Review of the manuscript entitled “MLUCM BEP+BEM: An offline one-dimensional Multi-Layer Urban Canopy Model based on the BEP+BEM scheme” by G. Pappaccogli et al. This manuscript describes and evaluates the performance of the most recent version of the one-dimensional multilayer urban canopy model (MLUCM) BEP+BEM. This upgraded version incorporates new features such as gardens and trees in street canyons, making it an ideal tool for evaluating adaptation and mitigation strategies to combat global warming. The BEP+BEM model is evaluated offline by comparing simulated against observed turbulent fluxes collected during an intensive observational period from August 2003 to November 2004 in a suburb of Melbourne (Australia). The model is forced with downwelling shortwave and longwave radiation, air temperature, specific humidity, wind speed, pressure, and precipitation, and its performance is evaluated by comparing modeled upwelling shortwave and longwave radiation, sensible and latent heat, and momentum flux against observations.

Three different urban scenarios are investigated with the BEP+BEM scheme based on the degree of site-specific urban morphology data used in the simulations. The first experiment (baseline simulation) uses site-specific observations for the impervious area fraction, tree area fraction, and grass area fraction. In this numerical experiment, the prescribed values for the LCZ6 (Local Climate Zone 6) urban category are used for the rest of urban parameters. The second experiment (detailed simulation) utilizes site-specific observations for six additional urban parameters. These parameters are the roof area fraction, mean building height, mean tree height, wall to plan area ratio, population density, and anthropogenic heat flux. Finally, the third experiment (complex simulation) is identical to the previous detailed simulation except for the building height distribution that is characterized with site-specific observations instead of prescribed values from the LCZ6 classification.

Results demonstrate (based on table 3 of the manuscript) that the complex simulation produced the best correspondence against observations for the upwelling shortwave and longwave radiation, the baseline experiment for the sensible and latent heat flux, and the detailed experiment for the momentum flux. Overall, the performance of the three numerical experiments was excellent (except for the latent heat flux that was considerably underestimated) and the differences among them were not significant. This article is interesting and represents an advance in urban climate modeling, but some clarifications are needed before it can be accepted for publication:

1) It is not clear if the MLUCM BEP+BEM is coupled to a land surface model to simulate land-atmosphere interactions for natural/rural surfaces. What are the sources of latent heat in BEP+BEM? How is the grid-averaged latent heat flux estimated?
2) Have the street-canyon-trees and street-canyon-gardens models been validated in a previous work? Are trees and gardens (in the street canyon) the unique sources of latent heat in these simulations?
3) Table 1 shows that tree area fraction is 0.225 for this neighborhood. How do sensible and latent heat fluxes change when this fraction is set to 0? In other words, is the role of trees important for mesoscale simulations? Was the impact of trees on near-surface air temperature and/or specific humidity modeled in the numerical experiments?
4) Similarly, table 1 shows that grass area fraction is 0.15 for this neighborhood. How do sensible and latent heat fluxes change when this area fraction is set to 0? Was the impact of grass area fraction on near-surface air temperature and/or specific humidity modeled in the simulations?
5) Overall, the baseline experiment produced good results compared to the other two experiments, which could indicate that some urban parameters are more important than others to accurately simulate the urban climate. Could you explain what is the added value of considering site-specific observations for six/seven additional urban parameters (compared to the baseline experiment) for mesoscale climate simulations?