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Impact of local buildings on flow and dispersion over a heterogeneous neighbourhood urban area

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This study is a part of the joint ASSURE project involving the Universities of Reading, Bristol, Southampton, Surrey, and Imperial College, funded through the UK NERC Highlight Scheme. The atmospheric airflows and dispersions over a heterogeneous neighbourhood urban area covering the University of Bristol campus and the nearby residential areas were investigated using the large eddy simulation method with synthetic turbulence inflow boundary conditions. The influence of significant local building features across St Michael's Park, such as a step-change in building height of approximately 20 m, was specifically studied. Various wind directions and pollutant emission source locations within the campus were tested to capture a wide range of scenarios. The numerical simulation was validated against EnFlo wind tunnel experiments conducted at the University of Surrey, ensuring the reliability of the results. The numerical data were processed to obtain time-averaged velocities, concentrations and second order turbulence statistics. The growth and decay of concentration fluctuations were investigated and compared with field measurements and DNS data in the literature. We are in particular focused on the influence of local building height change on the development of internal boundary layer, turbulent fluctuations and scalar fluctuations. These findings provide valuable insights into urban atmospheric dynamics and will be presented at the conference.