The paper has been revised following the precious comments and suggestions of the reviewers. Thanks to their comments we think that the paper is strongly improved especially concerning the effectiveness in communication of the obtained results.

In the following, our answers to each one of the reviewers' comments (in italics) are reported and when necessary the related revised text of the paper is reported in bold.

F. Marenco (Referee) franco.marenco@metoffice.gov.ukReceived and published: 7 January 2013

The paper by Gelsomina Pappalardo et al. combines the measurements by different lidar groups within the EARLINET network to establish an extended dataset of volcanic ash observations over Europe in April and May 2010. Volcanic layers were observed in the free troposphere at nearly all EARLINET stations, at different times during the eruption of Eyjafjallajökull: over Northern and Central Europe at first, followed by the South and the Southeast on the end of April, and later in May over Spain, Portugal, the central Mediterranean region, and the Balkans. An aerosol typing methodology based on backtrajectories has been established, which permitted to isolate aerosol classes based on their origin, and in the end compile a map of volcanic layers. The aerosol mask determined in this way is shown for four example sites (Hamburg, Palaiseau, Granada, and Cabauw), and discussed in detail. Finally, the European sites are grouped into five clusters, based on their region, and the evolution of the plumes for each cluster is described. The full dataset is made available for scientists on the EARLINET website. The main highlight of this article is the presentation of ground-based lidar observations on a continental scale for the full duration of the volcanic event. To my knowledge, this is the first time that such a detailed dataset is produced, and for this reason the paper deserves full attention: in fact, in the years to come such a detailed dataset could prove extremely precious for studies on dispersion modelling and on satellite retrievals. I feel, however, that the article could be differently organised, that the material could be presented in a more efficient manner, and that the discussion could try to summarise better the evolution of the volcanic layer at a continental scale. Indeed, this is stated as the main purpose for this article, but is actually a little lost in the discussion of the five clusters; moreover, although the quantitative estimates are briefly described in the text in terms of peak backscatter coefficient and AOD, all figures are limited to qualitative (aerosol mask) and geometric (vertical layering) aerosol properties. Presenting the results in terms of maps would probably help the reader make sense of the results in a pan-European view. Finally, I believe that the technical details of the relational database should not belong to the paper. In summary, very good scientific observations have been collected and summarised in one dataset, and they deserve just a slightly deeper insight in the form in which they are discussed, so as to give us the big picture and highlight the most interesting features of the volcanic ash plume over Europe. Note that at the time of writing these comments I have not gone through the dataset on the website; only through the material presented in the article.

We followed the reviewer's suggestions about the re-organization of the paper and added some maps and discussion about the volcanic aerosol load as observed over Europe. The technical description of the relational database as suggested also by the other Reviewer has been removed from the Appendix and simply used as manual of the relational database itself (available at www.earlinet.org).

Specific comments follow.

Major points:

1. *We need some maps of the lidar observations to meet the claim of a study on a continental scale. Therefore, I suggest replacing figure 1 with four figures (1a–1d) as follows. Each figure represents the location of the plume as from the dispersion model at a given date and time, and over it the observations are overlayed with a colour code in terms of ash AOD for each ground station. Each of the four figures represents a different date, i.e. 16/4, 17/4, 19/4 and 21/4. Similar maps at later times in May could also be shown, where the authors believe that interesting features are to be highlighted.*

Maps with the location of the plume forecast by the dispersion model overlayed by aerosol content obtained from lidar observations have been added. Integrated backscatter at 532 nm values have been preferred because more abundant throughout the network respect to IB at other wavelengths and AOD. However it should be considered that these maps have the only scope to better visualize the observations and do not represent a detailed comparison between dispersion model and the observations which are out of the scope of the paper because for this it would be necessary an extended discussion that would made heavy the paper (already long and full of information), and more important this kind of study would require a strong contribution by the modelers. Because the paper presents observations for the whole volcanic event (April – May 2010) and following the suggestion of the reviewer, we have decided to include maps covering the three main periods of the event (16-21 April, 6-10 May and 17-22 May). However, in order to reduce the number of additional figures we have grouped in a single figure each of the three main periods as identified from lidar observations.

These figures and related text are in the current version of the paper at the end of Results (old Section 5, now Section 4) for a twofold reason. First of all the old section 3 has been completely removed and moved to section 2 and 4 (now sections 2 and 3) following both reviewers' suggestion. In addition, the old figure 1 was intended for providing an overview of the event as described by independent source. In the current version, the revised figure 1 (now figure 11) and similar plots for the other two interesting periods (figures 12-13) report the maximum volcanic aerosol IB. The identification of volcanic aerosol layer was through the masking procedure (old section 4, now section 3). The geometrical properties of volcanic layers observed over Europe are reported in section 5 (now Section 4). Therefore the figure and the agreement with dispersion model are discussed at the end of Results Section (old section 5, now Section 4).

