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## Characterizing pollutant plume dispersion in urban atmospheric surface layer

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In highly urbanized cities, narrow streets are flanked by closely packed, high-rise buildings, forming arrays of street canyons. The dynamics below the urban canopy layer are different from those in the atmospheric surface layer (ASL) aloft. Moreover, the building-induced drag modifies the wind and pollutant dispersion. Advanced understanding of the pollutant dispersion over urban areas is utmost important for public health and the formulation of pollution control strategy. Gaussian plume model is the conventional method for pollutant dispersion prediction. Its accuracy mainly depends on the functionality of the empirical dispersion coefficients (σy in lateral and σz in vertical directions). ASL turbulence is complicated by land feature such as natural terrain or building morphology. It in turn influences the dispersion coefficient (especially σz), which, however, is often overlooked in the practice of pollutant dispersion modeling. Friction factor f, as a measure of surface roughness in engineering flows, has been adopted to parameterize street-level ventilation using both large-eddy simulation (LES) and wind tunnel experiments. As an extended effort of our on-going research studies, we report in this paper our attempt to parameterize the vertical dispersion coefficient σz in the conventional Gaussian plume model in terms of fiction factor and other flow variables. Analytical solution shows that the vertical dispersion coefficient σz in the Gaussian plume model is proportional to the friction length scale Lf (=x1/2×δ1/2×f1/4, where x is the distance after the pollutant source and δ the ASL thickness). Wind tunnel measurements are used to verify the newly proposed equation in which σz and Lf show a close correlation coefficient $R^2$=0.933. The analytical solution and wind tunnel measurements collectively demonstrate the importance of dynamics and surface roughness on the plume dispersion over urban areas.

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