Particle Number Size Distribution Statistics at Urban and Suburban Background and Remote Sites in Greece during Summer

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The number size distributions of sub-micrometer aerosol particles in the environment display a statistically significant modal structure (van Dingenen et al., 2004). This structure depends on a number of factors such as local atmospheric conditions, density and type of emissions as well as a number of atmospheric processes. A series of intensive campaigns were conducted over several sites in Greece during the summer of 2012, and the particle number concentrations as well as the respective size distributions were measured by means of Scanning Mobility Particle Sizers (SMPSs). After statistical analysis, preliminary results from the measured number size distributions are presented in Table 1 for four sites including two suburban background sites in Athens and Patras, one urban background site in Thessaloniki and the Mediterranean remote site of Finokalia in Crete. The highest median concentration is observed in Athens and the lowest at the remote station of Finokalia in Crete. Patras display the highest variability in the observed values followed by Thessaloniki in terms of min and max values. The relatively low median values observed at the Thessaloniki site are investigated further with respect to other particle size distribution metrics.

The size distributions were assumed to be reproduced by a sum of lognormal modes, each characterized by a geometric mean size $D_{pgi,}$ a standard deviation σ_{gi} and a particle number N_i. Least square fitting iterative analysis was performed on datasets by means of a modified algorithm based on the work of Hussein et al. (2005). The maximum number of log-normal modes was set to three and the algorithm was allowed to reduce that number to one, provided a better or equivalent fit was reached. Results were grouped on 3 types of modes generally attributed to Nucleation, Aitken and Accumulation modes, with each type allowed to appear in a small or larger size fraction (indicated by 1 or 2) within the boundaries of these modes. Results for the GAW site in Athens are displayed in Fig. 1. Higher variability in the mean concentration range during the 24-hour cycle is observed for the Nucleation and Aitken modes, but not for the accumulation mode. This is partly explained by the formation and transport mechanisms known to govern the occurrence of smaller ultrafine particles.

Table 1: Summary of partcle number concnetrations observed at different sites in Greece.

N [cm^{-3}]	Median (x 10^3)	Min (x 10^3)	Max (x 10^3)	Std (x 10^3)
Athens	6.16	1.88	27.12	4.79
Patras	4.27	0.96	456.28	12.61
Thessaloniki	3.52	0.48	132.02	2.66
Finokalia	3.13	1.06	9.33	1.02

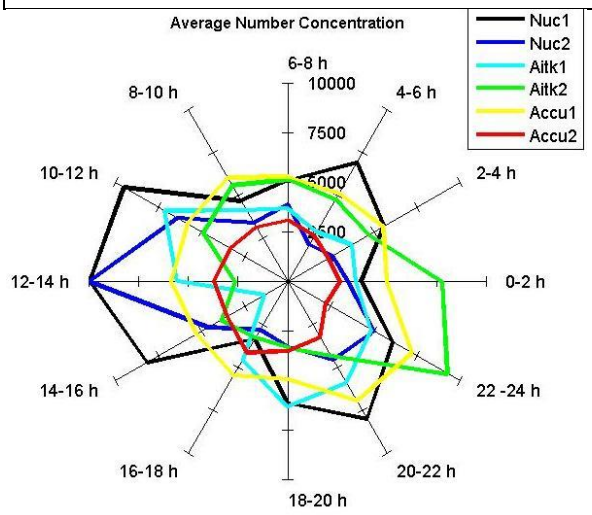

Fig. 1. Statistics of the average concnetrations for 2 hour periods observed over the 24hour daily cycle during the summer of 2012 at the Demokritos GAW suburban background station.

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