Supplementary Material of "Three years of aerosol mass, black carbon and particle number concentrations at Montsec (Southern Pyrenees, 1570 m.a.s.l.)"

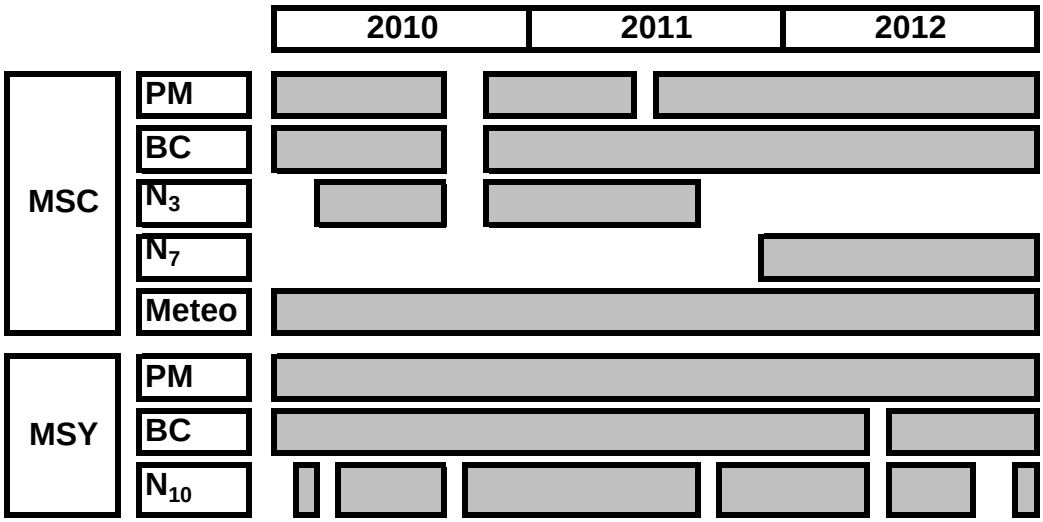


Fig. S1. Data schedule at Montsec (MSC) and Montseny (MSY).

Table S1. Arithmetic annual average of meteorological parameters at Montsec

Montsec d'Ares	T (ºC)	Tmax (ºC)	Tmin (ºC)	RH (%)	TotalPP* (mm)	WS** (m s^{-1})	WD** (degrees)	P (hPa)	SR (W m^{-2})
2007	8.6	28.3	-8.9	62	506	4.7	-	-	-
2008	7.9	27.2	-10.1	70	1186	4.3	-	-	-
2009	9	27.6	-9.8	66	639	5.8	297	843	-
2010	7.4	28.5	-12.4	69	755	4.4	293	846	189
2011	9.4	29.7	-9.9	65	597	4.3	247	852	198
2012	8.9	30.4	-13.5	59	640	4.9	312	851	203

*Annual accumulated precipitation

**Vector annual average

Table S2. Arithmetic seasonal average of meteorological parameters at Montsec during the study

Montsec d'Ares	T (ºC)	Tmax (ºC)	Tmin (ºC)	RH (%)	TotalPP* (mm)	WS** (m s^{-1})	WD** (degrees)	P (hPa)	SR (W m^{-2})
Spring	9.0	24.2	-3.7	69	215	4.4	218	850	242
Summer	17.2	30.4	3.5	57	57	3.8	203	854	288
Autumn	6.1	22.9	-8.6	72	119	4.9	319	848	121
Winter	1.7	15.4	-13.5	61	108	5.3	359	848	129

*Seasonal accumulated precipitation

**Vector seasonal average

Table S3. Arithmetic average of meteorological parameters at Montsec as a function of air mass origin.

Montsec d'Ares	T (ºC)	Tmax (ºC)	Tmin (ºC)	RH (%)	TotalPP* (mm)	WS** (m s^{-1})	WD** (degrees)	P (hPa)	SR (W m^{-2})
AN	5.4	25.5	-11.1	57	31	4.7	16	850	190
ANW	9.1	28.1	-8.4	66	68	4.7	291	850	208
ASW	8.0	24.3	-5.0	77	90	4.6	233	847	133
NAF	14.4	30.4	-1.9	63	92	4.6	178	852	232
MED	7.4	20.3	-3.4	71	35	4.0	134	851	161
EU	3.7	22.1	-13.5	58	9	4.7	30	849	194
WREG	4.3	20.2	-5.8	78	24	4.3	295	848	111
SREG	14.9	27.4	0.4	66	66	4.0	189	852	249

