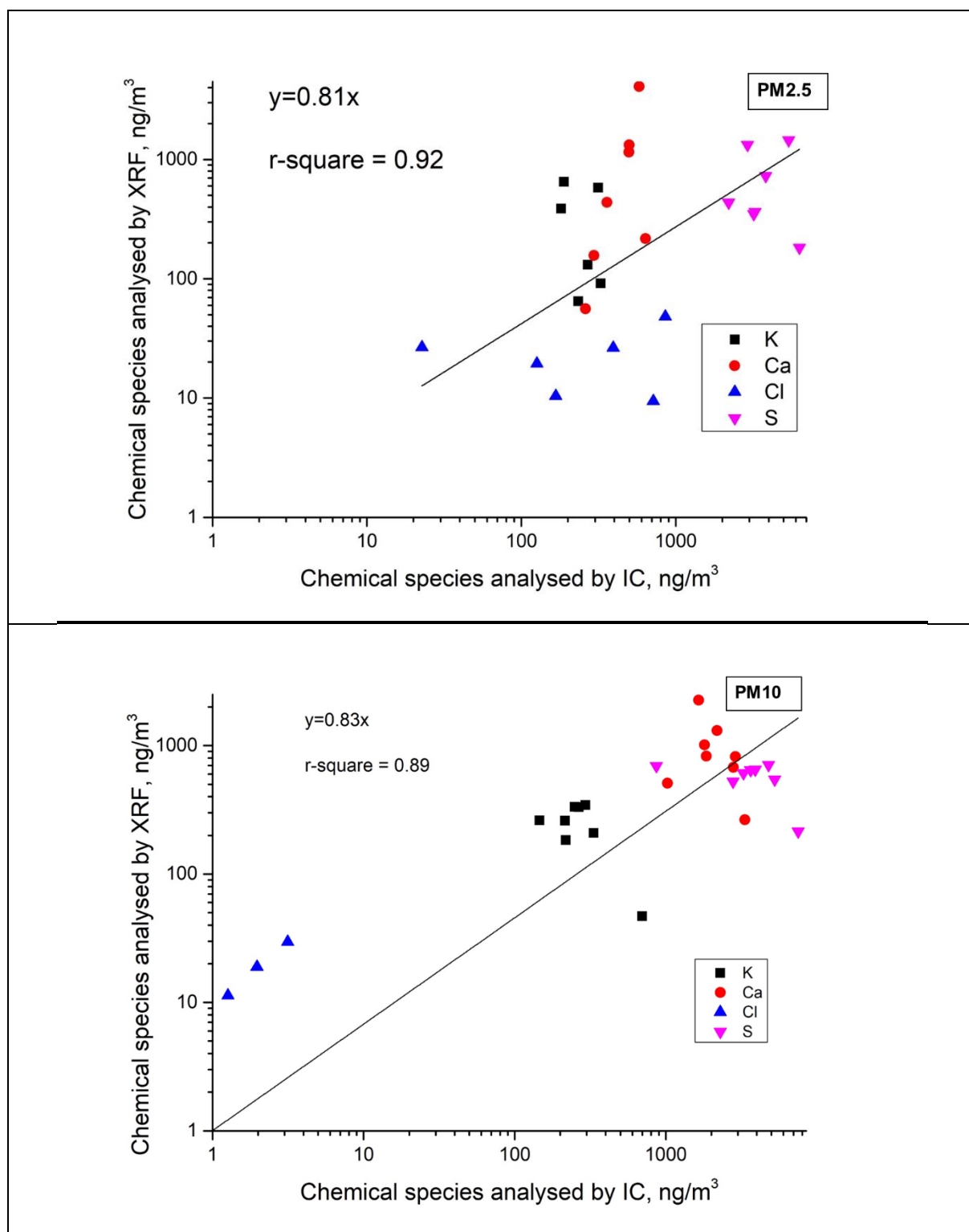## Supplementary Materials

Figure S1. Inter-comparison between Ion-Chromatography (for water-soluble ions) and X-ray Fluorescence (for the total elements) in PM2.5 (upper panel) and PM10 (bottom panel) fractions.
