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# Determining the variability of population exposure to air pollution while taking into account personal mobility – a case study for the UK

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**Abstract:** The quantification of population level exposure to ambient air pollution is typically based on static population distributions inferred from the postcode of residence, and annual average concentrations of priority air pollutants at that location. Contemporary atmospheric chemistry transport models (ACTMs) are capable of providing air pollution concentration fields with high spatial and temporal resolution, for instance generating 1 km × 1 km gridded maps at hourly time steps. In addition, the 2011 UK Census has generated a novel population data product accounting for the location of the workplace, the so-called 'workday population' distribution, which accounts for the location of individuals during working hours. This 'workday' or 'daytime' population maps include usual residents, as well as others present in an output area during regular working hours and does complement the regular maps of residents, without double-counting of populations.
In this paper, we demonstrate, for the first time, how accounting for personal mobility (e.g. commuting to place of work or study, or spending time away from the main residential address) affects the exposure of the UK population to selected priority air pollutants (fine particulate matter, $PM_{2.5}$; ground level ozone, $O_3$; nitrogen oxides, $NO_x$). The presentation will focus on the spatial data processing and evaluation of an integrated approach utilising land-use data, output from state-of-the-art ACTMs and the latest data on population distribution for the UK. The results presented will quantify potential under- or overestimation of population level exposures and pave the way for the routine application of this integrated modelling approach to better estimate public health effects of current air pollution, as well as improve the capability to model future scenarios and the effectiveness of air pollution control measures implemented by local and national scale policy makers.

***Keywords**:* air pollution; public health; personal exposure; atmospheric chemistry transport modelling.