*Accumulated precipitation

**Vector average

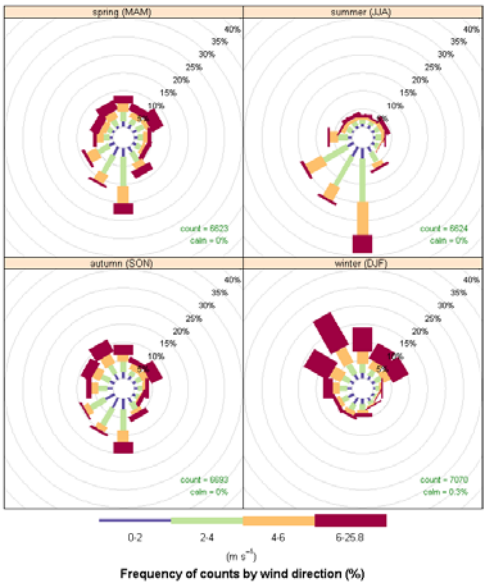


Fig. S2. Seasonal wind rose frequency for the study period at Montsec.

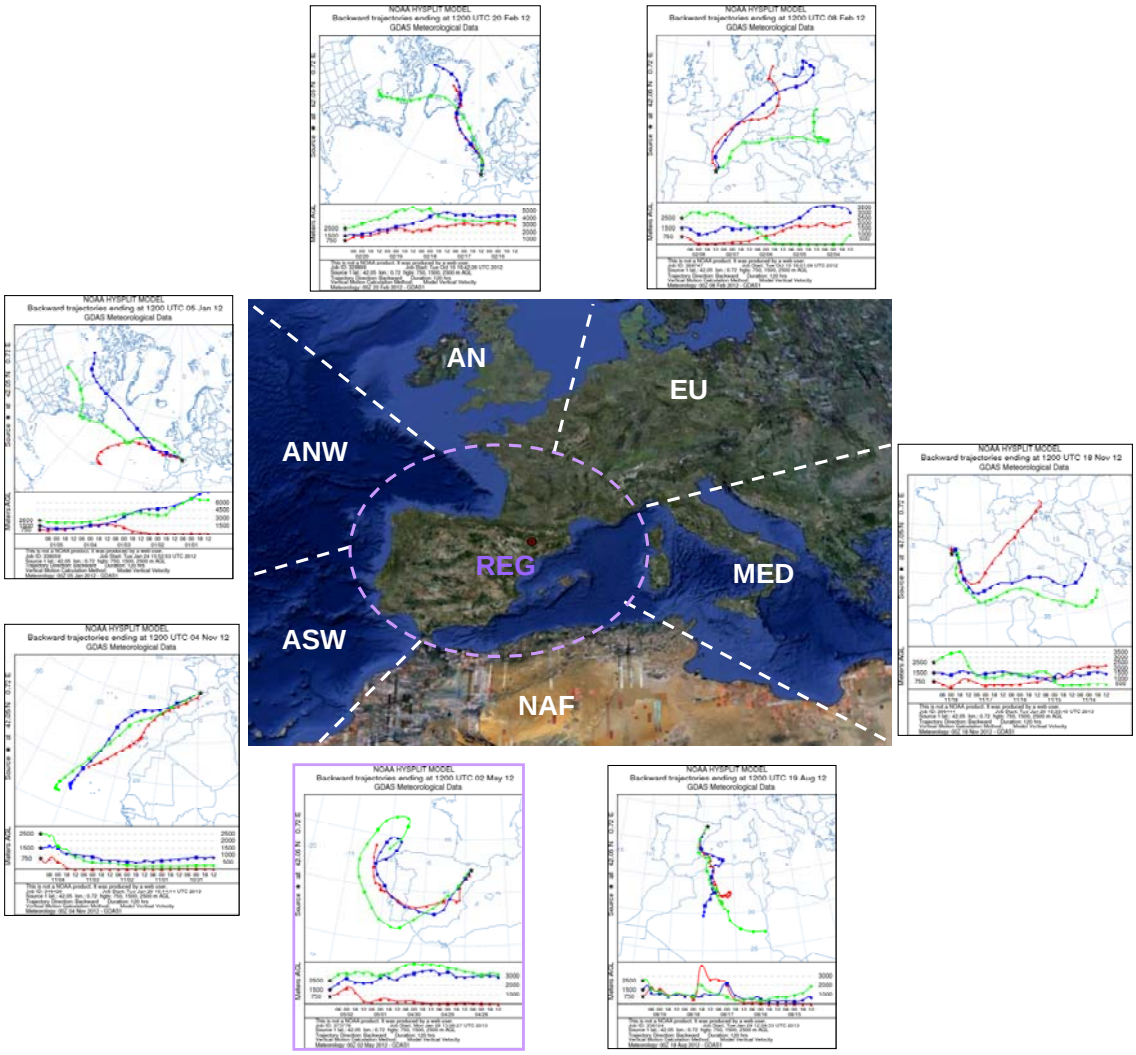


Fig. S3. Air mass origin sectors map and examples of backward trajectories for each sector according to their predominant transport direction.

Table S4. Three-year (2010-2012) arithmetic averages concentrations of PM, BC and N at different high altitude and rural stations in Europe.

		PM_{10} ($\mu g\ m^{-3}$)	$PM_{2.5}$ ($\mu g\ m^{-3}$)	PM_1 ($\mu g\ m^{-3}$)	BC ($\mu g\ m^{-3}$)	N_{10} (# cm^{-3})	N_7 (# cm^{-3})	N_3 (# cm^{-3})
Switzerland	Jungfraujoch (3578 m)	2.9	-	-	0.06*	634	-	-
	Rigi (1030 m)	8.0	7.5	5.8	-	-	-	-
	Chaumont (1137 m)	8.6	-	-	-	-	-	-
Italy	Mt. Cimone (2165 m)	8.8	-	-	0.33*	1847	-	-
