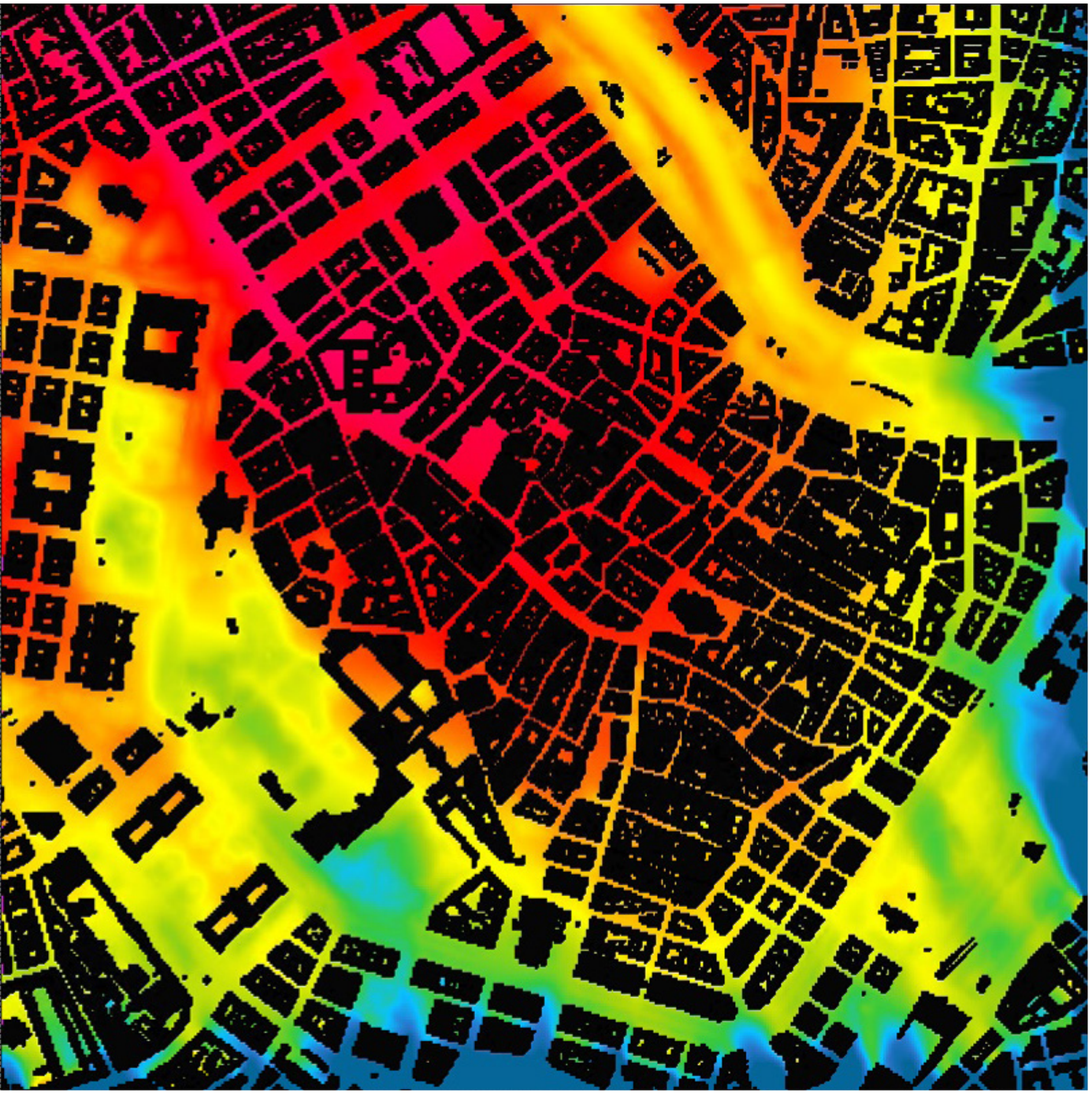


PET
Vienna
10 pm, 21 July

Urban Thermal Comfort:
UTCI, PET & PMV Simulations in Envi Met through Grasshopper

Workshop at

SimAUD 2021

Tutor
Joy Mondal, WEsearch lab
joy@wesearchlab.com

Title **Urban Thermal Comfort:**
UTCI, PET & PMV Simulations in Envi Met through Grasshopper

Description

This workshop is designed for researchers and practitioners interested in the temporal and spatial variability of urban heat island effect, and in quantifying the decrease or increase of the impact of the effect on urban thermal comfort through changes in design, material specification and/or addition of vegetation and water bodies.

