

Earth Syst. Dynam. Discuss., author comment AC3
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Reply on RC3

Si Chen et al.

Author comment on "Impact of urbanization on thermal environment of Chengdu-Chongqing Urban Agglomeration under complex terrain" by Si Chen et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-22-AC3>, 2021

Response to Reviewers#3

Dear Reviewers#3,

Thank you very much for your time involved in reviewing the manuscript and your very encouraging comments on the merits. To facilitate this discussion, we first retype your comments in *italic font* and then present our responses to the comments.

Comment 1: *"This is a manuscript on a very important topic of the impacts of urbanization on the microclimate. I have a few major concerns, which the authors may address:"*

Response 1: We appreciate your clear and detailed feedback and hope that the response has fully addressed all your concerns.

Comment 2: *"1. The write-up is a bit loose and so is the organization. For example, the abstract should clearly state the hypothesis, results, and implications of the results. The modeling framework is not discussed well."*

Response 2: Thank you for your sincere suggestions. We will modify the "Abstract" to make the assumptions and conclusions of the summary clearer. We will revised the manuscript as suggested in the revised version.

Comment 3: *"2. The details of the WRF simulation zone should be provided with the justification of the selection of such a zone."*

Response 3: We will revise the manuscript as suggested. The Chengdu-Chongqing Urban Agglomeration (CCUA) is the region with a high potential for economic development in southwest China (Latitude range: 28°10' to 32°25'; Longitude range: 101°56' to 108°57'), surrounded by the Qinghai-Tibet Plateau, Daba Mountain, Huaying Mountain, and Yungui Plateau (Fig. 1a). The surrounding mountains are primarily between 1,000 and 3,000

meters above sea level. However, the urban agglomeration is an extremely sensitive area where a series of ecological and environmental problems are highly concentrated and intensified. The CCUA was rapidly urbanized in the last four decades, has led to a three-fold urban area expansion increased to nearly 9,000 square kilometers, thereby affecting the weather and climate. To investigate the urbanization effects on the thermal environment in the CCUA under the complex terrain and explore the improvement of ideal urban planning policies on urban thermal environmental pressure, we conducted the simulations using the advanced WRF model together with the combining land-use scenarios and terrain conditions. We set up three one-way nested domains in the horizontal direction, with resolutions of 1km, 5km, 25km respectively (Fig. 1a).

Comment 4: *"3. The details of WRF parameterization need to be provided with validation and sensitivity analysis."*

Response 4: We will revise the manuscript as suggested.

Comment 5: *"4. I am wondering why authors are not using BEP parameterization for urbanization. Recent studies show that the urban structure does impact the microclimate, for example, they may see <https://www.nature.com/articles/s41598-018-22322-9> "*

Response 5: We now study the heat island effect caused by the expansion of urban area. It is feasible for us to choose SLUCM urban canopy model as a parametric scheme. In the later stage, if we pay more attention to the changes of urban thermal environment caused by building structure details inside the city and urban energy consumption, we will also use BEP model for simulation and comparison verification.

Comment 6: *"5. In figure 8, The authors said daily and nightly, does that mean day time and night time, daily may not be the correct term."*

Response 6: Thank you very much for your correction. It should be "daytime" and "nighttime". We will make corrections in the revised manuscript.

Comment 7: *"6. More detailed validation may be needed. For example, on a heatwave day, how do the hourly variation of simulations and observations match, what are the diurnal variations at different locations etc."*

Response 7: Thank you for your suggestion. We used meteorological observations from about 2400 meteorological observation stations (Fig.1d in the revised manuscript) to validate. We interpolated the observation data of these stations to the surface of the whole CCUA and obtained the grid observation data with 1km resolution. We carried out the surface verification of 2m air temperature in the whole area (Fig. 4b, 4d & 4f in the revised manuscript). Finally, we focused on the average daily average hourly variation of 2m air temperature and surface air temperature in the whole CCUA range (broken line diagram in Fig. 10).

Comment 8: "7. Is there any seasonal variation of UHI?"

Response 8: This study only focuses on the impact of urban expansion under complex terrain on the thermal environment of urban agglomeration in summer, since summer is the season with the most obvious urban heat island (UHI) effect of urban agglomeration and the season with the most obvious impact on residential comfort.

We would like to take this opportunity to thank you for all your time involved and this great opportunity for us to improve the manuscript. We hope you will find this revised version satisfactory.

Sincerely,

Si Chen, Zhenghui Xie, et al.

Please also note the supplement to this comment:

<https://esd.copernicus.org/preprints/esd-2021-22/esd-2021-22-AC3-supplement.zip>