APPLICATION OF MM5 AND UAM-V TO MODEL THE AIR POLLUTION IN LONDON USING AN IMPROVED TREATMENT OF SURFACE ROUGHNESS

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Urban air pollution is an environmental problem of major concern with important health implications. Numerical models have been used by environmental research agencies and regulators to predict and manage urban air pollution. Such models are not specifically designed for urban applications and normally do not include detailed urban parameterisation, such as for surface roughness or urban heat fluxes. Dispersion of air pollution within cities, however, is influenced by urban features such as increased surface roughness. This paper presents a study using MM5 and UAM-V to assess the effect of urban boundary layer features on meteorological parameters, and hence London's air quality.

MM5 is a non-hydrostatic (version 3), terrain-following sigma-coordinate model designed to simulate mesoscale and regional-scale atmospheric circulation. This paper considers the effect of an improved surface roughness treatment on meteorological profiles and pollution dispersion. Detailed surface roughness scale has been developed for a domain of 100x100km, including the urban area of London. Surface roughness length (z_o) values were calculated using Digital Elevation Model (DEM) data and land cover data. The DEM data were derived from the LANDMAP Project (Manchester Information and Associated Services, MIMAS) with a resolution of 30x30m. The land cover data were derived from the Centre for Ecology and Hydrology (CEH) database, with a resolution of 25x25m. The use of this more realistic z_o map is investigated with MM5 in terms of wind flow patterns for a London. The outputs of MM5 have been linked to UAM-V photochemical model to detect influences on NO_x and O_3 predictions. The predicted concentrations have been compared with monitored data obtained from the national air quality monitoring sites in Central London (Bloomsbury, Brent and Bridge Place), East London (Bexley) and West London (Hillingdon). The implications of improving the boundary layer parameterisation in models such as MM5 for use in urban air quality management are also discussed.

Keywords: Mesoscale modelling, Urban air pollution, Meteorological boundary layer processes, Surface roughness