Austria	Vorhegg (1020 m)	9.3	-	-	-	-	-	-
Germany	Schauinsland (1205 m)	9.3	7.3	-	0.38	-	-	-
	Schneefernerhaus (2650 m)	-	-	-	0.20	-	-	-
France	Puy de Dôme (1465 m)	-	-	-	0.22	2070	-	-
Spain	Campisábalos (1360 m)	10.3	5.1	-	-	-	-	-
	Risco Llano (1241 m)	11.5	5.8	-	-	-	-	-
	Montsec (1570 m)	11.9	8.2	5.3	0.19	-	2140	3716
	Zarra (885 m)	12.6	5.8	-	-	-	-	-
	Els Toms (470 m)	13.5	7.6	-	-	-	-	-
	Víznar (1265 m)	16.6	9.2	-	-	-	-	-
	Izaña (2373 m)	16.6	-	-	0.13	-	-	1467
	Cap de Creus (23 m)	16.8	7.9	-	-	-	-	-
	Montseny (720 m)	18.0	12.7	10.3	0.41	3475	-	-

Data from the ACTRIS Data Center web site.

* Jungfraujoch and Mt.Cimone BC concentrations averaged from 2007 to 2009.

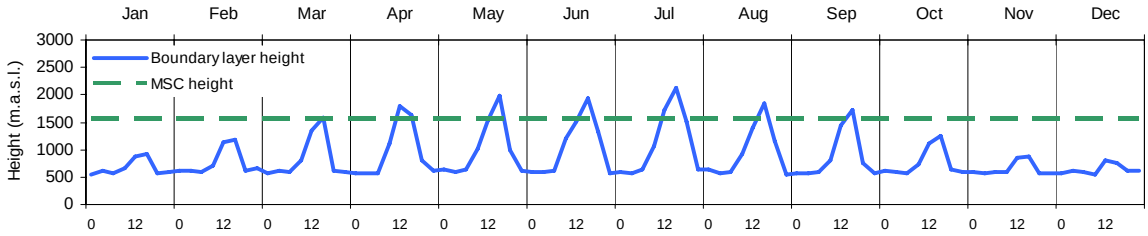
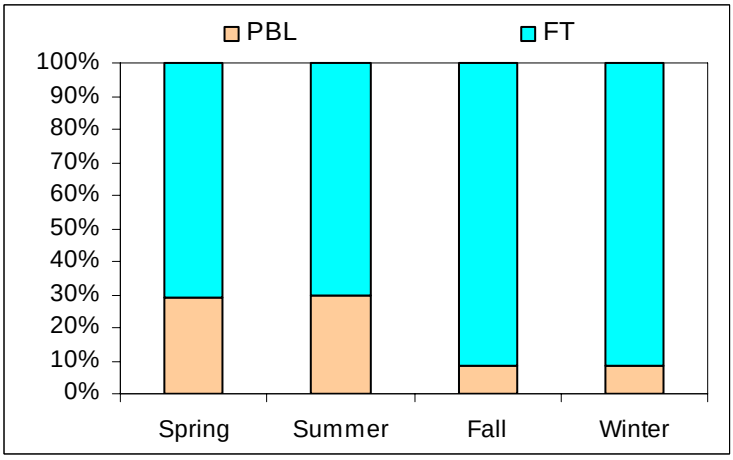
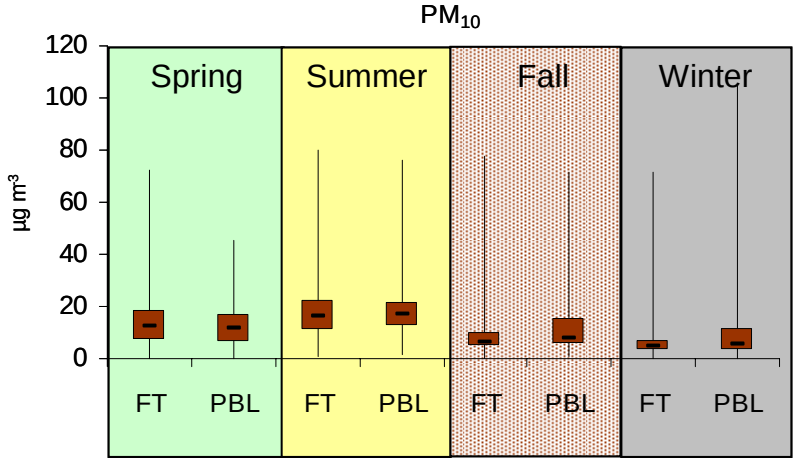


