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Interactive comment

Interactive comment on "Multi-model comparison of urban heat island modelling approaches" *by* Jan Karlický et al.

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We would like to thank to Anonymous Referee #1 for all comments, suggestions and corrections in his review of our manuscript. We addressed all and our point-by-point responses including the modifications in the manuscript follow:

Referee's Comment #1: 1. Page 4, Line 23 - 10km * 10km horizontal resolution and 30/23 vertical levels is a relatively low for a study of urbanization impact. Previous numerical studies generally used a higher resolution of less than 3km in order to better illustrate the region of urbanized area (e. g. Lin et al., 2008; Holt et al., 2009; Wang et al. 2012). I suppose this number is restricted by the used computer power, but could you add a comment about it? How the resolution number can influence the results?

Author's response: Yes, all mentioned studies computed with the horizontal resolution of 1–3 km and 28–40 vertical layers, but the time-range they analysed is much less than that in our study. Moreover, these studies focused on one or a few specific urban areas, while our study tries to be more general, concerning on all urban areas within a regional domain and on a long-term model comparison and impacts of urban surfaces. As such, 10 km x 10 km horizontal resolution a somewhat reduced vertical level number was chosen as a compromise. Finally, it is shown in Huszar et al. (2014) using the same resolution as us that considering dominant landuse instead of sub-grid landuse (2 km) leads to very similar impact of urban surfaces on the temperatures for sufficiently large cities (that we analyse in this study too).

Referee's Comment #2: Figure 2 - I suggest the author add a color bar (and the corresponding model) on the right side of the figure instead of the description in figure caption to make it easier to understand.

Author's response: We agree, the colour bar is added to the figure.

Author's changes in manuscript: The Fig. 2 is improved by adding a colour bar (attached to this reply).

Referee's Comment #3: Figure 5 - Why the temperature is generally overestimated by WRF but underestimated by RegCM model? Can you give some possible explanations for it?

Author's response: If we focus to the summer season, Fig. 2 shows that the main difference is in the temperature maxima. In the RegCM model, they are reduced by too wet model atmosphere and increased cloudiness, as written in the first paragraph of the discussion. In the WRF, increased temperature maxima can be explained by neglecting of realistic temporal and spatial distribution of aerosols in the model that use constant values of aerosol scattering properties, described also by Wang et al. (2012).

Author's changes in manuscript: A sentence about the temperature maxima overestimation in the WRF added into discussion to Figure 5: Maybe neglecting of the realistic temporal and spatial distribution of aerosols caused the summer temperature maxima overestimation, because the radiation scheme in the WRF uses values of scattering properties based on constant aerosol profiles, which is far from these in highly polluted urban areas.

Referee's Comment #4: Figure 11- what does the Y-coordinate represent for Figure 11 and 12? Does it mean the frequency distribution of VI and SI? The Y-axis title needs to be added.

Author's response: Yes, the Y-coordinate represents a frequency distribution, or, by other words, values of the estimated density function of the distribution. The area under all lines (or integral from density function) is equal to 1.

Author's changes in manuscript: Added information about the values of the estimated density function of the distribution to the caption of Figures 11 and 12.

Referee's Comment #5: Since the paper discussed the urbanization effect on pollutant dispersion, some important publications need to be mentioned in the manuscript.

Author's response: Yes, these studies also investigate the effects of the urban inclusion to pollution and the conclusions are very similar – the urban inclusion due to meteorological changes decreases near-surface PM10 (or other primary pollutants) concentrations and increases near-surface ozone concentration.

Author's changes in manuscript: Added sentence into the discussion: Also Liao et al. (2015) and Tao et al. (2015), who applied a coupled meteorological and chemical-transport model WRF-Chem with the SLUCM and BULK methods, found that the low level concentrations of primary pollutants decrease and ozone increase after the inclusion of urban surfaces.

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Discussion paper

Holt T, Pullen J, Bishop C. Urban and ocean ensembles for improved meteorological and dispersion modelling of the coastal zone. Tellus Series A-dynamic Meteorology Oceanography, 2010, 61(2):232-249.

Wang J, Feng J, Yan Z, et al. Nested high-resolution modeling of the impact of urbanization on regional climate in three vast urban agglomerations in China. Journal of Geophysical Research Atmospheres, 2012.

Lin C Y, Chen F, Huang J C, et al. Urban heat island effect and its impact on boundary layer development and land–sea circulation over northern Taiwan. Atmospheric Environment, 2008, 42(22): 5635-5649.

Huszar, P., Halenka, T., Belda, M., Zak, M., Sindelarova, K., and Miksovsky, J.: Regional climate model assessment of the urban landsurface forcing over central Europe, Atmospheric Chemistry and Physics, 14, 12 393–12 413, https://doi.org/10.5194/acp-14-12393-2014, https://www.atmos-chem-phys.net/14/12393/2014/, 2014.

Liao, J., T. Wang, Z. Jiang, B. Zhuang, M. Xie, C. Yin, X. Wang, J. Zhu, Y. Fu, and Y. Zhang (2015), WRF/Chem modeling of the impacts of urban expansion on regional climate and air pollutants in Yangtze River Delta, China, Atmospheric Environment, 106, 204-214, doi:10.1016/j.atmosenv.2015.01.059.

Tao, W., J. Liu, G.A. Ban-Weiss, D.A. Hauglustaine, L. Zhang, Q. Zhang, Y. Cheng, Y. Yu, and S. Tao (2015), Effects of urban land expansion on the regional meteorology and air quality of eastern China, Atmospheric Chemistry and Physics, 15, 8597-8614.

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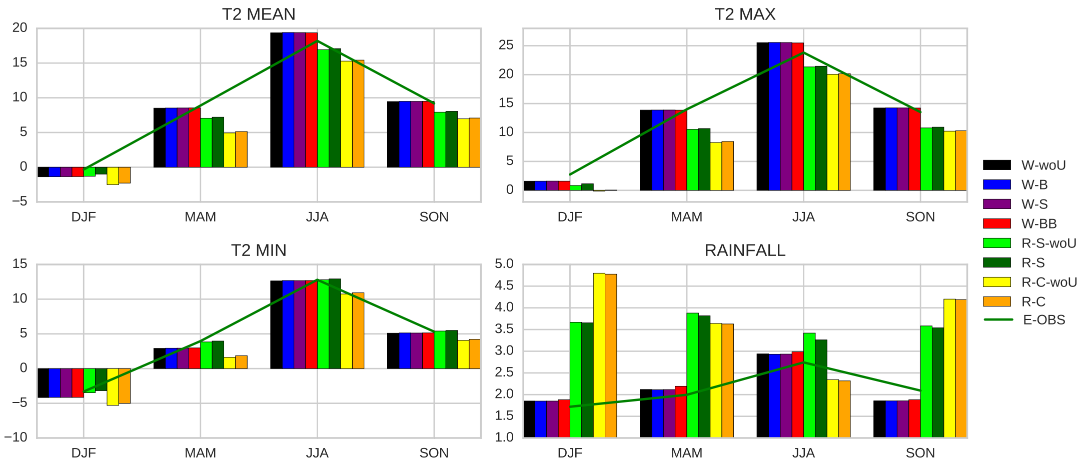

Fig. 1. Improved Fig. 2

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