The Study of Turbulent Scalar Transfer from Street Canyons

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Thermal modelling of urban surfaces and buildings is a very important concept for engineers, planners and meteorologists. Understanding the transfer of heat, pollution and other scalars from the surface layer to the air aloft is crucial to improve the quality of life, but still little is known about the influence of urban morphology on scalar transfers.

This talk concerns both wind tunnel and numerical modelling of scalar transfer from a traditional unit of urban morphology, a street canyon. The model described here is based on the flat roof resistance network model by Harman et al. (2004). The addition of a pitched roof greatly influences the dynamics of the flow and as a consequence, it also influences the turbulent transport from the surfaces of the canyon. A new transitional flow regime develops, against the typical three flow regimes for a flat roof case (Skimming Flow, Wake Interference and Isolated Roughness). The flow is assumed to be quasi two-dimensional. This work is motivated and validated against the unpublished data of Pascheke (2005), using the well-established naphthalene sublimation technique. The experiments involve using a single street canyon to quatify fluxes.

A new scalar transfer technique is currently being developed, where the use of a copper circuit board (Bohm, 2000) is being adapted to street canyons of different widths, where heat is used as a passive scalar. The technique will be used to investigate the departure from the quasi two-dimensional to three-dimensional flows, with winds oriented at an angle to the street canyon.