Atmos. Chem. Phys. Discuss., 10, C5135–C5137, 2010
www.atmos-chem-phys-discuss.net/10/C5135/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol dynamics in the Copenhagen urban plume during regional transport" *by* F. Wang et al.

Anonymous Referee #2

Received and published: 11 July 2010

The authors used a trajectory model to study the change of particle size distribution from urban plumes released from Copenhagen urban area. Although this topic is relevant for the journal, only five trajectories were used in the study, which are not sufficient to evaluate the performance of the model. The paper provides no significant new information regarding aerosol dynamics. Due to these problems, the paper should not be published in its current form, and I don't see a simple solution to the problems by simply reorganizing the paper and present results in different ways. The major problems are listed below:

1. Model pending peer-review. They authors used a new model (ADCHEM) in this study and referred to two unpublished papers (pending for peer-review) for details of the model. However, since this paper is based on the new model, and the results

might subject to change, it is unclear to this reviewer whether the results presented will need revision or not. Full consideration of this paper cannot be done until the model development paper is accepted and published.

2. Model input data. The authors used meteorology data with spatial resolution of $\sim$100 km and time resolution of $\sim$ 3 hrs for a regional scale simulation with resolution of $\sim$1km and time resolution of $\sim$15 s. Meteorology data were interpolated to required time and spatial resolution. The $\sim$100 km wind field is certainly not sufficient to accurately predict the trajectories through the three monitoring sites where observation data were obtained and used in model evaluation studies. Vertical resolution of the model is 100 m for the first layer. This is not sufficient to resolve the vertical pollutant concentration gradients. In summary, the meteorology input used in this study could not support fine scale regional simulation intended for this study. A complete prognostic regional meteorology simulation with proper spatial and temporal resolution should be used after going through detailed evaluation of the model performance.

3. Model evaluation. The Model evaluations were done in a rather nonstandard way for trajectory models. The authors used 5 cases (trajectories) from a large 6-week data set. The selection of the trajectories seems rather arbitrary. It is not sure why these trajectories are selected and why other trajectories are not selected. A much larger dataset should be used in the model evaluation. A more appropriate and standard evaluation should be: 1) calculate back trajectories that end at observation stations at each hour of the day for multiple days; 2) use appropriate initial conditions and emissions to predict concentrations at the end of the trajectories and statistically evaluate the model results of multiple pollutants with observations; 3) evaluate uncertainties in the model parameters to the predicted concentrations. In this way, more observations can be used to statistically evaluate the model performance. In the current study, only 5 trajectories (2 or 3 data points for each trajectory) were used. It is not possible to statistically evaluate whether the model performance is sufficient to support further detailed aerosol dynamics analysis.

4. New information/significant results It is unclear to the reviewer what the significant findings are in this study to warrant publication in ACP. The authors discussed sensitivity studies to evaluate importance of deposition, coagulation and condensation on aerosol size distributions. However, conclusions from this study are well known. For example, the author mentioned: “dry deposition decreases the total number concentration of particles . . . and volume concentration”, and “coagulation effectively decreased the total particle number concentration while it was not altering the particle volume concentration.” These are all standard conclusions from classical aerosol dynamics and not worthy publication in ACP.

The authors seem to avoid the more difficult part of the aerosol dynamics: nucleation. Numerous studies have pointed out the importance of nucleation in urban plume processing and particle aging and should be considered and discussed in the study.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 8553, 2010.