

Analysis of Urban Microclimate Characteristics Using ENVI-Met Modeling

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ABSTRACT

Urbanization leads to changes in land use, which in turn affects the local microclimate and has a direct impact on urban residents. Physical changes like shifts in land use influence micro-scale factors such as temperature and wind patterns in urban areas. These microclimatic changes can significantly affect thermal comfort and the dispersion of air pollutants like particulate matter. National weather data are often insufficient to detect these micro-scale variations, so using microclimate simulation tools is essential for accurate analysis. In this study, the microclimate simulation program ENVI-met was used to examine the microclimatic characteristics in an urban area based on its physical environment. The study focused on Won-i streets in Changwon, South Korea, which features various land use types, including single-family and multi-family residential areas. The area was modeled in the simulation, and the results were analyzed using ArcGIS Pro, dividing the area to extract data on land use ratios, impervious surfaces, sky view factor (SVF), and microclimatic variables. Correlation analysis showed that areas with larger impervious surfaces, such as those categorized as "roads" including parking lots, generally had higher temperatures. In contrast, lower temperatures were found in urban wetlands. When comparing single-family and multi-family residential areas, single-family areas were warmer. This was likely due to their low building height (1-2 floors), which provided less shading, and the surrounding impervious roads that caused heat to accumulate. In contrast, multi-family residential areas had more permeable surfaces, such as grass and trees, and taller buildings providing more shade, resulting in lower temperatures. These findings can help guide the management of urban thermal environments. Additionally, in areas with higher temperatures, the spread of air pollutants like particulate matter may be more active, making this data useful for managing pollutant dispersion.

Keyword: Urban microclimate/ Land use / ENVI-met/ Urban planning