

## ***Interactive comment on “Model evaluation of high-resolution urban climate simulations: using WRF ARW/LSM/SLUCM model as a case study” by Zhiqiang Li et al.***

### **Anonymous Referee #1**

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Review for ‘Model evaluation of high-resolution urban climate simulations: using WRF ARW/LSM/SLUCM model as a case study’ by Zhiqiang Li et al.

General comments: This study evaluates performance of the WRF model in terms of high-resolution urban climate modelling over an area encompassing two big cities, Shenzhen and Hong Kong. The chosen area of Shenzhen is heavily urbanized but only a small part of Hong Kong is urbanized. Perkins skill score is used as a major evaluation method throughout the evaluation. The authors argue that their study has proposed a methodological framework for evaluating model performance in high-resolution urban climate simulation. I think this work is useful and has provided some

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information about high-resolution urban climate modelling applied to south China. I very much appreciate the authors’ efforts to pursue this kind of modelling work. However, I feel that the manuscript in the current form cannot be accepted for publication. At a minimum, I would suggest some necessary revisions to make the paper publishable in the journal. But to engender a stronger paper, I feel that more extensive work might have to be done. I will leave it to the editor to decide whether such extensive work is required.

Major comments: 1) The introduction should be reformulated with greater care. The authors should survey the literature more thoroughly. Only a few papers are mentioned in the introductory section. I suggest the authors give a good overview of the existing studies on the topic, and point out the limitations of the past studies and challenges/constraints. Identifying a gap or proposing a new method as well as outlining the contributions of the study is also helpful.

2) The data and methodology section should be structured in a more logical way. I think the authors could place model description and experiment/model setup before evaluation method. Overall, both section 2 and 3 are a bit confusing. The introduction of the model is lacking. The authors should clearly articulate what has been done and how it has been done. This can aid the readers in understanding the experiment setup/design.

3) In section 2.1, more details about the new dataset developed by the authors should be offered. The reasons for focusing on the simulations in the year of 2010 should be discussed. In section 2.2, more details should be provided as to the four-day segment simulations. Did the model read in restart files every four days to continue the simulation? How may a different simulation strategy affect the modelling results? In section 2.3, instead of just giving two tables, I think more detailed descriptions of the data should be given. How are the comparisons between model output (grid points) and observations (stations) made? Representativeness of the observations and potential biases should be discussed. The authors should also indicate the reasons for

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choosing evaluation variables.

4) In section 2.4, no references are cited regarding the Perkins skill score. Is this a suitable method for this study? There should at least be some discussion. Authors should also discuss whether this method is suitable for all the variables evaluated in the study.

5) In section 3, choosing of the parameterization schemes needs discussion.

6) I think the authors should tune down many of their arguments throughout the paper to avoid overstating (e.g., P2L25-26). For example, I don't see any strong methodological framework being discussed and described in the text.

7) I have the impression that the authors have been too obsessed with 'good results' when evaluating the model's performance. Discussing 'good results' and 'bad results' at the same time, in my opinion, is fair. It's perhaps more important to identify areas for improvements.

8) The structure and writing are too repetitive in section 4. This is also true for the figures. The number of figures may be reduced. While the focus of the paper as stated in the paper is on the urban climate simulation, evaluation seems to be applied to also the vast rural regions. The authors should clarify this. I suggest the authors focus on the most important aspects of the urban climate simulation. I would suggest some points (see following) for the authors to consider and they should further develop a better evaluation framework.

-Some basic ability of the model such as spatial distribution temperature/precipitation and diurnal cycles of temperature must be assessed.

- The weather and climate variability in the study area is strongly associated with the monsoon flow. So the investigation of the simulation of precipitation and temperature is rather important. Both the spatial distribution (not found in any of the figures in the paper) and temporal variability should be considered. In particular, the authors

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may identify some strong urbanization impacts on the precipitation (e.g., precipitation maxima) and temperature (e.g., urban heat island). The model's ability to capture these effects is essential. In addition, simulation of sea breeze, wind distribution, boundary layer variability, and stability of the atmosphere should be examined. The impact of urbanization on the air quality may also be discussed.

- The evaluation can be done separately for different seasons. The evaluation should focus on the most important aspects of urban climate/weather.

- The scientific value can be enhanced if the authors can demonstrate how the model behaves in simulating the extreme precipitation events or heat wave/cold surge events, and How and to what extent these events may be related to the urbanization.

- The model's performance between different regions in the study area and between rural and urban regions can also be compared.

9) The figures can be better designed and drawn. Captions of the figures should provide more information. The language could also be improved.

Minor comments: The authors should check carefully the use of words and sentences throughout the paper. I suggest some serious edits/revisions. I list only some of the examples. P1L15: add 'have' before paid. P1L26-29: Please split the long sentence. P1L37: place 'into account' immediately after 'take'.

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