Ms. Ref. No.: UCLIM-D-17-00016R1

Title: Development of the VTUF-3D v1.0 urban micro-climate model to support assessment of urban vegetation influences on human thermal comfort

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Dear Dr. Kerry A Nice,

The reviewers have commented on your above paper. They indicated that it is not acceptable for publication in its present form.

However, if you feel that you can suitably address the reviewers' comments (included below), I invite you to revise and resubmit your manuscript.

I would appreciate if you could submit your revised paper by Nov 10, 2017.

Please carefully address the issues raised in the comments.

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a) outline each change made (point by point) as raised in the reviewer comments

AND/OR

b) provide a suitable rebuttal to each reviewer comment not addressed

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Yours sincerely,

Alexander Baklanov, Dr. Sci.

Editor in Chief

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Reviewers' comments:

Reviewer #2: Development of the VTUF-3D v1.0 urban micro-climate model to support assessment of urban vegetation influences on human thermal comfort

K. Nice, A.M. Coutts, N.J. Tapper

The authors have clearly attempted to respond comprehensively to the reviewer comments. The model is unique and a novel contribution, filling an important gap. The neighbourhood-average results are good; however the novelty of the model is not at this scale, but at the microscale. The authors have added a microscale model-observation comparison which assesses common thermal comfort quantities/indices Tmrt and UTCI. However, the model performance at this scale leaves something to be desired. My sense is that the model resolution, the model physics, and/or the mismatch between the model representation and observed reality (e.g. Tmrt for a patch on the ground vs. a measurement at 3m height) are contributing. Somewhat worrisome is the clear degradation of model performance for streets with more tree cover. To help give readers confidence, I think the reasons for the poorer model performance at the microscale and in more highly treed situations should be resolved (ideally), or at

very least explained in terms of limitations of the model (including clear guidance regarding what the model CAN and CANNOT do reliably).

Comments…

Abstract: The fact that TUF-3D and MAESPA are not fully coupled should be stated, i.e. that they are partially coupled, or similar. Also, the fact that impacts of trees on longwave exchanges is not captured should also be stated here and/or in the conclusions - this is an important effect of trees, especially at night. At present, it is not clear to me that the following statement at the end of the abstract is supported: "Using this model, it is now possible to conduct further analysis to quantify the impact each individual tree can have on conditions in urban canyons. Further, the model can help inform the optimal arrangement and quantity of trees to deliver improvements in HTC and be used to generate best practice guidelines for urban greening in support of HTC."

Highlights: I don't think the following is accurate: "VTUF-3D is the first micro-scaled urban surface energy balance model that allows inclusion of any type of urban vegetation." ENVI-met, for example, includes several types of vegetation. I think you want to be a bit more specific, e.g., which processes you are representing that ENVI-met or similar do not, or that you are including processes more rigorously or with better model evaluation.

Sect. 2: So the energy balance associated with a tree happens at the ground? For a large tree, does the MAESPA energy balance replace multiple surfaces/grid cells, or does it only replace the one associate with the tree trunk? If so, then it seems that latent heat will be underestimated - i.e. the appropriate TUF-3D surfaces will be shaded, but this shading will only affect sensible and storage heat. Please be clear in the text.

Fig. 3: It seems that use of "forward" and "reverse" when referring to ray tracing is "reversed" in terms of the actual flow of radiation. Do you mean "reversed" relative to TUF-3D?

Fig. 10: The color coding of the boxes appears backwards. Legend should say what the numbers in the figures represent.

P19L54: In general, air temperatures and wind speeds in the canyon, when used as above-canyon forcing for an urban climate model, do not lead to good performance. Please justify this approach.

Fig. 13: It does not appear that the model can capture the microscale variation of Tmrt (in particular the trend between sites, irrespective of the absolute value, even with the 30-day averaging). This raises concern that the model is missing a key process that varies spatially at the microscale. I think I would disagree with the statement on p. 23, line 18-19: "However, even at this relatively coarse resolution, VTUF-3D is still able to produce good results within a complex canopy." Also (line 23), the stronger agreement in the open canyon points to a potential problem with the implementation of trees - i.e., the more trees, the worse the model results?

p.24: What d-value is considered to be poor agreement? I think I have rarely seen a low d-value for diurnal energy balance/climate model-observations comparisons during fair weather. The fact that the main trend is driven by solar radiation and forcing air temperature means that correlation should be high, and therefore so should d. It strikes me that good agreement is probably d > 0.95, which many of the treed sites do not meet.

Table 8: Please make it clear in the table which statistics refer to Tmrt vs. UTCI.

Reviewer #3: The authors have adequately addressed all of my comments and more, and have substantially strengthened this paper. My greatest concern about the prior submission was in regards to the framing of the research gaps filled by this study and the statement of utility. As a member of the planning community, I think the addition of the last paragraph about the need to orient the results of this model specifically toward the needs of planners and policymakers is a great way to conclude the paper.  Additionally, Furthermore, I feel a much greater sense of the model's utility in the second to last paragraph about proper mitigation strategies tailored each section of the urban canyon. This is a very useful framing of the results, particularly for planners and urban designers. The paper is an appropriate and welcome addition to the greater scope of this journal.  I look forward to being able to use this model in the future, and encourage the authors to continue working with

planners and policymakers to enhance the utility of this model's output.

Detailed comments:

Page 25, line 45: "addition" to "additional"

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