EGUsphere, referee comment RC1
https://doi.org/10.5194/egusphere-2022-978-RC1, 2023

Comment on egusphere-2022-978

Anonymous Referee #1

Referee comment on "Effect of radiation interaction and aerosol processes on ventilation and aerosol concentrations in a real urban neighbourhood in Helsinki" by Jani Strömberg et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-978-RC1, 2023

General

The paper examines the impact of thermal conditions and aerosol processes on local air pollutant concentrations in an urban environment using large eddy simulation (LES) model. It shows that including radiative interaction in LES improves the simulation of near-surface temperatures and ventilation of air pollutants, reducing the pedestrian level total particle number concentration. The inclusion of aerosol processes has a smaller effect. The study concludes that including radiative interaction and aerosol processes in LES is important for realistic simulation of near-surface aerosol particle concentrations.

The paper does not present a clear and sufficient level of novelty in the proposed approach and the model description (radiation part) is lacking in technical detail and clarity (see major issues).

Major issues

- **Novelty.** The effect of solar radiation and surface thermal emissions of flow dynamics and pollutant dispersion is a topic that has been well studied in the field of urban climatology and wind engineering. In PALM's related publications in this topic the radiation effects are even discussed in more details where the individual components of radiative transfer processes are tested (Maronga et al., 2020; Krč et al., 2021; Salim et al., 2022). In this case findings of the current study lack novelty. Authors should cleatly show what is new in this paper and how it adds to the existing body of knowledge on the topic and how it may push the boundaries of the field in any substantial way.
- **Objectives.** Authors did not clearly state their objectives. Without clear objectives, it is difficult to understand the purpose of the study and how the research questions align with the overall goal of the paper. This lack of clarity can make it challenging for readers to understand the significance of the findings and how they contribute to the field of research. Furthermore, it may also make it difficult to understand the rationale behind the study design, making it hard to evaluate the methods used and the validity of the results. For example, authos should clearly state why it is important to know the effect of switch on/off the radiation and/or aerosol processes. Is it because the simplicity of the code, the computation time, the data availability, etc. Also, you need to justify why did you consider neighborhood in Helsinki (it is even in the paper's title).
- **Flaws in model description.** In Sec. 2.1.1 authors described RRTMG as the radiation model in PALM and they stated that it is capable of calculating multiple reflections,

diffuse radiation and absorbed radiation on different surfaces. This is actually not accurate. Based on the radiation related publications for PALM (e.g.: Maronga et al., 2020; Krč et al., 2021; Salim et al., 2022), RRTMG is 1D external radiation model which is used to provide the radiation at each column in the domain for flat terrains. In case of obstacle, as in this case, RTM is used to calculate the radiative interactions within the urban area (urban surfaces and resolved vegetation). RRTMG itself is not capable to calculate multiple reflections, diffuse radiation and absorbed radiation on different surfaces. Having that said, it is not clear how the run R0A0 is formulated in terms of radiation settings. Is it pure neutral case? Was RTM only switched off or both (RRTMG/RTM)? How LSM and USM were working in this case? Why we see temperature distribution then in case R0A0 (Fig. 3.a)?

- **Generalization.** The paper has a significant drawback in that it lacks discussion of the findings. Without proper discussion, it is difficult to understand the implications of the results and how they relate to previous research in the field. Additionally, the lack of generalizability of the findings is a concern, as it limits the applicability of the study to a large audience. This may make it more difficult for others in the field to build upon the research and could hinder the advancement of knowledge in the area. Overall, the paper would benefit from a more thorough discussion and a clearer explanation of the generalizability of the findings. Section 3 reads as result section only and it does not contain adequate discussion. Also the conclusion section reads as a summary of the study and the results. Authors need to convince the readers that the lessons learned from the study are applicable for other model domains.

Minor issues

- The abstract is quite long and reads more like a summary of the results rather than providing a concise overview of the research and its key findings. The purpose of the research, the methods used, and the significance of the results should be more clearly stated in the abstract. The abstract should also provide a clearer and more comprehensive picture of the research context, problem and key findings.
- The figures present data plotted on a geographical coordinate (latitude and longitude) rather than a Cartesian grid. This makes it difficult to compare the data between different figures and to accurately measure the distances and areas depicted, especially in microscale simulations (limited domain size). I beleive that PALM uses Cartesian grid so did you projected the data before plotting and why? At lease add a scale in meter.
- The reference Salim et al. 2020 should be updated to the final paper published in GMD not in the GMD(Discussion).
- Page 9 line 121: I assume that aerosol processes may affect RRTMG and hence radiation inputs