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# Assessing the thermal behavior of different local climate zones in the Nanjing metropolis, China

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## Abstract

A Local Climate Zone (LCZ) system comprises an objective and systematic classification of field sites for heat island studies. Each LCZ type is defined by structural and land cover properties at local scales that influence screen-height temperatures. This study aims to assess the thermal behavior of different local climate zones with temperature observations from the sprawling metropolis of Nanjing, China. Fixed-point measurements were employed to simultaneously collect air temperature data from 14 different local climate zones across Nanjing over a period of 401 days from July 2016 to August 2017. Based on the long-term observational dataset, the thermal behavior of different LCZ classes in Nanjing was extensively analyzed for both general and ideal weather conditions. The temperature differences between the LCZ classes were examined on multiple time scales (hourly, daily, monthly, seasonal, and annual). Temporal dynamics of cooling and warming rates of the LCZ classes were evaluated. In addition, the temperature-based indices of heat island/cool island degree-hours and cooling/heating degree-days were employed to provide a more comprehensive assessment on the local climates of LCZ classes. The results reveal that each LCZ class presents a distinguishable thermal behavior that is associated with its surface structural and land cover properties. The distinct patterns of thermal behavior for LCZs are clear and consistent when temperature differences were analyzed on relatively long time scales. The results of this study support the idea that the LCZ scheme can be used as a comprehensive climate-based classification system for urban and rural sites during temperature studies.

**Key words:** urban climate; local climate zones; canopy urban heat island; fixed-point observations; thermal behavior

## 1. Introduction

Urbanization and human activities significantly affect the climate of cities and most obviously in near-surface air temperature. Traditionally, an urban heat island (UHI) is defined as the air temperature difference between the urban area and the surrounding rural area. However, a re-evaluation of UHI studies by Stewart [1,2] has suggested that in

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