Comment on acp-2021-914

Qi Li (Referee)

Referee comment on "Revising the definition of anthropogenic heat flux from buildings: role of human activities and building storage heat flux" by Yiqing Liu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-914-RC3, 2022

This paper has provided an innovative perspective on the definition of anthropogenic heat flux $Q_{F,B}$, which distinguishes it from the widely used proxy building energy consumption Q_{EC}. The key connection between them lies in the building storage heat flux. The paper started with a conceptual discussion of their distinctions and then conducted building energy simulation using EnergyPlus for a typical building in Beijing, China. Based on a one-year simulation, the building storage heat flux and other relevant surface energy budget terms are compared and discussed for different scenarios of building energy use and differences between Q_{EC} and $Q_{F,B}$. The results caution the effects of such differences in future studies using the inventory approach to quantify anthropogenic heat flux, especially in atmospheric modeling. The paper is well written and organized. I have only minor comments.

- line 43: The last sentence of this paragraph seems to only discuss the building energy used for heating. It can be rephrased in a more general heating and cooling context.
- line 53 – 57: The first two sentences appear a bit contradicting. The first sentence says that $Q_{F,B}$ is the heat released from buildings into the atmosphere and is zero when building is unoccupied. The second sentence says that 'heat released from the unoccupied building is non-zero'. I understand that heat released from the unoccupied building is not $Q_{F,B}$. Perhaps it is less confusing and more consistent with introduction of Eq. 1 and Eq. 5 to mention first that regardless of whether human activities are present, buildings exchange (as you showed later $Q_{F,B}$ can be positive or negative, so not just releasing heat) heat with the atmosphere.
- Eq. 5 has subscripts 'o' to distinguish some of the common terms from those in Eq. 1. However, to emphasize, it may be helpful to re-iterate that introducing of $Q_{interal,o}$ on the LHS modifies the entire energy balance in your chosen control volume.
- Eq. 15: It appears to the reviewer that a long time limit exists, such that $Q_{F,B} = Q_{EC}$, as the long time average of storage heat flux tends to zero. Also, does the simulation data support this speculation? Maybe this is helpful to comment on, especially regarding using Q_{EC} from the inventory as a proxy for some annual/seasonal averaged

quantities.
- Fig.3: it may help visually to put a R=1 line.
- Line 365: does ΔB refer to the definition in Eq. 9?
- Does the ambient temperature considered in the building energy simulation kept as an externally imposed forcing? i.e., there is no feedback between heat released from the buildings and the ambient air.