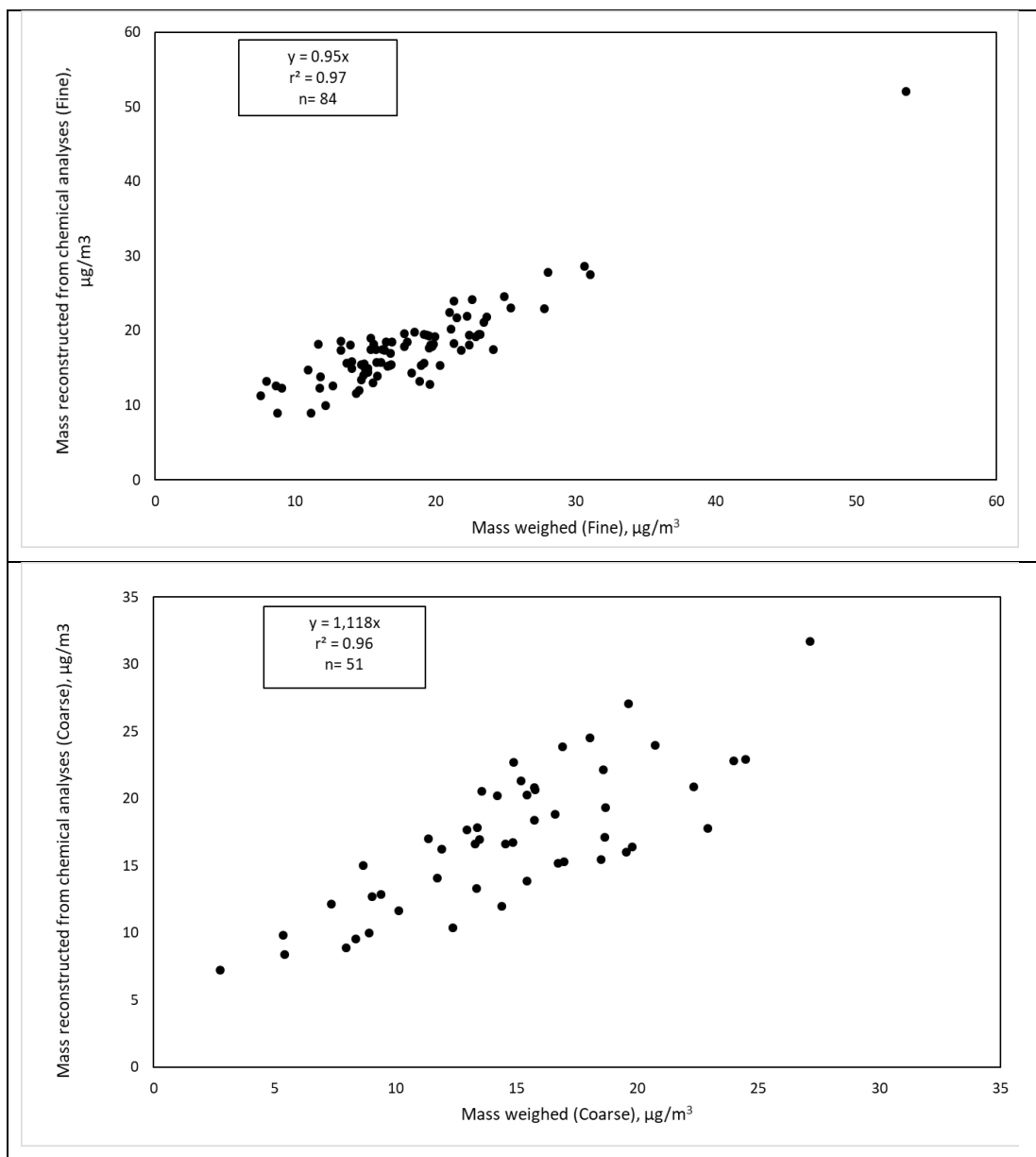
Figure S2. Consistency between the weighed and the reconstructed masses of the fine mode (k = 1.20 and f =0.229) (upper panel), the coarse mode (k = 1.20) where mineral dust was estimated with Malm et al. [42] method (bottom panel).

