Geophysical Research Abstracts
Vol. 17, EGU2015-6850, 2015
EGU General Assembly 2015

Evaluation of aerosol processes between roadside and neighbourhood scale

Matthias Karl (1), Jaakko Kukkonen (2), Liisa Pirjola (3,4), and Menno P. Keuken (5)

(1) Norwegian Institute for Air Research, NILU, Kjeller, Norway (mka@nilu.no), (2) Finnish Meteorological Institute, Helsinki, Finland, (3) Metropolia University of Applied Sciences, Helsinki, Finland, (4) Department of Physics, University of Helsinki, Helsinki, Finland, (5) TNO, Netherlands Applied Research Organisation, Utrecht, the Netherlands

Particle emissions from road transport include vehicle exhaust emissions, tire/brake wear and re-suspension of road dust. Vehicle exhaust emissions usually constitute the most significant source of ultrafine particles (UFP), i.e. particles with diameters <100 nm, in urban environments. Several toxicological studies have concluded that UFP are more toxic than larger particles with the same chemical composition and at the same mass concentration. Since UFP contribute negligibly to the mass concentration of PM10 and PM2.5, they should be described in terms of particle number (PN) concentration. However, only PM10 and PM2.5 are regulated by current air pollution legislation. UFP emitted from road traffic are subject to complex dilution and transformation processes in the urban environment. This model study evaluates the influence of aerosol processes on PN concentration on the spatial and temporal range between the roadside, typically represented by measurements at a traffic monitoring site, and the neighbourhood scale, extending from several hundred meters to several kilometres. Several dispersion scenarios for the cities Oslo, Helsinki and Rotterdam were simulated using the multicomponent aerosol dynamics process model MAFOR, approximating dilution by a power-law function. Aerosol processes considered in this study were condensation/evaporation of n-alkanes, coagulation and the dry deposition of particles. Under typical dispersion conditions dilution clearly dominated the change of total PN on the neighbourhood scale. Dry deposition and coagulation of particles were identified to be the most important aerosol dynamical processes controlling the removal of particles from emitted from vehicular exhaust on urban time scales. The effect of condensation/evaporation of organic vapours emitted by vehicles on particle numbers and on particle size distributions was examined. A simplified parameterization for the implementation of coagulation and dry deposition of particles in urban air quality models is presented. Further work is needed to validate size segregated PN concentration distributions modelled by the urban models.