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Spatiotemporal assessment of heat risk for high-density urban areas: a case study in Dublin, Ireland

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Ireland's climate is changing and these changes are projected to intensify into the future posing an increasing risk to Ireland's environment, society and economy. For Ireland and its urban areas in particular, projected changes in the frequency and intensity of heatwaves is considered a moderate but real risk. For example, it is considered likely that Ireland's capital city Dublin will experience increases in the frequency and intensity of heatwaves under projected climate change. Moreover Ireland's population is ageing faster than other parts of Europe and becoming increasingly vulnerable to heat stress.

To date, little attention has focussed on heat-related risks for Ireland's urban areas, focussing primarily on risks associated with sea level rise and changing patterns of precipitation. Through this work, we provide an innovative approach that allows for the integrated assessment of current and future heat risk for the Greater Dublin Area. Employing a range of modelling approaches, landcover projections have been developed and future changes in urban heat projected, and spatiotemporal variations in level of exposure to heat stress have been calculated using the Universal Thermal Climate Index (UTCI) for current and future periods (2020s – 2050s) under a range of radiative forcing scenarios (RCP4.5 and 8.5). These assessments are combined with vulnerability information (socio-economic data) to obtain spatially-explicit indexes of heat risk and for different scenarios (RCPs). As a result of projected changes in landcover and temperatures, our assessments show that the level of exposure to extreme heat stress will increase in the coming decades and this is particularly the case for the RCP 8.5 scenario. In combination with assessments of vulnerability, this study identifies significant spatial clusters in the denser urban core of the city and peri-urban areas that are considered to be at relatively high levels of heat risk.

Spatial planning and land use planning are emerging as policy areas that can have significant influence on adaptation to and mitigation of climate change. Through spatial planning, the ways in which cities are designed in order to minimise risks can be re-evaluated and the complexity and uncertainty of climate change tackled. This study provides spatially explicit information at a fine scale on the evolution of exposure and vulnerability related to thermal heat stress that will support stakeholders to implement strategies and policies aimed at mitigating and adapting to ongoing and future urban heat risk.