2. *Figures 2–10 contain a lot of useful information, but are lacking in terms of showing the quantitative estimates. Therefore, for each cluster in figures 6–10, I propose showing an additional time series for the ash optical depth at either: all sites in the cluster; the average of the cluster; or a representative site in the cluster. Moreover, a similar plot could also be shown, with peak backscatter or peak extinction instead of OD.*

A figure with IB time series for each cluster was added (Figure 10). A further figure was added in order to improve the readability instead adding time series to the old Fig 6-10 (now figures 5-9) because as from both reviewers' comments those figures were already difficult to read. As above, IB has been chosen as quantity to be reported because more abundant than AOD. We reported IB time series for the average of the cluster and for a representative site in the cluster.

3. *Section 3. This section seems to interrupt the flow of reasoning, and moreover overviewing the volcanic event is not an aim of the article. I would therefore break it as follows: (a) the paragraphs on p. 30212 could become part of the introduction; (b) the first paragraph of p. 30213 (good agreement between EURAD and EARLINET) would be better in the conclusions, with some more detailed supporting evidence given within the paper; (c) the remaining part of section 3 could be attached to section 2.*

Section 3 has been completely removed from the new version of the paper. Part of the text was moved to Section 1 (the volcanic event), Section 2 (EARLINET quick report of the event), and old Section 5 (now section4) (fair agreement with EURAD).

4. *The last paragraph of section 5 (aim of the paper) could actually be moved to the introduction as well.*

The sentence about the aim of the paper has been moved from Results section to section 1 following this suggestion.

5. *Remove appendix and figures A1–A4. This material will be better placed in a data user manual on the EARLINET website.*

Done

6. *p. 30209, line 4. The paper by Marenco et al. (2011) does not only show that airborne lidar observations are feasible, but also makes a detailed dataset available in a similar way to the present paper. Ash layers have been identified in time and space, and quantitative estimates of concentration and optical proper- ties are given. This dataset has already proven useful in a series of modelling and remote sensing studies. I think therefore that it could be worth mentioning with a little more detail here that these two papers show complementary data, and maybe some general quantitative comparison could be given in the results and/or discussion, indicating similarities and differences between the datasets.*

The reviewer is right, we know that Marenco et al. (2011) does not only show the feasibility of airborne lidar observations for such kind of event. However, in this specific section we are just mentioning all the other lidar observations carried out for this volcanic event from different platforms (ground-based, airborne and satellite). It is not the aim of this paper to discuss detailed comparisons with other observations because this should be done for the whole period (April-May) and for all the other observations/campaigns (including all the airborne and satellite data) and this would be too much for a single paper. However because in Marenco et al., (2011) quantitative estimates of concentration and optical properties are given, we have included this reference also in the paragraph related to specific cases studied in detail.

7. *p. 30214, lines 16–18. (a) "Longest available wavelength": add the words: "for each station"; (b) the wavelength used will depend from site to site, but it is worth specifying a range of longest available wavelengths, e.g. "532–1064"; (c) specify your detection criteria in quantitative terms, e.g. what thresholds are used on the backscattering coefficient and/or its derivative?*

OK for points a) and b). About c), details about the detection criteria in quantitative terms are reported in Mona et al., 2012. However the main points about the detection criteria are reported in the paper:

- Only backscatter data with a relative statistical error lower than 50%

- where the derivative method is not applicable, layers are identified layers are identified as those regions where the scattering ratio (i.e. the total-to-molecular backscatter ratio) is higher than a pre-defined threshold chosen as the value for typical aerosol background conditions plus 15%

For the sake of clearness, we add the limit on SNR for switching between derivate and scattering ratio methods for layering.

Tests performed on several EARLINET station data identified 30% as a reasonable statistical error limit for the application of the derivative method.

