LARGE EDDY SIMULATION OF SHADING EFFECTS ON NO2, NO AND O3 CONCENTRATIONS WITHIN AN IDEALISED STREET CANYON

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Obstacle resolving numerical models are an established technique applied for the assessment of air quality within the obstacle layer of urban areas. Increasingly, these models account not only for passive tracers, but also for chemical reactions, whereas chemistry modules of different complexity are used. A number of chemical transformations considered in these models are driven by solar radiation. The complex obstacle configuration within most urban areas leads to patches of shaded and unshaded areas within close vicinities. Hence the rate of certain chemical reactions can vary considerably in space. The influence of these shading effects on the photochemical reactions, pollutant dispersion, and kerbside concentrations within street canyons is investigated in this study.

The numerical model employed in this study is the Regional Atmospheric Modelling System (RAMS) by Pielke et al. (1992) with modifications for the application to the obstacle layer by Cui et al. (2004). A chemistry module accounting for the reactions of NO, NO2 and O3 has been introduced by Baker et al. (2004).

Numerical model simulations have been carried out for an idealised street canyon with typical scenarios representing background concentration and traffic emission rates of an urban area. Different magnitudes of the actual change of reaction rates in the shaded areas have been assumed as well as varying locations of the shaded area. Results for a case with a moderate emissions show differences in kerbside locations of up to 4 ppb for all three pollutants. The effect might be expected to be higher for cases with different NOx / O3 ratios.