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Interactive comment on "Winter and summer time size distributions and densities of traffic-related aerosol particles at a busy highway in Helsinki" *by* A. Virtanen et al.

A. Virtanen et al.

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We would like to thank the referee #3 and #2 for their comments and correction suggestions, which help us to improve the paper. Here we refer to them point by point.

General

"English should be improved significantly".

We have checked through the whole paper and many parts are rewritten.

Specific comments

Introduction: Ref.#3: Motivation is not sufficiently presented. What is new in your

study? What is different compared to former studies? Why are these data needed such as density? Ref. #2: The introduction is too superficial. The author should concentrate the major part of the state of the art literature in the introduction.

These comments were very useful and helped us to improve the introduction. We have rewritten the whole chapter.

Ref #3: "Instrumentation: More information about the ELPI would be useful, type, company etc. I think that ELPI measures aerodynamic diameter like other impactors, this should be mentioned here as well. How do you compare it later with the mobility diameter."

More information concerning ELPI has been added to the text. The manufacturer does not give any type number for the ELPI. ELPI measures aerodynamic diameter. The sentence: "It should be noted that ELPI measures the aerodynamic size of the particles" has been added to the text. We don't compare mobility diameter measured by SMPS to ELPI diameter at any point of the paper. Anyhow, there is no big difference between these two equivalent sizes, because the particle density is close to 1 g/cm3.

Ref#2: "The author should also describe the method how the density is determined"

The method is now described in chapter 3.

Ref. #3: Results: How well the measurement periods represent the whole season (weather conditions, traffic rate)?

Although both winter and summer measurement periods were relatively short, the meteorological conditions and traffic rates were typical for the season. Therefore the results are believed to represent typical particle population at road side of Itäväylä. This is now mentioned in the text (paragraph 4.1).

Ref. #3: Results: Fig 2: how the background values have been calculated?

The number of background measurement days was 17 during the summer campaigns

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the average background concentration shown in figure 2 b) is calculated from several short-time measurements made by the mobile laboratory. The number of background measurement days was 17 during the summer campaigns and 11 during the winter campaigns. The time periods during which the background measurements took place were between 7:00-10:00 and 14:00 - 20:00. The explanation has been added into chapter 4.1 (3 rd paragraph). There was not enough data to calculate the diurnal variation of background particle concentration.

Ref. #3: Results: Fig 2: mixing height should be correctly height of the mixing layer -correction done

Ref. #3:Results: what kind of diameter is used for ELPI here?

Every time we represent results measured by ELPI we use aerodynamic diameter.

Ref. #3: “P558, l.24-29. The differences in mixing process between summer and winter should be considered. They may also have significant influence on concentration in the different size ranges.” + “p559, l. 5-9: again difference mixing process have an influence on the measured number size distribution in summer and winter”

We assume that lower temperature in winter time is the main reason for the number concentration of dp$<$63 nm particles being higher in winter than in summer time. The smaller height of the mixing layer in winter time could, in principle, result in higher particle concentration. However, we believe that when measuring this close to the source, the vertical mixing process has not yet affected that much and the temperature plays a stronger role. It is not fully clear how the vertical mixing process of planetary boundary layer air actually affects different particle sizes. Somewhat surprisingly, the number concentration of dp$>$63 nm particles is fairly equal when winter and summer times are compared. This agrees with the result of Hussein at al. (2002) who, in their urban measurement site in downtown of Helsinki, also observed rather equal accumulation number concentrations in winter and in summer. We believe that the effect of vertical mixing process on the fine particle size distribution is a challenging topic, and should

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be studied in more detail and in a larger context in forthcoming research on urban aerosol. This is now explained in the paper (section 4.1, paragraph 10).

Ref. #3: p.559: 1) did you do any comparison between nano-SMPS and long-SMPS? 2)Did you correct any losses like diffusion? Are the lengths of inlet lines comparable?

1) No we did not. It was not possible to compare the instrument readings directly, because the instruments were at different locations. The nano-SMPS located at 9m and long-SMPS located at 65 m distance from the road. 2) Diffusion losses are not corrected. The inlet lines of both instruments were comparable.

Ref. #3: p. 560, l. 14. What means 'typical measured SMPS size distribution'?

We have replaced the original sentence with the sentence: "In Figure 6., the average SMPS size distributions for winter and summer time rush hours are shown."

Ref. #3: p. 560, l.14: we have removed the sentence.

Ref. #3: Conclusions should be improved: we have rewritten the conclusions as the referee suggested.

Ref #2: English should be improved! - Done

Ref #2: the quality of the graphs in not good enough. - The quality of the graphs is now better.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 549, 2006.