This is a nice manuscript with a good attempt to include urban characteristics in VIC to make VIC usable for urban regions. I have a few comments, which the authors may address:

Reply: We appreciate your positive assessment of our study in integrating urban characteristics into VIC. The replies can be found below.

1. Urban models should have a strong human component characterized by human behavior and it is difficult to consider the same in VIC. THis is my major concern. The data requitement for development such module is also huge. The authors need to consider this very seriously.

Reply: Thanks for the concern regarding the strong human component in urban modeling. We fully recognize the pivotal role of human factors in shaping urban environments.

In the VIC-urban model, human behavior is partly addressed through several key parameters: land cover changes, interior building temperature, and anthropogenic heat/water input. Land cover is derived from Liu et al. (2010), Wang et al. (2020), and Global Land Surface Satellite (GLASS) products. Interior building temperature, assuming that heating or cooling of building interior is occurring, ranges between *Tmin* and *Tmax*, with values determined based on regional conditions (de Munck et al., 2018). For our study area, *Tmin* and *Tmax* are defined as 5°C and 29°C, respectively. The anthropogenic heat input is maintained as a constant value, and the anthropogenic water input is represented by 12 monthly cycle values which can be defined by users. In this study, these parameters are set with reference to the UT&C model.

Moreover, urban-related parameters, except for the highly-sensitive ones (e.g., height-to-width ratio, layer thickness), are referenced from Jackson et al. (2010). These highly sensitive parameters are manually calibrated based on MODIS and runoff observation data.

We acknowledge the challenges associated with integrating human components into VIC, and admit that there are still many factors have not been fully addressed, such as infrastructure dynamics. Your feedback is greatly appreciated, and we are dedicated to continually enhancing our model to better represent urban systems.

Liu, J. et al., 2010. Spatial patterns and driving forces of land use change in China during the early 21st century. Journal of Geographical Sciences, 20(4): 483-494.

Wang, Y. et al., 2020. Quantifying the response of potential flooding risk to urban growth in Beijing. Science of the total environment, 705: 135868.

de Munck, C., Lemonsu, A., Masson, V., Le Bras, J. and Bonhomme, M., 2018. Evaluating the impacts of greening scenarios on thermal comfort and energy and water consumptions for adapting Paris city to climate change. Urban Climate, 23: 260-286.

Jackson, T.L., Feddema, J.J., Oleson, K.W., Bonan, G.B. and Bauer, J.T., 2010. Parameterization of Urban Characteristics for Global Climate Modeling. Annals of the Association of American Geographers, 100(4): 848-865.

2. For urban heat balance, the anthropogenic heat plays a major role, and I am not

sure how do the authors consider them. There are weekly variations in energy budget, like in weekends the office areas will have low energy requirements. The transportation component have a strong sub-daily variations. These are very important and I am a bit curious how to consider them in VIC.

Reply: Thank you for emphasizing the importance of anthropogenic heat and its variations in the urban environment. Addressing the factor is indeed essential for accurately modeling urban heat dynamics within VIC.

The VIC-urban model proposed in this study simulates the hydro-thermal dynamics independently at the grid scale, the magnitude of anthropogenic heat can be defined by users according to factors such as building density, population density. Therefore, there is spatial heterogeneity in anthropogenic heat distribution, such as variations between office areas and transportation areas. Unfortunately, temporal changes in anthropogenic heat were not considered in the model, because of the difficulty in obtaining input data and uncertainty in the formulation. Like other urban models, the VIC-urban applied a constant value to represent anthropogenic heat. This is a general limitation in urban models e.g., UT&C, and BEPS (Building Energy Prediction and Simulation).

To remedy this limitation: the model included indoor and outdoor conductive heat fluxes based on the internal building temperatures, and it was calibrated with observed urban heat fluxes and land surface temperatures. We will add related statements in the manuscript.

3. The same point is applicable for water use as well.

Reply: For the anthropogenic water input, similar to the anthropogenic energy input, we considered its spatial heterogeneity, and took into account its monthly variations. However, we did not consider diurnal-scale temporal variations in anthropogenic water inputs.

We acknowledge that several factors, such as drainage and industrial wastewater, have not been fully addressed in the model. It's important to note that addressing these issues are highly related to the availability and accuracy of data sources. We will add related statements in the manuscript.

4. There are existing models like SUEWS, how is the proposed model bettter than SUEWS frameowrk.

Reply: There are substantial differences between the SUEWS model and the VIC-urban model. First, SUEWS mainly focuses on water and energy balances in urban land cover (i.e., impervious surface), but VIC-urban is able to simulate water and energy balances for multiple land cover types (e.g., impervious surface, bare land, water bodies, agriculture, and forests) with considering urban geometry, radiative interactions, and human impacts. Second, SUEWS is generally applied at small spatial scale, such as a single city, but VIC-urban is suitable for large-scale applications (e.g., regional and global scales). And third, SUEWS is primarily used to quantifying urban microclimate condition, but VIC-urban can be used in land surface hydrothermal environments, including regional and global water/energy balance estimation, and land cover/climate change impact assessments.