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Assessment and removal of building-induced errors from rooftop anemometer observations for mesoscale NWP and T&D applications

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In urban areas anemometers are commonly mounted on masts above rooftops. However this data may not be representative of the larger scale flow over the urban canopy because of local flow distortions introduced by the buildings in the vicinity of the anemometer. Thus the use of this data may introduce biases in the assimilation process for numerical weather prediction (NWP) models and in transport and diffusion (T&D) calculations within the urban environment. This paper summarizes some numerical case studies that have been performed using the building resolving large eddy simulation (LES) model EuLag to: 1) determine the effects of buildings on the wind field distortion above the rooftops for different ambient (upstream) winds (speed, vertical shear, direction relative to building), thermal stabilities, and building geometries; 2) investigate methods for accounting for building-induced biases in the wind field; 3) estimate the effects of the wind field biases on NWP calculations; and 4) estimate the effect of building-induced biases on T&D calculations. In particular, a sensitivity study for the Washington, D.C. area illustrates that allowing the building wind observations to be used uncorrected would have significant negative impacts on the winds analyzed and forecasted by a mesoscale model and thus on plumes released in the metropolitan area.