

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

Anonymous Referee #2

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1. General Comments

This study evaluates the performance of the urban-scale chemistry-transport model CHIMERE in simulating aerosol pollution episodes over the Paris region using aerosol measurements taken during the ESQUIF project. Specifically, measurements taken during two intensive observation periods during July 2000 were used as the basis for model evaluation. The ability of the model to simulate aerosol mass, chemical composition, three-dimensional distribution, and optical properties was examined.

While the study is fairly comprehensive, some details and explanations are lacking.

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Even though detailed description of the measurements and data set is already provided in published papers, more details should be included in this paper to make the paper more self-contained and easier to read. More model description is also needed. Some questions that arise from the evaluation still need to be addressed. The specific comments are provided below.

2. Major Comments

1. There is no mention of what instruments were used to measure particulate organic matter and BC. How was the hydrophilicity (mentioned in section 5.4) of the aerosol determined? Are the AIRPARIF sites the same as the ground sites mentioned in section 2.2? If not, what instrumentations were used for the AIRPARIF network to measure ozone, NO_y , and PM_{10} ?
2. Similarly, more details must be provided about the aerosol model. How was secondary organic aerosol modeled? How were the aerosol dynamics and size distributions modeled? What gas-phase precursors relevant to aerosols are included? What is the model time step?
3. Figure 1 is difficult to read and is not fully explained. For the flight tracks, what is the difference between the yellow and the gray lines? What are the blue lines? Consider using a three-dimensional figure to better represent the altitude and direction of the flight tracks. A brief description of the flight plan should be provided so that Figures 5, 7, and 8 are easier to understand. It would also be helpful to label the upwind and downwind portions in Figures 5, 7, and 8.
4. A map indicating the locations of the AIRPARIF stations and the Saclay ground site is needed. How many of the AIRPARIF stations are urban and how many are

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- rural? Figure 3 indicates that ozone concentrations are very similar for urban and rural stations. What is the definition of an urban and a rural site?
5. On page 12 the papers states “A very specific traffic pattern is expected during the last days of July when lots of people start their vacations.” Is this “very specific traffic pattern” considered in the emissions used in the simulations? How is this pattern different from the “normal” pattern?
 6. The definition of total particulate matter (TPM; section 5.3) is confusing. The model simulates aerosols up to $40\text{ }\mu\text{m}$ in geometric diameter while the ground measurements include aerosols up to $10\text{ }\mu\text{m}$ in aerodynamic diameter. Does the simulated TPM in Figure 9 include mass of aerosols up to $40\mu\text{m}$ or $10\mu\text{m}$? Is density correction applied for conversion of geometric diameter to aerodynamic diameter?
 7. Top of page 18 states that ignoring primary sulfate emissions is a possible reason for the negative bias, on the order of 30-60%, of the model in predicting aerosol sulfate mass. This is unlikely; 2% of the SO_2 emissions is very small compared to secondary sulfate that is eventually formed downwind of emissions. Other factors are involved in the negative bias.
 8. The text in section 5.3.3 and the caption and labeling of Figure 12(b) are confusing. In Figure 12(b), are the plotted “Measurements” concentrations of POM or 85% of POM?
 9. How are the results (meteorological variables, ozone and NO_y concentrations, and aerosol distributions) different between the R1 and R2 simulations? More specifically, does the vertical resolution of the model affect the results of meteorological variables and location of the plumes? How does aerosol bin resolution affect aerosol predictions?

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10. What is the uncertainty in the lidar-derived AOT arising from assuming constant backscattering-to-extinction ratio and refractive index? How much variability is in the calculated refractive index using Mie theory and accounting for aerosol composition and relative humidity?
11. In Figure 16(a), there is peak in aerosol backscattering ratio at altitude ~ 1.5 km and latitude $\sim 48.7^\circ\text{N}$. This location is upwind of urban Paris for this date and this peak is not simulated by the model (Figure 16(b)). To a lesser extend, this peak is also seen in the lidar-derived AOTs as shown in Figures 14 and 15. What is the reason for this peak in the lidar measurement and why is this peak not seen in the model?
12. Section 5.5 (“Other aerosol properties”) should be moved to before section 5.4 (“Aerosol optical properties”).
13. Clearly, the model does not predict aerosol size distribution well. The reason for this is not explained thoroughly in the paper. What are the initial and boundary conditions for aerosol size distributions? Are they unimodal, bimodal, or trimodal? Wrong initialization can easily lead to wrong results. A strong possibility, as mentioned in the paper, is that more and smaller size bins are needed to limit numerical diffusion. The model includes aerosols up to $20\text{ }\mu\text{m}$ in diameter. Given that there are negligible aerosol mass and number above $10\text{ }\mu\text{m}$ in diameter, more size bins should be used in the smaller diameter range.

3. Minor Comments

1. Sometimes the notation “ NO_y ” is used; other times “ NO_Y ” is used. Be consistent.
2. “ PM_{10} ” vs. “PM10”: again, be consistent.

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3. Page 10: In several instances, “wind velocity” should be “wind speed”.
4. Page 15, line 5: “PPM” should be “TPM”.
5. Page 17, line 12: “...the gas/particle partitioning...” should be “...the **temperature-dependence of** gas/particle partitioning...”
6. Page 17, line 14: Unless I misunderstood the paragraph, “...very **high** partitioning...” should be “...very **low** partitioning...”
7. Page 21, line 3: “Hanel” should be “Hänel”.
8. Page 21, line 7: “ proportional” should be “linear”.

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

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