

# UNDERSTANDING CLIMATE IMPACTS ON CITIES: THE URBAN INTEGRATED ASSESSMENT FRAMEWORK (UIAF)



ARCADIA FACTSHEET 1

Contact: jim.hall@eci.ox.ac.uk katie.jenkins@ouce.ox.ac.uk

*Urban areas are particularly vulnerable to economic and social impacts of climate change, such as floods and excessive heat. This is due to their high concentrations of people, assets and the Urban Heat Island (UHI) effect. This factsheet provides a description of the UIAF, which integrates a system of models to analyse climate risks and assess the performance of adaptation options to climate change in London.*



## Context: Benefits of using an integrated approach

- ◆ The development of adaptation strategies for urban areas requires integrative thinking to understand and model relationships between the built environment, land-use, infrastructure systems, the urban economy and climate.
- ◆ Given the range of different actors and policies in contrasting sectors of urban areas, working at different spatial and temporal scales, developing fully integrative strategies can be complex and challenging.
- ◆ Such considerations underpinned the development of the UIAF, established to simulate processes of long-term change at the city-scale.
- ◆ The UIAF incorporates a spatial model of climate change in London, which includes the additional effects of waste heat and urban land cover on temperatures (contributing to the UHI effect); a new model of future land-use change; an economic model; and a model of the urban transport network (fig. 1).
- ◆ Integrating outputs from the models facilitates an assessment of the direct and indirect impacts of high temperatures and flooding on people, buildings and infrastructure, and an assessment of adaptation options.

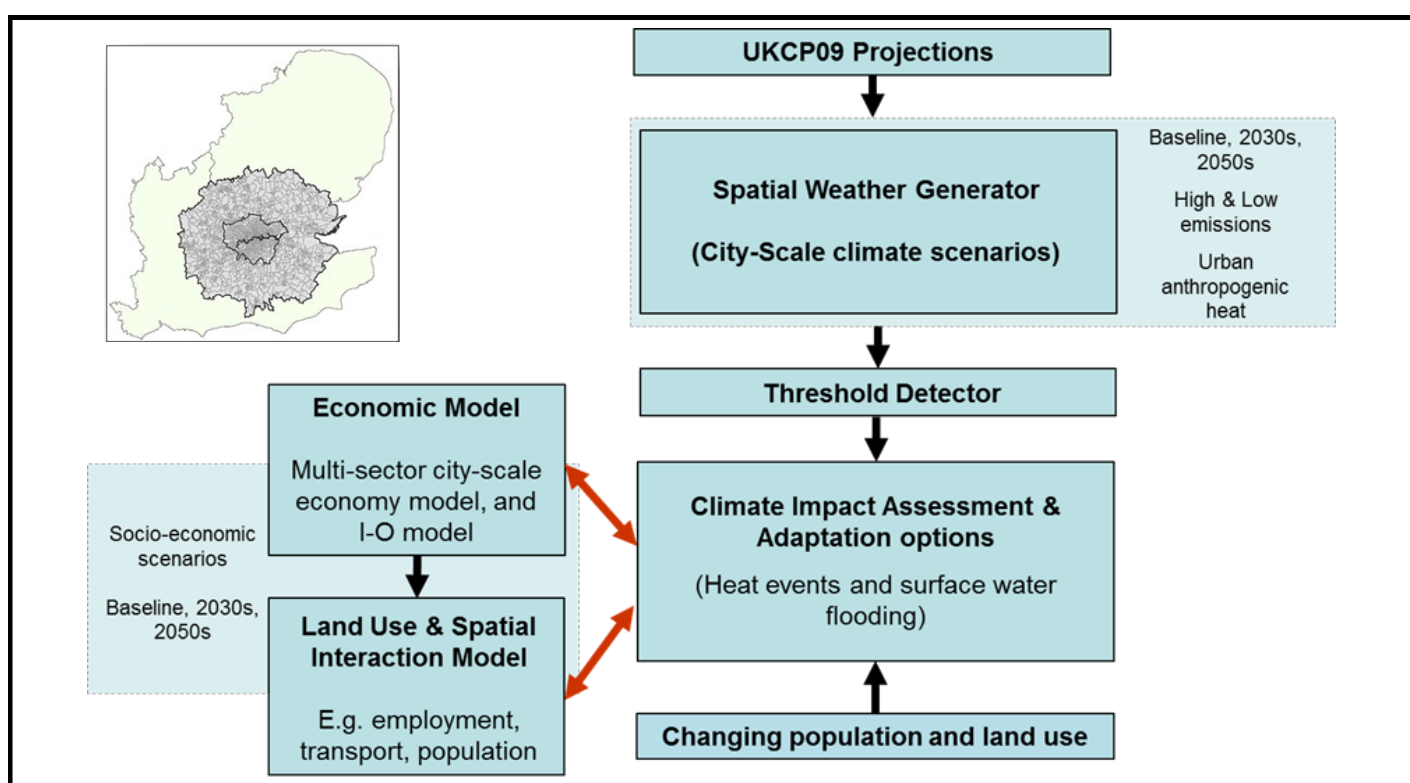
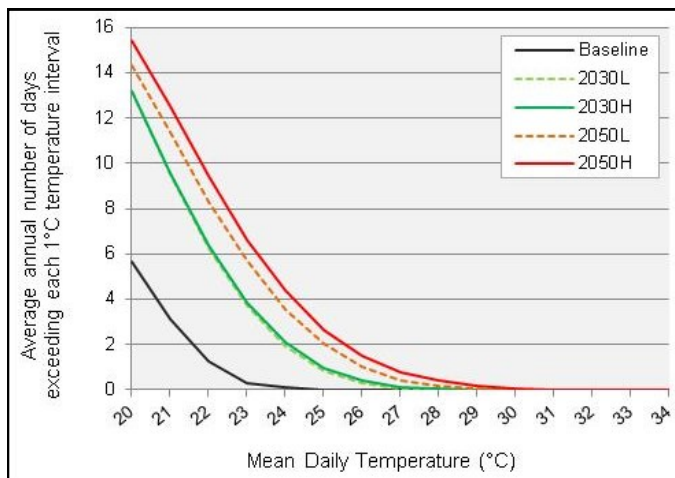


