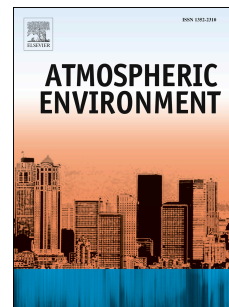


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# A cost-effective method for simulating city-wide air flow and pollutant dispersion at building resolving scale

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## Abstract

1 A cost-effective method is presented allowing to simulate the air flow  
 2 and pollutant dispersion in a whole city over multiple years at the building-  
 3 resolving scale with hourly time resolution. This combination of high res-  
 4 olution and long time span is critically needed for epidemiological studies  
 5 and for air pollution control, but still poses a great challenge for current  
 6 state-of-the-art modelling techniques. The presented method relies on the  
 7 pre-computation of a discrete set of possible weather situations and corre-  
 8 sponding steady-state flow and dispersion patterns. The most suitable sit-  
 9 uation for any given hour is then selected by matching the simulated wind  
 10 patterns to meteorological observations in and around the city. The cata-  
 11 logue of pre-computed situations corresponds to different large-scale forcings  
 12 in terms of wind speed, wind direction and stability. A meteorological model  
 13 converts these forcings into realistic mesoscale flow patterns accounting for  
 14 the effects of topography and land-use contrasts in a domain covering the  
 15 city and its surroundings. These mesoscale patterns serve as boundary con-  
 16 ditions for a microscale urban flow model which finally drives a Lagrangian  
 17 air pollutant dispersion model. The method is demonstrated with the mod-  
 18 elling system GRAMM/GRAL v14.8 for two Swiss cities in complex terrain,  
 19 Zurich and Lausanne. The mesoscale flow patterns in the two regions of  
 20 interest, dominated by land-lake breezes and driven by the partly steep to-  
 21 pography, are well reproduced in the simulations matched to in situ obser-  
 22 vations. In particular, the combination of wind measurements at different

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