

Interactive comment on “Modelling the dispersion of particle numbers in five European cities” by J. Kukkonen et al.

Anonymous Referee #3

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The authors present an overview of the particle number concentrations (PNC) modelling activities performed within the FP7 project TRANSPHORM.

The PNC modelling is definitely a challenging activity and the proposed work is interesting because it verifies the possibility to model PNC at continental and city scales with state-of-the-art air quality models without introducing relevant aerosol model developments. Therefore, the authors investigate the possibility to realize PNC evaluations to support air quality management.

The simulations have been performed at regional scale with the chemical transport model LOTOS-EUROS and at city scale with different types of air quality models in different cities.

C2098

The heterogeneity of the modelling approaches used to reproduce PNC concentrations in the different cities strongly limits the comprehension of study results and the significance of the proposed conclusions. The reasons why a more harmonized analysis was not possible should be illustrated. If the use of different models in different cities can be understood on the basis of previous local tools development and use, the reason of different approaches in emission estimate and background concentration evaluation is hardly understandable.

The authors should revise the manuscript making efforts to explain the reasons why different sources like house heating, ports and airports activities are taken into account in some cities and not in the others. The paper revision should enable the reader to understand the reason of similarities and differences among the results obtained for the different target cities.

Section 2.2.2

The reasons of the different emission estimate for the different cities should be explained. If wood burning for house heating is considered relevant for PN emission in Oslo, why the general approach should be different in Helsinki, that is located in similar climatic area, and in the other cities. Why the harbor activities are not taken into account in Rotterdam? Why airport emissions have relevant effects in Athens and are not considered in London?

Different emission factors for traffic source sector have been used in different cities. It is not clear why it has been not possible or advisable to use the same emission factors for all the target cities.

Section 2.3.1, pag 5886

The sentence “The PN emissions were converted to values that are compatible with the M7 module, using assumptions on the chemical composition of particulate matter.” is rather obscure. The used assumptions should be mentioned explicitly.

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Section 2.3.2, pag. 5891

From the description of the model simulation performed for Rotterdam it is not clear if the model computed hourly concentration time series like e.g. in Helsinki or if an annual average concentration was directly estimated has suggested by the sentence "The contribution of traffic emissions to annual average concentrations has been assumed to depend on the emission rate, the annual average wind speed and the road type."

Pag 5893

The authors say that "The magnitude of these evaluated values for the urban background were checked, by comparing these with the measured PNC values at the station of North Kensington" but no information is provided on the results of the mentioned verification. It is not specified if any correction has been applied to the background concentration values.

The sentence "For evaluating the annual concentration means, a weighting scheme was applied on the daily concentration fields, based on a classification of local meteorological patterns" makes the reader think that a limited number of days have been simulated for Athens, but no detail on the number of days and their selection method is provided.

It is not clear why LOTOS-EURO simulation results have not been used to estimate PNC background values in Athens.

Section 3.1.1, pag 5894, lines 8-10

After the evaluation of the 60% PN emissions attributed to the transport sector it would be interesting to add the estimate of the contributions attributed to the other major sectors.

Line 24

The reference to Fig.2a should be probably to Fig. 3a.

C2100

Pag 5895, line 4

The reference to Fig. 2b should be probably to Fig. 3b.

Line 27

The meaning of the sentences "Although PN emission factors were not included in the uncertainty evaluation of the above mentioned study, it is possible to indirectly estimate also the uncertainties of the PN emissions. The latter were derived by combining the available experimental data on mass and PN emissions with COPERT PM emission factors" is not clear.

Section 4, pag 5904

The authors say that "the present knowledge is not sufficiently accurate regarding the variation of PN emission factors in terms of the various source categories, especially for shipping and small-scale combustion, and for various environmental conditions.". They should try to quantify the impact of these sources on the PNC in the cities where they have been included in the emission inventory.

The sentence "As expected, the most important local source category in terms of the PNC's was 20 local vehicular traffic in all the target cities." and the following discussion is quite questionable in the proposed form because in some cities traffic emissions were the only one to be considered.