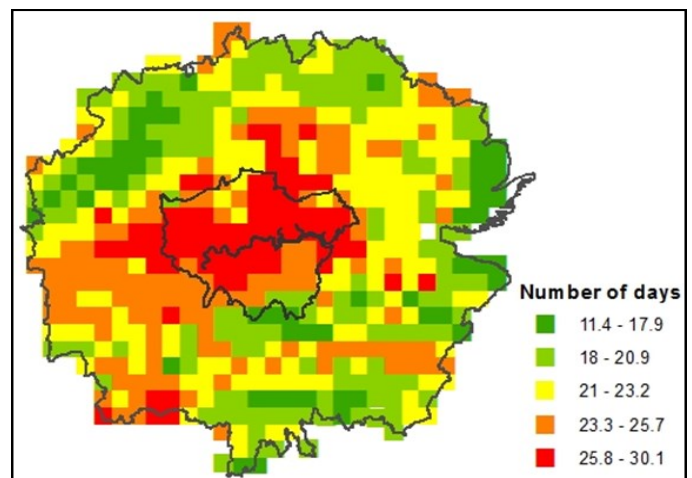
Fig. 1: An overview of the UIAF and the geographical location covered

## Addressing future climate risks

- ◆ The UIAF includes a probabilistic model of climate change in London (the spatial Weather Generator), which includes the additional effects of waste heat and urban land cover on temperatures.
- ◆ The spatial Weather Generator is compatible with the UKCP09 climate scenarios. It allows a variety of emission scenarios to be tested for different time-periods to assess future weather extremes (fig. 2).
- ◆ Spatial patterns of risk can also be identified and mapped (fig. 3)

