Seasonal characterizations of organic and elemental carbon in atmospheric particles over south-eastern Italy

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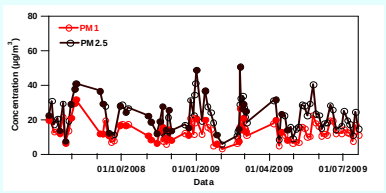
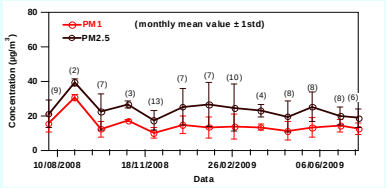
Results on OC and EC mass concentrations, determined by the Thermal-Optical-Transmission technique (TOT) on PM2.5 and PM1 samples are reported. PM2.5 and PM1 samples have been simultaneously collected by a Hydra dual-sampler from July 2008 to July 2009 at a suburban site of southeast-Italy.

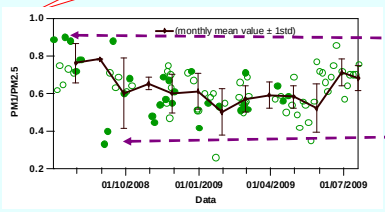
Time Evolutions and Correlation of PM2.5 and PM1 Mass Concentrations

Yearly mean value ± 1std:
PM2.5= 22 ± 9 μg/m³
PM1= 13 ± 6 μg/m³

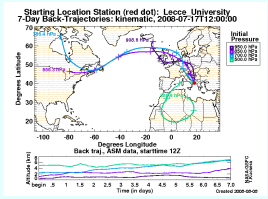


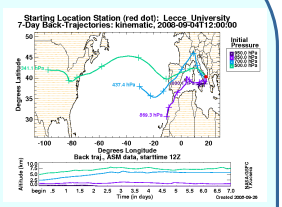


PM2.5 and PM1 mass concentrations do not reveal any marked seasonality and are highly correlated.

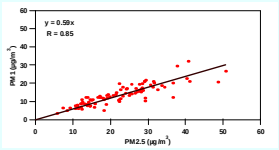


PM1/PM2.5 ratios vary from 0.26 to 0.90: the contribution of PM1 particles is larger on summer.

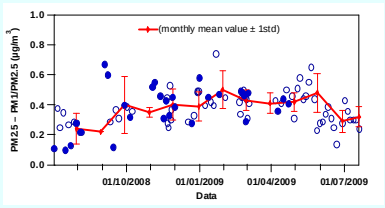




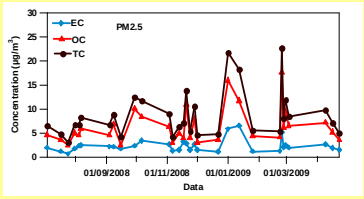
7-day analytical back trajectories show that the PM1/PM2.5 ratio is affected by the advection pattern: continental particles are advected to Lecce on 17 July 2007 (PM1/PM2.5=0.90) while, dust particles are advected to Lecce on 4 September 2008 (PM1/PM2.5=0.33).

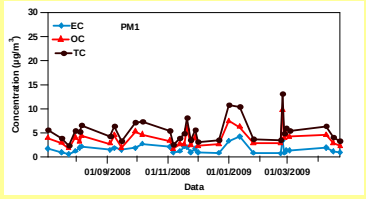


Hence, the contribution of coarse mode particles gets smaller on summer

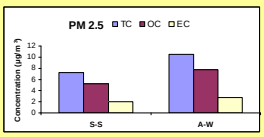


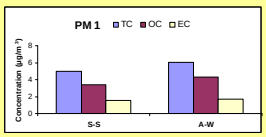
Total Carbon (TC), Organic Carbon (OC) and Elemental Carbon (EC) Time Evolutions in PM2.5 and PM1 Samples



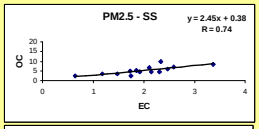


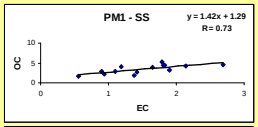
Time series of EC, OC and TC mass concentrations do not reveal any marked seasonality both in PM2.5 and PM1 samples

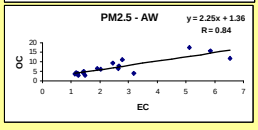


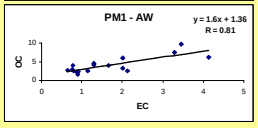


Seasonal variations of TC, OC and EC Concentrations in PM2.5 and PM1 samples show a slight seasonal dependence.





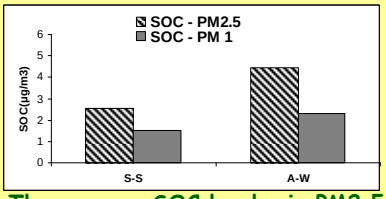


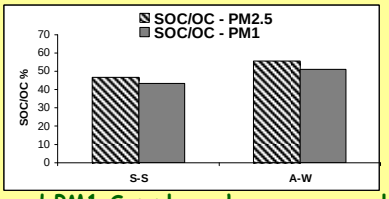


A good correlation between OC and EC has been observed in the SS and AW periods, with higher carbonaceous aerosol concentrations in AW. Similar slops of regression are found between SS and AW, implying similar emission sources of carbonaceous particles.

Estimation of the secondary organic aerosol by EC Tracer Method(*):

$$OC_{sec} = OC_{tot} - EC \times (OC/EC)_{min}$$





The average SOC levels, in PM2.5 and PM1 Samples, show a seasonal pattern of being higher in AW and lower in the SS.
Besides, the relative contribution of SOC to OC is ~ 45 % and 54% in two seasons respectively.

	PM 2.5		PM 1	
μg/m³	S - S	A - W	S - S	A - W
Concentration	25 ± 10	24 ±12	16 ± 8	13 ± 6
OC	5.3 ± 2	7.2 ± 4	3.5 ± 1	4 ± 2
EC	2 ± 0.7	2.6 ± 2	1.5 ± 0.6	1.7 ± 1
TC	7 ± 3	9.8 ± 6	5 ± 1.6	5.7 ± 3
OC/EC	2.7 ± 0.7	2.9 ± 0.8	2.4 ± 0.6	2.9 ± 1
TC/PM	31 ± 10	39.6 ± 8	33 ± 9.4	42.8 ± 10
SOC	2.6 ± 1.5	4.5 ± 3	1.3 ± 0.7	2.3 ± 1.3
SOC/OC	46.8 ± 12	55.7± 15	43 ± 14	51 ± 17

Statistical Data on OC, EC TC and SOC in PM2.5 and PM1 Samples

Main Results

- Though EC and OC levels in Spring-Summer are lower than those in the Autumn-Winter, they do not reveal any marked seasonality in PM1 and PM2.5 samples.
- Carbonaceous aerosol concentration (TC = EC+OC) accounted for ~ 36% of the PM2.5 and 38% of the PM1 sampled mass.
- The average OC/EC ratio is 2.9 for PM2.5 and PM1 samples in Autumn – Winter, slightly larger than Spring-Summer.
- The average SOC level in Autumn-Winter is about 1.7 times the Spring –Summer average, and the relative contribution of SOC to OC is higher by 20% in AW than SS, both in PM2.5 and PM1.
- These results are related to meteorological conditions: a very limited mixing height evolution is associated with Winter season leading to decreased air renovation when compared to Summer season.

(*) Turpin,B. J., Huntzicker, J.J., 1995. Atmospheric Environment 29, 3527-3544.