

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

### **Anonymous Referee #1**

Received and published: 28 June 2010

**Summary:** Author applied newly developed model (ADCHEM) to study regional scale aerosol dynamics in the Copenhagen urban area. They designed 5 cases to investigate the role of aerosol dynamics in urban plume during regional transport.

**Reviewer’s recommendation:** This paper should not be published in its present form. The key problems are

1) Development of the aerosol dynamics model is a significant scientific progress. This manuscript, however, is only the application of the Model. In this case, their investment must show significant improvement of modeling techniques (e.g. model performance, computational time etc.) or answer scientific questions which other models could not answer. With field measurement data, authors studied 5 cases with ADCHEM model. These dataset are not enough to achieve their aimed goal. Their findings were not sig-

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nificant. Their findings cannot answer unsolved aerosol dynamics, and those findings were already expected by other models. Authors requires well designed hypothesis and simulation scenarios.

2) Before application paper is submitted, evaluation and sensitivity of ADCHEM model paper should be in at least "in press" status. Model results should be supported by evaluation and sensitivity analysis quantitatively and qualitatively. If not, this manuscript require more evaluation data set to support their arguments which is based on their model results.

3) 72hours trajectory gives regional transport (200 - 300 km). Regional transport usually investigated by the proven Eulerian models such as CMAQ etc. What ADCHEM can answer scientific questions which an Eulerian model cannot answer for regional transport? Is the assumption of ADCHEM valid for 72 hours trajectory? Especially when wind come through urban area, wind speed and direction cannot be constant. How this can be deal with?

4) Their findings does not explained aimed complex urban aerosol dynamics, physics and chemical species changes. Reviewer expected at least one of followings. i) Scientifically unsolved/unexplained aerosol dynamics with number/chemical species volume size distribution explained more effectively by using ADCHEM. ii) If findings are not significant, then ADCHEM shows computationally effective (for example 10 less computation time etc) with the same amount of precision of other models. New module of ADCHEM which other model could not be applied because of technical difficulty

Conclusion: Several of these problems cannot be addressed by rewriting or editing. First, authors must wait until their new model is in peer-reviewed. Then, they need to prepare a much larger and richer (more species and variables) evaluation and simulation dataset, and state a clear findings which is scientifically significant or significant model improvements.

Detailed comments: ABSTRACT Abstract needs major revision. If this is all they found,

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this paper cannot be published. There is no significant findings. Most of them is introductory sentences and gives ambiguous results such as "satisfactory agreement, acceptable agreement", then finalized with possible source of errors such as spatial MET data. Author should state interesting findings in abstract to attract reader to read whole body text.

P8554, L12 "The measured and modeled increments in NO<sub>x</sub> ~ satisfactory agreement ..." => What is the criteria of satisfactory agreement? This is ambiguous sentence.

P8554, L14 "For three out of five case studies" => There is no explanation of five case studies. Reader does not know what conditions of five cases before reading whole text. Abstract should be stand alone without reading whole text. Hence, it should rephrase for example urban background plume case etc.

P8554, L18 "the model reaches acceptable agreement" => What is the criteria of acceptable agreement? Need quantitative expression.

P8554, L24 "Real-world ~ can be used ~in urban plume studies" => this is very ambiguous sentences. I don't know exactly what author tried to say. They have this emission factor ? Or they said this emission factor is required? Either way, this sentence is not helpful for abstract.

INTRODUCTION In title of this paper, the aim of this study is regional transport. However, in this introduction it is focused on urban scale aerosol dynamics (near-road to background). Author must include literature which Lagrangian approach is valid for regional transport study (72hours).

P8555, L2 Airborne aerosol particles => Aerosol or Airborne particles. P8555, L3 visibility degradation (Malm, 2003) => I don't think Malm et al is the most significant finder of visibility degradation. P8556, L13 In tunnels, ... 2004a) => Very confusing sentences. Tunnel study is for control volume emission factor. P8557, L4 Roldin et al. (2010a) => Refer to the paper "to be submitted" is not valid.

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2. Experimental studies Since this manuscript is for model application, experimental studies are not valid. This seems like Author did experimental study for this model evaluation which is not true. These measurement dataset were used for the evaluation. Hence, this section should be in model study section and one of sub-section such as summary of evaluation data.

P8558, L10 (Kemp et al., 2008). => No need to cite this paper. Kemp et. al. reported these site belong to Danish Air Quality Monitoring Programme?

P8559, L2 three sites were of good quality => Need citation here. Just saying good quality is not valid. Should cite paper which is reporting QA/QC.

3. Modeling methods In general, before this model is used, the performance of model should be peer-reviewed.

P8561, L21 Wang et al. 2009 => There is no reference. Is it 2010? P8562 2nd paragraph => As author mentioned in introduction, aerosol dynamics are rapidly changes from near road to background. How ADCHEM can handle this with these coarse resolution of emission inventory?

P8563,L26 Background trajectories were ... HCOE location. => Why 48 hours background and 24 hours forward? Any technical reason for this? Lagrangian approach is valid for these long trajectory?

Figure 5 - 9. These figures have same structures with not much information. They have time series with two point or three points measurement data. For example, Fig 5 d, PN at 12:00 and 13:00 is provided. But PN changes after 13:00 is the correct estimation? If it is correct, what important information is given by showing long time series? These figures can be summarized into 2 figures. Too many figures with not much important information.

Figure 10. Vertical profile of pollutant is very important information and a special feature of model. Is this evaluated with vertical profile measurement? Or purely based on

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modeling?

Table 3. Large, Moderate, Small are not technical words. Quantitative criteria should be provided. What this table give information to reader?

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

ACPD

10, C4559–C4563, 2010

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