8. *p. 30215, line 11. Specify how cloud screening is done, i.e. manual vs. automated, thresholds used, etc. In a similar way, indicate how you distinguish cirrus from aerosols (p. 30221, line 21). As a matter of fact, cirrus data could be left in the database if properly flagged as such, and could represent a valuable starting point for studies on the aerosol-cloud interaction. Several publications exist that highlight the formation of ice clouds within volcanic layers.*

Clouds are removed manually: low clouds are identified mainly by eye, cirrus instead are identified by temporal dynamical evolution, high particle linear depolarization ratio, and almost neutral backscatter spectral dependence. The cloud screening procedure is part of the methodology for aerosol masking reported in Mona et al., 2012 and therefore we refer to it for more details. A short sentence has been added in the revised paper:

Cloud screening is performed manually by each station (low clouds) and in a centralized way (cirrus clouds). In particular, cirrus clouds are identified on the basis of cirrus high particle depolarization ratio, neutral wavelength dependence and temporal evolution.

Cirrus data, when retrievable, are reported in the original EARLINET file and correspondingly the file is labeled as containing cirrus information (i.e. it belongs to the "cirrus" category file). Data about possible interactions between cirrus and aerosols are not removed. We fully agree with the reviewer: aerosol-cloud interactions are in general and in particular for volcanic cloud a really interesting topic. A devoted discussion about this aspect is needed, but the discussion about it is out of the aim of the paper and it could be addressed in a different paper.

9. *p. 30215, line 12 and following. Specify how you set the aerosol type based on backtrajectories. Is it an automated method or do you do it manually? Have you got predefined criteria? How universal do you think the criteria are?*

The aerosol type is not set from backtrajectories analysis. As stated in the paper, "the aerosol type is set using model output and with the support of Multiwavelength Raman lidar measurements performed within the network", once the particle main path is identified. The procedure used was manually applied. The use of backtrajectory analysis for the identification of aerosol origin is nowadays well recognized, especially for large-scale sources such as desert regions. Particular attention is needed in presence of highly localized sources, as in the case of volcanic eruptions. The trajectory/models/observation integrated approach demonstrated already in the past to be the best way for the aerosol type identification (e.g. Mona et al., 2006b; Muller et al., 2009; Pappalardo et al., 2010) and for volcanic aerosol in particular (Villani et al., 2006). Initial results obtained using the HYSPLIT runs are compared to the other backtrajectories analysis. In most of the cases, the origin and type of the observed particles is clear already at this level, but particular attention should be devoted in case of transition between different atmospheric conditions because of the high instability of the backtrajectory analysis in the transient regime between different situations. For these cases, advanced lidar observational capability and climatological analysis available at the observational site could permit the aerosol typing. An example of this type of condition is reported in details in Mona et al., 2012. At the end however situations not clear with this kind of approach still remains and are reported as "Unknown aerosol" in the masking.

A short paragraph about this has been added:

Within EARLINET, it has been shown that a careful analysis based on lidar observations, air-mass backtrajectories and modeling tools allows for a detailed classification of the observed aerosols (e.g. Mona et al., 2006; Muller et al., 2009; Villani et al., 2006; Pappalardo et al., 2010). The methodology described above has been manually applied to all the layers identified. In most of the cases reported in this paper, the origin and type of the observed particles is clearly defined through the backtrajectories-models combined approach. Particular attention was needed in case of transition between different atmospheric conditions because of the high instability of the backtrajectory analysis in the transient regimes. For these cases, advanced lidar observational capability and climatological analysis available at the observational site could permit the aerosol typing. An example of the aerosol typing for this condition is reported in details in Mona et al., 2012. Situations not clearly identified with this kind of approach still remains and are reported as "Unknown aerosol" in the masking.

10. *Subsection 4.1. The Hamburg site shows a marked diurnal cycle, as opposed to other sites. I suggest commenting why this is. Is the effect real, or is it an instrumental effect due to how the alternance of day and night affects the background? Ancillary meteorological data should be able to confirm it (e.g. diurnal cycle of temperature near the surface).*

The observed diurnal cycle in Hamburg observations is an instrumental effect. We revised the sentence for making it clear:

The apparent temporal behaviour of the top altitude of the volcanic layer is exclusively related to an instrumental effect of the differences between daytime and night-time signal-to- noise ratio conditions.

11. *Subsection 4.2. I believe that it could be quite hard to distinguish a volcanic ash layer from a Saharan dust layer, based on lidar observations, or to identify the boundary between the two; even more difficult would be to tell when two such layers are mixed together. On the other hand, are backtrajectories alone reliable enough as to be sufficient for separating these two air masses with certainty?*

The case EX2 is reported here as example of results. We do not aim to describe here in details the methodology and its application to the whole Eyja related database collected within EARLINET. Again, Mona et al., 2012 described in much more details the used methodology. Particularly interesting about the point raised by the reviewer is the description in Mona et al., 2012 of the aerosol typing in a case of Saharan dust and volcanic co-presence at Potenza site. In Mona et al., it is described how the dust/volcanic aerosol mixing and separation are identified.

