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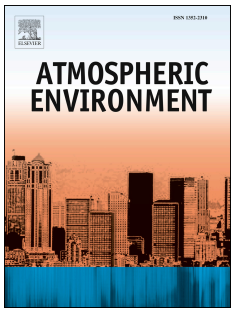

Land use regression models for total particle number concentrations using 2D, 3D and semantic parameters

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Abstract

Total particle number concentration (TNC) was studied in a 1x2 km area in Berlin, the capital of Germany by three Land Use Regression models (LUR). The estimation of TNC was established and compared using one 2D-LUR and two 3D-LUR models. All models predict total number concentrations TNC by using urban morphological (2D resp. 3D) and additional semantical parameters. 2D and semantical parameters were derived from Open Street Map data (OSM) whereas 3D parameters were derived from a CityGML-based 3D city model. While the models are capable to depict the spatial variation of TNC across the study area, the two 3D-LUR showed better results than the 2D-LUR. The 2D-LUR model explained 74 % of the variance of TNC for the full data set with root mean square error (RMSE) of 4014 cm^{-3} while the 3D-LUR explained 79 % of the variance with an RMSE of 3477 cm^{-3}. The further introduction of a new spatial parameter, the Frontal Area Index (FAI) that represents the dynamic factor wind direction enhanced the 3D-LUR to explain 82 % of the variance with RMSE of 3389 cm^{-3}. Furthermore, the semantical parameters (e.g. streets type) played a significant role in all models.

Keywords:
TNC
CityGML
Process chain
Geoinformation system
Urban morphology
Multiple regression
Frontal Area Index

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