A LUR model for NO_2 and BC to assess exposure of schoolchildren to traffic-related air pollution at their home address

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To assess the health impact of traffic related air pollution on schoolchildren, the HEAPS study (Health Effects of Air Pollution in Antwerp Schools) was performed.
The HEAPS study comprises the biomonitoring of 130 children (aged 6-12) from 2 schools by measuring oxidative stress, inflammation and cardiovascular markers and simultaneous air quality monitoring.

To assess the exposure of the children, air quality measurements were performed at the school locations, at a selection of 40 home locations and while in transport. In addition the land use regression (LUR) technique was applied to model exposure to BC and NO_2 at all 130 home locations. BC and NO_2 measurements were performed at 8 home locations simultaneously during 5 consecutive weeks resulting in 40 home locations sampled. Monitoring was performed in two seasons: spring and autumn. NO_2 was monitored using diffusive sampling tubes resulting in a weekly average. BC was measured using µ-Aethalometer (AethLabs), resulting in 30 min time profiles and a weekly average. NO_2 was measured at 40 and an additional 13 locations simultaneously in each season. In addition, NO_2 and BC measurements were performed during the entire monitoring campaign at two school locations and at an urban location of the AQ monitoring network. The data of the last location were used to rescale BC and NO_2 concentrations that were measured consecutively.

Three categories of potential variables are included in the LUR: land use (CORINE land cover), traffic variables (e.g. traffic densities, road length, number of heavy duty vehicles), population density (addresses). To build the LUR model, the method as described by Henderson et al. (2007) was applied. For both pollutants a LUR model was set-up for spring, autumn and a yearly average.

Significant variables for both models (NO_2 and BC) in spring are traffic load (50m), heavy duty traffic (100 m) and road length (1km). At short distance (50 m and 100m), traffic characteristics are important for the variability of both pollutants. At a larger distance also the total number of roads affects the pollutants concentrations, probably as a proxy for urbanization. The BC model also includes the intensity at the nearest busy road (>10,000 vehicles) and the NO_2 model includes also nature with a negative estimate.

The LUR for autumn includes an additional variable 'number of address within 50 m'. This can be explained by additional sources of household heating, that are only relevant in the cold season.

Model validation was performed using leave-one-out cross-validation. Results for spring are presented in Table 1.
The paper will present the LUR results for spring, autumn and yearly average. Significant variables will be discussed and model validation will be presented.

Table 1: Results of model validation (spring)

	Conc. Modelled ($\mu g/m^3$)	Conc. Measured ($\mu g/m^3$)	r	IA	NMSE
BC	1.55	1.59	0.63	0.77	0.05
NO_2	28.1	28.2	0.90	0.94	0.01

Henderson S.B., Beckerman B., Jerrett M., and Brauer M., 2007. *Environmental Science and Technology* ***41****(7),* pp. 2422-2428.