



Impacts of extreme heat days and nights on urban heat environment: a perspective of local climate zones

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Increasing human activities and urbanization have posed huge challenges to the urban climate, such as the urban heat island effect, which makes air temperature in urban areas higher than that in suburban areas. Meanwhile, the urban heat island intensity (UHII) suffers impacts from the exacerbation of observed extreme heat events, but how extreme heat events affect UHII in different subdivided urban spaces remains unclear. In this paper, we attempt to address the impact of extreme heat days and nights on urban heat environment from the perspective of local climate zones (LCZs). Firstly, we propose a framework for LCZ classification for higher precision LCZ mapping over the Guanzhong Plain urban agglomeration in China. Secondly, to select extreme heat days and nights based on six extreme temperature indices (TXx, TNx, TX90p, TN90p, SU25 and TR20), the daily maximum, minimum and average seamless 1-km air temperatures are estimated using the random forest method for the period from 2000 to 2020. Finally, combining the LCZ map and gridded temperature product, we analyze variance in air temperature and UHII among different LCZs at daytime and nighttime, as well as the influence of extreme heat conditions on air temperature and UHII in different LCZs.

Our results indicate that the air temperature difference within LCZs is greater under extreme heat conditions compared against that under non-extreme conditions. Meanwhile, extreme heat conditions aggravate the urban heat risks at daytime, which is manifested in the following two aspects: (1) the temperature difference within LCZs on extreme heat days is greater than that on extreme heat nights; and (2) UHII at nighttime is stronger than that at daytime in most LCZs under non-extreme conditions, but under extreme heat conditions, it is the opposite. In addition, although the rank of UHII in different LCZs varies due to differences in time and definition of extreme heat days and nights, LCZ 6a (agricultural greenhouse) stands out for suffering the highest UHII under all conditions (different extreme temperature indices, on days and nights), to which particular attention should be paid. Our results could be contributed to conducting mitigation measures of urban heat risks and providing more explicit guidance to policymakers and urban planners.