Urbanisation-induced climate warming in Great Britain

Richard Bassett\textsuperscript{1,2,3}, Paul Young\textsuperscript{1,2}, Gordon Blair\textsuperscript{2,3}, Xiaoming Cai, and Lee Chapman

\textsuperscript{1}Lancaster Environment Centre, Lancaster University, United Kingdom
\textsuperscript{2}Centre of Excellence for Environmental Data Science, Lancaster University, United Kingdom
\textsuperscript{3}School of Computing and Communications, Lancaster University, United Kingdom

In Great Britain (GB) 5.8\% of the total land area is considered urban, yet the wider impact of Urban Heat Islands (UHIs) beyond city scales has not been fully explored. Through scaling data from a high-resolution urban monitoring network we estimate the current (2014) spatial daily-mean urban warming across GB to be 0.04°C [0.02 °C – 0.06°C]. Despite this GB-wide contribution appearing small (94\% of the land cover is still rural), half of GB’s population currently live in areas with average daily-mean UHIs of 0.4°C. GB is also experiencing rapid urbanisation, with urban land cover expanding from 4.3 to 5.8\% between 1975 and 2014. Purely due to urbanisation in this period, we estimate GB as a whole is warming at a rate that is both equivalent and in addition to \textasciitilde 3\% of the background surface-level climate change (i.e. natural and greenhouse gas induced). In areas with the greatest urban expansion, we find UHI-induced warming rates are up to three times this average. Although our study only applies to GB, the simplicity of our method means that it can be equally applied to other countries. Urbanisation is undeniably a global phenomenon with urban expansion in many countries far exceeding that found in GB.