

## Accepted Manuscript

Title: From urban climate to energy consumption. Enhancing building performance simulation by including the urban heat island effect

Author: M. Palme L. Inostroza G. Villacreses Andrea Lobato-Cordero C. Carrasco



PII: S0378-7788(17)31102-7  
DOI: <http://dx.doi.org/doi:10.1016/j.enbuild.2017.03.069>  
Reference: ENB 7494

To appear in: *ENB*

Received date: 6-12-2016  
Revised date: 1-3-2017  
Accepted date: 29-3-2017

Please cite this article as: M. Palme, L. Inostroza, G. Villacreses, A. Lobato-Cordero, C. Carrasco, From urban climate to energy consumption. Enhancing building performance simulation by including the urban heat island effect, *Energy and Buildings* (2017), <http://dx.doi.org/10.1016/j.enbuild.2017.03.069>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# 1 From urban climate to energy consumption. Enhancing 2 building performance simulation by including the urban 3 heat island effect

4 M. Palme<sup>1,4,\*</sup>, L. Inostroza<sup>2,3</sup>, G. Villacreses<sup>4</sup>, Andrea Lobato-Cordero<sup>4</sup>, C. Carrasco<sup>5</sup>

5 <sup>1</sup> Universidad Católica del Norte, Escuela de Arquitectura, Antofagasta, Chile

6 <sup>2</sup> Institute of Geography, Ruhr Universität Bochum, Germany

7 <sup>3</sup> Universidad Autónoma de Chile, Temuco, Chile

8 <sup>4</sup> Instituto Nacional de Eficiencia Energética y Energía Renovable, Quito, Ecuador

9 <sup>5</sup> Universidad de Valparaíso, Facultad de Ingeniería, Valparaíso, Chile

10 \*Corresponding author: [mpalme@ucn.cl](mailto:mpalme@ucn.cl)

## 11 **ABSTRACT**

12 Cities are dissipative structures. As such, cities generate heat, a phenomenon known  
13 as urban heat island (UHI). Even though the UHI is one of the most relevant effects of  
14 urbanization on urban climate, up-to-date methodologies to include it in the  
15 estimation of buildings' energy consumption are still scarce. During the last 30 years,  
16 different methods and software have been developed to measure a thermal building's  
17 demand. Building performance simulation is commonly used to calculate heating and  
18 cooling demand. However, such techniques do not adequately include the urban heat  
19 island effect, which could have an extreme impact on a building's energy consumption.  
20 In fact, building operation is doubly connected with the urban environment: on the  
21 one hand, buildings generate heat that warms up the environment, and on the other  
22 hand, the urban environment alters building performance by the influence of UHI. In  
23 this paper, a methodology to incorporate the UHI effect in building performance  
24 simulation is proposed. Urban weather data were downscaled at the urban  
25 morphology building level to estimate the cooling demand of different types of  
26 residential buildings. The global energy penalty for the whole residential building  
27 stock was estimated in four South American Pacific coastal cities. The results indicate  
28 that when UHI is incorporated, an increase in energy demand between 15 % and 200  
29 % can be expected. These results challenge the validity of current assessments  
30 performed in absence of the UHI effect. At the same time, these results open up the  
31 discussion for the inclusion of urban planning measures aiming at reducing the UHI  
32 effect on a building's energy demand.

## 33 **KEYWORDS**

34 Cooling demand; urban weather generator; GIS; spatial analysis; building  
35 performance simulation; weather data, Antofagasta, Lima, Guayaquil, Valparaíso

## 36 **HIGHLIGHTS**

- 37  
38  
39  
40  
41  
42  
43 - A methodology to downscale the urban climate to the building level is  
44 proposed.

Download English Version:

<https://daneshyari.com/en/article/4914161>

Download Persian Version:

<https://daneshyari.com/article/4914161>

[Daneshyari.com](https://daneshyari.com)