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Simulations of the Birmingham Urban Heat Island and estimates of the associated current and future health burdens during heatwave conditions

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Birmingham is the second most populous city in the UK and observations indicate it has a pronounced urban heat island (UHI), i.e. higher ambient temperatures in the city centre compared to surrounding suburban and rural areas. The effects of UHIs are often enhanced during anticyclonic summer weather conditions, with low winds and clear skies, such as during heatwaves. Enhanced temperatures in cities and towns where there is a high population density can mean that significant numbers of people are at risk from heat related illness during hot weather. This health risk is likely to be exacerbated in the future, as summer temperatures continue to rise due to climate change. We present the first ambient temperature simulations of Birmingham and the West Midlands Metropolitan region using a high resolution, regional meteorological model (WRF – the Weather, Research and Forecasting model) with the BEP urban canopy scheme and detailed urban surface categories across the region. We find that the UHI intensity (the difference between urban and rural temperature) in the West Midlands throughout the heatwave of August 2003 was around 3^{o}C on average, but reached a maximum of 7^{o}C. Climate change projections for Birmingham indicate an increase in annual mean temperature of up to 5^{o}C by the 2080s. However, these projections do not include the effects of the UHI, which need to be considered in addition to climate change. Neglecting the enhanced temperatures related to the UHI when estimating heat related adverse health effects using climate change projections is likely to underestimate the actual extent of future health impacts. We further investigated the health burden due to enhanced temperatures associated with the UHI across the West Midlands Metropolitan region during heatwave conditions, and the potential impact of climate change on heat related mortality in future decades in urban areas.