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Application of urban micro models for assessment of bioclimatic conditions within the wider Athens area, Greece

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The study of the urban environment in a micro scale is of great interest for both scientists and local authorities, because the interpretation of the extracted results could be used for city development planning or improvement of the existed urban structure.

The objective of this research is to measure and analyze the bioclimatic conditions in an urban environment (Kallithea city) at the southwest suburbs of the greater Athens area (GAA) using geographical information system (GIS) and urban micro models such as RayMan and SkyHelios. The quantification of the bioclimatic conditions was succeeded by the estimation of the Physiologically Equivalent Temperature (PET), which is a bioclimatological index based on the human energy balance. We made field measurements of air temperature, relative humidity, wind speed and total solar irradiance, for different sites of the examined micro urban environment, in order to calculate PET. Additionally, the calculations were done by different sky view factors, and compared to a reference site (National Observatory of Athens). The global radiation was transferred to the examined sites with the RayMan model, which considers the sky view factors for the adaptation of the radiation fluxes to simple and complex environments. Digital elevation models (DEM) along with datasets concerning urban obstacles (OBS), such as trees, and heights of buildings constructed a database, which was used in order to estimate the bioclimatic conditions in urban micro scale.

The findings revealed significant differences in PET quantification, even in very close sites, which differs in sky view factor and buildings' orientation and height. Besides, this study highlights the beneficial impact of trees and green cover in a complex environment, indicating that planting of trees among other actions could be the solution of mitigating strong/extreme heat stress, improving the quality of living in cities.