

# ***Interactive comment on “Characterization of forest fire smoke event near Washington, DC in Summer 2013 with multi-wavelength lidar” by I. Veselovskii et al.***

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Dear Referee #2, many thanks for careful reading of our manuscript and useful suggestions. Answers to your comments are reported below.

1. How do the authors calibrate the backscatter coefficient? They cite Ansmann et al., 1992, for that purpose; however there is always a need to find a reference height and value for each individual backscatter profile. It should be stated how the authors do that for their high resolution profiles, i.e., do they assume the same value and height interval for every single 2-min profile and if yes which one.

The reference height was checked for every single profile. It was done by analyzing lidar signal at 1064 nm, because it is the most sensitive to particle presence. The reference point is chosen inside the height interval, where 1064 nm lidar signal fits the model molecular signal. The corresponding comment is added to the text. “The reference point, where particles scattering can be neglected, was found for every individual profile.”

2. I do not agree with the comment “The quality of the input data can be characterized by the discrepancy ,” (page 26869 ,line 17). In my opinion the discrepancy is a measure how well the inversion could perform for the specific input data set, i.e. how accurate it can reproduce these data. The error of the input data set itself cannot be directly estimated by this parameter.

It is true. Low discrepancy is necessary condition for retrieval, but not sufficient. Low discrepancy can't guaranty that data are free of errors. However high discrepancy can mark the regions, where retrievals make no sense. And this is how we used it.

3. Therefore I would like to know and it should be stated how the error of the input parameter can influence the inversion. Later it was briefly stated that the error of the extinction coeff. at 532 nm leads to oscillations in effective radius. However, the order of magnitude is not stated. This should be done to estimate the uncertainty of the effective radius retrieval at high temporal resolution.

The detailed study of influence of errors in every input optical coefficient was presented in our recent publication (Pérez-Ramírez et al., 2013). So we just provide the reference. 10% error in extinction at 532 nm leads to uncertainty in effective radius estimation up to 20%. Basing on our previously performed numerical simulations we estimate the uncertainty of particle volume and effective radius retrieval to be below 30%.

4. In addition with respect to this topic, the authors assume the uncertainties in the input data as independent but also mention the influence of the overlap function on the retrieval (page 26870, top). The influence of the overlap function however influ-

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ences all input data similarly and thus the uncertainty with respect to the overlap is not independent, right? Is the made assumption thus still valid?

We didn't make retrievals at heights where overlap was not complete, because it affects backscattering and extinction coefficients in different way. During prolonged lidar operation the system alignment could change leading to some increase of overlap height. Such data are normally characterized by enhanced discrepancy at low heights and are removed from consideration.

5. I would be very happy to see also high-temporal resolution panels of lidar ratio and Angström exponent as they are more or less used for the inversion, too.

We provided time-averaged profiles of the lidar ratio and Angstrom exponent. The quantitative retrievals are made for these time-averaged profiles. High-temporal resolution panels are mainly illustrative, so we think there is no reason to provide such panels for lidar ratio and Angström exponent.

Specific comments:

6. 26866, 16 “values” at wrong location in sentence?

It looks like location is correct.

7. Figure 2: Again, overlying borders would help a lot to understand the images.

Borders are added

8. Figure 8: Are there also error bars for the lidar ratio at 532 nm?

For these time- and range-averaged profiles the uncertainties for both wavelengths we estimate to be the same  $\pm 15\%$ , so we show it for only one wavelength.

9. Figure 9: Please explain in caption which Angström exponent is shown.

One curve was lost in this figure. Corrections were done.

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