In the complex world of urban microclimate, climatic parameters, built structures, surfaces, vegetation and water bodies constantly interact with each other. These resulting interdependencies affect the primary microclimate attributes of an urban scene such as radiation, air and radiant temperature, wind speed, or humidity. These attributes coalesce at the human body as an individual sensation of the local climate conditions. Envi Met offers an hourly analysis of the heat and energy fluxes coming from the environment for any position within the model domain. Using sophisticated bio-meteorological indices of urban thermal comfort such as Universal Thermal Climate Index (UTCI), Physiological Equivalent Temperature (PET), and Predicted Mean Vote (PMV), the overall thermal sensation of a person standing in the virtual environment shall be simulated for any given urban scenario.

The workshop shall use Grasshopper to extract shapefiles from map, build a 3D urban scene using the shapefile, assign materials, export and simulate the scene in Envi Met, and visualise the simulation result. Participants shall be able to quantify the decrease in primary attributes of an urban scene (radiation, air and radiant temperature, wind speed etc.) and, consequently, its derived attributes (UTCI, PET and PMV) through changes in 3D models, materials, vegetation, and green walls and roofs. As a result, participants will be able to identify areas in an urban scene that are either too hot or too cold, and subsequently optimise the areas' urban thermal comfort through changes in design parameters.

The key components of the workshop are as following -

1. Introductory presentation,
2. Extract shapefile from map,
3. Developing 3D models from extracted shapefile (using GHSHP) or from scratch,
4. Exporting and simulating the 3D models in Envi Met using DragonFly (Grasshopper plugin), and
5. Visualising the simulation results using Ladybug (Grasshopper plugin).

Relevance to the Community

The simulation power of Envi Met and Grasshopper's ability to talk to Envi Met provides the perfect familiar parametric platform for designers to understand the temporal and spatial variability of urban heat island effect. Through calculations of urban thermal comfort indices like UTCI, PET and PMV, urban heat island effect can be quantified and mitigated. Additionally, Grasshopper's visualisation capabilities of the simulation results shall allow designers to generate complex and legible visuals.

Takeaways

The participants shall be able to learn the following –

1. Analyse the temporal and spatial variability of urban heat island effect,
2. Understand the concepts and differences between UTCI, PET and PMV in the context of urban heat island effect,
3. Be able to extract shapefiles from map to make real-world 3D,
4. Be able to export and simulate 3D models in Envi Met through Grasshopper,
5. Be able to visualise simulation results graphically and numerically in Grasshopper,
6. Be able to quantify the decrease or increase in primary attributes of an urban scene (radiation, air and radiant temperature, wind speed etc.) and consequently its derived attributes (UTCI, PET and PMV) through changes in 3D models, materials, vegetation, and green walls and roofs.

