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Wind Tunnel Measurements of Turbulent Boundary Layer over Hypothetical Urban Roughness Elements

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Urban morphology affects the near-ground atmospheric boundary layer that in turn modifies the wind flows and pollutant dispersion over urban areas. A number of numerical models (large-eddy simulation, LES and k-É[U+009B] turbulence models) have been developed to elucidate the transport processes in and above urban street canyons. To complement the modelling results, we initiated a wind tunnel study to examine the influence of idealized urban roughness on the flow characteristics and pollutant dispersion mechanism over 2D idealized street canyons placed in cross flows.

Hot-wire anemometry (HWA) was employed in this study to measure the flows over 2D street canyons in the wind tunnel in our university. Particular focus in the beginning stage was on the fabrication of hot-wire probes, data acquisition system, and signal processing technique.
Employing the commonly adopted hot-wire universal function, we investigated the relationship in between and developed a scaling factor which could generalize the output of our hot-wire probes to the standardized one as each hot-wire probes has its unique behaviour.

Preliminary experiments were performed to measure the wind flows over street canyons of unity aspect ratio. Vertical profiles of the ensemble average velocity and fluctuations at three different segments over the street canyons were collected. The results were then compared with our LES that show a good argument with each other. Additional experiments are undertaken to collect more data in order to formulate the pollutant dispersion mechanism of street canyons and urban areas.