Fig. S4. Diurnal variation of the boundary layer height (computed with HYSPLIT model) averaged for each month during the study period at Montsec.

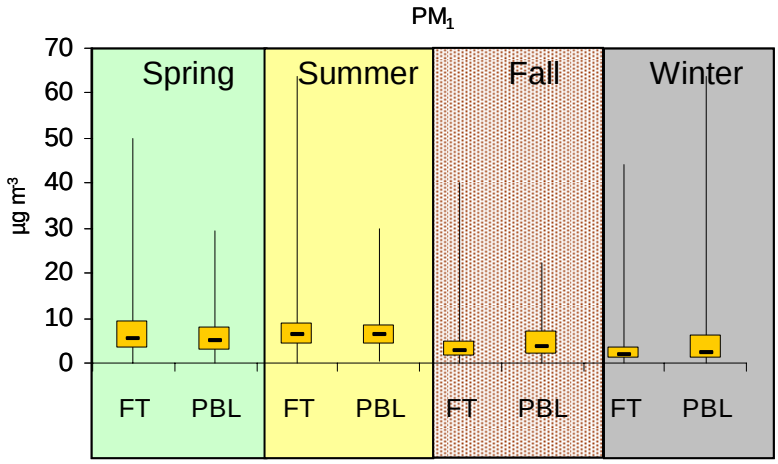
a)



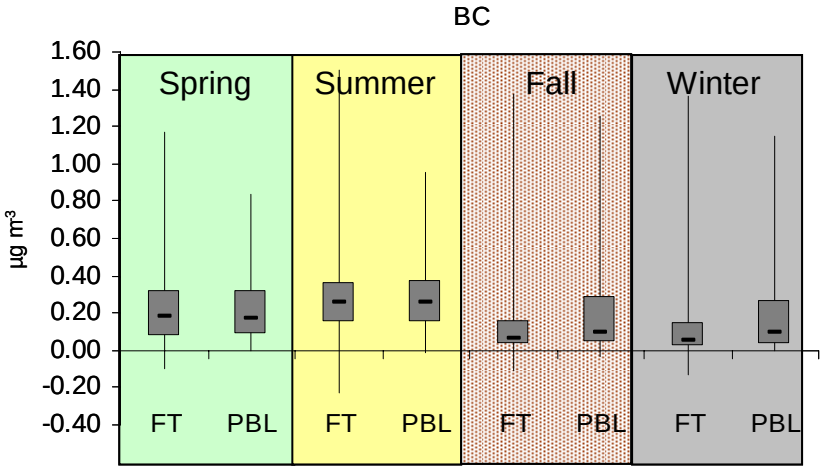
b)


PM10
120
100
80
60
40
20
0
µg m3
Spring
Summer
Fall
Winter
FT
PBL
FT
PBL
FT
PBL
FT
PBL

c)


