Review for Journal of Advances in Modeling Earth Systems

This manuscript by Sun et al. introduces a new scheme in CESM to simulate urban albedo impacts on urban thermal environments, energy consumption at a large scale during 2015-2099. Specifically, the authors use different urban albedo configurations, i.e. albedo with static and increasing annually by a fixed rate, as well as in different urban surfaces (roof, wall, and road) and urban land units (TBD, HD, and MD) to quantify patterns of urban heat island, heat stress, urban energy changes in different seasons at a global scale. Findings of this manuscript highlight the importance of targeted interventions on urban areas in mitigate urban heat island. This manuscript is well-written and well-organized overall, the experiment for simulation is detailed designed, and the scope of this manuscript fits well with the Journal of Advances in Modeling Earth Systems, I would recommend this manuscript be accepted with minor revision.

Major comments:

L371-L399: section 3.2 aims to explore the energy response to roof albedo, but the authors put most of efforts on the long-term trend change (which is a bit unnecessary as the atmospheric forcing such as FSDS show the similar pattern in long-term run), rather than on the intercomparison among different albedo configurations, which is the focus on this part. I believe readers are more interested in changes among those configurations. For instance, it will be interesting to see contributions of high albedo on AC flux change, or the amount of reduction on urban absorbed solar radiation FSA due to high albedo roof, as well as the HEAT/AHF increase accordingly.

Minor suggestions:

L206-207: Link can not be accessed.

L267-268: not sure why there are some gap year periods from 2061-2081 for long-term projection. Check if it's a typo.

L269-270: please specify units of heat stress indices (eq (3)-(7)), I notice you mentioned in Fig.4 but to me it is inconsistent with unit calculation, for example, AT is in ℃ but how vp and u10 ends up with temperature unit?

L272: It would be better to include formula for calculating Wt.

eq. (11) what is α in ALB? I guess it is albedo, right?

L301-302: The information here regarding CUHI averages during day and night is not shown in Fig. 3, did you include the results somewhere? As you compare the finding with observations from previous study, it is persuasive to include the results maybe in appendix.

L309-310: response of SUHI to 0.9 roof albedo is more pronounced than CUHI, any ideas/reasons to support the finding?

L312-313: negative SUHI is observed, does that mean changing albedo can eliminate urban heat island? Or what is the implication here?

L415-421: I was wondering if a similar pattern in CUHI can be observed for SUHI (day and night), did you compare that?

L424-432: at the beginning it is about SUHI dropping on compounding albedo modifications, but I don't see figures/tables related to the results. Same for energy consumption FSA on the combined albedo scenarios.