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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of urban parameterization on high resolution air quality forecast with the GEM – AQ model" *by* J. Struzewska and J. W. Kaminski

Anonymous Referee #1

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This manuscript describes impact of urbanization (using Town Energy Balance (TEB) module) of the GEM-AQ model on high resolution air quality forecasts in selected modelling domain (with a focus on Polish urban areas/cities). Simulations were performed for 3 different meteorological situations having specific weather conditions (in November, January, and March) without and with (2 different options of urban related classes-categories were applied: UF1 & UF2) TEB module included. Sensitivity, analysis of modelling results for 3 cases/dates and comparison with measurements (meteo+chem. at limited number of measurement sites) were done using differences in anomalies of key meteorological parameters (air temperature and wind speed; humidity is described but not shown in figures) and concentration of selected chemical species.

First, it should be noted, that for better judgment on operational use a longer (at least, a few months) runs with GEM-AQ-urbanized are needed to decide/ find if TEB module is useful/ applicable for that (authors mentioned this issue). Changes seen from analysis of specific cases considered here might not be seen at all after averaging over a longer period of simulations. For long-term runs and evaluation, the additional statistical measures including a hit rate for forecasts of meteo.parameters will be useful to add, at least.

Second, there are, for sure, more than 3 meteorological stations in Poland, and hence, comparison for meteorology (at least, air temperature and wind speed, plus humidity, as authors selected) should be done using more number of stations. These could divided into urban and rural (probably, also adding suburban stations) for mentioned Polish urban areas in section 4.1. This could show on how well the meteorological model performs without/with TEB urban module.

Third, sections 4.1 and 4.2 can be combined with section 4.1 reduced into Table; and reference should be given to original database from which all mentioned urban characteristics for Polish cities and urban classes/categories were extracted. Clarification is needed for <5, 5-35, > 35% - does it mean that in each greed cell (what about presence of both, or even 3 urban classes within one grid cell; clarify)

Fourth, the number of chemistry measurement stations, of course, is more limited (only 3?) and attributed to studied urban areas. But observed vs. modeled concentrations of selected chemical species would be also useful to include (as it has been done for meteorology – Figures 14-15). This could show on how well the chemical transport model performs taking into account outputs from meteorological model without/with TEB urban module.

Firth, in section 5.5, the chemistry measurements are taken near the surface (what is the exact height? clarify). The meteorology measurements are also taken there: air temperature at 2 m? wind speed at 10 m? But the comparison is done for averaged

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values within the 1st model level (i.e. from surface to 27 m). Such way of comparison is too crude. Or simply the modeled temperature and wind should be recalculated at levels of measurements at 3 stations for correct comparison. Hence, evaluation given in this section might have completely different results/outcomes. That part of analysis should be re-done in a correct way. Moreover, in Ch.5 in each of the previous sections although differences between 2 types of runs – urban vs. non-urban - are shown in Figures (5-6, 8-9, 11-12), but a comparison with observations is missing (only between urban vs. non-urban); so, additional information is needed, and hence, it could be useful to add re-evaluation of modelling results taking into account observations.

Illustrative material: too many Figures, some of which could be combined together into one (see suggestions and details below); and moreover, Figures are shown at different UTC times – some unification for selected times would be needed (or explanation why these specific UTCs are selected); Figures with synoptical maps could be omitted and only corresponding text describing meteorological situation is necessary (the focus is on the modelling domain with Polland) – see comments below; Table 1 - in reality is not necessary/used (partly info from this table can be moved into Table 2 – see comments below); and Table 3 – info on measurement stations can be also included into text and Table excluded.

Minor comments to text of the manuscript: ———————

Abstract: p.9518-lines23-25 – this 2 sentences are more for discussions and conclusions part of the paper; p.9518-line6 – use passive instead of “we”;

1. Introduction: p.9519-lines 2+6+26 – pollutants concentration to pollutant concentration; and emissions sources to emission sources; and pollutants concentration to pollutant concentration p.9519-lines 27 – due to population density to due to large(larger?) population density p.9520-lines 5 – omit “Presented work . . . GEM-AQ model” p.9520-lines 9 – omit “extensively”, you have only few stations used in analysis;

2. TEB . . .:

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p.9520-lines 18-19 – may be ? omit “To the knowledge of the authors” p.9520-lines 26 – may be ? better : “roofs, walls and streets“ to “buildings (roofs, walls) and streets”; p.9521-lines 5-7 – rephrase text with reference, omit Table 1 moving some info into Table 2 (see below comments for Tables 1 and 2); change “some of the default parameters” to “some of the default parameters selected in this study”;

3. EcoForecast . . .:

p.9521-lines 12 – may be ? add “numerical” to weather prediction model; p.9521-lines 17 – may be ? change “forecast horizon” to “forecast length”; p.9521-lines 17 – may be ? change “starting 18:00 UTC” to “starting at 18:00 UTC”;

4.1. EcoForecast . . .:

p.9522-9523 –lines starting 12 might be ? better to make as a Table where each urban area/city will be listed in rows with info (in columns) on total area, dominating urban categories, heights of buildings, etc. (i.e. this section has too much unnecessary text which can be composed into Table;

