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First results from the International Urban Energy Balance Model Comparison: Model Complexity

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A great variety of urban energy balance models has been developed. These vary in complexity from simple schemes that represent the city as a slab, through those which model various facets (i.e. road, walls and roof) to more complex urban forms (including street canyons with intersections) and features (such as vegetation cover and anthropogenic heat fluxes). Some schemes also incorporate detailed representations of momentum and energy fluxes distributed throughout various layers of the urban canopy layer. The models each differ in the parameters they require to describe the site and the in demands they make on computational processing power. Many of these models have been evaluated using observational datasets but to date, no controlled comparisons have been conducted.

Urban surface energy balance models provide a means to predict the energy exchange processes which influence factors such as urban temperature, humidity, atmospheric stability and winds. These all need to be modelled accurately to capture features such as the urban heat island effect and to provide key information for dispersion and air quality modelling. A comparison of the various models available will assist in improving current and future models and will assist in formulating research priorities for future observational campaigns within urban areas.

In this presentation we will summarise the initial results of this international urban energy balance model comparison. In particular, the relative performance of the models involved will be compared based on their degree of complexity. These results will inform us on ways in which we can improve the modelling of air quality within, and climate impacts of, global megacities.

The methodology employed in conducting this comparison followed that used in PILPS (the Project for Intercomparison of Land-Surface Parameterization Schemes) which is also endorsed by the GEWEX Global Land Atmosphere System Study (GLASS) panel. In all cases, models were run offline to ensure no feedback to larger scale conditions within the modelling domain. Initially, participants were issued with just forcing data from an unknown urban site (termed "Alpha"); in subsequent stages, further details of the site were provided. Results from each stage, for each participating model, were then compared using a variety of statistical and graphical techniques.

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