Reviewer Comments

MLUCM BEP+BEM: An offline one-dimensional Multi-Layer Urban Canopy Model based on the BEP+BEM scheme

The authors have done quite a lot of work in responding to the reviewers comments from the first round. The manuscript now does a better job of highlighting assumptions that are within this model formulation. I also appreciate the extra care they have done in responding to my comments about clarifying the performance of the energy fluxes.

After carefully reading through this new paper, I still have a few reservations about the presentation of this model. Specifically, this model is being presented to "bridge the mesoscale and microscale phenomena occurring in the planetary boundary layer and within the urban canopy, accounting for exchanges and feedback between different scales and processes" (line 63). Yet, there are critical processes that are missing that make this a tool that would not be useful outside of a very small subset of heavily urbanized regions that lack much vegetation. While those are important (the most heavily urbanized and likely to have the most intense impacts of heat), this model formulation is likely going to be severely biased due to the lack of hydrology and reliance on empirical formulations.

I agree that this model will be useful as either a quick analysis of longterm simulations of modulation of thermal parameters or after substantial model development be able to fill a gap in actionable science for climate adaptation that could be used by decision makers. Unfortunately, at the current state, the latter is not possible despite some language used in the manuscript. My comments are directed to help clarify this point and give a better representation of what this model could provide and where it would be helpful to use.

Comments (all are pretty major):

- As the authors have mentioned in their reviewer comments, a user manual should be created to be ready for publication when this paper is live to ensure that the code is as accessible as possible.
- Do the authors believe that 8 cm is enough hydrologically active soil to be able to model rain gardens? While appropriate for a green roof, specifically an extensive green roof with short shrubbery as is modeled by Zonato et al. 2021, rain gardens usually do not have such a shallow growing media and to not have an impermeable bottom. This could be a difference that is occurring due to terminology, where a rain garden could mean a planter boxes that have an impermeable bottom, but should thus be defined more clearly.

- I believe that the presentation of the results, specifically for sensible and latent heat, are obfuscating the real impact that these model simplifications (e.g. lack of hydrology and reliance on empirical coefficients) are causing. I would ask that the authors re-create Figure 3, but only during daylight hours. This would give a better idea of Sensible and Latent heat flux biases. Both fluxes are more variable during the daytime (latent heat is ~0 during the night most of the time, and sensible heat is slightly negative). This does not need to be in the main body of the text but should be pointed to for a clear representation that model structural development choices are creating.

- The new results, even after the new parameters that the authors have identified, do not introduce much model sensitivity. The improvement of the Baseline simulation compared to the Complex simulation are not as large as the "Results show that the integration of detailed, site-specific information on urban elements such as building geometry and vegetation generally improves the simulation of energy fluxes" on line 461 mentions. Please revise, especially as the changes between comparisons in Table 3 and Taylor diagrams in section 4.3 are not that large.

- Line 473: "Its computational efficiency makes it particularly suited for exploring long-term trends and assessing large-scale mitigation strategies." Please clarify what mitigation strategies that this model would be helpful in. The model, as is currently stands, would be useful in modulating radiative parameters, but the lack of hydrologic treatment and therefor the increase/decrease of latent heat would make this difficult to use in the widespread application of green infrastructure. To work with green infrastructure, one would need to add hydrology to the land surface model in a more sophisticated way. The authors may consider citing alternatives that would be appropriate for green infrastructure strategies when they clarify this point.

- Finally, the authors mention the computational efficiency as a key selling point for this model. It would help if the authors provided somewhere (could be in a table, could be in an SI figure) differences in computational load that was needed to run this model vs. the other models in this paper. Including runtime, number of CPUs, etc. would help justify the computational efficiency point in this paper.