Analyzing the Relationship Between Local Climate Zones (LCZ) and Land Surface Temperature (LST) Focusing on Impervious Surfaces

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ABSTRACT

As urbanization rapidly progresses worldwide, more than 57% of the global population now resides in cities. This shift has resulted in a dramatic transformation of natural environments into built environments, leading to a significant increase in impervious land cover such as concrete, asphalt, and buildings. These changes have intensified urban environmental issues, notably the Urban Heat Island effect and heatwaves, both of which are directly linked to rising temperatures and have severe implications for aspects such as health, energy consumption, and overall urban life quality. Furthermore, the concentration of impervious surfaces in cities alters local climate patterns by reducing natural cooling processes, such as evaporation and shading, intensifying the heat accumulation in urban areas. Given the growing occurrence and severity of extreme heat events driven by climate change, it is becoming ever more crucial to understand thermal vulnerabilities across various physical environments within cities. Comprehensive knowledge of these vulnerabilities can inform the development of effective mitigation and adaptation strategies, which are essential for ensuring sustainable development in the face of growing climate challenges. In this study, we utilized the Local Climate Zones (LCZ) classification, which is based on consistent land cover types and urban spatial structure, to analyze the distribution of Land Surface Temperature (LST) across different types of physical environments. Furthermore, we examined the correlations between LST the share of impervious surfaces, along with building heights, for each LCZ type. This analysis allows us to identify the thermal characteristics and vulnerabilities of each LCZ type, providing foundational data for developing sustainable urban planning strategies that consider thermal environments and adapt to climate change.

Keyword: Local climate zone/ Land surface temperature/ Climate change/ Correlation analysis/ Urban planning

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