Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2019-176-RC1, 2019

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "The Vertical City Weather Generator (VCWG v1.0.0)" *by* Mohsen Moradi et al.

Anonymous Referee #1

Received and published: 22 October 2019

The paper introduces a computational platform for the simulation of urban microclimate that is composed of four sub-models (all together named VCWG). The introduced model is a vertical diffusion urban microclimate model that communicates with and receives its boundary conditions from a rural model, a building energy model, and a radiation model. While the idea of generating a computationally efficient model that considers the effect of the main microclimate contributors (buildings, trees, etc.) is useful for practical applications, the model fails (fundamentally) in representing the true physics. The level of simplification in the modeling assumptions, together with the use of too many 'unjustified' parameterization is overwhelming. Major revision in modeling is required before making it open to the public. I'll try to mention some of the major issues:

- In the rural model, the authors mention that a mixing length based on Obukhov length may fail in some condition, but what is the justification for the use of eq 3?

Printer-friendly version

Discussion paper

-In the mixing length equation (eq. 3), how Ccrur, which is a scaling correction factor, is optimized? It is mentioned that it is 'optimized' to 1 during unstable conditions and 1.5 during stable conditions (line 31, page 8). Why and how C* is optimized to 1?

-Looking into Aliabadi et al. 2019, it does not seem that the condition for eq. 4 is relevant for the rural model in this work. If it does, it is not mentioned/justified by the authors. In addition, it is not clear how this equation is found from Aliabadi et al. 2019.

-What is the reference for equation 10? Why does it need a scaling factor and why is it fixed to a value of 10? Based on which reasoning this equation is also scaled with Hbl=2000?

-What is the reference for the convective heat transfer equation (eq 7)? What are the assumptions behind this model? How is it found, and for which condition it is valid?

-The same questions (regarding the justification, validity, references in the literature) is also valid for the parametrization/equations of the pressure gradient and density equations.

-Equations 1 to 9 that are used in rural model contain too many random/unjustified scaling parameters that are just simply mentioned as optimized parameters. This allows the existence of too many free knobs that can be fixed/switched freely to fit the results to desired ones.

-A detailed uncertainty quantification analysis for all parameters used in the model is required to show the robustness of the model and to avoid over-fitting.

-The whole rural model (that is based on several models, which are not physically justified) can be replaced by simple day and nighttime potential temperature profiles that are widely exist in the literature (even text books, e.g. Stull's book) based on several field studies. Even an assumption of constant profile in the mixed and SBL is a more reliable approach.

-Equations 10 and 11 (and rest of the equations in section 2.1.2) provided for the ur-

Printer-friendly version

Discussion paper

ban vertical diffusion model are based on the assumption of horizontal homogeneity together with a zero mean vertical velocity. Both these assumptions are strongly invalid inside an urban area that makes the use of these equations inappropriate and wrong. Santiago and Martilli (2010) are referenced for the use of these equations. However, this reference uses these formulation for a mesoscale model over an urban area. Horizontal homogeneity and zero mean vertical velocity could be valid for a mesoscale model, but there is no way to justify these assumptions for an urban area.

-Based on what I mentioned above, the validation study in Sect. 3 is not reliable. However, for future references, a complete validation study is desired for all aspects of the model. The model is composed of four sub-models that their combined performance should be tested (especially when they have a feedback interaction with each other). The validation study does not provide any information regarding the building energy and radiation models.

-I noticed that the contribution of two of the authors is described as 'have improved the one-dimensional vertical diffusion model for the urban climate based on large-eddy simulations'. Based on the scope of the work, it is not clear how this improvement is done.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-176, 2019.

Printer-friendly version

Discussion paper