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Interactive comment on "An urban ecohydrological model to quantify the effect of vegetation on urban climate and hydrology (UTC v1.0)" *by* Naika Meili et al.

Anonymous Referee #2

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General comments

The manuscript titled "An urban ecohydrological model to quantify the effect of vegetation on urban climate and hydrology (UTC v1.0)" by Meili et al. describes a comprehensive numerical model that incorporates various urban components (grass, trees, urban facets, etc.) and their ecohydrological processes. The authors also provide a very detailed descriptive document as the technical reference manual. In the model comparison using flux tower data, simulated results using the proposed model are generally consistent with or even better than previous studies. Overall the manuscript is well written, and the study (both model development and numerical evaluation/validation) is well designed. I therefore recommend publication after resolving the issues / answering the

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Discussion paper

questions below in the revision.

Specific comments

1. Line 97: "The anthropogenic heat flux Q_f is directly added to the sensible heat budget of the canyon air." The anthropogenic heat flux should be on the LHS of Eq. (1) instead of RHS.

2. Line 101: "hourly time steps". Is this enough to ensure numerical stability?

3. Lines 151–152: "The air volume within the canyon is subdivided into two layers with a height of 4 m for the first layer and a height of ($H_{Canyon} - 4$) m for the second layer." This geometry setting will largely limit the application of the proposed model if the height (4 m) is fixed.

4. Lines 172–173: ". . .interior building temperature T_b, which is set equal to the atmospheric forcing temperature within the range of a specified minimum $T_{b,min}$ and maximum temperature $T_{b,max}$." Is there any specific reason for such setting? The interior building temperature is usually distinct from outside temperature (forcing) when H/AC is used (as mentioned in line 174).

5. Lines 380–381: "The simulation time series length is . . . mean daily cycles averaged over the whole year". Did the authors observe any seasonal variability?

6. Figure 5(i): Sensible heat flux is generally overestimated by the model during daytime. Please provide some possible reasons.

7. Section 4.1.3: Probably the observed discrepancy can also be attributable to the assumption of irrigation water use.

8. Figure 10: The dynamics of soil moisture over time are very interesting. Can this be evaluated with field measurements (of moisture)?

9. Lines 569–570: "Higher air temperature decrease in drier climates is often

linked to urban irrigation though as shown by Broadbent et al. (2018b) in Melbourne ....” and lines 30–37 about the advantages of urban vegetation: please note that using nature-based solutions for cooling should also consider the tradeoff between irrigation water use and the cooling effect the urban vegetation can provide, especially in dry areas like Melbourne or Phoenix, see Yang and Wang (2017) (https://doi.org/10.1016/j.landurbplan.2017.07.014) for a regional simulation in Phoenix and Wang et al. (2019) (https://doi.org/10.1016/j.compenvurbsys.2019.101397) for a continental simulation in U.S.

Technical corrections

1. Line 81: please add “,” after “accounted for”.
2. Line 515: “The sensitivity to maximum Rubisco capacity ($V_{c,max}$), as indicative of plant photosynthetic capacity, leads to an average reduction of T_{2m} by 0.3 °C and an increase of RH_{2m} and ET_{canyon} by 1.6
3. Figure 13: Please move the legend to the right side (outside subplot c).

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