Editorial: Responding to changing urban climates

J. A. Salmond

Urban planners and decision makers have taken climatic conditions into consideration in the development of urban infrastructure and provision of community services for over two millennia (Yoshino, 1990). Even in relatively benign climatic regions such as those found in New Zealand, urban planning, design, regulation and assessment activities all encompass some notion of acceptable risk based on the known climatic variability of the region. Increasingly however, the notion of climatic stability and certainty (as defined by 30-50 year statistically-derived climatic norms) is proving untenable. Planners and decision makers now have to work within a framework where there increasing recognition that climate is variable, and that the magnitude, direction and timescales of change is uncertain. In the New Zealand context, for example, the mid-range projected increase in mean temperature at a regional scale is expected to be small; 1°C by 2040, and 2°C by 2090 compared with 1990 (Ministry for the Environment, 2008). However, the upper-end of the range of projected temperature increase is 5°C by 2090. When these mid- and end-range temperature increases are superimposed on existing climate variability, the net result is likely to be a change in the frequency and intensity of extreme meteorological events (MfE 2008).

Such climate-related risks are clearly not a new phenomenon. In the last 12-18 months alone meteorological events in New Zealand such as the 'golf ball' sized hailstorm which occurred in Christchurch (September 2012), the flooding and subsequent landslips in Nelson (December 2011), the snow in Wellington (July 2011) and the destructive tornadoes in Auckland (May 2011) have all caused social and economic disruption. However, urban planners, designers, architects and regulators now have to manage uncertain changes in the magnitude and frequency of these risks in an era (unlike any before) where they are presented with vast amounts of (often conflicting) information which must be appropriately scaled and assimilated into coherent decision making and risk management strategies for a specific locality.

There is a pressing need to translate this vast body of information, applicable at a multitude of interdependent scales, into a common language which is accessible to non-specialist decision makers, governments and local councils. The urban impacts *Toolbox* (Tait et al., 2012), published in this special issue, represents an important step forward in this regard. The *Toolbox* is a carefully crafted web-based package of guidance and design tools aimed at supporting policy makers by incorporating climate change into decision making within the urban environment. It comprises of 57 different reports or 'tools', each designed to be stand alone but collectively grouped into five 'trays' which support a range of activities from providing information, to identifying adaptation options and assisting with the evaluation of cost-benefit scenarios. The *Toolbox* is primarily targeted at regional, city, and district councils in New Zealand. However, it provides a useful framework within which to consider the issues of climate change adaptation in urban centres more generically, and a much needed starting point from which different places can start to engage with issues of preparedness and risk at an international scale (Wilby & Keenan, 2012).

Successful application of climate related risk management strategies requires the identification of co-benefits such as the development of robust infrastructures, reduced vulnerability and ultimately the transition towards lower carbon societies. Grappling with the problematic reductionist trap of treating climate related risks in isolation from other planning concerns and ideals (Hulme, 2011), Tait et al (2012) emphasise the need for policies aimed at responding to climate change to be conceived within the wider context of environmental, social and economic challenges, whilst Keenan and Oldfield (2012) demonstrate some of the challenges associated with putting this into practice. The *Toolbox* can also be used to support a consultative approach to managing change, facilitating inclusive discussion, community participation, the identification of threats and opportunities, and collective assessment of decision making. Such an approach has been shown to have potential elsewhere (Moser & Stein, 2011).

One of the challenges associated with the determination of the risks to urban areas associated with climate change is the scaling down of global processes, ideas and data to appropriate urban and local scales. At the heart of this *Toolbox* lies an underlying philosophy which tries to emphasise the importance of the local social, economic and environmental context of urban environments. Users can enter the toolbox at any level appropriate to their local conditions and tailor the contents to meet local needs. This feature of the *Toolbox* is illustrated by the case studies presented in this special edition (McMillan et al., 2012; Keenan and Oldfield, 2012). The first of these case studies demonstrates how the *Toolbox* can be used to promote good practice in the assessment of flood risk in Westport, New Zealand (McMillan et al., 2012). The second case study draws on their results to apply a different set of tools from the *Toolbox* to explore the value of selected adaptation options to reduce flood risk in the same town (Keenan and Oldfield, 2012).

