Geophysical Research Abstracts
Vol. 21, EGU2019-15169, 2019
EGU General Assembly 2019

The impact of the Urban Heat Island on heat related mortality in a European city, and potential benefits of adaptation measures

Clare Heaviside (1,2,3) and Helen Macintyre (2,4)

(1) Environmental Change Institute, University of Oxford, United Kingdom (clare.heaviside@ouce.ox.ac.uk), (2) School of Geography, Earth and Environmental Sciences, University of Birmingham, United Kingdom, (3) Department of Social and Environmental Health Research, London School of Hygiene and Tropical Medicine, Keppel Street, London, UK, (4) Centre for Radiation Chemical and Environmental Hazards, Public Health England, Oxon, UK

The urban heat island (UHI) effect describes the phenomenon whereby temperatures in cities are generally higher than temperatures in surrounding rural areas, largely due to differences in the energy balance between urban and rural environments. The effects of the UHI are most pronounced at night time, when urban materials emit longwave radiation, raising the local ambient temperature. However, during heatwaves, the UHI effect can mean that maximum daytime temperatures in cities can be dangerously high.

The link between heat and health is well established, with mortality rates increasing above certain local heat thresholds; urban populations are at increased risk from heat associated with the UHI. Climate change and increasing urbanisation in most parts of the world will exacerbate heat risks, although local urban temperatures are not always well characterised by global climate models, due to the difference in spatial scale between cities and global model resolution. This means that future impacts from heat may be underestimated in cities.

To assess this risk, we ran WRF (Weather Research Forecasting) model simulations of a densely urbanised region (West Midlands in the UK) to quantify heat related mortality associated with the UHI during a heatwave, for current and future climate. Simulations were run at 1 km resolution, and included the Building Energy Parameterization (BEP) Scheme with 3 urban land categories.

We found that up to half of the heat related mortality was associated with the UHI during the heatwave of 2003. Furthermore, spatial analysis revealed that areas of the city which are resided by populations with the highest levels of social and economic deprivation were co-incident with the highest local temperatures. This suggests that more vulnerable populations are at higher risk from overheating, and highlights potential inequalities.

We previously found that urban or building level interventions can limit overheating in buildings, and therefore reduce heat related health impacts; shutters were found to be particularly effective in this respect. Reflective 'cool' roofs can also help lower temperatures by reflecting solar energy. We ran simulations based on implementation of cool roofs in different parts of the city, and found that this type of intervention can also limit heat related mortality, and is particularly effective at reducing maximum daytime temperatures. Installing cool roofs on commercial buildings in the city centre reduced the impact of the UHI on heat related mortality by around 25%. Results of this research can help policy makers to target interventions to improve health, and decrease inequalities in urban areas.