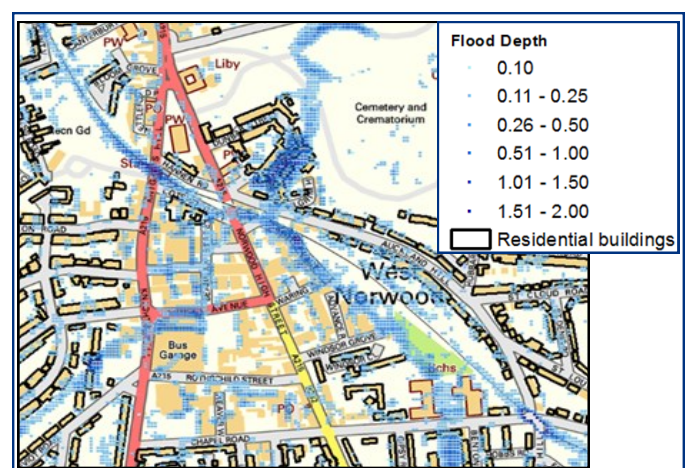


**Fig. 2: The average annual number of days where daily mean temperature exceeds 20°C or more. The range in results reflects different time periods and high (H) and low (L) emission scenarios.**



**Fig. 3: A spatial map showing the annual number of days when maximum temperature exceeds 27°C in Greater London and the surrounding region (for the 2050s under a high emission scenario)**

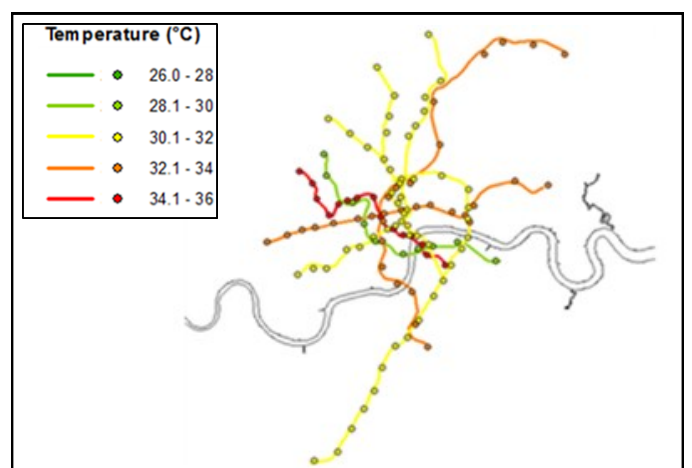
- ◆ The UIAF has been developed to address a range of climate impacts. For example, heat related mortality; impacts of heat on railway infrastructure; and damage from surface water flooding.
- ◆ The UIAF facilitates high resolution spatial modelling of impacts (e.g. fig. 4).
- ◆ Changing vulnerability due to socio-economic change as well as from climate change is also incorporated.



**Fig. 4: High resolution modelling of flood risk**

## Making the case for adaptation

- ◆ The UIAF can provide information on the probabilities of extreme weather events, their characteristics, related impacts, and the implications for adaptation policies.
- ◆ Hazards are defined based on specific temperature and precipitation thresholds for each impact.
- ◆ These thresholds can be adjusted to represent and assess various impact specific adaptation options.
- ◆ The spatial information can highlight specific populations and assets at risk, and highlight hotspots which will be vulnerable to a range of impacts (e.g. fig. 5).



**Fig. 5: Spatial pattern of maximum daily temperatures reached on trains on deep-level Tube lines . Median results for the baseline period (1960-1991)**

### For additional information see:

- ◆ ARCADIA factsheet number 2
- ◆ ARCADIA website: [www.arcc-cn.org.uk/project-summaries/arcadia/](http://www.arcc-cn.org.uk/project-summaries/arcadia/)