NO_2 and PM_{10} exposure models for Europe using satellite-derived measurements

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Background: Land use regression (LUR) models are often used in environmental epidemiology to assess air pollution exposures. We explore the potential for improved continental scale modelling through use of satellite-derived pollutant measurements.

Methods: LUR models for NO_2 and PM_{10} were developed at 100m spatial resolution using annual-mean concentrations measured at >1500 monitoring sites across Western Europe. In addition to satellite-derived NO_2 and PM, predictor variables included land use characteristics, road density, and population density extracted in zones from 0.1km to 10km. Altitude and distance to sea were also considered. Models with and without satellite-derived measurements were developed for years 2005-2007.

Results: Model performance for NO_2 ranged from R^2 = 0.48 to 0.58 (CV R^2 = 0.46 to 0.56) and for PM_{10} ranged from R^2 = 0.22 to 0.50 (0.25 to 0.47). Including satellite data marginally improved model performance for NO_2 (R^2: 0.55 without, 0.58 with satellite data in year 2005), while PM_{10} exhibited greater improvements (R^2: 0.36, 0.50 in year 2007).

Conclusions: Fine resolution Europe-wide models of NO_2 and PM_{10} concentrations were developed using readily available data, with satellite-derived measurements improving model performance. These models were used to evaluate population exposures across Europe, and are available for use in epidemiological and health risk assessment studies.