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Spatio-temporal modelling of air pollutant exposure at population and individual scale – where space and time matters

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Spatio-temporal modelling of air pollutant exposure at population and individual scale – where space and time matters

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Abstract: We are applying an atmospheric chemistry transport model (ACTM) - EMEP4UK (http://www.emep4uk.ceh.ac.uk) - in combination with high-resolution census data for residential and workday populations for the UK to identify the difference in potential exposure to air pollution taking into account general mobility at population level. Analyses at population level revealed that the potential exposure calculated for three key air pollutants (nitrogen dioxide, fine particulate matter and ground level ozone) was only marginally different, when taking the variation of population densities during workday hours and the remaining time of the week into account. However, exploratory simulations for individual level potential exposure by selecting a range of randomly selected grid cells (1 km x 1 km horizontal resolution) and comparing the difference between 'residential only' and 'including mobility' scenarios indicated substantial differences depending on residential and workday locations.

Here, we will demonstrate our approach to utilise GIS and spatial data analysis techniques using Python to close the gaps between individual and population level potential exposure. Furthermore, we illustrate how accounting for socio-economic factors in the analysis of modelled air pollution exposure can inform the distributional effects of spatial and temporal air pollution inequalities.

The quantitative analyses presented here make use of modelled air pollution concentrations at ~1 km x ~1 km horizontal and one-hourly temporal resolution. Population data from the 2011 UK Census and the CEH Land-Cover Map 2015, as well as from the Scottish Index of Multiple Deprivation (SIMD) are used to map and model population densities.

***Keywords**:* population data; mobility; atmospheric modelling; air pollution exposure.