Geoscientific
Model Development
Discussions

Interactive comment on "Modelling atmospheric dry deposition in urban areas using an urban canopy approach" *by* N. Cherin et al.

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We thank both reviewers for their interest in our manuscript and their attentive review of our text. Please find below our answers to the first reviewers'questions and remarks.

Specific comments

R#1: Section 5.1 "Evaluation by comparison with observations"

This section doesn't provide the model-observation comparison. In fact, it summarized the range and uncertainty of measurements in previous studies. I suggest shortening

this section to one paragraph and insert it into Section 5.2.

A: We agree that the title of this section is not really consistent with its content. We think however that this content is valuable. Therefore it has been moved to an appendix titled "Overview of dry deposition observations" and a reference to the appendix has been added in the section "Base simulation".

"It appears unfeasible to proceed to a quantitative comparison of the proposed model to a set of measurements due to the paucity of dry deposition observations (see the discussion in Appendix B)."

R#1: Section 5.2 "Base Simulation"

Are the surface resistances the same for different urban surfaces (e.g., roof, street, wall) in this new model? If yes, it is better not to use the expression like "resolves three types of surfaces" in Conclusions (page 8733, line 26).

A: As mentioned in the section, line 22-23, the local roughness lengths applied to the walls and the streets are different. With the model proposed by Zhang et al. (2001) this leads to different surface resistances. The roofs are seen in our model as surface collectors at the scale of the urban boundary layer with a citywide roughness length. This corresponds to the application of the roughness approach to quantify the deposition over the roofs. A sentence was added in the section to clarify this point.

"The surface resistances were computed following the model of Zhang et al. (2001), but the different local roughness lengths applied to walls and streets and the classical roughness length approach apply to roofs lead to different surface resistances for these three types of surfaces."

R#1: Section 5.2 "Base Simulation"

Are the new model and the roughness-length model (ZHANG model) using the same

meteorology inputs? It looks that ZHANG model was driven by WRF outputs while the new model utilized meteorology outputs from the Polyphemus platform.

A: The two models use the same meteorological inputs. As mentioned on line 12, these meteorological inputs are obtained from simulations conducted with the WRF model. However the simulated meteorological fields are not directly used to compute the dry deposition velocities. There is a preprocessing step to interpolate the fields from the WRF discretization grid to the Polyphemus discretization grid. The dry deposition velocities are computed for both models within the Polyphemus discretization grid. The paragraph was slightly reorganized to clarify this point.

"The dry deposition model presented above was implemented within the Polyphemus air quality modelling platform (Mallet et al., 2007). The roughness length model based on Zhang et al. (2001) was already available in the Polyphemus platform. The meteorological fields are interpolated from the WRF discretization grid to the Polyphemus one. After this preprocessing, meteorological data are provided with a horizontal resolution of 0.04×0.027 every hour."

R#1: Section 5.2 "Base Simulation"

It is unclear about the size of particle of which Vd is outputted as an example. From line 13-14 "The dry deposition velocities are computed for fine particulate matter (PM2.5)", it looks Vd for each size bin was calculated and the averaged Vd for PM2.5 was derived using some pre-assumed size distribution profile. While line 15-16 stated that Vd of PM with a single diameter was simulated.

A: The sentence "The dry deposition velocities are computed for fine particulate matter (PM2.5)" was misleading. It was removed. The computations were performed for a single particle diameter.

R#1: Fig 7-9

It is better to show the urban area in the figures.

A: One figure was added to show the urban area.

Technical corrections

R#1: page 8727, line 1: provide the full name of SD at its first appearance in the text

A: Done.

R#1: page 8728, line 18: $\Delta V_d = \frac{V_{canyon} - V_{roughness}}{V_{roughness}} \times 100\%$

A: Done.

R#1: page 8729, line 4-5: there are no purple and green lines in Figure 11. Remove them in the text

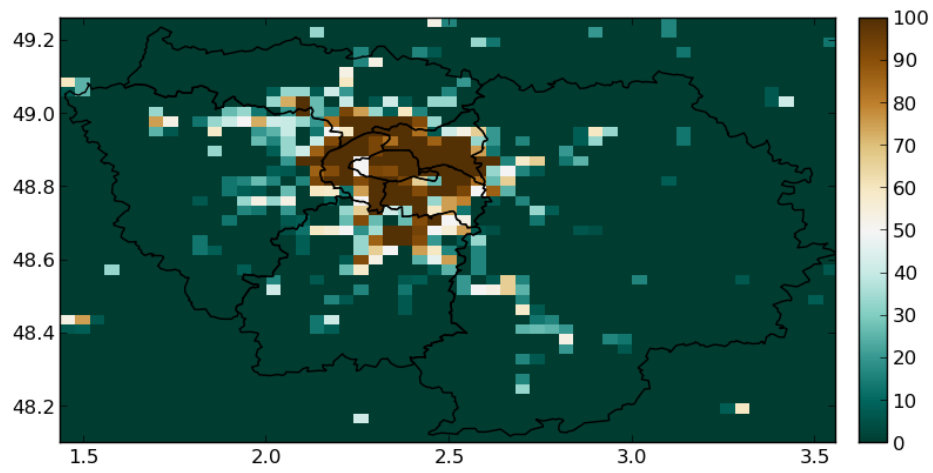A: Done. The comments are now consistent with the figure.

R#1: Fig 10: in the legend, λ -> λ_p (consistent with the text)

A: Done. Figures 13, 14 and 15 have also been corrected.

Interactive comment on Geosci. Model Dev. Discuss., 7, 8703, 2014.

Fig. 1. Spatial distribution of the urban land cover type (in \%) as derived from the Global Land Cover 2000 database.

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