Modelling of air quality : number of particles

S. Deschamps[1], K. N. Sartelet[1], F. Freutel[2]

[1]CEREA, Joint Laboratory École des Ponts ParisTech/EDF R&D, Université Paris-Est, 77455 Marne-la-Vallée, France
[2]Particle Chemistry Department, Max Planck Institute for Chemistry, D-55128 Mainz, Germany
Keywords: Aerosol, air quality model, Number concentration.
Presenting author email: stephanie.deschamps@cerea.enpc.fr

Although ongoing air quality regulations only apply to particle mass, the number of particles may also has a negative impact on human health. Therefore it is essential that air quality models simulate both particle mass and number, and that simulations represent well the measured concentrations in the atmosphere. Particle mass is regulated for particles with aerodynamic diameters less than 2.5 and 10 µm ($PM_{2.5}$ and PM_{10}). Ultra fine particles, which have diameters less than 0.1 µm, usually have low mass concentrations, but high number concentrations.

The Polyphemus air quality modelling system is modified in order to simulate as accurately as possible both particle mass and number. The modelling of particle number has to include some processes which are not essential to the modelling of particle mass, such as nucleation and the Kelvin effect, which allows to consider the curvature of particles for condensation/evaporation. Furthermore, a numerical algorithm that accurately represent the evolution of both number and mass concentrations of particles (*Devilliers et al*, 2013) for condensation/evaporation is implemented.

Table 1: Comparisons of simulated mass concentrations to BDQA measurements ($\bar{o}$ represent measured concentrations and $\bar{c}$ simulated concentrations. MFB is the mean fractional bias and MFE the mean fractional error).

	$\bar{o}$ ($\mu g.m^{-3}$)	$\bar{c}$ ($\mu g.m^{-3}$)	MFB (%)	MFE (%)
$PM_{2.5}$	13.6	10.8	-16.8	39.6
PM_{10}	25.7	12.8	-60	63.9

The model is evaluated for both mass and number concentrations by comparisons to measurements performed during the "MEGAPOLI" campaign in July 2009 in the Paris metropolitan area.

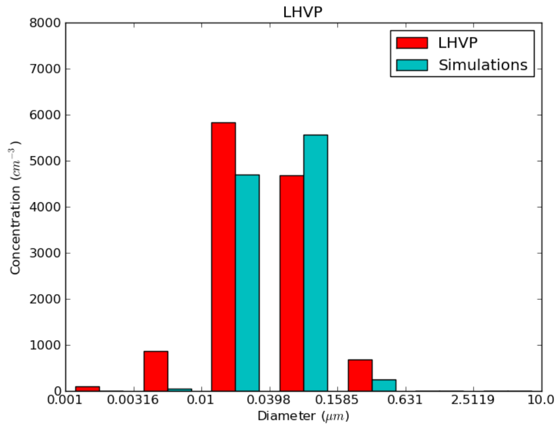

Figure 1: Comparison between simulated and measured number concentrations at LHVP (Laboratoire d'Hygiène de la Ville de Paris).

The authors would like to thank Maik Merkel, Alfred Wiedensohler (Leibniz Institute for Tropospheric Research) and Evangelia Kostenidou (FORTH Institute) for providing aerosol number concentration measurements.

Devilliers, M., Debry, E., Sartelet K. N., Seigneur, C. (2013), *A new algorithm to solve condensation/evaporation for ultra fine, fine and coarse particles*, Journal of Aerosol Science, **55**, 116–136.