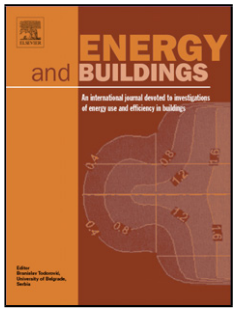

Title: Study on heat fluxes of green roofs based on an improved heat and mass transfer model

Authors: Yudi Tian, Xuelian Bai, Ben Qi, Lexiang Sun

PII: S0378-7788(16)30880-5
DOI: http://dx.doi.org/doi:10.1016/j.enbuild.2017.07.021
Reference: ENB 7761

To appear in: *ENB*

Received date: 20-9-2016
Revised date: 19-6-2017
Accepted date: 10-7-2017

Please cite this article as: Yudi Tian, Xuelian Bai, Ben Qi, Lexiang Sun, Study on heat fluxes of green roofs based on an improved heat and mass transfer model, Energy and Buildingshttp://dx.doi.org/10.1016/j.enbuild.2017.07.021

Study on heat fluxes of green roofs based on an improved heat and mass transfer model

Yudi Tian[a,b], Xuelian Bai[a,b*], Ben Qi[a,b], Lexiang Sun[a]

[a] Key Laboratory of the Three Gorges Reservoir Region's Eco-Environment, Ministry of Education, Chongqing University, Chongqing, 400045, China.
[b] National Centre for International Research of Low-carbon and Green Buildings, Chongqing University, 400045, China.

*Corresponding author: Faculty of Urban Construction and Environmental Engineering, Chongqing University, Chongqing, 400045, China. Tel.: +8615902396696; E-mail address: xuelianbai@cqu.edu.cn

Highlights

- The mathematical expressions of heat fluxes of green roofs are presented.
- A heat and mass transfer model is built to get the distribution of temperature and moisture content in soil.
- Keeping a high level of VWC is benefit for the thermal performance of green roofs.
- The contribution of various thermal behaviors of the green roof in summer are discussed.

Abstract: Analyzing heat fluxes of plants and soil is necessary to explore the thermal performance of green roofs. This paper presents mathematical expressions of heat fluxes of green roofs, and specially a heat and mass transfer model is built to get the distribution of temperature and moisture content in soil. The developed model is validated with experimental data from the intensive planted roof located in Chongqing. And the effectiveness of the model for predicting the temperature and water content variations are demonstrated by the comparison between the experimental results and simulation. Furthermore, the performance of green roof during summer in Chongqing is discussed based on the experiment. Through analyzing heat fluxes of green roofs, the study presents the contribution of each thermal behavior including reflection, convection, evapotranspiration and thermal storage to the thermal effects of the green roof quantitatively. The weight of various thermal behaviors of the green roof changes in different time, resulting in different thermal performance of green roofs. The study of the transient heat fluxes of green roofs will not only contribute to a high efficient usage but also a better application of engineering.

Keywords: green roof; heat flux; thermal performance; heat and mass transfer.