Figure S3. Temporal evolution of the identified PM sources contributed to PM$_{2.5}$ levels during the study period.
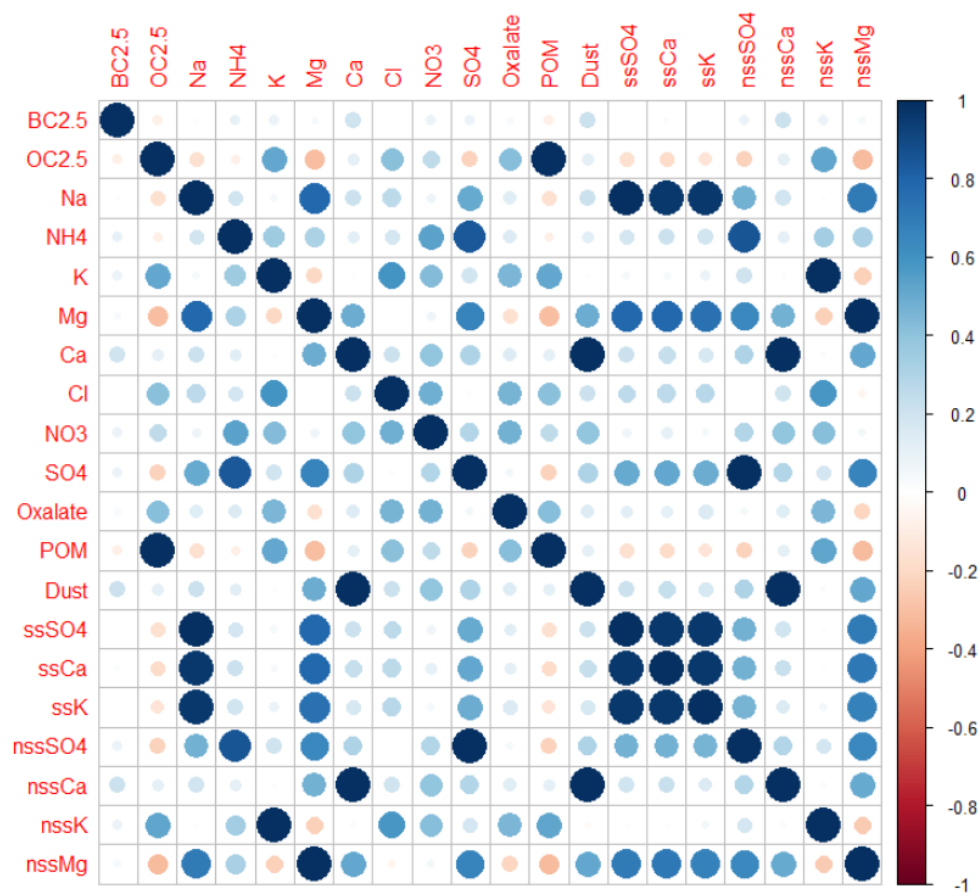
Figure S4. The correlation coefficients (r) between several source-indicating species in PM$_{2.5}$ in Tetouan.

Table S1. Summary of EPA PMF 5.0 settings and output diagnostics for receptor modeling of Tetouan PM$_{2.5}$.

Parameters	PM$_{2.5}$
Settings	
N species	12
N samples	89
N factors	5
Treatment of missing data	No missing data
Treatment of data below the detection limit (BDL)	Data used as reported, no modification or censoring of BDL data
Treatment of concentrations equal to or less than zero	Data used as reported, no modification or censoring of data ≤ 0
Extra modeling uncertainty	20%
Robust mode	Yes
Constraints	None
Seed value	Random
N bootstraps in BS	400
r2 for BS	0.6
DISP dQmax level	4, 8, 15, 25
DISP active species	All (BC specie was made weak)
N bootstraps; r2 for BS in BS-DISP	100; 0.6
BS-DISP active species	OC, Na$^+$, NH$_4^+$, K$^+$, Mg^{2+}, Cl$^-$, NO$_3^-$, SO$_4^{2-}$, C$_2$O$_4^{2-}$
BS-DISP dQmax	0.5, 1, 2, 4
Diagnostics	
Qtrue	504
Qexpected	395
Qrobust	502
Qrobust/Qexpected	1.27
DISP diagnostics:	
Error code	0
Largest decrease in Q	0
DISP % dQ	0.0%
DISP swaps by factor	0
BS-DISP Diagnostics:	
BS mapping (Unmapped)	97% (3)
BS-DISP % cases accepted	81%
Largest Decrease in Q:	-8.09
BS-DISP % dQ(Robust)	-1.61
# of Decreases in Q	0
# of Swaps in Best Fit:	5
# of Swaps in DISP:	71

Table S2. Factor Profiles (concentration of species and % of species total) obtained from the PMF analysis for the PM$_{2.5}$ datasets.