The open-ended nature of the way in which the *Toolbox* is intended to be applied also allows for future research and new ways of thinking to be incorporated into future iterations of the system. For example, it may become important to include the impact of the urban surface on the atmosphere in future assessments of climate risk in urban areas (Cleugh and Grimmond, 2012). Increased nocturnal temperatures associated with urban heat islands have been shown to exacerbate the impact of heat waves on human mortality in cities in other parts of the world (e.g. Tan et al., 2010). However, it is not yet clear the degree to which inadvertent modification of climate associated with urbanisation will act to mitigate or exacerbate the symptoms of climate change in the New Zealand context.

In many ways, cities are inextricably linked to climate change (Cleugh & Grimmond 2012). The density of human population and economic and social activities leads to high carbon emissions, whilst the complexity of urban systems and high dependency on fixed infrastructure and service delivery makes cities vulnerable to external environmental conditions. There is therefore a pressing need for urban areas to both prepare for and adapt to the likely climate change impacts, and play an important role in reducing greenhouse gas emissions. Climate variability may differ regionally and climate extremes will likely affect urban areas differently depending on the quality, age and location of fixed infrastructure and assets, housing and the geographical conditions of the local terrain. Given the

timescales of urban development, the decisions made today will determine the trajectory of urbanisation into the future.

On a positive note, from a policy perspective, urban scales may present the ideal opportunity to enact change (Bulkeley and Newell, 2010). The tag line 'think global act local' has real relevance and meaning at this scale where decision makers, supported by community action, can make a real difference. Urban areas need to be adaptable and resilient if they are to be sustainable and pleasant places in which to live into the 21st century. Climate sensitive, low carbon urban plans can be developed and realised whilst minimising risk, reducing vulnerability and facilitating social and economic development. The urban impacts *Toolbox* (Tait et al., 2012) provides a helpful distillation of emerging climate change adaptation thinking and practice, and the papers in this special issue provide concrete application which demonstrates the translation of that knowledge into a context that is actionable and especially relevant to the New Zealand context.

Acknowledgments:

Many thanks to Marc Tadaki, Anthony Fowler, Brian Giles and Kim Dirks for their helpful reflections on this piece.

References:

Bulkeley, H. and Newell, P., 2010. *Governing climate change*. Oxon: Routledge.

Cleugh, H.A., & Grimmond, C.S.B., 2012. Urban Climates and Global Climate Change. in Henderson – Sellers A & Mc Guffie K (ed). *The Future of the World's Climate.* Elsevier Chapter 3, 47-76 + references,DOI: 10.1016/B978-0-12-386917-3.00003-8 ISBN: 9780123869173

Hulme M., 2011. Reducing the future to climate: a story of climate determinism and reductionism. *Osiris,* 26, 245-266.

Keenan, N. J., & Oldfield, S. G., 2012. Initial assessment of climate change flood adaptation options: Westport case study. *Weather and Climate,* 32, 2, 41-61

McMillan, H., Duncan, M., Smart, G., Sturman, J., Poyck, S., Reese, S., Tait, A., Hreinsson, E., Walsh, J., 2012. Modelling the effect of climate change and sea level rise on future flooding in urban environments in NZ. *Weather and Climate,* 32, 2, 21-40

Ministry for the Environment, 2008. *Climate change effects and impacts assessment. A Guidance Manual for Local Government in New Zealand.* – 2nd Edition: Mullan B; Wratt D; Dean S; Hollis M; Allan S; Williams T, Kenny G and MfE. Ministry for the Environment, Wellington. xviii + 149 p.

Moser, C. & Stein, A., 2011 Implementing urban participatory climate change adaptation appraisals: a methodological guideline. *Environment and Urbanization* 23, 463-485, DOI: 10.1177/0956247811418739

Tait, A., Allan, S. Oldfield, S. & Semadeni-Davies, A., 2012. A climate change toolbox for urban environments in New Zealand. *Weather and Climate,* 32, 2, 6-20

Tan, J., Zheng, Y., Tang, X., Guo, C., Li, L., Song, G., Zhen, X., Yuan, D., Kalkstein, A.J., Li, F., 2010 The urban heat island and its impact on heat waves and human health in Shanghai. Int J Biometeorol, 54, 1, 75-84.

Wilby, R.L., & Keenan, R., 2012. Adapting to flood risk under climate change. Progress in Physical Geography, 36, 3, 348–378

Yoshino, M., 1990/1991. Development of urban climatology and problems today. Energy and Buildings 15- 16, 1-10