Editorial: Urban Climatology ICUC6

This special issue focuses on the topic of Urban Climatology. Urban areas represent one of the most challenging environments for atmospheric research. The complex three-dimensional structure of the city, combined with the mixture of surface types with contrasting radiative, thermal and moisture characteristics and an often-polluted atmosphere, makes the application of standard measurements and models difficult. Instrumentation and theory are frequently tested to their limits. However, it is critical that researchers are in the pursuit of new theories or frameworks that are able to describe the physics of the atmosphere over complex environments. Today, approximately 50% of the world’s population lives in urban agglomerations and this fraction is increasing. These concentrations of people and activity are exerting an increasing stress on the natural environment with impacts at urban, regional and global levels. Cities across the world are the primary sources of greenhouse gases and industrial pollutants and the locus of consumption of most global resources. Consequently, there are compelling practical issues relating to human health and well-being and long-term environmental sustainability, in addition to challenging scientific questions to be addressed.

The 13 peer-reviewed papers published here are from the International Association for Urban Climate’s (IAUC) Sixth International Conference for Urban Climate (ICUC6) which was held in Göteborg, Sweden, 12–16 June 2006. The papers represent a small subset of those presented. A complete programme and preprints can be found on the IAUC website (www.urban-climate.org). The papers by Klein et al., Martilli, Mills, Ooka, Pearlmutter et al. and Roth were invited to review specific aspects of urban climate research. The papers by Christen et al., Coceal et al., Emmanuel et al., Kawai et al., Kuttler et al., Piegeon et al. and Thorsson et al. were contributed papers, selected for inclusion by the chairs of sessions.

Pearlmutter et al. (2007) and Roth (2007), in their review papers, consider the influence of a city’s climatic setting. Pearlmutter et al. (2007) focus on arid cities where availability of water is a significant issue. Water resources are diverted into cities and the urban areas modify the quantity, quality and timing of water leaving the region. Roth (2007) directs attention to the climate of cities in the (sub-)tropics, noting the wide range of conditions found in these settings and the urgency of such research given the dramatic growth of urban areas in the low latitudes. Mills (2007) adopts a different perspective and considers the issues that are associated with aspects of global change and the role of cities.

Human comfort in the urban environment is a major theme of urban climate research, illustrated here by the papers of Emmanuel et al. (2007), Ooka (2007) and Thorsson et al. (2007). Emmanuel et al. (2007) use the ENVI-met model (Bruse and Fleer, 1998) to look at the role of urban designs in Colombo, Sri Lanka and their impact on physiologically equivalent temperature. They suggest shade enhancement as an important design strategy to improve outdoor thermal comfort in the humid tropics. Thorsson et al. (2007) use the RayMan model (Matzarakis, 2000) with observations of radiant temperatures in Göteborg Sweden to assess thermal comfort in an open square. Ooka (2007), in his review of assessment tools for urban climate, provides an overview of approaches that are being used, especially in Japan. The tools, which are primarily numerical models, range in the scale of their application from individuals to city-wide scales.

The papers by both Ooka (2007) and Martilli (2007) provide insight into the current status of modelling at the meso-scale. Models at this scale allow urban areas to be resolved and can provide the upper boundary conditions for more detailed modelling as Ooka (2007) demonstrates. Turbulent processes are addressed in detail by Christen et al. (2007), Coceal et al. (2007) and Klein et al. (2007). Coceal et al. (2007) use Direct Numerical Simulations (DNS) modelling for an idealized three-dimensional array, whereas Christen et al. (2007) and Klein et al. (2007) are concerned with the analysis of real-world situations. Christen et al. (2007) use sonic anemometers at six levels to analyse coherent structures within and above a street canyon, while Klein et al. (2007) combine wind tunnel and real-world analysis of a downtown street canyon. These three papers are concerned with transport and dispersion at the micro-scale.

Energy balance processes are considered generally in the papers by Pearlmutter et al. (2007), Roth (2007), Ooka (2007) and Martilli (2007). Kawai et al. (2007) evaluate the performance of a numerical urban energy balance model using energy balance data collected from an outdoor physical scale model. Pigeon et al. (2007) examine the anthropogenic heat flux in detail from both an energy balance measurement and inventory perspective. The latter allows for a more detailed analysis of spatial variation. Kuttler et al. (2007) in their study of atmospheric moisture, consider spatial variation between urban and rural areas. Such urban–rural differences are also examined in the reviews of Pearlmutter et al. (2007) and Roth (2007).
Although only a small subset of the research presented at ICUC6, the papers included here illustrate the diversity of research currently under way on urban climates with respect to scale, process, areas studied and methodological approach (measurement, numerical modelling and scale modelling), with attention increasingly focused on urban design and its implications in a changing global climate.

The next IAUC conference will be held in Yokohama, Japan between 29 June and 3 July 2009 (www.urban-climate.org).

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References


