CRCLCL exemplar 4: Urban Microclimates - Evidence for Policy and Product Development

Dr Conrad H. Philipp
Postdoctoral Research Fellow
University of South Australia (UniSA)

13 November 2014
RP2005 Urban micro climates

• Urban microclimates is a study applying knowledge about urban microclimates in Sydney, Melbourne and Adelaide.

• The project aims for a sharing of information about urban microclimates between cities.

• The project outlines characteristics of urban microclimates, and aims to produce an effective way to monitor and record information about microclimates for use by planning agencies, service providers and developers.
World Population

- Since 2007 more than 50% of global population now live in cities
- By 2050 in excess of 90% of Australia will be urban
- In 1970 only 2 "megacities" by 2027 there will be 37
Urban heat effect

Heat absorption and retention is greater in cities, leading to a temperature increase of 3° to 10°C. Plant transpiration and water evaporation from the soil are reduced in cities, contributing to the heat island effect. Water penetration is also affected, further exacerbating the urban heat effect.

The diagram illustrates the difference in temperature between rural and urban areas, with rural regions having lower temperatures due to higher evapotranspiration rates and open space reflecting solar energy out to space. Cities, on the other hand, have less evapotranspiration and the buildings trap solar radiation, leading to higher temperatures.

15/02/2015
Project Partners

Post-Doc Research Fellow (UniSA): Conrad H. Philip
Overall synthesis and coordination (0.6 FTE)

Theme (i): Mapping of key contributors in different scales
Theme (ii): Linking Quantities with Qualities in urban context
Theme (iii): Comparative analysis of different strategies based on Australian context
Theme (iv): Design framework for urban planners, designers and architects

Interaction between the main research strands

CRC for Low Carbon Living

Gertrud H.-Kovacs Ehsan Sharifi Judy Bush Jonathan Fox

3rd Party Project Partners
City of Adelaide: A. Sakes, P. Smith
City of Melbourne: M. Hall, D. O'Keeffe
City of Parramatta: CSIRO

End-User Reference Group
Major Cities Unit, Commonwealth Gov
ASBEC and PIA
Local Government Association
City of Perth
City of Brisbane
City of Parramatta
Comparative Study of Urban Heat Islands
A five scale methodology across three Australian cities on macro & micro levels.

Thermal analysis, facades & walls.

Aims to establish a better understanding of the urban heat island effect through the evaluation of building and street surfaces.

- Individual buildings
- Clusters of buildings
- Urban areas

Socio-behavioural analysis.

- Identifying the socio-economic factors influencing urban heat islands
- Identifying the socio-economic factors influencing urban heat islands

Satellite thermal imaging.

- Monitoring urban heat islands using satellite technology
- Identifying areas of heat islands

Low Carbon Living CRC

In partnership with:
Measurements of the land surface temperature
Remote sensing technique

Source: C. Philipp
Measurements of the land surface temperature
Thermal conditions of the CBD of Adelaide compared to the suburbs?

Source: C. Philipp
Measurements of the land surface temperature
Aerial flyovers with thermal sensory equipment

Source: CC Melbourne
Measurements of the land surface temperature
Thermal hand cameras (for example FLIR camera)

Source: BatesSmart Pty Ltd

Source: Jonathan Fox
Measurements of the land surface temperature
Aerial flyovers using drones with thermal cameras attached

15/02/2015
Activity thermal resilience and Urban Greenery

How can we make more heat resilient public spaces?
Outdoor activity patterns and micro climate variations are being analysed in Australian cities

Source: Ehsan Sharifi
RP2005 Urban micro climates

Research topics:
- impact of LUT
- different climate
- rooftop colour
- seasonal effect
- building density
- urban hot spots
- change of land use type
- interaction between different land use types

Image: Conrad H. Philipp
Urban microclimates: retrofitting Australian precincts for heat wave resilience

1. Better knowledge about the heatwave resilience (CBD+suburbs)
2. Save energy, water, human life during heatwaves
3. Enhance indoor and outdoor thermal comfort
4. Name the best (and worst) urban design and architectural practises related to heatwave mitigation and adaptation
5. Supply a guide for practitioners and for building industry
Urban greenery and the urban heat island effect in Australian cities: policy and communication

Source: Judy Bush

- Investigate the sustainability transitions in mitigation of urban heat island effect, with policies for urban greenery as socio-technical transitions

- How theories of sustainability transitions can be applied in practice

- Working with local government, businesses and households to take action on climate change: energy efficiency and renewable energy

- Qualitative research in a case study with the Moreland Energy Foundation via data collection using policy documents and semi-structured interviews
Conference participation & Workshops

Australia

The 2014 World Green Infrastructure Congress, Sydney on 07 - 10 October

Climate Adaptation 2014 Future Challenges, 30 September - 02 October 2014

7th Making Cities Livable Conference, 9 - 11 July 2014

International

Bauhaus Summer School Weimar, Weimar (Germany), 15 - 29 August 2014

Third International Conference on Countermeasures to Urban Heat Island, Venice (Italy), 13 - 15 October 2014

ARUS advanced research in urban studies, Essen (Germany), 20 - 21 October 2014

**CRC RP2005 Workshops:**

1st - 11 October 2013 - UniSA
2nd - 21 February 2014 - UNSW
3rd - 26 September 2014 - UoM
4th - April 2015 - UniSA
5th - November 2015 - UNSW
6th - June 2016 - UoM
Urban heat island effect felt more strongly in humid cities

18 July 2014

18 July 2014 — BRIEF: A city’s local background climate may have a greater role than previously thought in variations of the urban heat island effect — a phenomenon that causes many cities to be warmer than their rural surroundings.

The UHI effect has long been thought to be controlled by the lower rates of evaporative cooling in urban areas, which should tend to increase temperatures, but in a report published in Nature this week, Kuhu Lee and colleagues show that UHI variations can instead be explained by changes in the efficiency of convection between the land surface and the lower atmosphere.

If an urban area is aerodynamically smoother than surrounding rural areas it is harder for heat to disperse into the broader atmosphere and urban warming occurs, conversely, cooling tends to occur in urban areas that are aerodynamically rougher.

“The ‘rougher’ surfaces of the vegetation triggers turbulence, and turbulence removes heat from the surface to the atmosphere,” lead author Lee Zhan said. “But where there is a smoother surface, there is less convection and the heat will be trapped in the surface.”

How can we make more heat resilient public spaces?

Public activity patterns and outdoor climate variations are being explored in Australian cities.

The CRC’s ‘five micro-climes’ project summary image shows the major challenges of climate change, which are to build urban communities that are resilient to the impacts of climate change, develop urban heat management systems and support communities.

15/02/2015 18
Thank you

To find out more, contact:

CRC for Low Carbon Living Ltd
www.lowcarbonlivingcrc.com.au
Room 202-207, Level 2
Tyree Energy Technologies Building
UNSW Sydney NSW 2052 Australia

Twitter: @CRC_LCL
info@lowcarbonlivingcrc.com.au
P: +61 2 9385 5402
F: +61 2 9385 5530

Extra contact details if required:

Dr Conrad H. Philipp
Postdoctoral Research Fellow
University of South Australia (UniSA)
conrad.philipp@unisa.edu.au