

Interactive comment on “Multi-scale modeling of urban air pollution: development and application of a Street-in-Grid model by coupling MUNICH and Polair3D” by Youngseob Kim et al.

Anonymous Referee #3

Received and published: 22 November 2017

The paper describes the newly developed Street-in-Grid (SinG) model, for which the street-network model MUNICH has been coupled with the CTM Polair3d. Air quality models for urban areas are either used for urban background scales or street canyon scales, and a coupling of different models for different scales is often not consistent. The advantages of the SinG model presented in this work are a consistent treatment of physical and chemical processes at the different scales as well as emission input data and the influence of street level on urban background concentrations and vice versa. The paper is well written and well structured, and I recommend publication in Geoscientific Model Development with minor revisions.

C1

I would ask the authors to revise the following main points (see specific comments below):

- More detailed justification and motivation for choices of the model components and the model configuration
- More details on the model evaluation, including the meteorological data used as model input
- Please include an overview table summarizing all model simulations described in this study

Specific comments:

Abstract: specify explicitly that simulations were done both with SinG and with MUNICH as stand-alone model

Section 2.2.1: I suggest moving the derivation of the alternative equation to the Annex. Instead, please motivate your choice of equation and explain why you have chosen it over the alternative. What would the differences imply for the model results? Would they have consequences for simulated concentrations?

Section 2.1.2: Please motivate the choice in wind profile descriptions. Why is the ‘MUNICH’ version more realistic than the ‘SIRENE’ version?

Page 7, line 25: “[. . .] are compared below.” Please indicate where they are specified.

Section 2.4: How does the dry deposition approach for the urban canopy differ from dry deposition outside urban areas, or other approaches used? Why is this one chosen?

Section 3: Please mention here that the computational cost will also be evaluated

Section 4.1: Why was this location chosen? How much time was used as spin-up of the model?

C2

Section 4.2: Please include a more thorough description of Figure 5. Where are the main differences?

Section 4.4: Please provide more detail on the model performance of the WRF simulations. What impact would the biases in meteorological variables have on the results? Is the setup used for WRF described somewhere? I would strongly recommend a more thorough evaluation of the WRF model results if not done within a different publication yet.

Section 4.5: Please also describe the roadside measurements. Where are they located? It would be good if their location was indicated in Figure 4 or in an additional figure.

Section 4.6: How do the modeled roadside peak concentrations mentioned on page 11, lines 8 and 9, compare to observed peak concentrations? How is the diurnal cycle simulated? (daytime vs. nighttime)

Page 14, line 1: Please reformulate; in my opinion it is not possible to “replace” the measurements by simulated concentration. Rather, “base the calculations on simulated urban background concentrations” or something along those lines.

Page 15, line 12: I would suggest only using the term “significant” if you have actually done a test for statistical significance. Otherwise it should be replaced with a different formulation (e.g. considerable). This also applies to later instances in the manuscript.

Page 16, line 19: Which numbers are you comparing here in brackets? Please be more specific.

Page 16, line 23: Please specify the settings (e.g. in the table mentioned above)

Page 18, line 9: Please provide more detail on the differences in model performance. The results could for example be included in Table 1.

Figure 5: please increase the line width and size of the legend

C3

Figure 6: please increase the size of the legend

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C4