

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.

Anonymous Referee #5

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GENERAL COMMENTS:

In this paper fine particle size distributions and meteorological parameters have been measured near a busy highway at two distances in the summer and in the winter. The measured particle concentrations have been compared to the traffic rate on the highway in three different size classes (3–30 nm, <63 nm, >63 nm). Also diurnal and seasonal differences have been analyzed. Parallel measurements with SMPS and ELPI have been used in calculation of the particle density in each mode by using a fitting method developed in this work. Particle concentration and size distribution

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measurements in urban environments have been carried out widely in recent years, as the authors also point out. However, the particle density measurements are not so frequently done. In this work, according to the authors, the calculated density of nucleation mode particles brings out new data that have not been published earlier and shall thus be published.

The structure of the MS is clear and well organized. The results are well discussed and compared to other relevant work. The measured size distributions and calculated densities (nucleation mode excluded) are in good agreement with those obtained by other researchers. Also the laboratory tests verify well the validity of the density calculation method itself.

SPECIFIC COMMENTS:

1) The abstract is now almost identical to the conclusions. A short description of the methods (especially the density calculation method) could be inserted in the abstract. The conclusions could contain only actual conclusions.

2) In the introduction a couple of long reference lists are given without describing the contents of these works. The authors should either describe the work on each reference shortly and/or refer to the most relevant works.

3) In Section 2 a title (e.g. "Measurement site description") for the subsection describing the measurement site should be inserted.

4) In the methods a few clarifications are needed (see also the specific comments below). Because of its key role in this work, the multi-modal density calculation method could be described in more details. The multi-modal density calculation method should also be commented for its applicability to the measurements at hand. Also an explanation to omitting the third mode mentioned in the SMPS data fitting procedure should be given. More confusion is caused by the fact that the earlier work by Virtanen et al. includes two references in the year 2004, but they are not separated from each other

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(with letters a/b).

5) The experimental setup could be described in more detail, at least the sampling inlets and lines, pre-cutting separators, etc. should be described. Also the counting efficiency and losses in sampling should be discussed. In many cases also Pirjola et al., 2006 can be referred to.

6) The measurements have been carried out in four two-week campaigns; two in the summer and two in the winter on two consecutive years. The periods are quite short but may be long enough to recognize the typical diurnal patterns, if every measurement day during the time periods has been successful. Comments on this?

7) In comparison with the traffic rate the situation is better because of several data pairs per day. The location of the traffic census point, however, is reported to be 3 km away from the measurement point. The authors should comment whether there are major crossroads between the measurement point and the traffic census point and whether these affect the traffic density (by increasing/decreasing) at the measurement point.

8) The authors are also further encouraged to check the English. Attention should be paid at least to the prepositions and the definite and indefinite articles, punctuation (especially with "that"), singular/plural (especially with "data"), and terms and prepositions with seasons, dates and times.

9) Minor specific comments (page/line):

550/12: The sentence "The dependence of particles ..." should be clarified, whether it means that the effect of traffic rate on the concentration of particles smaller than 63 nm is stronger than on that of the larger particles.

551/2: The first sentence should be clarified (what kind of laboratory studies, what vehicle types). Are the exhaust particles always distributed into two modes?

551/15-20: The paragraph should be clarified. Why is the nucleation mode particle formation a problem? Does the nucleation mode appear only with high load as mentioned

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in Vaaraslahti et al., 2004.

552/18: To what points of the highway are the distances 9 m and 65 m related (e.g. midpoint)? Comments on the different lengths of the road in the sectors of these two measurement points, i.e. the 65 m point "sees" longer part of the road than the 9 m point?

553/8: The nano-SMPS could be defined in the same way as "long-SMPS" below. At least the DMA Model should be inserted.

555/19-20: Comments on the measured/calculated densities and the bulk densities of the compounds?

556/4: Is the traffic fluent during the rush hours or is it (partly) jammed causing reduced speed? If so, is it supposed to have influence on the emissions?

556/29: The time for maximum concentration should be inserted when comparing to the reported hours by Hussein et al.

557/8: The "distribution" is compared to other work before being discussed in this MS.

557/18: Any suggestions for the exponential dependence of the particle concentration on the traffic rate?

558/13-15: Comments on the effect of (low) traffic rate on (higher) accumulation mode particle concentration? Or should it read that the fraction of the accumulation mode particles is higher?

560/4: The "calculated maximum concentration" is hard to understand and could be clarified.

561-562: Also the obtained GSDs could be discussed in the text and compared with the others' results.

562/6-7: The sentence "They also found out..." is unclear and should be clarified.

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TECHNICAL CORRECTIONS (page/line):

550/14: The acronym GMD should be clarified. Also the terms Mode 1 and Mode 2 could be accompanied with the relevant size ranges.

550/18: The summer and winter values and the calculated uncertainties for the density of Mode 1 particles could be inserted.

550/26: The term "traffic flow rate" could be changed to "traffic rate" for consistency.

551/3: The "small" is vague and could be omitted and replaced with the relevant GMD.

551/11: The "form" should be "from".

551/13: The preposition "related... to".

551/14: The "etc." is loose and could be omitted. The same on 555/23.

551/26: The "Specially" apparently should be "Especially".

552/1: The "sights" should be "sites".

553/7: The "every 5th second" could be changed to "every five seconds".

553/23: The "Helsinki City" should be changed to "City of Helsinki".

554/4: The weather station Model could be specified.

555/13: The Fomblin could be more described.

557/13: The "averaged" could be "average".

557/23-24: The term "2nd impactor stage" could be "impactor stage 2".

558/2: The "lowest" could be "lower".

558/4: Which two particle size classes?

559/9: A "to" is missing after "Accordinging".

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562/9: Typo in the word "single".

563/24: Typo in the word "externally".

566/10: Typo in "in a".

566/22: Typo in "horizontal".

566/25: Typo in "particle".

566/33: Pirjola et al., 2006 has been published.

567/17: Typo in "tandem".

567/27-568/24: References not in alphabetical order.

568/7-8: The reference should indicate it's been published in Suppl. 1.

568/17: Typo in "Atmos. Environ." and in the volume number (should be 38 not 28).

568/19: The title of the reference does not match the title in the publication.

568/21: Typo in "Ristimaki"?

Figures 4 & 5: The logarithmic nature of y-axis could be emphasized with axis tick marks.

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

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