PM1
70
60
50
40
30
20
10
0
µg m3
Spring
Summer
Fall
Winter
FT
PBL
FT
PBL
FT
PBL
FT
PBL

d)


BC
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
µg m3
Spring
Summer
Fall
Winter
FT
PBL
FT
PBL
FT
PBL
FT
PBL

e)

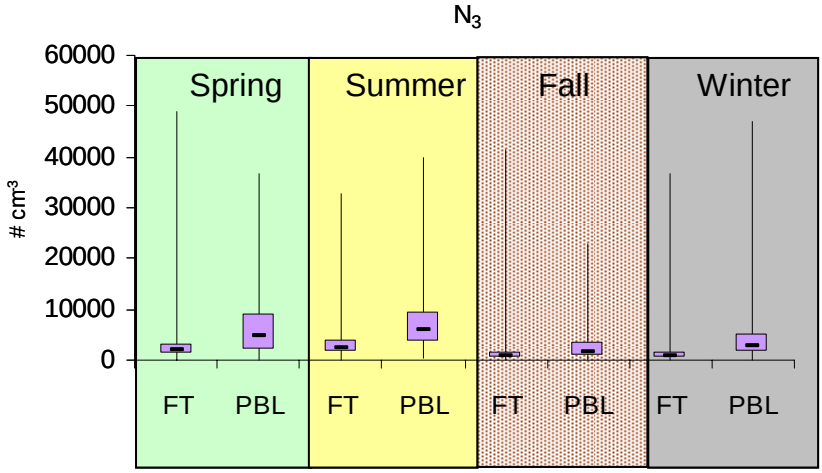


Fig. S5. (a) Percentage of time that Montsec is within or outside the PBL as a function of season. FT indicates that Montsec was in the free troposphere; PBL indicates that Montsec was within the planetary boundary layer. (b-e) Median (black line within the boxes) and percentiles (5-25-75-95, boxes and whiskers) of BC, PM_{10}, PM_1 and N_3 concentrations during the study period as a function of the season and the PBL height.

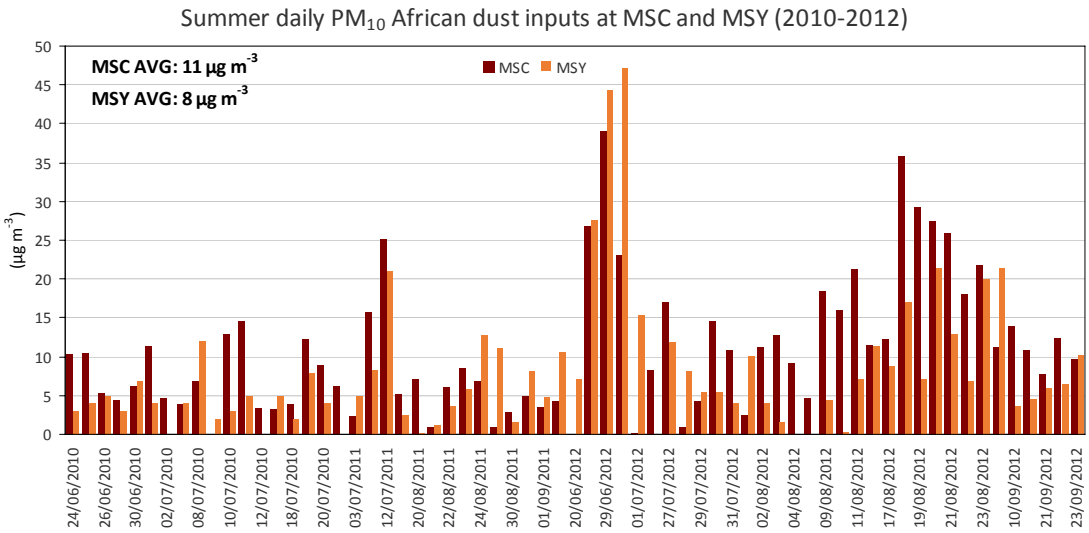


Fig. S6. Mass load from PM_{10} attributed to African dust in the warmer seasons and the three-year average at Montsec and Montseny.