At this point in the revised paper we added the following sentence:

Aerosol typing in situations with different long-range transported aerosols is really challenging. In such cases advanced lidar observational capability and climatological analysis available at EARLINET sites could permit the aerosol typing. In particular, intensive properties and their temporal evolution are used here for discriminating different aerosol types such as dust and volcanic particles. A detailed example of aerosol typing for mixing situations is described in Mona et al., 2012.

12. *Subsection 4.3. The volcanic ash shown in figure 5 on the evening of 17 May has also been sampled by the DLR and FAAM aircrafts, and it has been studied in several papers (Turnbull et al. , 2012; Newman et al. , 2012). It is a very good case study, and I believe that the differences and similarities between results could be given.*

Reviewer probably refers to section 4.4, Fig. 5 (now sect 3.4 fig 4), Cabauw 17-20 May.

The references suggested by the reviewer have been included in this example about the consistency with the altitude of the main layer as observed by the DLR and FAAM aircrafts on 17 May. No further discussion about differences and similarities are reported here because, as stated previously, this is out the aim of this paper. The references suggested by the reviewer have been included also in the introduction when the authors refer to specific cases studied in detail.

The text was revised as follows:

The strongest feature is located at about 5 km a.s.l. around 18:00 UTC on 17 May, consistently with what observed by the DLR and FAAM aircrafts (Turnbull et al., 2012; Newman et al. , 2012).

13. *Section 5. The figures are too small to be able to identify the features described in the text, e.g. the apparent descent of the aerosol layer (p. 30222, lines 27–29, and p. 30223, lines 9–12). This section is hard to follow with such small figures. I would try to lighten this section a bit and at the same time extend table 1 where all the highlights and differences for the clusters can be summarised.*

In the revised version of the paper figures 6-10 (now 5-9) are larger: related pages are now horizontally oriented and fig 6 (now 5) and 7 (6) in particular are 1 full page figures. Related text has been slightly lightened here. However following the reviewer's suggestion we added a new figure with IB for each cluster (Figure 10) and we added comments on it. Moreover, highlights and differences for the clusters are discussed later on where the new map figures are described.

14. *Where quantitative information is given, is it worth attempting an estimation in terms of ash concentration as well? E.g. the features described on line 20 on page 30223 could be worth ∼ 2500–3000 μ g/m 3 , which is a large concentration.*

The reviewer is right when he says "estimation" in terms of ash concentration, because with lidar observations we can provide just estimation for ash concentration. These estimations are based on specific assumptions which could be valid for a specific case (specific location and time) and not for the others. Because the aim of this paper is to present the volcanic cloud (both ash and volcanic aerosol) over Europe as observed by EARLINET for the whole April-May period, we have decided to do not include any specific estimation for ash concentration which in this case, for the whole event, not necessarily can be based on a simple conversion based on a general assumption. These estimations could be provided in a specific further study where EARLINET observations could be integrated with models and with all the other available measurements (mainly airborne measurements both remote sensing and in-situ). Regarding the features described on line 20 on page 30223, these refer to the observations over Hamburg. Those are the first EARLINET observations of the event, direct transport from the first eruption. This is also the maximum value, in terms of backscatter, as observed from EARLINET for the whole event. Please note that this is a peak value observed for a 1 hour time window only.

Minor points:

15. *"four-dimensional" (see title, abstract, and article text). It is unclear what the article means with this term. I suggest to use more traditional terminology, such as e.g. aerosol mapping and layering.*

4D data and analysis is currently a main point of interest at European and Global level for meteorological, environmental and climate purposes. This term is commonly used in international programmes as GAW. In this general context, we decided to keep four-dimensional term.

16. *"centre of mass" (this expression is used in several places within the paper). I believe that this term is not the most appropriate, because sampling is only in the vertical direction. Moreover, the layers not being rigid bodies, I would probably not claim that their dynamics can be simply summarised in terms of the centre of mass (p. 30220, line 21).*

The sentence about the meaning of the centre of mass" has been revised as follows:

The center of mass gives us information about the altitude where the most relevant part of the aerosol load contained is located. In absence of wind, the temporal evolution of the center of mass of the aerosol layer could give insight about the dynamics of the whole layer.