4.2. Urban land-cover . . .:

p.9523-line 6 – replace “sand” to “bare soils”; p.9523-line 9 – replace “For most of the cells” to “ For most of the urban cells” p.9523-line 13 – omit “default”; p.9523-line 13 – abbreviate anthropogenic heat flux to AHF and use thereafter in lines 15, 18, 21, 27, etc and further in the manuscript; p.9523-line 16 – replace “is lower and set at 8 m” to “is lower (8 m)”; p.9524-line 5 – replace “In the first approach” to “As seen in the first approach”;

5. Analysis:

p.9524-line 12 – abbreviate urban heat island to UHI, and use thereafter;

5.2. Results for 6 Nov 2010:

p.9525-line 19 – see comments to Figure 4 below; add “According to MeteoSchweiz”

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and make a reference (as a footnote?) to http-address of the map (if publicly available); p.9525-line 26 – replace “shows” to “showed”; p.9525-line 26 – omit “in this case”; p.9526-line 3-4 – do you mean? “The average (On average?) wind speed was lower”?;

p.9526-line 10-12 – move “(up to 5 ppbv)” after “are slightly lower (. . .)”; add also value for ozone after “are slightly higher”;

5.3. Results for 3 Jan 2011:

p.9526-line 14 – see comments to Figure 7 below; add “According to MeteoSchweiz” and make a reference (as a footnote?) to http-address of the map (if publicly available); p.9526-line 16 – replace “favoured temperature decrease” to “favoured air temperature increase”; p.9526-line 14 – see comments to Figure 7 below; add “According to MeteoSchweiz” and make a reference (as a footnote?) to http-address of the map (if publicly available); p.9526-line 28 – add text in brackets “(not shown)” at the end of the sentence, because only temperature and wind speed + concentrations are shown in figures;

5.3. Results for 3 Jan 2011:

p.9527-line 10 – see comments to Figure 10 below; add “According to MeteoSchweiz” and make a reference (as a footnote?) to http-address of the map (if publicly available); p.9527-line 11 – clarify through from? over? Scandinavia;

5.4. Comparison . . .:

p.9528-line 5 – replace “is given in” to “are given in” p.9528-line 7 – add at the end of sentence - “suburbs of the three mentioned cities”; p.9528-line 8-9 –At which level the measurements are taken? Air temperature at 2 m? wind speed at 10 m? Specify clearly. The comparison of these mentioned meteorological parameters with averaged values within the 1st model level (from surface to 27 m) will be too crude. Simply the modeled temperature and wind should be recalculated at levels of measurements at 3 stations for correct comparison. Hence, evaluation given below might have completely

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different results/outcomes. p.9528-line 14 – replace “weather during” to “weather conditions during”;

p.9528-line 20-21 – clarify “The average slope of temperature . . .” -> “The diurnal cycle of temperature was relatively well reproduced” p.9528-line 21 – replace “On 29 March the” to “On 29 March 2011 the”; p.9528-line 27 – replace “measurements shows” to “measurements showed”; p.9529-line 1 – may be add ? years to mentioned dates of the months; p.9529-line 7 – replace “reduces the bias” to “improves the bias”;

6. Conclusions:

p.9529-line 14-15 – move to section 5. Analysis to page 9524 p.9530-line 4 – “The average regional wind speed” - ? On average/ In general ? the regional wind speed” p.9530-line 9-10 – instead of “It should be noted that” to “Probably”; summer case was not studied – so this conclusion may be speculative’ clarify the sentence (as you have done in lines 18-20 for concentrations); p.9530-line 23 – replace “land cover” to “land-cover”;

Illustrations: ———————————— Table 1 – is not necessary for this paper, because input is provided in Table 2 (plus, add in Table 2 relevant info for 3 categories listed in Table 2 from columns of Table 1 with grass, trees and bare soils fractions). But the reference to content of Table 1 could be useful to include into text of the manuscript, Table 2 – include UNITS for columns with building height, anthropogenic heat flux, and urban fraction Table 3 – omit last column for station type, and place it in the caption of the figure as “. . . of the urban background monitoring sites”; add UNITS for longitude+latitude; OR info on measurement stations can be also included into text of the manuscript and Table excluded.

Figure 1a – not really necessary; so, mentioning in the text would be sufficient that it covers the globe; Figure 1b - keep this figure, but add along vertical-horizontal the geographical coordinates of latitude-longitude; Figure 2 – select scale (legend on the right side of figure) for urban fractions at the same increment (for example: every 10%);

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and probably, it is better to combine Figure 1b and 2 together (as Figures 1a and 1b) Figure 3 – clarify in caption of figure “land-use” vs. land-cover; include UNITS for meteorological parameters and chemical species (concentrations) on all 4 legends; clarify for temperature (? Air temperature at 2 m?) and wind speed (Wind speed at 10 m?) Figures 4, 7 and 10 – are these really necessary? May be it is sufficient to have only texts describing meteorological situations (what you have done already with remark: “According to MeteoSchweiz, . . .”) – otherwise too much info which is not really used in this paper?; Figures 5-6 – Combine these 2 figures as you have done for Figure 3 (see also similar comments given for Figure 3) Figures 8-9 – combine as above; Figures 11-12 – combine as above; Figures 14-15 – combine together as a+b

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 9517, 2012.