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Thermal Comfort Maps to estimate the impact of urban greening on the outdoor human comfort

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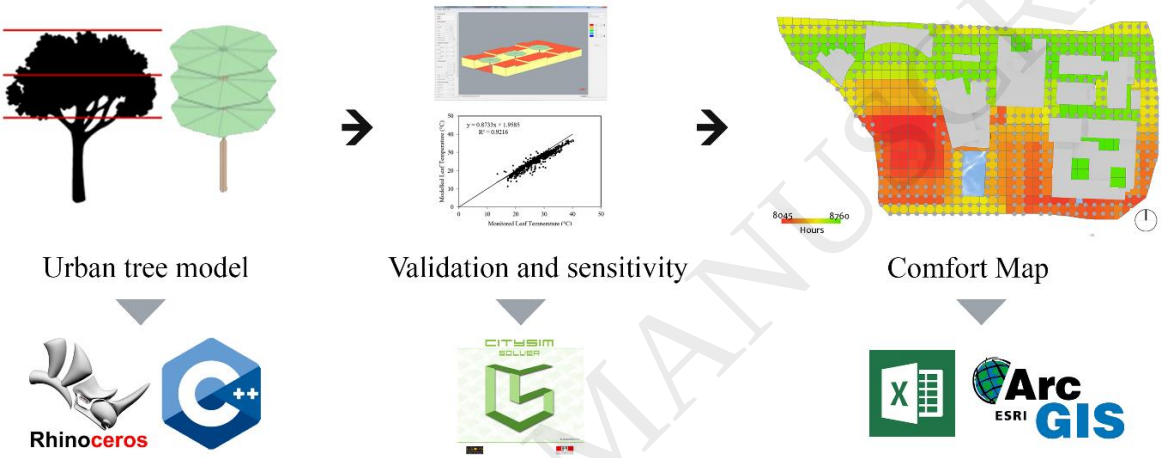
Graphical Abstract



Highlights

- Developed a model to quantify the cooling potential of trees within the urban environment
- Created thermal comfort map to dynamically visualize pedestrians' thermal comfort
- Used model to assess tree planting scenarios on school campus in Dubai

Abstract

Outdoor human comfort is an important factor in the evaluation of the liveability of a city as well as for promoting people's health and well-being. In hot arid climates in particular, urban planning and design can considerably impact the day-to-day thermal comfort of the pedestrians, for better or for worse. Strategies to reduce thermal discomfort include shading structures, water bodies, and the promotion of natural ventilation – and most significantly, green areas. Trees have a major impact on the pedestrians in the built environment as they not only provide shading but also improve the microclimate in urban areas, thereby reducing the time during which discomfort is felt. The objective of this paper is to present a new methodology for dynamically quantifying the impact of different plants in urban areas on outdoor human comfort, through 3D urban energy modelling. The proposed methodology makes use of an urban energy modelling tool, providing a comprehensive view of the city energy fluxes, with a focus on the impact of trees on the human thermal comfort. Outdoor human comfort is assessed using the Index of Thermal Stress for the campus of the Swiss International School of Dubai (UAE), where "Thermal Comfort Maps" are designed to quantify the pedestrian thermal sensation and its variation in time and space. Additionally, the energy fluxes impinging on the urban