Factor Profiles (conc. of species) from Base Run #3 (Convergent Run)					
	Factor sources				
conc. of species (μg/m³)	Ammonium sulfate	Road Traffic and Biomass Burning	Fresh Sea Salt	Aged Sea Salt	Oxalate rich
PM$_{2.5}$	5.17	5.89	3.23	2.89	0.42
BC	0.13	1.84	0.00	0.76	0.13
OC	0.00	3.34	1.22	0.19	0.44
Na+	0.00	0.00	0.06	0.39	0.05
NH$_4^+$	0.82	0.00	0.12	0.12	0.00
K+	0.13	0.07	0.13	0.00	0.05
Mg^{2+}	0.02	0.00	0.00	0.07	0.00
Ca^{2+}	0.06	0.07	0.01	0.18	0.02
Cl-	0.00	0.00	0.34	0.04	0.00
NO$_3^-$	0.30	0.00	0.28	0.13	0.21
SO$_4^{2-}$	1.78	0.01	0.00	1.06	0.12
Oxalate	0.00	0.00	0.00	0.01	0.07
Factor Profiles (% of species sum) from Base Run #3 (Convergent Run)					
	Factor sources				
% of species sum	Ammonium sulfate	Road Traffic and Biomass Burning	Fresh Sea Salt	Aged Sea Salt	Oxalate rich
PM$_{2.5}$	29.36	33.48	18.36	16.41	2.38
BC	4.68	64.14	0.00	26.52	4.66
OC	0.00	64.30	23.55	3.72	8.42
Na+	0.00	0.00	11.78	77.79	10.43
NH$_4^+$	77.64	0.00	11.41	10.96	0.00
K+	33.27	19.16	33.49	0.00	14.08
Mg^{2+}	18.33	0.00	0.00	81.67	0.00
Ca^{2+}	16.42	21.48	2.28	54.68	5.13
Cl-	0.00	0.00	88.97	11.03	0.00
NO$_3^-$	32.08	0.32	30.67	13.91	23.03
SO$_4^{2-}$	59.94	0.46	0.00	35.62	3.97
Oxalate	0.00	0.00	0.80	7.54	91.66

Table S3. Monthly average of temperature (°C), precipitation (mm), wind speed (m/s), relative humidity (%), Boundary layer height (m), and ventilation coefficient (m/s²) derived from daily measurements at Tetouan city. Meteorological data records were retrieved from the weather station Sania-Ramel (35.58°N, 5.33°W) located in Tetouan, about 3.3 km from the sampling site (http://www.tutiempo.net, accessed in 2018). Boundary layer height (BLH) was estimated using the HYSPLIT™ model (Version 5.0) by running Meteorological Profile. The ventilation coefficient is defined as the product of boundary layer height and wind speed.

Month	T (°C)	Precipitation (mm)	WS (m/s)	RH (%)	BLH (m)	VC (m/s²)
May 2011	20.06	1.18	4.30	76.55	439.42	1959.92
Jun 2011	23.94	0.32	3.66	67.78	390.41	997.56
Jul 2011	24.88	0.00	4.56	60.55	384.33	1887.33
Aug 2011	26.11	0.08	3.63	62.39	350.87	1313.56
Sep 2011	23.89	0.27	4.05	70.29	465.33	1847.15
Oct 2011	21.19	0.95	3.91	72.31	488.98	1981.77
Nov 2011	16.68	3.86	3.73	73.21	515.52	2039.41
Dec 2011	14.42	0.36	4.48	65.90	443.08	2107.03
Jan 2012	13.18	1.82	3.78	69.55	410.45	1588.44
Feb 2012	12.20	0.71	4.53	57.31	500.82	2091.42
Mar 2012	15.39	0.45	5.65	67.07	536.47	3039.74
Apr 2012	16.97	1.74	6.30	58.54	659.90	3838.40