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Interactive comment on “Regional climate model assessment of the urban land-surface forcing over central Europe” by P. Huszar et al.

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Response to Referee 2’s comments

Review: Huszar et al., Regional climate model assessment of the urban land-surface forcing over central Europe

Dear Referee,

thank you for your valuable comments. We tried to take each into account. Our responses follow point-by-point

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- 1. *The major concern about the manuscript has been already raised in the interactive comment submitted by Dr. Trusilova. In line with Dr. Trusilova's comment, I would suggest that the authors re-conduct the statistical analysis of their results, since the majority of the examined variables cannot be assumed to follow a normal distribution, which should be the case when using the t-test. Non-parametric tests should be used instead.*

Authors' response:

(Answer also given to K.Trusilova's SC) It is true that the assumptions of the t-test, in their strictest form, do require normality (or, more accurately, normality of sample means), and the statistical distributions of the variables investigated are not precisely Gaussian, certainly not for precipitation or wind speed. In our test setup, however, we did not work with these variables directly, but rather applied a paired setup, thus analyzing the differences of matching values in the signals compared. As a result, the signal subjected to the significance testing was substantially closer to being Gaussian than the original series themselves, even for a variable as asymmetrical in its distribution as precipitation. Admittedly, there were still assumption violations even in the paired test setup (especially in case of precipitation, mainly due to high number of zero-zero pairs), and significance tests for precipitation and wind speed were therefore also carried out using a sign test, the results of which are now used in the manuscript. Nevertheless, it can be mentioned that differences between the spatial patterns of statistical significance obtained by t-test and by sign test were generally quite small (likely due to asymptotic behavior of the t-test for large samples, such as ours).

In the revised manuscript, the use of paired t-test setup is now explicitly mentioned in the methods description; sign test is now used for assessment of statistical significance in case of precipitation and wind speed.

- *The number of figures in the manuscript should be significantly reduced. To my view, the current large number of figures does not help in highlighting the*

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value of the study. Reducing the figures could certainly improve the quality of the manuscript. Reduction of figures could be achieved by means of removing certain variables from the analysis. For instance, the cross section diagrams could be removed, as well as one of evaporation/specific humidity. Selecting between monthly/hourly profiles for the examined variables could also help in reducing the figures and making the manuscript's message more clear to the interested reader. According to my opinion, hourly profiles are of more usefulness than monthly profiles, considering that the heat island effect is examined. In summary, the authors should re-visit their results and decide what is most important to show.

Authors' response:

In line with the referee's proposal, we removed the evaporation figure (Fig.6 in the original manuscript). This variable is directly connected to the type of the landuse, so its decrease is a direct consequence of the urban treatment and its analysis brings relatively little new information. Furthermore, as significant impact on precipitation is modelled only for summer, we removed the winter precipitation change subfigures and did similarly for the specific humidity, and we merged these two fields into one figure.

We decided to keep the vertical cross-section figure for temperature as it gives interesting information not only on the horizontal distribution of temperature response and helps interpreting the results.

We removed the monthly plots and instead, we use a table where only the summer means are presented, when the UHI is important.

- *P18543, 2nd paragraph: I would suggest that the authors slightly extend the description of the heat island generation. Since their study is based upon this particular urban effect, a more clear and concise description is necessary. For instance, several aspects of heat island generation are not referenced, including*

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evapotranspiration and anthropogenic heat.

Authors' response:

The heat island generation description has been extended in the revised manuscript to focus on more aspects of UHI (like evaporation, anthropogenic heat etc.).

- *Section 2.1: I would suggest that this particular section of the manuscript be revised. The presentation of the implemented model is somehow hard to follow, since several aspects of the adopted configuration are mixed up with information about changes in the model characteristics between different versions. I would propose to the authors to re-write this section, allowing for a more concise presentation of the implemented model and the adopted configuration (e.g. short description of the model, adopted configuration for the various physics processes, focus on the parameterization of landsurface processes).*

Authors' response:

In the revised manuscript, the description of the model without experiment specific information is now included in Section 2.1, while Section 2.2 gives – again, without experiment related configuration – a description of the urban canopy model used. Section 2.3 then contains all the configurations for the performed experiments.

