200 Impact of urban boundary layer processes on sustainable building design

The thermal environment of buildings is determined by heatexchange with the atmosphere. But to what extent is the thermal response of individual buildings determined by their own design, the characteristics of the local urban canopy, or boundary layer processes acting at city scale? In terms of improving energy performance of buildings, robust modelling tools are required based on a sound understanding of urban microclimatic processes informed by laboratory and full-scale observations. The ACTUAL project (Advanced Climate Technology Urban Atmospheric Laboratory) aims to investigate processes from the scale of individual buildings up to boundary layer scale. This talk presents an overview of experimental methods and model validation. Due to a general lack of urban boundary layer data, focus has been on the development of ground-based remote sensing, i.e. a Doppler lidar, and a new "urban sodar" for measuring wind and turbulence profiles. These instruments have been tested against measurements at two heights: 1) an "upper level platform" at 190m consisting of turbulent and radiative flux measurements and an automatic weather station, and 2) a "lower level platform" on a roof-top at 18m, consisting of identical instrumentation. An "indoor platform" has recently been developed to relate indoor to outdoor climate, and extensive use is made of idealised wind-tunnel experiments to complement the full-scale observations. Data has been collected since summer 2010, and examples will be presented of urban climate at different scales, and the evaluation of models, such as building performance software and a numerical weather prediction model.

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Back