

## Accepted Manuscript

Numerical simulation of ground source heat pump system considering unsaturated soil properties and groundwater flow

Chaofeng Li, Peter John Cleall, Jinfeng Mao, José Javier Muñoz-Criollo

PII: S1359-4311(17)36506-7  
DOI: <https://doi.org/10.1016/j.applthermaleng.2018.04.142>  
Reference: ATE 12139

To appear in: *Applied Thermal Engineering*

Received Date: 10 October 2017  
Revised Date: 12 April 2018  
Accepted Date: 30 April 2018

Please cite this article as: C. Li, P. John Cleall, J. Mao, J. Javier Muñoz-Criollo, Numerical simulation of ground source heat pump system considering unsaturated soil properties and groundwater flow, *Applied Thermal Engineering* (2018), doi: <https://doi.org/10.1016/j.applthermaleng.2018.04.142>

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.



**Numerical simulation of ground source heat pump system considering unsaturated soil  
properties and groundwater flow**

Chaofeng Li <sup>a</sup>, Peter John Cleall <sup>b,\*</sup>, Jinfeng Mao <sup>a,\*</sup>, José Javier Muñoz-Criollo <sup>b</sup>

<sup>a</sup> PLA University of Science and Technology, Nanjing 210007, PR China

<sup>b</sup> Cardiff School of Engineering, Cardiff University, Cardiff CF24 3AA, Wales, UK

\* Corresponding author.

E-mail address: cleall@cardiff.ac.uk (P. J. Cleall)

Keywords: Ground source heat pump, Borehole heat exchanger, Unsaturated soil, Groundwater flow

**ABSTRACT**

This paper analyzes the influence of unsaturated soil properties and groundwater flow on the performance of ground source heat pump (GSHP) systems. A mathematical model of GSHP systems, which considers the influence varying unsaturated soil thermal properties, groundwater table depth and saturated groundwater flow, is introduced and coupled to a heat pump model to consider dynamically-changing loads due to specific heat pump coefficient of performance (COP) characteristics. The model is validated against experiment results and an analytical model reported by others. Finally, numerical simulations are performed to investigate the effect of inclusion of a heat pump, moisture content variations, groundwater table fluctuations and groundwater flow rates on the performance of the GSHP system. Results show that neglecting

Download English Version:

<https://daneshyari.com/en/article/7045131>

Download Persian Version:

<https://daneshyari.com/article/7045131>

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