Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 6, 2411-2421, 2006
www.atmos-chem-phys.net/6/2411/2006/

Winter and summer time size distributions and densities of traffic-related aerosol particles at a busy highway in Helsinki

A. Virtanen[1], T. Rönkkö[1], J. Kannosto[1], J. Ristimäki[1], J. M. Mäkelä[1], J. Keskinen[1], T. Pakkanen[2], R. Hillamo[2], L. Pirjola[3,5], and K. Hämeri[4,5]

[1]Tampere University of Technology, Institute of Physics, Aerosol Physics, P.O. Box 692, 33101 Tampere, Finland

[2]Finnish Meteorological Institute, Air Quality Research, Sahaajankatu 20 E, 00810 Helsinki, Finland

[3]Helsinki Polytechnics, Department of Technology, P.O. Box 4020, 00099 Helsinki, Finland

[4]Finnish Institute of Occupational Health, Department of Physics, Topeliuksenkatu 41, 00250 Helsinki, Finland

[5]University of Helsinki, Department of Physical Sciences, P.O. Box 64, 00014 University of Helsinki, Finland

Abstract. Number concentrations and size distributions of traffic related aerosol particles were measured at a roadside in Helsinki during two winter campaigns (10–26 February 2003, 28 January–12 February 2004) and two summer campaigns (12–27 August 2003, 6–20 August 2004). The measurements were performed simultaneously at distances of 9 m and 65 m from the highway. Total number concentrations were measured by a condensation particle counter (CPC) and particle size distributions by a scanning mobility particle sizer (SMPS) and an electrical low pressure impactor (ELPI). This study concentrates on data that were measured when the wind direction was from the road to the measurement site. The total concentrations in the wintertime were 2–3 times higher than in the summertime and the concentrations were dominated by nucleation mode particles. The particles smaller than 63 nm (aerodynamic diameter) constituted ~90% of all particles in the wintertime and ~80% of particles in the summer time. The particle total concentration increased with increasing traffic rate. The effect of traffic rate on particles smaller than 63 nm was stronger than on the larger particles. The particle distributions at the roadside consisted of two distinguishable modes. The geometric mean diameter (GMD) of nucleation mode (Mode 1) was 20.3 nm in summer and 18.9 nm in winter. The GMD of the larger mode consisting mostly of traffic related soot particles (Mode 2) was 72.0 nm in summer and 75.1 nm in winter. The GMD values of the modes did not depend on the traffic rate. The average particle density for each mode was determined by a parallel density fitting method based on the size distribution measurement made by ELPI and SMPS. The average density value for Mode 1 particles was 1.0±0.13 g/cm^3 and 1.0±0.07 g/cm^3 both in summer and winter respectively, while the average density value for Mode 2 was 1.5±0.1 g/cm^3 and 1.8±0.3 g/cm^3 for summer and winter, respectively.

Final Revised Paper (PDF, 2164 KB) Discussion Paper (ACPD)

Citation: Virtanen, A., Rönkkö, T., Kannosto, J., Ristimäki, J., Mäkelä, J. M., Keskinen, J., Pakkanen, T., Hillamo, R., Pirjola, L., and Hämeri, K.: Winter and summer time size distributions and densities of traffic-related aerosol particles at a busy highway in Helsinki, Atmos. Chem. Phys., 6, 2411-2421, 2006. Bibtex EndNote Reference Manager