Tutor's Name: Joy Mondal

Affiliation: WEsearch lab

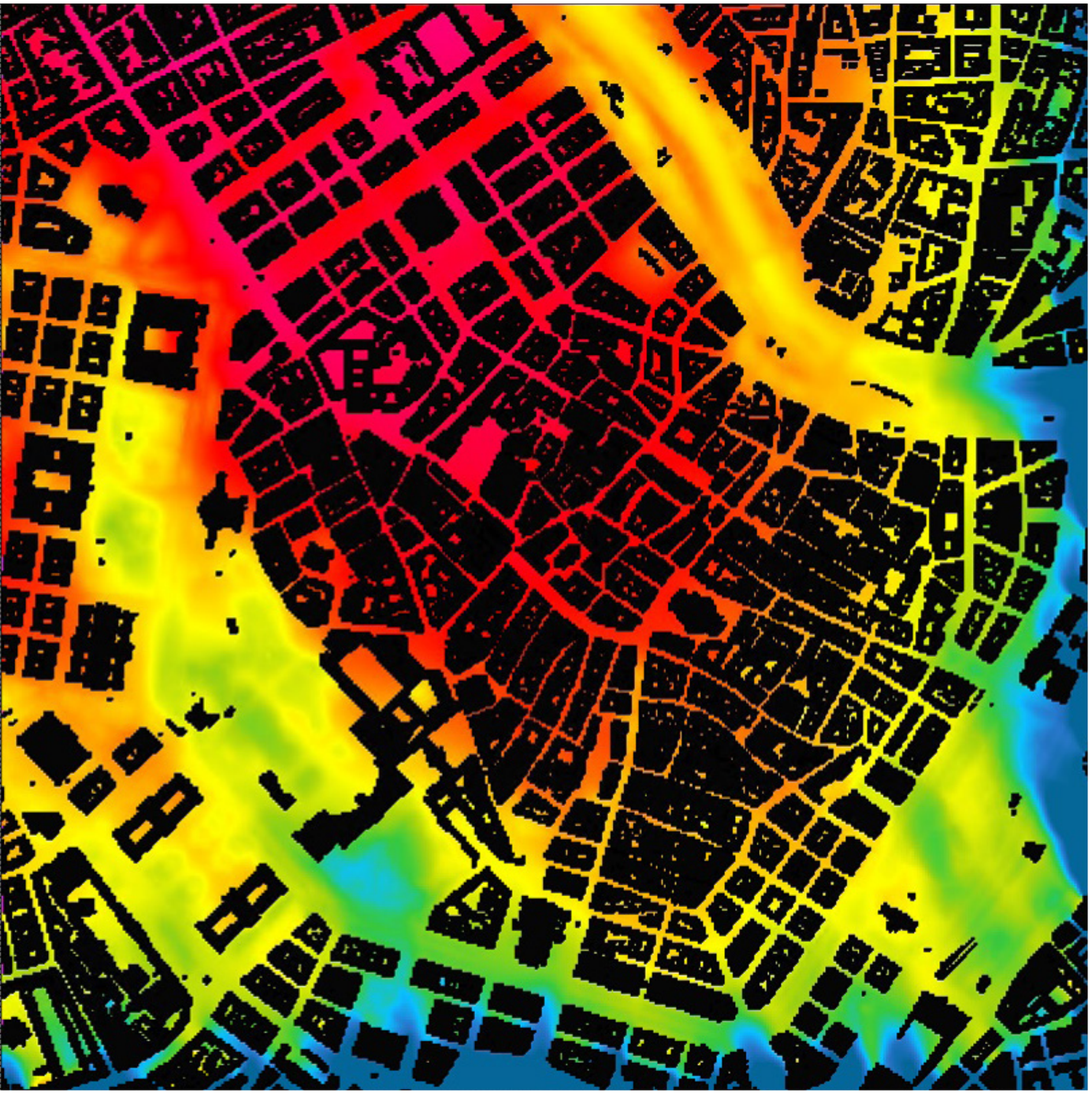
Bio

Joy Mondal works at the intersection of performance simulation, architecture design and computation. He leads WEsearch lab which offers design computation consultancy to architecture practices in Southeast Asia. He has released Grasshopper plugins to automate column-beam placement (Eelish) and to generate Piet Mondrian inspired 2D composition and 3D massing (Chingree). He was the recipient of the inaugural Saint-Gobain research scholarship. Earlier, he worked with the Sutainability Group at AECOM to setup POT (Parametric Optimisation Technology), which offered parametric and performance simulation solutions to architects for the first time in India.

Joy is a TEDx fellow, presenting ways of democratising architecture for everyone by using graph theory and shape grammar to automate residential design generation, thereby making design services available to 97% of Indians who cannot afford to hire architects. He has taught at SPA, Delhi and CEPT University, Ahmedabad. He has tutored multiple international workshops including at Rethinking The Future workshop series, Digital FUTURES 2020, ASCAAD 2021 and CAADRIA 2021.

Duration	3 hours
Participants	30 (max)
Pre-requisite	Beginner level knowledge of Grasshopper
Attendance	Workshop open to additional people
Session type	(c) Application of software developed externally

TEDx talk	https://youtu.be/SxTOPRlp5NU
Digital FUTURES workshop	https://www.digitalfutures.world/workshops-asia-pacific-blog/mondal
ASCAAD workshop	https://www.ascaad.org/conference/2021/workshops.htm
CAADRIA workshop	https://caadria2021.org/workshops-full#online_workshop_9



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