ANALYSIS OF FLOW AND SCALAR TRANSPORT IN A MODELLED STREET CANYON BY LARGE-EDDY SIMULATION

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This study uses large-eddy simulation (LES) to illustrate the flow and turbulence structure and to investigate the mechanism of passive scalar transport in a street canyon. Calculations for a modelled street canyon with building height to street width ratio of unity at Reynolds number equal to 12,000 are conducted. When the approaching wind is perpendicular to the street axis, the calculation produces a primary vortex in the street canyon similar to previous studies. An evaluation of the LES results with wind tunnel measurements reveals good agreement for both mean and turbulence parameters of the flow and scalar fields. The computed primary vortex is confined to the street canyon and isolated from the free stream flow such that the removal of a scalar emitted at the street level is accomplished by turbulent diffusion at the roof level. We determine from the calculation that very little scalar is removed from the street canyon, while 97% of the scalar is retained. The scalar mixing at the roof level occurs primarily on the leeward side of the street canyon. In addition to the primary vortex, three secondary vortices are located in the corners of the street canyon at which scalar mixing is enhanced. An examination of additional simulations shows how the location of the scalar source affects the distribution of the scalar.