**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Optical, microphysical,
mass and geometrical properties of aged volcanic
particles observed over Athens, Greece, during
the Eyjafjallajökull eruption in April 2010 through
synergy of Raman lidar and sunphotometer
measurements" *by* P. Kokkalis et al.

Anonymous Referee #2

Received and published: 8 May 2013

Review of the ACPD paper by Kokkalis et al.

The authors analyze in this paper certain properties of aged volcanic particles ob-
served over Athens, Greece using raman lidar and sunphotometer measurements. The
paper presents very interesting results which are based on high quality data and state
of the art algorithms. The results presented provide additional useful information to
our knowledge for aged volcanic ash, considering the large distance between the Ice-

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Interactive Discussion

Discussion Paper

landic volcano and Athens. The paper however would benefit with a better focus and a better structure. It is not very clear what the main objective of the paper is. Do the authors aim to a validation paper for FLEXPART or they use FLEXPART as a tool for the interpretation of their results? Certain parts of the manuscript suggest a validation exercise, while other parts try to use the model for the interpretation of the measurements. To my opinion the authors should avoid the validation character of the paper and focus only on the interpretation, which in few cases could also be clearer, based on less assumptions. In general I suggest that the paper should be accepted to ACP considering my comments for revisions below:

P5317. Abstract: The large range given in the abstract for the effective radius, lidar ratio and the refractive index leaves the impression to the reader that all these values correspond to pure aged ash and the variability could be associated to different age, which is probably not the case. The authors should add a comment here on the cause of this large variability. In addition the authors should avoid to provide a correlation coefficient between LIRIC and FLEXPART which is based on few cases and should rather restrict themselves on a qualitative statement.

P5318-5319. Introduction. Since the paper is part of special section, some parts of the description of the volcanic activity could be shortened. In the last paragraph of the introduction the authors should mention clearly what is the main objective of their study. Is it to characterize pure aged volcanic ash? To determine the mixing of ash with local aerosol sources? To validate FLEXPART?

P5320-5321. Instrumentation (lidar and CIMEL) . This part should be drastically shortened, providing a basic description (avoiding too many technical details) and citing the appropriate references.

P5324. Equations (1) and (2). It is not clear the way it is written which variable corresponds to the output of LIRIC . Is it C(z) in eq.2? The authors provide eq.1 as a method to convert ppb to mass concentration, but in the right part of the equation it is missing

the quantity to be converted. The authors should also provide a physical meaning of the term ppb when it comes to aerosol concentration. Ppb as a unit suggests a ratio. In line 25 what does pure non-volcanic mean? Please rephrase.

P5326 The author should provide here a short description what is the case study all about. In addition in line 5 the authors mention that for this period no dust was predicted, does this necessarily mean that no dust was actually observed? Please add an appropriate comment.

P5327-5328: It would help the reader a lot if Figs 2,3 and 4 would be merged in a single multi-panel figure keeping the same time-span for the x-axis (which is not the case now), so that they could be directly comparable. As it is know these figures include different number of days and this brings some confusion.

P5328. Line 7. The radiosonde could not show the existence of a dry aerosol layer, could only indicate a dry layer. Please rephrase. Line 20: Is the aerosol-cloud discrimination scheme an automated procedure? Any references?

P5329 and P5330. Figure 5 is highly confusing. It suggests a multi layer structure (not simply upper and lower troposphere) not discussed or shown earlier. In addition it is risky to associate measured lidar signals around 2 km to ash. A scatter plot would be more helpful if a comparison of the CM is what the authors want to demonstrate. P5330-Lines8-13. Are these small particles in the lower troposphere associated with the volcano? Any physical explanation? lines 14 to 24 (P5330) there is a discussion on correlations based on an analysis not shown. The authors should either remove this part or if they think that it is essential for the paper they should support this with a different figure 5. To my opinion Figure 6 does not provide anything new in the discussion. The text provided here could assist the description of a revised figure 5.

P5331. Since FLEXPART uses only ash as a source the comparison with LIRIC, which uses lidar signals that correspond to the real atmosphere, would help to determine the state of mixing with other aerosol types rather than to validate the model. The authors

should make an appropriate comment here.

P5332. The positioning of the LIRIC layers is directly associated with the layers in the lidar signals, so there is no need to repeat here the discussion on the height of the layers. The authors should focus how the concentrations compare and give emphasis on pure and mixed layers. The discussion about correlation coefficients should be avoided, since they are based on limited cases and they don't have any statistical significance.

P5334. Lines 13-15. The authors probably mean μg/m3 and not mg/m3. The discussion of the lower part of figure 10 is highly speculative and confusing. Is surface PM10 based on measurements? If yes such a small variability of surface PM10 could associated to many other factors (local variability, meteorology etc). I would suggest to remove this part if not supported with further evidence.

P5335 to 5337. This part of the discussion is very well written but it comes late in the paper. Eventually the authors should merge this part with the previous section, first present this part and then LIRIC, and thus they would avoid describing many times the same layers with a different perspective every time.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 5315, 2013.