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Forecasting the weather
- ensemble techniques
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Very large organized motion of turbulence within a modeled urban canopy layer

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Instantaneous flow structure "within" a cubical canopy was investigated using large eddy simulation (LES). The main interests are (1) large scale coherent flow structure within a cubical canopy if there are any, (2) how the structure is coupled with the turbulent organized structures (TOS) above, and (3) the classification and quantification of representative instantaneous flow patterns within a street canyon in relation to the coherent structure.

We used a large numerical domain (2560 x 2560 x 1710 m) with a fine spatial resolution (2.5m), thereby simulating a whole daytime atmospheric boundary layer as well as explicitly resolving a regular array of cube (40m height) at the bottom. The typical urban atmospheric boundary layer was numerically set up; the constant heat supply from all roof and floor surfaces sustained a convective mixed layer as a whole but the strong wind shear near the canopy top resulted in keeping the surface layer near-neutral.

The results revealed that there are large coherent structures of both in velocity and temperature fields "within" the canopy layer. The size of the structures is much larger than that of the cube. It was also found that the shapes and locations of these structures are closely related with the TOS above.

We classified the instantaneous flow patterns in a cavity. We specifically focused on two characteristic flow pattern; namely, 'flushing' and 'cavity-eddy'. Flushing indicates a strong upward motion, and cavity-eddy has a vortical motion dominating within a single cavity.

The flushing was clearly correlated with the TOS above; it frequently occurred below low momentum streaks above. The instantaneous momentum and heat transport within and above a cavity by flushing and cavity-eddy was also quantified.