EGU24-12490, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-12490
EGU General Assembly 2024
© Author(s) 2024. This work is distributed under
the Creative Commons Attribution 4.0 License.

Digital thermal 3D model for thermal comfort analysis at district scale.

Chaimaa Delasse[1,2], Rafika Hajji[2], Tania Landes[1], Hélène Macher[1], Pierre Kastendeuch[1], and Georges Najjar[1]
[1]ICube Laboratory UMR 7357, Photogrammetry and Geomatics Group, National Institute of Applied Sciences (INSA Strasbourg), 24, Boulevard de la Victoire, 67084 Strasbourg, France.
[2]College of Geomatic Sciences and Surveying Engineering, Institute of Agronomy and Veterinary Medicine, Rabat 6202, Morocco.

Today's cities face many challenges, including those related to climate change, energy efficiency, and human well-being. These issues are closely linked to the thermal dynamics of the built environment. Sub-optimal solutions and increased vulnerability often result from a lack of deep understanding of the spatial and temporal variations of thermal interactions in the urban context, particularly in data-limited regions. The primary objective of this thesis is to develop a methodology for creating "as-built" digital thermal models through 3D reconstruction of urban scene objects such as buildings, trees, and pavements. The coupling of 3D geometry and TIR (Thermal Infra-Red) acquisitions at different periods enhances the semantic richness of the model and facilitates the study of building-tree thermal interactions. This, in turn, enables the calculation and the monitoring of the evolution of thermal comfort indices at a micro-scale (<2km). To this end, the TRIO team has developed LASER/F (Latent And Sensible Radiation Fluxes), a microclimate simulation software that can replicate the effect of buildings and trees on the urban microclimate. The buildings and trees of interest are modeled with a high level of detail (LOD3) to improve the accuracy of the simulations. The simulated thermal model will be evaluated using "real" thermal and eco-physiological data collected in the field. The validated model will be used to simulate various scenarios for improving thermal comfort, making it a valuable decision-making tool for urban planning. The study will be conducted at two sites, one in Strasbourg (France) and the other in Rabat (Morocco). This study aims to analyze, compare, and improve LASER/F simulations at two sites, in two different countries and climates. The goal is to assess the impact of existing vegetation configurations and propose scenarios for improving thermal comfort. This may include changes to tree species or positions and the modification of urban geometry. Measurement campaigns have been carried out at the Strasbourg site during the summer of 2023. Fixed environmental measurements such as wind speed, relative humidity, global radiation, and sap flow were carried out. 3D geometry acquisitions were performed using laser scanners. TIR data was also acquired thanks to thermal cameras at fixed positions and thermobuttons located on facades. Moreover, a mobile system composed of RGB (Red Green Blue) cameras and a TIR camera has been specifically designed. Similar campaigns are planned for the Rabat site in 2024.