Atmos. Chem. Phys. Discuss., 6, S1363–S1366, 2006
www.atmos-chem-phys-discuss.net/6/S1363/2006/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol chemical and optical properties over the Paris area within ESQUIF project" *by* A. Hodzic et al.

A. Hodzic et al.

Received and published: 23 June 2006

1 SPECIFIC ANSWER TO REVIEWER 3

General Comment: *This article compares the observed and the simulated chemical and optical properties of aerosols over the Paris area. The comparison is focused on two pollution episodes during the ESQUIF project. The comparison results presented in the article are informative and provide insight into the future improvement of the aerosol transport model (CHIMERE). The following are my comments on both the model simulation and the interpretation of the comparison results.*

Comment 1: Uncertainty in the aerosol emission inventory. *The authors indicate (line 21 on p. 408) that in their simulation all primary emissions are lumped into a single*

compound (i.e., the primary particulate matter) due to the lack of specification in anthropogenic emission inventories. There is no doubt that such an approach introduces errors in the aerosol simulation. The question is how great the errors are. I suggest that a sensitivity simulation experiment be performed to estimate how much difference will be made in the simulation if various species are specified in the primary emissions.

Answer 1: In the current model version all primary emitted species are assigned to a single component called PPM (the primary particulate matter). We agree that the speciation between black carbon (BC) and organic carbon (OC) in anthropogenic emission inventories will be valuable information in order to simulate more accurately the composition of the aerosol carbonaceous fraction. Not considering this speciation could introduce uncertainties in model simulations of the aerosol composition since a part of the mass remain undefined in the primary fraction (40% of PPM). However, it does not influence the accuracy of model simulations of the aerosol inorganic and secondary organic fraction (produced by the chemistry reactions) as well as the aerosol total mass (PM10) considered in this study.

Because the emission specification is not available for the Paris region and will require adding strong assumptions on the specifications of primary species in the model, we think that it will not improve the interpretation of the comparison results between the model and observations. We thus retain the interesting idea of the reviewer for a future work.

Comment 2: Lack of vertical resolution. *Since there are only 8 hybrid sigma-pressure levels between the surface and 500 hPa in the CHIMERE model (line 16 on p. 409), I am not convinced that it is sufficient to accurately simulate the vertical transport due to the vertical mixing in the atmospheric boundary layer (ABL), given that the meteorological model has much higher resolution within the lower half of the troposphere than the CHIMERE model. I suggest that a sensitivity simulation experiment be carried out to provide the reader with the information on how much improvement can be achieved if a higher resolution (e.g., 16 levels) is used between the surface and 500*

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hPa.

Answer 2: The standard model configuration described on p.409 line 16 includes only 8 hybrid sigma-pressure levels between the surface and 500 hPa and we agree that this is not sufficient to study the vertical distribution of aerosols and transport of plumes. Therefore, for the purpose of this study we performed two simulations as described in section 3.2. In the first simulation (R1) devoted to the assessment of the aerosol chemical composition at the ground, the number of aerosol sections was increased to 11 bins, while in the second simulation (R2), devoted to the study of the aerosol optical properties and their vertical distribution, vertical resolution was increased from 8 to 20 sigma-pressure levels.

The R2 simulation was used for the comparison with airborne measurements in order to evaluate the model performances in simulating the plume transport and aerosol vertical distribution.

Therefore, the referee's suggestion to increase the number of model vertical layers from 8 to 16 has already been taken into account in the manuscript as we originally considered 20 model vertical layers and further simulations are not necessary.

Comment 3: Uncertainty in conclusion (ii) *The authors attribute the underestimated aerosol load at the top of the ABL to the misdisplaced pollution plume and the underestimate of the relative humidity at the ABL top. I suspect that the lack of vertical resolution in the CHIMERE model may be blamed as well. I strongly suggest that this issue be reexamined once the sensitivity simulation experiment is conducted to address my concern with the lack of vertical resolution in the CHIMERE model.*

Answer 3: According to our previous remarks, the lack of the vertical resolution in the CHIMERE model can not be blamed for the underestimation of the aerosol load at the top of the ABL since we have considered 'high resolution' (20 vertical layers) model simulation, called R2.

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Editorial recommendation Please notice that figures have been renumbered in accordance with the referees' suggestions.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 401, 2006.