

Two years fine and ultrafine particles measurements in Rome, Italy

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Introduction

The main objective of this study were to establish validated and consistent data sets of particle number concentrations in Rome. These data-sets will be used for quantifying the contributions of various pollution sources of ultrafine particles and to develop a method to estimate the previous number concentration of ultrafine particles. These data were collected and will be used in the framework of the research project : "Health effects of air pollution on susceptible sub-population - traditional air pollutants, ultrafine particles and myocardial infraction: data base and health assessment" which main objectives are to quantify the risk of hospitalisation and of death due to air pollution, in particular airborne ultrafine particles, in individuals with coronary heart disease and to quantify the attributable risk of environmental exposures among a sensitive subgroup in order to facilitate appropriate public health strategies for the prevention of air pollution related health effects.

Material and Methods

Two-year measurement of ultrafine particles using condensation particle counter (CPC 3022A, TSI) have been performed, together with others classic pollutants (PM₁₀, PM_{2.5}, CO, NO₂, NO, NO_x, O₃ collected only at the primary site).

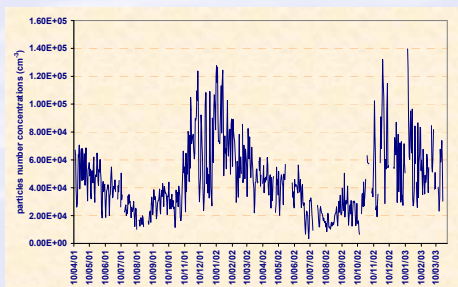


Primary site:
(ISS - traffic oriented) from April 2001 to March 2003.

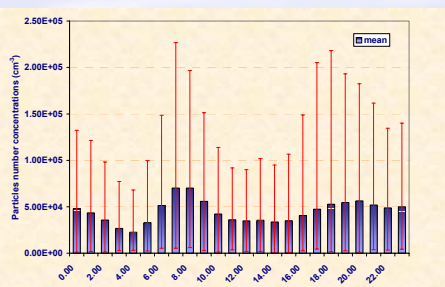


Secondary site (Orto Botanico - Urban background) from February 2002 to March 2003).

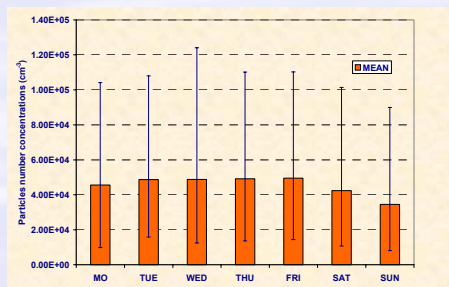
Results



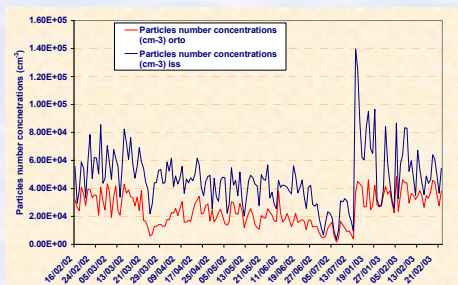
Daily trend trough the years are reported. Higher values were found during winter period.



Hourly averages trend trough the years are reported. Particles concentrations were very well correlated with traffic, with the higher mean values during the hours of higher traffic volume.



Week-day typical trough the year are reported. Mean concentrations for the different days of the week are very close, with a minimum, as expected, during Sunday.



The concentration of particles at the background site were about 50% lower with respect to the traffic oriented site. In both sites particles concentrations were very well correlated with traffic, with highest mean values during rush hours. Otherwise, peak concentrations decreased sharply with the distance from the sources. Comparison between the particles number concentrations measured at the two sites showed a good correlation ($r = 0.74$).

In the most polluted cities the problem of the spatial variability of UF is a relevant issue.

	Valid N	Mean	S.D.	Min	25th Perc	Median	75th Perc	Max
PM _{2.5} (µg/m ³)	387	24.0	12.2	4.4	16.2	21.3	29.0	87.9
PM ₁₀ (µg/m ³)	389	42.0	18.7	6.7	30.2	38.6	48.5	124.9
PM _{2.5} /PM ₁₀	314	0.58	0.13	0.21	0.49	0.58	0.67	0.99
CO (mg/m ³)	659	1.4	0.8	0.3	0.8	1.2	1.7	6.3
NO _x (µg/m ³)	661	86.8	54.7	14.4	49.6	70.7	108.5	344.9
NO (µg/m ³)	661	41.9	44.9	1.6	12.7	25.7	52.3	288.9
NO ₂ (µg/m ³)	661	44.9	14.5	12.1	34.4	44.5	53.9	89.2
O ₃ (µg/m ³)	688	32.8	18.1	2.9	17.3	32.9	46.8	86.2
Particles iss (pp/cm ³)	630	4.58E+04	2.47E+04	3.50E+03	2.76E+04	4.10E+04	5.80E+04	1.40E+05
Particles orto (pp/cm ³)	178	2.50E+04	1.11E+04	1.73E+03	1.65E+04	2.41E+04	3.43E+04	4.83E+04

Mean of the 24 hours daily mean over the whole period and descriptive statistics of total particles number concentrations, PM_{2.5}, PM₁₀, CO, NO_x, NO₂ and O₃ are reported. Mean values trough the year were lower than the target value recommended by the UE Directive, except for PM₁₀. No target limit values were still proposed by UE for PM_{2.5} and particles number concentration.

Variable	PM _{2.5}	PM ₁₀	CO	NO _x	NO	NO ₂	O ₃	Particles
PM _{2.5}	1.0000							
PM ₁₀	0.8511	1.0000						
CO	0.6452	0.5729	1.0000					
NO _x	0.7052	0.6269	0.8954	1.0000				
NO	0.6710	0.6037	0.8970	0.9767	1.0000			
NO ₂	0.5550	0.4598	0.5852	0.7456	0.5851	1.0000		
O ₃	-0.4044	-0.3080	-0.7039	-0.7082	-0.6756	-0.5851	1.0000	
Particles	0.5534	0.4976	0.7688	0.8336	0.8168	0.6234	-0.6341	1.0000

CO, NO and NO_x are all highly correlated with ultrafines (577, 576 and 576 obs. respectively). CO could be used as a retrospective exposure parameter.

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