

European NO₂ land use regression incorporating satellite- and ground-based measurements

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Background and Aims: Land use regression (LUR) models have increasingly been applied to assess air pollution exposures typically at the city level. Fewer examples at the continental scale exist. With recent improvements in data quality and availability, including pollutant measurements from satellites such as Ozone Monitoring Instrument (OMI), modelling over larger areas at finer spatial resolutions is possible.

Methods: Land use regression was used to model ambient NO₂ using ca. 2000 monitoring sites across Western Europe from the Airbase network. The network includes sites located in background, industrial and traffic environments. Characteristics of land use in buffers from 100 to 10,000m included high and low density residential, industrial, ports, urban green space, total built up, and natural areas. Major, secondary and local roads, derived from a 1:5,000 road network for Europe, were extracted in buffers up to 1000m. Information on altitude, population density and distance to sea were also available. LUR models with and without satellite-derived (OMI) NO₂ concentrations were explored for years 2005-2007 for all sites combined.

Results: Preliminary results for year 2007 indicate a model performance of $R^2 = 0.49$, with a SEE of 0.452 based on annual-mean concentrations (natural log) at monitoring sites. Inclusion of satellite data improves model performance (R^2 : 0.44 without satellite data, 0.49 with satellite data). Current refinements to the model are expected to improve performance. Preliminary models include satellite measurements, proportion of built up land, local roads and major roads as the most important independent variables. LUR models for 2005 and 2006 will also be presented.

Conclusions: Preliminary results support the potential to build a Europe-wide LUR models for NO₂ using readily available data. Satellite-derived measures of ground-level NO₂ appear to improve model performance. Our results will be used to construct high resolution (~100m) maps of NO₂ concentrations across Western Europe.