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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Correlation between traffic density and particle size distribution in a street canyon and the dependence on wind direction" *by* J. Voigtländer et al.

J. Voigtländer et al.

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We would like to thank the referee for his useful and insightful comments regarding this work.

We took the reference comments into regard in the following way:

"The authors cite previous work, however, at least to my opinion, they should point out more clearly what is really new in their work compared to former work."

The introduction part was rewritten and extended. Further preview studies were included in the citations.

"They mainly argue that in contrast to previous work they measure the particle

size distribution with a high size resolution, not just total mass or total number concentration. But when looking at the discussion of the results, only little use is made of the information, obtained from the size distributions. Some results are presented, but not really discussed."

The discussion part was extended. We had to change the figure with correlations results, because it was the wrong. Instead, a new with Spearman correlation coefficients was included. In the new figure, it gets more clear that correlations at the lee side of a street canyon are mainly influenced by traffic.

"As all limits and many previous studies are based on mass measurements, it would be helpful to have some mass based information for comparison to other work - even if I fully agree that the information, obtained from the number size distribution, is more relevant."

To get the particle mass from measured particle number size distribution, particle density have to be known. We had no information of particle density in our experiment. In literature values about 1.5 to 1.7 g/cm^3 can be found for accumulation mode particles, while diesel soot particles are agglomerates with about 1 g/cm^3.

We didn't need particle mass in our investigations, but for additional information, we added a table including total particle volume (<800 nm) in the Eisenbahnstrasse for different days.

"Compared to the amount of data presented, the discussion part is relatively small, I would appreciate a more detailed discussion of the results, e.g. the meaning of Fig. 7."

The discussion part was rewritten and extended. Especially, the regression analysis part has been detailed.

"Some arguments why the authors developed their own CFD model instead of using an existing one would be helpful - as well as some more info on the model

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(boundary conditions etc.)."

Of course it shouldn't have been necessary to develop a own numerical model. There are no advantages compared to existing CFD-models. The model was developed and tested for education in our institute. The simulation of the street canyon was an application of the model. We found that a relatively simple model is sufficient for an appropriate simulation of the flow field in a regular street canyon like the Eisenbahnstrasse.

The model uses a steady finite difference solver on a 2D or 3D cartesian grid. For boundary conditions no slip conditions were used at the wall and at the bottom of the grid. At the top a moving wall was used to simulate the flow. The simple model is able to explain the flow conditions in the canyon very well.

"Ev. Fig. 5 could be included in Fig. 4. The number of figures showing the traffic density can ev. be reduced."

We have extended fig. 5 upon request of referee #1. Unfortunately a combination of figs 4 and 5 is no longer possible. But some other figures were changed or extended.

"When the road construction started, the traffic density was reduced by almost a factor of 10, the particle concentrations only by about 50 percent. This is in contradiction with the high correlation between number concentration and traffic density, mentioned already in the introduction. Again, this should be discussed."

The high correlation between particle number concentration and traffic density were only calculated for northerly wind directions. The main wind direction was south-west (0-90°: 18.4 percent, 90-180°: 22.2 percent, 180-270° 42.2 percent, 270-360° 17.2 percent). Over all data, the correlation between traffic volume and total particle number concentration was only about 0.5.

Additional, the correlation explains only the observed variation of the parameters. Thus, a high correlation coefficient is independent from background particle concentration. This means, more than 50 percent of particle number concentrations belong to the

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urban background. The high correlation coefficients show, that at Lee side conditions, a large fraction of the diurnal variation of particle number concentration between about 10 and 100 nm in diameter can be explained by traffic volume in the street canyon. Again, we pointed this out more intensely in our paper.

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