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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Modelling and assimilation of lidar signals over Greater Paris during the MEGAPOLI summer campaign" *by* Y. Wang et al.

**Anonymous Referee #1**

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General comments:

The paper deals with the assimilation of lidar profiles in a chemistry-transport model (CTM) called Polair3D to improve the simulation of particulate matter (PM) concentrations. The authors present the results they have obtained during a field experiment in Paris. The experiment has lasted for 6 days but the assimilation exercise was performed only for 2 days. The lidar profiles were acquired aboard a mobile van. The profiles are assimilated following an optimal interpolation algorithm in two ways, rather affecting PM10 alone or PM2.5 and PM10. The authors conclude that in general the assimilation of lidar profile tends to improve the simulation of PM10 and PM2.5, espe-



cially when analyzing PM2.5 and PM10.

The subject of the paper is within the scope of ACP. Data assimilation is of primary importance for atmospheric chemistry and chemical weather forecast. This paper provides an original approach of this question regarding aerosol properties. I would recommend the paper for publication after major modifications. My main remark concerns the conclusions of the paper regarding the comparison between both methods for assimilation. Additional test cases should be added to strengthen the conclusions.

Specific comments:

A) Regarding the calibration of the lidar signal in paragraph 3.1, there is no evidence that the proposed method improves the calibration of the lidar signal. Indeed you may find a reference altitude that is closer to the laser source, i.e. with a better signal-to-noise ratio but how does it affect the general accuracy of the assimilation procedure when applying this method for the calibration rather than taking a fix range for the reference? Please provide numbers for that. Also explain why you have used a least absolute deviation rather than least square method.

B) In the model evaluation, explain why you think that the model performance goals are met. Moreover, I think that the discussion about comparing the aerosol optical depth (AOD) measured by the Sun photometer and simulated by the model is awkward. Indeed you are not able to reproduce the AOD variability and the reason you give is unclear. It can't be only a question of vertical mixing in the model. Clearly state in the paper that the model is not able to reproduce the AOD.

C) You have to explain again (in 1 or 2 sentences) at the beginning of the section 6 why you retain only 2 days of measurements.

D) In the section 6, I don't consider that you are proposing 2 new algorithms. You are testing 2 different ways of implementing a data assimilation algorithm based on the optimal interpolation. It appears that the 2 methods give almost the same results (table

4). You have to clarify this point in your conclusion (starting from Line 479) or you can provide new test cases.

E) The beginning of the conclusion (until Line 478) needs to be modified as well. Include quantitative information on the model performance to simulate actual optical properties. The sentence "(. . .) if the aerosol layer is well simulated." is really confusing. I understand that the model is not able to simulate aerosol.

Technical comments:

1) L205. Use PR2 or S, not both.

2) Figure 2: I can't see the blue points. It's a black solid line. . .

3) Explain all the arguments in equation 14.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 27115, 2013.