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Interactive comment on "Modelling spatiotemporal variations of the canopy layer urban heat island in Beijing at the neighbourhood-scale" *by* Michael Biggart et al.

Anonymous Referee #3

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Review of Biggart et al

The manuscript investigates the ability of the urban climate component of the ADMS-Urban model to simulate the Urban Heat Island (UHI) in Beijing in summer and winter by comparison to temperature observations made at an urban and rural site and also to satellite-derived land surface temperatures. Different model simulations performed demonstrate the impact of anthropogenic heat emissions (AHE) and surface moisture levels. The base model underestimates the Urban Heat Island Increment (UHII) through the night in both seasons, but overestimates the daytime UHII in summer particularly during heatwaves. The nighttime modelled UHII could be increased

by enhancing the AHE suggesting that hotspots associated with dense inner-city road networks and building developments may be underestimated by the model at its current resolution. During the summer, in the daytime, the modelled UHII could be decreased by reducing the modelled surface resistance to evaporation. However, the blanket increase in urban moisture was found to reduce the correlation with satellite land surface temperatures suggesting that it is unresolved fine-scale green spaces at the urban site which influence near-surface temperatures in the daytime in the summer.

The authors recommend strategies aimed at reducing the daytime storage heat flux to decrease nighttime UHIIs in summer by reducing nocturnal heat release, hence lowering the cooling energy demand at night and therefore the contribution from AHEs to urban warming as well as urban planning strategies aimed at increasing the density of cooler spaces associated with green spaces and waterways.

The manuscript is generally well written and logically presented. I would value the authors addressing the following specific comments:

Line 102 – 104: It would be informative to add some discussion (either to the conclusions or at the end of section 3.1) on how the inclusion of AHEs and surface moisture to other cities where ADMS-Urban has been used (e.g. in Kuala Lumpur and Dublin) would likely impact the modelled UHI – can these changes improve model simulations in other cities?

Line 226 – 228: 'The nocturnal contribution from transportation is increased, following Biggart et al. (2020), to account for the influx of heavy-duty diesel trucks (HDDT) into urban Beijing after the daytime ban within the Fourth Ring Road (Zhang et al. 2019).' How significant is this influx of HDDT to the nocturnal AHE? Could the authors expand on the discussion on the impact increasing this contribution has to the modelled UHI?

Line 305: The authors are comparing model simulations to observations made at a different location in Beijing. Is there any reason why there may be strong local AHE at the IAP site relative to the other sites in Beijing where UHIs have been reported?

Line 312: 'Cao et al. (2016) found a strong correlation between high concentrations of particulate matter over urban areas and the nocturnal UHI for several megacities in China ...'– was any correlation seen between the measured model UHII discrepancy with observed PM loading, particularly in winter?