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Analysis of heat wave features and urban heat island effect under climate change

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Extreme events such as heat waves occurred in urban have a large influence on human life due to population density. For urban areas, the urban heat island effect could further exacerbate the heat stress of heat waves. Meanwhile, the global climate change over the last few decades has changed the pattern and spatial distribution of local-scale extreme events. Commonly used climate models could capture broad-scale spatial changes in climate phenomena, but representing extreme events on local scales requires data with finer resolution. Here we present a deep learning based downscaling method to capture the localized near surface temperature features from climate models in the Coupled Model Intercomparison Project 6 (CMIP6) framework. The downscaling is based on super-resolution image processing methods which could build relationships between coarse and fine resolution. This downscaling framework will then be applied to future emission scenarios over the period 2030 to 2100. The influence of future climate change on the occurrence of heat waves in urban and its interaction with urban heat island effect for ten most densely populated cities in China are studied. The heat waves are defined based on air temperature and the urban heat island is measured by the urban-rural difference in 2m-height air temperature. Improvements in data resolution enhanced the utility for assessing the surface air temperature record. Comparisons of urban heat waves from multiple climate models suggest that near-surface temperature trends and heat island effects are greatly affected by global warming. High resolution climate data offer the potential for further assessment of worldwide urban warming influences.