Review Report for the Manuscript ID egusphere-2024-697

September 2, 2024

Summary of the Study

The manuscript titled "Simulation of the heat mitigation potential of unsealing measures in cities by parameterizing grass grid pavers for urban microclimate modelling with ENVI-met (V5)" presents an innovative approach to urban heat mitigation through the application of grass grid pavers (GGPs). In light of the increasing frequency of summer heat events and the growing urban population, the study highlights the need for climate adaptation measures that do not require additional space or alter the fundamental function of urban areas.

The authors have developed a new GGP parameterization for the ENVI-met V5 microclimate model, filling a research gap in the field. The study includes scenario analyses that assess the cooling potential of GGPs in a high-density urban area in Cologne, Germany, under extreme heat conditions. The realistic implementation scenario also demonstrates substantial cooling effects, confirming that partial unsealing through GGPs can effectively mitigate urban heat, provided that water availability is sufficient.

General Opinion

The study presented in this manuscript is timely and relevant, particularly as cities worldwide face the challenges posed by climate change and increased urban heat. The use of GGPs as a measure to reduce urban temperatures through unsealing strategies is a contribution to the field of urban climate adaptation. The development of a new parameterization for GGPs within the ENVI-met model is also an advancement. However, there are several issues that need to be addressed to enhance the manuscript's impact and suitability for publication in a journal like *Geoscientific Model Development* (GMD).

Issues

1. **Insufficient Development Contribution:** While the development of the GGP parameterization for ENVI-met is a key aspect of the study, it is not sufficiently highlighted. The contribution of this development to the broader field of urban microclimate modeling is underemphasized, and the manuscript could benefit from a more detailed explanation of the parameterization process, including its novelty and significance compared to existing approaches.

2. **Lack of Review on Similar Parameterizations:** The manuscript does not include a review of similar parameterizations in other microscale urban climate models, such as PALM, MITRAS, or ENVI-met itself. A thorough comparison with these models would provide context for the significance of the new GGP parameterization and could strengthen the paper's contribution to the field.

3. **Need for Discussion on Cooling Effect Measures:** The manuscript could be improved by discussing the differences in cooling effect measures, specifically air temperature (T_{air}), Universal Thermal Climate Index (UTCI), and surface temperature ($T_{surface}$). This discussion would benefit from referencing studies such as `https://doi.org/10.1175/BAMS-D-20-0193.1` and `https://doi.org/10.1016/j.enbuild.2023.113324`, which address the complexities of these different metrics in the context of urban heat mitigation.

4. **Reiterating Points from Reviewer Comments:** Most of the issues I recognized have already been listed by RC2 (`https://egusphere.copernicus.org/preprints/2024/egusphere-2024-697/egusphere-2024-697-RC2-supplement.pdf`). I agree with the points raised, particularly regarding the need for a more in-depth discussion of the modeling approach and its implications for the accuracy and applicability of the results.