

## ***Interactive comment on “High resolution modelling of aerosol dispersion regimes during the CAPITOU field experiment: from regional to local scale interactions” by B. Aouizerats et al.***

### **Anonymous Referee #2**

Received and published: 7 February 2011

General comments: This paper aims on reproducing the distribution of aerosol particles during different dynamical conditions by the use of high resolution simulations. Although the title and abstract give the impression that this paper is based on high resolution investigations of aerosol particle evolution in urban plumes and the impact of dynamics on the aerosol plumes, the main focus is put on the dynamical effect on the dispersion of the primary emitted aerosol component. Other effects such as aerosol dynamics and chemical evolution within the plumes are treated simplified and rarely discussed at all. It is questionable whether the simplified treatment with respect to the chemical composition of the aerosol particles is justifiable at horizontal resolutions down to 500 m. Some extensions are suggested for the revised version of the paper.

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These are outlined in the following. Specific comments: In this study, high resolution simulations of down to 500 m are performed. For these investigations the aerosol-gas-phase thermodynamical equilibrium is treated by the EQSAM module, which was designed by Metzger et al., 2002 for the global scale. EQSAM was not developed for high resolution regional scale investigations, such as the present study, and treats the exchange between the gaseous and particulate phase simplified by assuming chemical equilibrium. The reviewer finds it contradictory to investigate the distribution of particulate matter by performing simulations with very high resolutions, but using such a simplified module as EQSAM. It is strongly suggested that the uncertainties of the assumptions made by using EQSAM are highlighted and discussed in the scope of this paper. It must be clear that the scope of this study is put on the investigation of the structure of urban plumes, under different conditions, and that the chemical evolution of the plume not is investigated. The following points should be clarified in the revised version of this manuscript: p. 29573 l10. What input data is required for the town energy budget scheme? p. 29573. Section 2.2. What about interaction between the aerosol particles? Is e.g., coagulation between the particles considered? Is there an interaction between primary emitted black carbon and the secondary aerosol particles. p. 29574 l 16. Please describe the treatment of background aerosols more detailed. This is an important factor for the investigation and the results. It is suggested to shortly describe the applied method at this place. p. 29574. The section 2.3 “Emission inventory” needs to be extended. Are emissions only considered from traffic sources? What about emissions from e.g., the industrial sector? Are emissions only available for the smallest domain? How are emissions for the simulations of the two other model domains treated? p. 29576. Section 3.1.1. Cloudiness and temperature should be presented for the considered situation. These are generally important factors for the photochemistry. p. 29576l23. Are there only observations available in Toulouse? It would be helpful to have additional observations of the aerosol concentration in the investigated domains to evaluate the simulated horizontal distributions. Based on what information are you certain that pollution from Barcelona exactly is re-

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sponsible for these high concentrations? Barcelona is not part of any of the model domains. Please clarify and motivate this statement. p.29585 l8. What is the reason for this elevated aerosol layer? Which impact may this elevated layer of primary aerosol have on the SOA? What about the vertical distributions of the larger domains? Is the long range transport proven by the results of these simulations. Please comment. The authors should not mix American English and British English (e.g., analyse/analyze, initialise/initialize, modeled/modelled). The use of prepositions need to be looked over. In general, the English needs improvement and should be edited in the revised version. Minor Comments: p. 29570 l15. population lives in p. 29570 l16-20. Should be rewritten. p. 29571 l1. particle pollution events. p. 29571 l2-5. This sentence is awkward. “computations are averaged over several hours”, do you mean that a large time step is required as a result of high computational costs due to the high horizontal resolution? p. 29571 l10. Replace “which occur in observations” by e.g. “that are found in observation”. p. 29571 l15. IOP should be defined. p. 29571 l18. How can measurements lead to a modeling experiment? p. 29572 l16. .. are especially.. p. 29572 l22. Moreover, p. 29572 l23. A comma is missing after the citation. p. 29573. Which time step was applied during the simulations? p. 29573 l12. What do you mean with that the “physics is relatively complete”. Please be more specific. p. 29573 l12-13. You have used “.” twice in one sentence. p. 29574 l22. ..to form a 500 m resolution.. p. 29575 l6. NH3 in italic font. p. 29575 l17. Please mention for which height the mass concentrations are illustrated. Are they surface concentrations? p. 29575 l22. ..has an maximum aerosol mass.. p. 29575 l24 ..maximum concentration of.. p. 29576 l22. The concentrations are simulated, and “observed” is for this reason misleading. p. 29577 l26-28. Awkward sentence. Suggestion: use “..that accumulated during the night”. p. 29577 l27. What gas-phase precursors???. p. 29578 l1. Urban scale simulation analysis(analyses). p. 29578 l7. Define UHF. p. 29578 l11. Model domain. p. 29578 l14. The simulated wind regimes compare well with observation for the studied. . . p. 29578 l15-17. These two sentences are contradictive. p. 29578 l24. “Observations were consistent on”..on what? p. 29579 l7. Layers thinner than 1000 m. p. 29579 l17. Another criteria of

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the model.. p. 29579|18. ..the evolution of the measured.. p. 29580 |17. Use only acceptably OR well, not both. p. 29583 |16. 200 m. Space before the unit is missing. p. 29584 |15. ..the same sets of the 4 instantaneous fields.. p. 29584 |19. Space missing after the comma. p. 29584 |25. Figure 9c shows that the.. p. 29585 |1. ..in Figures 9b.. p. 29585 |3. Differences..are. p. 29585 |6. 10 K higher. p. 29585 |27. 500 m. p. 29584 |12. Use either “this structure” or “those structures”. p. 29585 |15. The first sentence of the conclusions is awkward. p. 29585 |21. ...for an adequate.. p. 29585 |24. ..permits the investigation of the role..

Fig. 1. a) Black text on dark shaded colours is difficult to read. Please choose another colour. c) The units for the emissions of black carbon are wrong. Usual units for particulate emissions are mass per area and time unit. X- and y-labels are missing. Fig 2-6. Please use the date format day/month/year. Fig 2. The colour bar and text run into each other. Text: a comma is missing before “and M for Marseille.” Fig. 3-5, 8-9. The units are to be written without a period between the letters. Fig 3. The abbreviations for the cities are difficult to read on the left pictures due to the dark background. Fig 4c-d. Caption: wind direction with small w. Fig 5. The text on the y-label is small and difficult to read. b) The blue and black lines are difficult to distinguish. Fig. 6. Caption: The observed and modeled boundary layer heights are shown. Please indicate the location of comparison. The labels are of different font types. The numbers on the colour bar are of bad quality. The text and numbers on the y-label run into each other.

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