

## ***Interactive comment on “Optical thickness matching algorithm applied to the case study of an accidental fire smoke plume over the Paris area with N<sub>2</sub>-Raman lidar” by Xiaoxia Shang et al.***

### **Anonymous Referee #2**

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The authors present and analyze measurements performed during a large accidental fire near the metropolitan area of Paris. Lidar measurements for such fresh smoke plumes not related with biomass are hard to find and thus such measurements are very useful to extend our database with optical and microphysical properties of certain type of smoke. Therefore the paper is a valuable contribution and suitable for publication in AMT. However the structure of the paper and its focus as written, do not highlight the truly new information shown and the presentation of the fire event could be drastically improved. The paper should be accepted for publication after considering my comments and suggestions below:

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Section 3: The greatest part of the paper (section 3) provides a detailed overview of existing methodologies how to retrieve aerosol extinction and backscatter coefficient, Lidar ratio and particle depolarization ratio and their uncertainties. It is a nice overview but there is no really new methodologies proposed to deserve, in such a context, such an extensive discussion. Moreover in the frame of the European Lidar community there is a decade long effort and discussion to homogenize algorithms, processing and lidar products, which the authors seem to ignore. I would certainly suggest to drastically shorten this section by simply providing references to the algorithm they use and the associated QA/QC procedures they follow and providing information for the uncertainties of their retrievals.

Results: The aerosol structure is rather complex during the event studied, both concerning the layering and the typing. This fact should be better demonstrated and highlighted. A table would help to summarize average properties per layer, possible origin and eventually typical values of these types. The discussion with the trajectories and meteorological fields should be linked better with the discussion. In addition since the authors have PDR measurements they could make an attempt to quantify the mixtures at least when two major components are dominant (smoke and dust or urban pollution and dust). At the end of this paragraph there should be a clear message concerning the intensive properties of the observed smoke and how these differ from other types of smoke found in the literature. Again here a table would help to highlight this information.

Is it necessary to show both figures 3 and 9? Mostly they show the evolution of the same event. The authors could consider to merge them.

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