RP2005

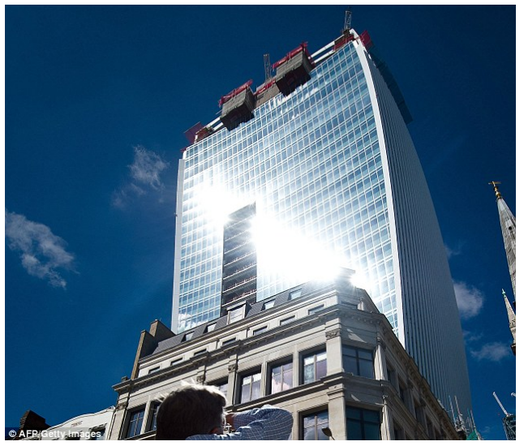
URBAN MICROCLIMATES

COMPARATIVE STUDY OF MAJOR CONTRIBUTORS TO THE UHI EFFECT IN SYDNEY, ADELAIDE AND MELBOURNE

Research Questions

How do BUILDING FACADES contribute to or mitigate URBAN HEATING and improve outdoor thermal comfort? What facade parameters – form, materials and orientation – determine facade thermal behaviour? **What KNOWLEDGE will assist built environment professionals to DESIGN cooler facades and comfortable, healthier outdoor spaces?**

Figure 1: 20 Fenchurch Street, London, melts a car and dazzles pedestrians in 2013



Methodology

This research combines mobile in-situ METEOROLOGICAL DATA collection, ground-based thermal and multispectral REMOTE SENSING, facade modelling and IMAGE PROCESSING, outdoor thermal comfort assessment and thermo-spatial analysis on a geographic information system (GIS) platform. Spatial, thermal and radiative data are "mapped" to develop a predictive STATISTICAL MODEL to optimise external facade thermal performance under typical microclimates found in Australian cities.

Pilot Study

A pilot study is underway. Individual facades were modelled using close-range photogrammetry software prior to export into ArcGIS:

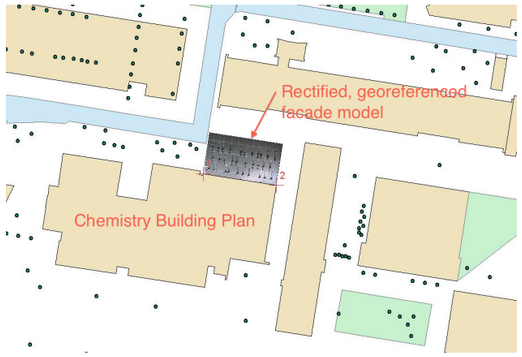


Figure 2: Screenshot of rectified and georeferenced facade – Chemistry Building at UNSW

To account for intervening radiative effects (e.g. shading and reflections) key urban canyon-scale variables such as aspect ratio (H/W) and sky view factor (SVF) were measured in situ and automatically derived in ArcGIS from cadastre and other spatial databases:

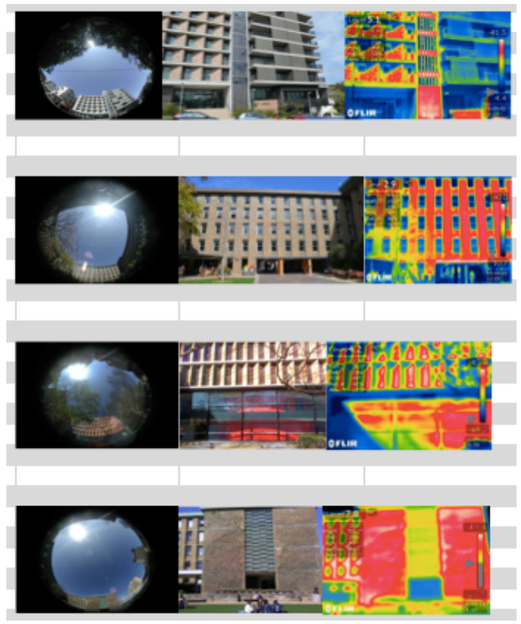


Figure 3: Screenshot of hemispherical (fish-eye) photographs to quantify SVF. Unrectified facades and thermal infrared (7.5–13µm) imagery obtained using ground-based image sensors

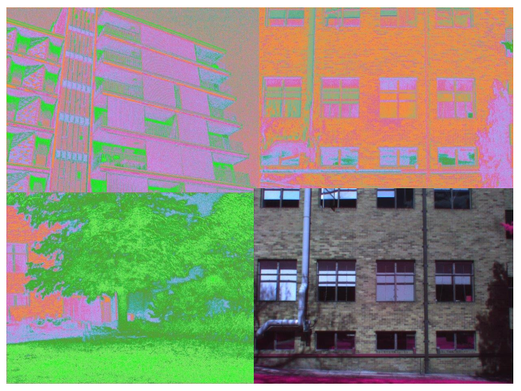


Figure 4: False colour multispectral (0.52-0.92µm) images of facades used to quantify spectral reflectance ("albedo")

Anticipated impacts

For ARCHITECTS to adopt microclimatic design principles, they require diagnostic tools and predictive information about the microclimate effects of building design at spatial scales relevant to their DECISION-MAKING.

By quantifying the thermo-radiative performance of facade designs this research develops new observational and analytical techniques to advance the key challenge for CLIMATE-SENSITIVE DESIGN at all scales: that of linking physical characteristics of urban elements to intentional climate modification.

The predictive model will quantify the impact of individual design decisions on outdoor climate and thermal comfort variables

Further information

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