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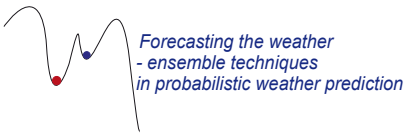

Numerical Analysis of Flux Footprints over An Urban-like Surface by Using Large Eddy Simulation Model

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We calculate and analyze flux footprints using Large Eddy Simulation (LES) model. Urban surfaces are very rough and the roughness elements (buildings) are tall. Thus flux measurements are mostly carried within the roughness sub-layer, where the standard (analytical) footprint models are not fully valid. To gain a deeper insight into the effects of atmospheric flows in the obstacle topology, we use LES model for turbulent boundary-layer flow over a simplified urban-like topography in combination with Lagrangian stochastic trajectory scheme for footprint estimates. Details of turbulence characteristics are compared with those in regular arrays. The sensitivity analysis is done for effects of the measurement height and comparisons are performed between a LES model with explicitly described building blocks and a model where the surface roughness is given only as a bulk parameterization. Different atmospheric stability classes are considered and the presence of anthropogenic heating can be included by given sensible heat fluxes.