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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of urban canopy meteorological forcing on aerosol concentrations" *by* Peter Huszar et al.

Peter Huszar et al.

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Author response to the Referee #3's comments on manuscript "Impact of urban canopy meteorological forcing on aerosol concentrations" - acp-2018-415 by Peter Huszar et al.

We would like to thank to Referee #3 for the reviewing our manuscript and for all the comments, corrections and suggestions. We will consider all of them and our point-by-point responses follow.

Referee #3 comments:

Specific comment: In P10, L15 authors mentioned that "largest contribution is made by sulfates and nitrates being around 50 %, while sulfates dominate especially over

eastern European cities". What is the reason for the sulfate dominance over eastern C1 ACPD Interactive comment Printer-friendly version Discussion paper Europe?

Authors response: In the used emissions database (TNO MACC-III), emissions of SO2 over eastern European countries are higher than over western Europe while the opposite is true for the NOx emissions. As ammonium emissions are also slightly higher over western Europe, it is clear that over eastern Europe, sulphate ions will prefer to stabilize nitrate ions resulting in ammoium sulphate formation while over western Europe, the emissions ratios will favor the formation of ammonium nitrates (Schaap et a., 2004).

Changes in the manuscript: This detailed discussion was added to the manuscript to clarify the differences in contributions to the total PM2.5

Specific comment: It is not clear to me how the input data for building heights and street width is used in CLM4.5 on a 10 km $\times$ 10 km scale. What are the sources of this data?

Authors response: We provide the answer given to the other referee: As written in the manuscript, the urban morphology parameters are obtained from LandScan2004 global 2D data (Jackson et al., 2010) which defines 132 regional categories (the world is divided into 33 regions with similarities in urban characteristics and each category is subdivided into 4 subcategories representing different urban intensities - tall building district (TBD), high density (HD), medium density (MD), and low density (LD)). For each bottom category, average building heights (H), urban canyon height-to-width ratios (H:W), and fraction of pervious surface (e.g., vegetation), roof area, and impervious surfaces (e.g., roads and sidewalks) are defined, among other parameters. Jackson et al. provide all of the data sources from which these data were compiled. We checked the data for particular cities over the domain and they are within the range of the typical urban geometry represented by central European cities (see Huszar et al., 2014 for a few values representative for Prague, Czech Republic). Urban landunit within CLM4.5

is represented as fraction in percentages of three (of the four in Jackson et al.) urban intensity (HD, MD and LD). This gives a reasonable description of urban coverage even at 10 km resolution and even small cities well below 10 km in diameter are accounted for. Of course, within the model gridbox and within one urban intensity, urban parameters do not vary in space, however we consider this variation within the uncertainty range of other inputs like boundary conditions or physical parameterization etc.

Changes in the manuscript: We included some more detailed description (in Section 2.1.1) of how the urban parameters are obtained for the region in focus.

Specific comment: In P11, L19 authors commented “The SOA is an exception here, where concentrations are suppressed all over the domain peaking over urban areas up to -0.04 μgm$-$3”. What is the reason for this exception?

Authors response: The SOA suppression here is the probably result of both larger removal of precursor semi-volatile species (SOA precursors) and the increased removal of SOA itself. These two processes concern the whole domain thus the SOA decreases everywhere. For inorganic aerosols, the latter process (concentration decrease) acts for the entire area, however, the primary species have different emission ratios across the domain thus turbulence impacts them with different magnitude and the competition between sulfates, nitrates and ammonium ions leads to different inorganic aerosol response.

Changes in the manuscript: This has been detailed in the revised manuscript.

Technical comments: Technical Comments: Please correct all the typing errors throughout the manuscript. I have listed some of them below:

Authors response: All typing errors have been corrected (some of them explicitly mentioned by the other reviewer)

References:

Oleson, K.W., Bonan, G.B., Feddema, J., and Vertenstein, M. 2008. An urban pa-

rameterization for a global climate model. 2. Sensitivity to input parameters and the simulated urban heat island in offline simulations. J. Appl. Meteor. Clim. 47:1061-1076.

Schaap, M., van Loon, M., ten Brink, H. M., Dentener, F. J., and Builtjes, P. J. H.: Secondary inorganic aerosol simulations for Europe with special attention to nitrate, Atmos. Chem. Phys., 4, 857–874, doi:10.5194/acp-4-857-2004, 2004.

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