- *P18548, L20-23: The authors state that the CORINE land cover database was used for deriving land use information, summarized in the definition of two urban land use categories (i.e. urban, sub-urban). However, the procedure for deriving the land use information from CORINE is not described. For instance, the CORINE database includes several urban land use categories, such as continuous/discontinuous urban fabric, port areas, airports, and green urban areas, just to mention a few. What was the procedure followed for grouping and remapping*

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the different CORINE urban land use categories into the two (urban, sub-urban) categories used by RegCM?

Authors' response:

As mentioned in the manuscript on P18548, line 20-23, two databases were used to create the land use map of the model domain – Corine2006 and Global Land Cover 2000 ([http:// bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php](http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php)) for areas where Corine2006 was not available. From the Corine2006 dataset we used only the Urban fabric category (Level 2 cat. 1.1, included in Artificial surfaces group). The land use category “urban” in the manuscript is a compilation of Corine2006 category 1.1.1 – Continuous urban fabric and category 22 – Artificial surface and associated areas from the GLC2000. The “sub-urban” category is identical to Corine2006 category 1.1.2 – Discontinuous urban fabric. The other Corine2006 categories from the group of Artificial surfaces (i.e. Level 2 categories - Industrial, commercial and transport units; Mine, dump and construction sites; Artificial non-agricultural vegetated areas) were not taken into account.

The following two sentences were added to the manuscript: “Urban category is a compilation of 'Continuous urban fabric' land use type (cat. 1.1.1 from Corine2006) and 'Artificial surface and associated areas' (cat. 22 from GLC2000). Sub- urban category is identical to 'Discontinuous urban fabric' land use type (cat. 1.1.2 from Corine2006).”

- *Specific minor comments*
- *The authors should try to reduce the use of the first plural (“we used”, “we changed”, etc) within the entire manuscript, since, to my view, it lowers the presentation quality of their manuscript.*

The first plural sentence has been – where possible – removed in the revision.

- *P18543, L6-8: “.., which is a well-known phenomenon”. Which is the “well-*

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known phenomenon" referenced herein? This part of the sentence needs to be rephrased to be more clear and concise.

We meant UHI here. The sentence was rephrased to be more specific.

- *P18546, L6-11: The part of the paragraph describing the changes from verions 3 to version 4 of RegCM does not really add much to the manuscript and could be removed.*

This part was removed.

- *P18546, L20: "An improvement of the BATS scheme: : :". Improvement relevant to what? Needs rephrasing.*

We meant improvement in describing the surface fluxes against the case, when the sub-grid division of the grid box is not applied. The sentence was reformulated and extended accordingly.

- *P18548, last paragraph: The comparison between the 10km and the 2km grid does not really add much to the manuscript. Instead, I would suggest using Fig.2 for presenting the overview of the used modeling domain, along with the urban coverage (Fig. 2, left) as resolved in the model simulations.*

We removed both figures and replaced them by one which shows the model orography at the "dynamical" 10 km x 10 km resolution and the urban coverage at the subgrid scale 2 km x 2 km resolution.

- *Figures 10-11-12: Adding error bars for the computed profiles would be helpful, allowing for a better interpretation of the data.*

We added error-bars for the diurnal figures (the monthly figures where replaced by a table).

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- *P18558, L20-24: It is stated that in winter, the impact of AHR is greater during the day. I would expect that AHR have a greater impact during the night, when temperatures are lower and central heating is extensively used.*

The hourly profiles of AHR in our simulations assume that significantly larger heat is released from vehicular traffic during the day than during night and that AHR from indoor heating peaks during morning hours as the heat from nocturnal heating is released with a lag due to thermal conduction through the roof and wall. As a result, daytime AHR is slightly larger than during the night.

The technical corrections were all implemented in the revised manuscript as well.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 18541, 2014.

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