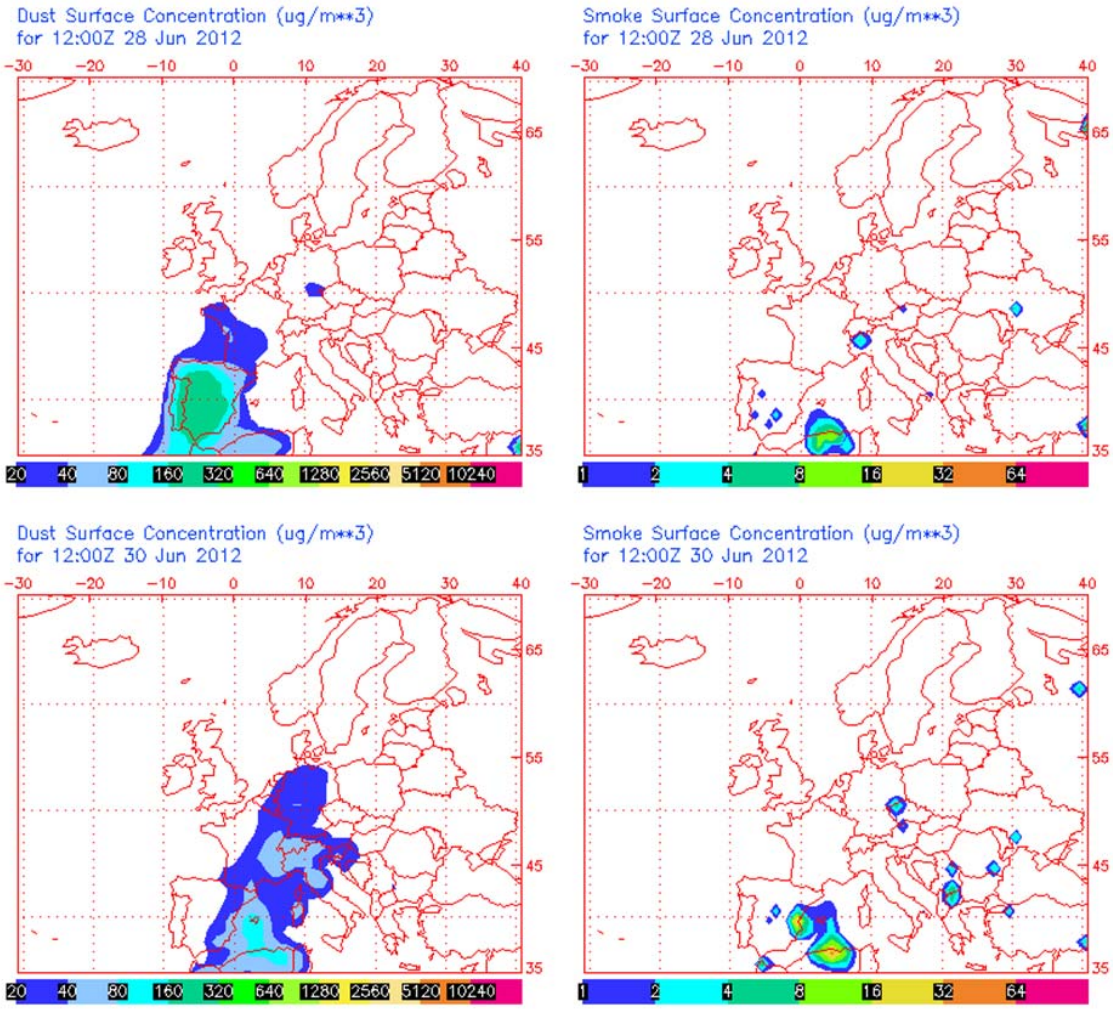


Fig. S7. Dust and smoke surface concentration from the NAAPS model under Saharan dust intrusion and wildfire episode affecting Montsec area.

