**Atmospheric
Chemistry
and Physics
Discussions**

# *Interactive comment on* "Detection and characterization of volcanic ash plumes over Lille during the Eyjafjallajökull eruption" *by* A. Mortier et al.

**Anonymous Referee #1**

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The paper presents AERONET and single wavelength lidar measurements during Eyjafjallajokull volcanic ash advection over Lille. A methodology for deriving ash concentrations based on the synergy of the passive and active sensors used is presented. Beyond the advanced instrumentation and methods used in this study, the paper is well written and the results are clearly presented. Important information regarding volcanic ash concentration levels over France is presented, contributing to the scientific discussion related to the impact of ash on air quality, environment and climate. I suggest that the paper should be accepted for publication in ACP, after the authors address the following questions/concerns:

1. The lidar ratio of 48sr for volcanic ash is in accordance with direct LR measurements taken by advanced Raman lidar systems in Europe operated in the frame of the EARLINET. This is referred correctly by the authors in page 31038. I would avoid the discussion regarding the comparison of the LR with Catrall's retrieved values for dust. Dust has different composition from ash and the comparison is not representative. Moreover, new retrievals for dust presented in Schuster's paper suggest greater LRs for Saharan dust, which are in accordance with Raman lidar measurements over Europe and Africa.

2. Please, describe more analytically Figure 5, so the reader will be able to follow the statements. Refer to exact times and layers detected. For information that is not available in the figure but referred in the text with numbers (e.g. the cloudiness period), please mention that these data are not presented in Fig. 5.

3. Figure captions are too short. Please describe the figures more analytically so the reader would be able to follow. Moreover, there are many statements, data and methods in the paper that are not referenced. Please take care of these omissions. For example, you should add references or clarifications for the following: - Page 31042, line 17: What exactly is filtered by FFT? - Page 31043, line 25: How the extrapolation is done? - Page 31045, last paragraph before Results section: Please elaborate

4. There is a fragmentary discussion regarding the uncertainties of the methods presented. The most important uncertainty is the one revealed for the concentration calculations. The authors should get together and report clearly which uncertainties are taken into account for this. For example, are the lidar signal uncertainties included?

5. The relative humidity profile is estimated from a standard atmosphere model fitted to a surface reference. This does not explain anything regarding the lofted ash layers. The authors should use radiosondes or indicative water vapor CIMEL measurements to comment on RH impact on ash layers.

6. The assumption on the volcanic ash density is acceptable, however the authors use

a density value for the fine mode particles (1.5 g cm-3) which in my knowledge is not supported by the literature. Please elaborate on this assumption.

7. Finally, please comment on the VSD, RI and LR AERONET retrievals. From what I understand, these "typical" values are calculated from one day case study and then are assumed constant for all the other cases presented. Are these typical volcanic ash properties?

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