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Interactive comment on “Assessment of vertically-resolved PM₁₀ from mobile lidar observations” by J.-C. Raut and P. Chazette

Anonymous Referee #1

Received and published: 27 July 2009

General Comments:

The manuscript presents an approach for estimating vertically-resolved PM using lidar measurements. The relationship between PM₁₀ and extinction coefficient used is developed in a clear manner and several case studies are given from the resultant PM profiles.

Specific Comments:

The ground sites shown in the top panels of Figures 3-8 require further description. Are these sites directly influenced by traffic or industrial pollution, or are they more representative of Paris background? This may also help to explain some of the discrepancy between lidar-based PM₁₀ and surface measurements.

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p. 13476 - line 24-25 - A citation should be given for the 10% given here. Also, the authors need to mention the high degree of regional variation associated with this number.

p. 13482 - line 4-8 - Liu et al. (2004) were not limited to total aerosol loading. They included vertical information from a chemical transport model, using an approach similar to van Donkelaar et al. (2006) cited later in this paragraph.

To avoid confusion, individual symbols should only be used once in sections 3.2 and 3.3. α is defined as the scattering Angstrom exponent in the text (although “a” is used in equation 2 and on lines 9-10 of p. 13483), while $\alpha_{\text{scat}, 700}$ is used for aerosol scattering coefficient. Also σ is used for uncertainty in Section 3.2 and $\sigma_{\text{ext},355}$ for extinction cross-section.

p. 13488 - line 14-16 - The numeric value of this “poor correlation” should be given, and for all fitted lines.

p. 13490 - line 13-15 - The authors should state over what period the agreement between nephelometer and lidar extinction coefficients was found. It is unclear whether this was during the campaigns in question, and if so, from how many measurements/days, and if not, a citation should be given.

Section 6 needs to be improved prior to publication. It begins by comparing the lidar-based PM at 200 m with ground measurements and closes by stating that such a comparison is meaningless, which it then says “suggests a good reliability of the approach developed in this study.” The extinction tomograph given in Figure 10 is relevant and interesting, but a single profile is not enough to completely disregard the poor agreement found with surface measurements (although the inclusion of the Chazette paper does start to build a case). A simple scatter plot of the ground PM with the lidar-based PM would make it easier for the reader to compare. Even if we disregard the ground measurements as suggested, we are, at best, left with no validation of the given approach and have no physically-based estimate of its accuracy. In no way can it be stated that

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this implies “good reliability” and this declaration must be removed.

Technical Corrections:

p. 13476 - line 23 - “Aerosol studies experience a revival of interest...” should read “Aerosol studies have experienced a revival of interest...”

p. 13477 - line 3-4 - “. . .foremost of its size...” should read “. . .foremost on its size...”

p. 13477 - line 9 - “. . .whose number is going to increase...” would be more appropriate to read “. . . whose number is expected to increase...”

p. 13478 - line 9 - “. . .(~12 millions inhabitants)...” should read “. . .(~12 million inhabitants)...”

p. 13478 - line 12-13 - “. . .programs has been...” should read “. . .programs have been...”

p. 13478 - line 14 - “. . . study lies on...” should read “. . . study relies on...”

p. 13479 - line 24 - “. . .onboard small personal...” should read “. . .onboard a small personal...”

p. 13479 - line 24-25 - “The advantage of such a small car... small atmospheric volumes.” This sentence does not make sense. Are you referring to a small vehicle’s ability to follow small atmospheric features due to its manoeuvrability?

p. 13487 -line 6 - “During this latter...” should read “During the latter...”

p. 13487 - line 23 - “. . .in Paris area...” should read “. . .in the Paris area...”

p. 13488 - line 5 - “. . .leads to a very nice correlation between...” The correlation value should be given to support to statement.

p. 13488 - line 13 - “. . .has concerned a...” would be better written as “. . .involved a...”

p. 13490 - line 11 - “. . .which can explains...” should read “. . .which can explain...”

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- p. 13491 - line 2 - "...the role of this latter.." should read "...its role..."
- p. 13492 - line 1 - I am unfamiliar with the term "delimited" in this context. I would suggest "identified" instead
- p. 13493 - line 12 - "the factor 2 on the..." would better read "...doubling of..."
- p. 13496 - line 8 - "The value of sext,355..." needs a space between "of" and "sext,355"
- p. 13496 - line 14-15 - "aged dust has shifted to smaller sizes during transport..." it would be much clearer to state the large particles have settling thereby shifting the particle size distribution.
- p. 13496 - line 29 - "...do not enable to conclude." should read "...are inconclusive."
- p. 13497 - line 1 - "...vertical profile..." should read "...vertical profiles..."
- p. 13497 - line 4 & 11 - "...more important..." More important is subjective. It is better to state "greater".
- p. 13497 - line 7 - "...enables to clearly follow..." should read "...enables us to follow..." Table 2 - Adam et al. (2004) refers to Baltimore, Maryland, USA, not Baltimore, Canada.
- p. 13513 - Figure 2 - The discussion pertaining to this figure centers on the slope of each panel. It would be far more effective to maintain a constant ratio between the x and y axis limits for comparative purposes.
- Figures 3, 7, 8 - The lower limit of the altitude should always be given.
- Figures 3-9 - The inclusion of a mean profile is helpful, but more than 2 axis labels are needed as it is unclear if the scale is linear or logarithmic. I would also suggest making this axis cover a larger width for feature visibility.
- Figure 9 - Time should be given in UTC for consistency with other figures.

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