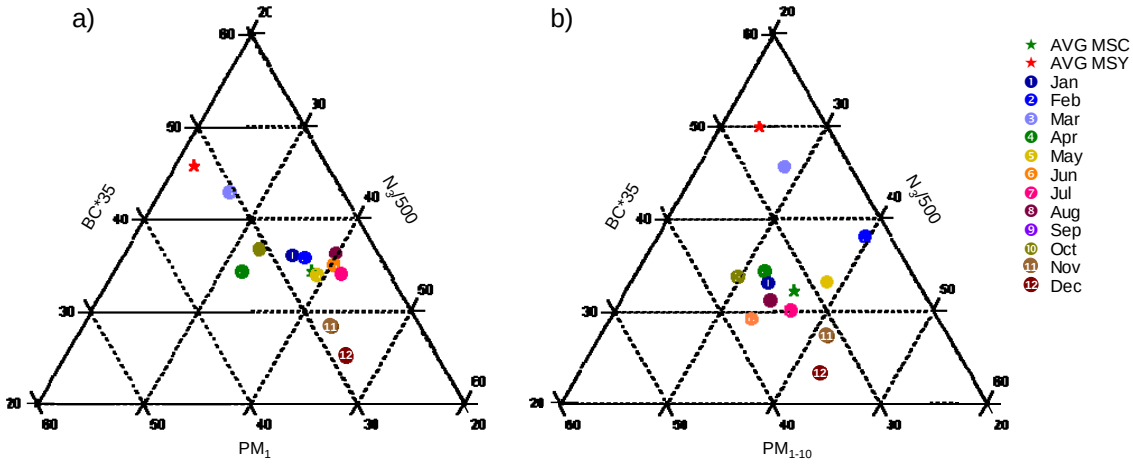


Fig. S8. Ternary Plot of (a) PM_1, BC*35 and N/500, and (b) PM_{1-10}, BC*35 and N/500 average and monthly averages concentrations at Montsec during the study period.

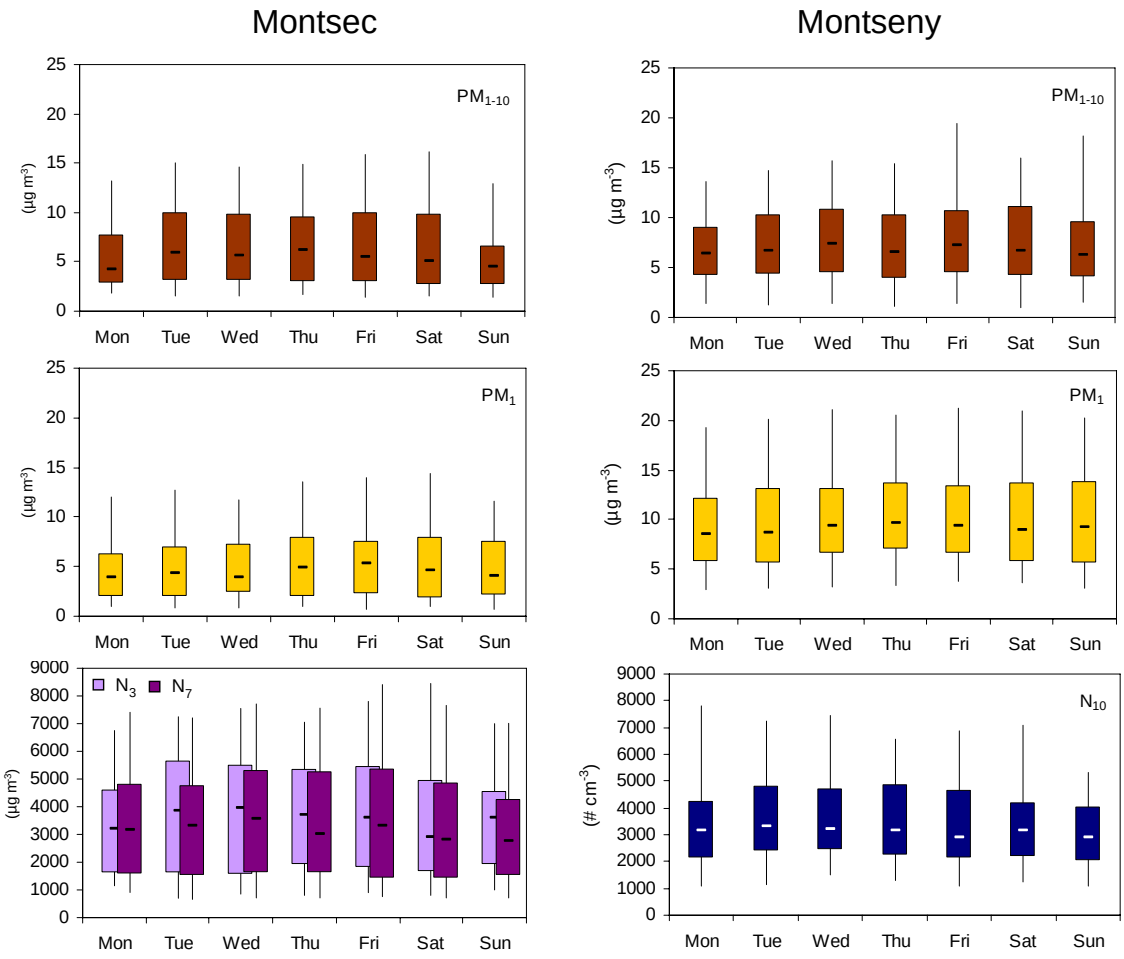


Fig. S9. Daily median (black line within the boxes) and percentiles (5-25-75-95, boxes and whiskers) of $PM_{1\text{-}10}$, PM_1 and N concentration during the study period at Montsec and Montseny.

