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Urban Geometry and Surface Radiation Effects on Microclimate: A Manhattan case-study

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Existing research have investigated the effect of urban geometry and mean radiant temperature on surrounding microclimate extensively. Nevertheless, uncertainties remain regarding the variations in surface radiation in relation to the corresponding urban geometry. Particularly, the role of longwave radiation on the microclimate and pedestrian comfort in urban settings compared to the direct shortwave radiation is not fully understood. Existing studies focusing on the outdoor thermal comfort of pedestrians in urban areas primarily rely on air temperature conditions. Despite previous research indicating that mean radiant temperature has a greater influence on outdoor thermal comfort than air temperature, the latter continues to be regarded as the primary parameter. Additionally, the current body of research on mean radiant temperature primarily emphasises the comprehension of average radiation conditions within urban spaces, rather than exploring the effects of urban geometry and surface materials on longwave and shortwave radiation. The understanding of these factors is crucial to alleviate urban heat and improve comfort conditions at pedestrian levels. This study explores the aforementioned factors through real-time microclimate measurements using advanced tools and equipment collected during an urban climate walk in Manhattan's high-density context. The data gathered during the climate walk consists of urban geometry details captured through fish-eye images, photographic surveys of the measurement points, and microclimate data including air temperature, relative humidity, globe temperature, wind speed, and measurements of longwave and shortwave radiation from six directions. Considering the urgency of mitigating urban heat, the analysis of this data will enable us to comprehend the influence of urban geometry and surface radiation in a densely populated urban context. Consequently, the study seeks to propose strategies aimed at reducing urban heat and enhancing microclimate conditions for pedestrians. The methodology and findings of the study can provide valuable insights for future decision-making in the context of microclimate-focused spatial planning and design interventions.

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