

## Modelling Birmingham's urban heat island

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### Project description

Extreme heat events are likely to occur more frequently in a warmer future climate. Urban heat island (UHI) has recently attracted a great attention from government and public because it will exacerbate the impact of climate change on urban populations and infrastructure, such as thermal comfort (e.g. heat stress), mortality, energy consumption, urban planning etc.. The 2003 heat wave in Europe indicated that most of the excess deaths during the period were in urban areas and were a direct result of the increased temperatures experienced in towns and cities. For this reason, amongst others, the study of UHI is becoming increasingly relevant. *This studentship aims at developing a modelling technology that is capable of capturing local-scale climate variability and providing an insight into the generic processes which determine the magnitude and variability of the UHI.* An advanced meteorological model will be adopted to cover the whole Birmingham with a nested domain to cover the city centre area. An on-going project, HiTemp, will create a unique climate facility for international urban climate research and will provide an excellent dataset (~200 sites) for the purpose of the model validation. The robustness of the models will be demonstrated through validations by analyzing the simulated results in comparison with the observations. Together with the HiTemp dataset, the modeling output will provide an insight to the generic processes that determine the urban heat island. The results of the project can be used as guidance to the mitigation to be adopted, for example by improved planning, for example, passive cooling, green roofs and trees. Such adaptations are essential to prevent a repeat of the devastating effects of the 2003 heatwave in the future.

### Methodology

The research team at University of Birmingham has recently applied an energy balance model (Fig. 1) to derive the spatial pattern of urban heat island in Birmingham. This proposed study will adopt a well-developed meteorological model, the Weather Research & Forecasting model (WRF), which has been equipped with urban canopy models. As the HiTemp project delivers temperature data with a very high density in Birmingham, this project provides an opportunity of evaluating the WRF model. A series of simulations will be performed for some selected periods when the urban induced climate modification is likely to be most pronounced. The periods of the simulations will be determined by a data analysis of the high-density temperature dataset obtained from the HiTemp project. The robustness of the model will be demonstrated through model evaluation by analysing the simulated results in comparison with the observations. In addition, a series of simulations and sensitivity studies will be carried out to examine the influence of background meteorological conditions on spatial distributions of air temperature and UHI intensity.

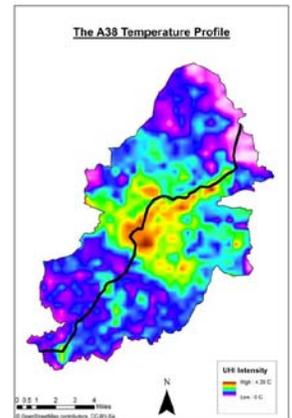


Fig. 1 An example of modelled urban heat island in Birmingham

### Training

The goal of this project is to train the student to become a mature researcher with the expertise and skills in the areas of urban climate modelling. The University's IT Services provide subject specific training, e.g. UNIX, parallel computation, computing languages (Matlab, R, and FORTRAN). Apart from receiving generic training from the University's programme, the student will receive training on meteorological modelling, organised by The National Centre for Atmospheric Science (NCAS). The student will work in a vibrant modelling group in which several researchers are running WRF and communication between the students will benefit the research. In addition, frequent visits to the HiTemp sites will provide hands-on experience of observation.

Applicants should apply via

<http://www.birmingham.ac.uk/postgraduate/courses/research/gees/environmental-health-risk-mgt.aspx> where they should click on 'Apply now' and choose the option 'PhD in Department of Division of Environmental Health and Risk Management' and give the PhD title in the 'Funding details' section of the online application.