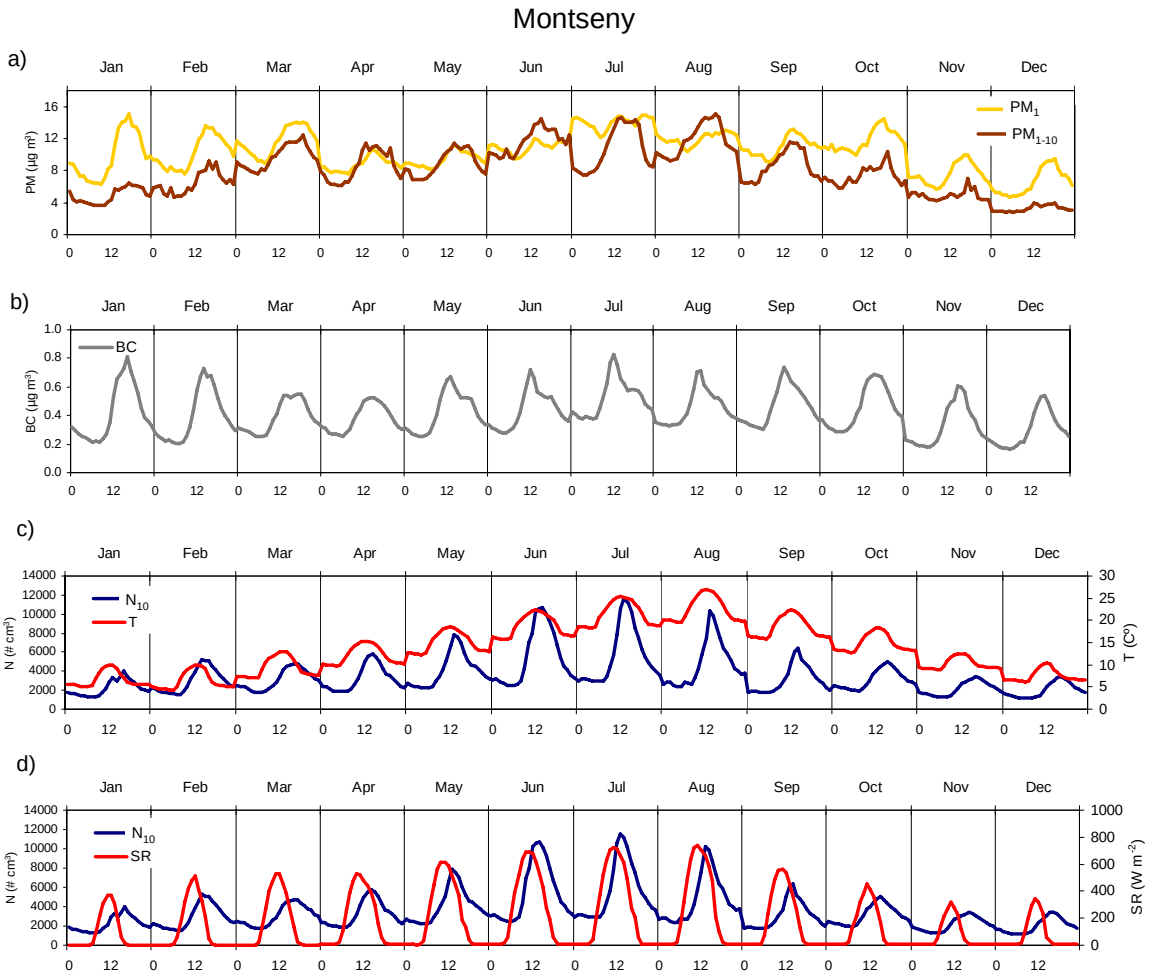


Fig. S10. Daily patterns of hourly (a) PM_1, $PM_{1\text{-}10}$, (b) BC, (c) N_{10} and temperature, and (d) N_3, N_7 and solar radiation (c) N measurements averaged for each month during the study period at Montseny.