17. *"descent": this expression is used several times in the paper to describe the decrease in altitude of the aerosol layers at a fixed location. It has however been shown (see, e.g., Dacre et al. , 2011) that these features are often the result of the advection of a sloping layer rather that by an actual vertical motion. I suggest therefore the term "apparent descent".*

Done

18. *Use a consistent time scale across figures to facilitate reading: either time and date as in figures 2–5 or hours since April 15 as in figures 6–10. Using both is rather confusing. Moreover, if you are going to use the date/time type of scale, it would be a bonus to have a consistent time across dates.*

In the revised paper time scales are now homogeneous throughout the figures: hours since April 15, 0000 UTC scale is used for figures 2-10 (now 1-9). In particular, figures 2-5 (now 1-4), where data for max 8 days are reported, the date/time type scale also reported allows one a better timing identification on these shorter time scales. On the other hand, fig. 6-10 (now 5-9) also report information about date in the upper part of the panels.

19. *Colours used in figures 2–5. In my printed copy continental and medium ash content show in the same colour; the same can be said for PBL and unknown.*

The colours on the screen are clearly different. This could be probably a problem related to the printer.

20. *p. 30206, line 7, "Raman". I believe that Raman channels are in general only used at night, and that a large part of the observations here pertain to elastic channels.*

The reviewer is right. Most of the aerosol optical properties profiles contained in this paper are obtained using only elastic channels because Raman signal detection is typically done during night-time conditions. However the Raman capability available at most of the EARLINET stations (20 over 27 up-to-date) is fundamental for this work as well. This capability is important for different reasons:

- day by day, the information obtained by elastic/Raman measurements is used for improving the elastic retrieval in daytime conditions (e.g. more reliable lidar ratio S assumptions)

- the long-term Raman measurements available at each site are essential for the calibration procedure needed for the backscatter retrieval from the only elastic signal

- climatological studies on S value available at Raman lidar stations provide reference S value to be used in the elastic retrieval of backscatter profiles

- the knowledge about S and Angstrom exponent typical for a site in the various scenarios (local aerosol, dust intrusion and so on) as from long-term Raman measurements is fundamental for the aerosol typing investigation

Because of it, even if reported measurements are often limited to the only elastic channels, the Raman capability available within EARLINET is an essential characteristic of the network for realizing the 4D analysis object of this paper.

21. *p. 30306, line 19, "lower stratosphere". No stratospheric observations are shown in this paper.*

Removed from the abstract.

22. *p. 30207, line 12, "aerosol typing". Replace with "proxies for aerosol type" (no direct measurement of composition is made).*

The expression "aerosol typing" (or equivalent ones) is used commonly in the community meaning proxies for aerosol typing. A typical example is the world-wide used CALIPSO data. Therefore we decided to leave the expression as it is.

23. *p. 30209, line 23. A few words should be spent here to say how the ash mask is determined, e.g: "... aerosol mask, based on backtrajectories and supplemented with estimates of lidar ratio, depolarisation ratio and colour ratio (Mona et al. , 2012)".*

We revised the sentence as follows:

Volcanic particle layers have been identified for all the EARLINET stations using a specific backtrajectory-models-lidar observations integrated methodology for a volcanic aerosol masking (Mona et al., 2012).

24. *p. 30218, lines 16–18: observation of ash layers within the PBL. State your criteria to say that ash is mixed within the PBL (I believe that you use depolarisation, but it should be stated).*

In the specific case the reviewer refers to, the intrusion of volcanic particles inside the PBL is supported by the depolarization measurements. However the temporal evolution of the layers and the vertical and temporal behavior of the different aerosol parameters, in particular of the intensive ones, are used for identifying the intrusions of volcanic particles into the PBL. Of course whenever depolarization measurements are available they are really useful for the detecting intrusion of ash particles in particular in the PBL (where urban polluted no depolarizing particles are expected), but we have to underline here that in this paper we are considering not only ash particles but volcanic particles in general (ash and no-ash particles). Therefore both high and low depolarization values could be observed in case of intrusion into the PBL corresponding to ash and no-ash particles, respectively. The investigation of the temporal evolution of the layers and of the aerosol intensive optical properties is used for the identification of intrusion into the PBL.

The following sentence has been added in the revised paper:

These situations are identified, in the whole study, on the basis of the temporal evolution of the layers and modification of aerosol optical properties in the PBL region, in particular of particle linear depolarization ratio and other intensive properties.

25. p. 30227, line 25, "resolution". Add "vertical".

Done

References:

Dacre et al. (2011), J. Geophys. Res. 116, eid: D00U03, doi: 10.1029/2011JD015608.

Marenco et al. (2012), J. Geophys. Res. 116, eid: D00U05, doi: 10.1029/2011JD016396.

Newman et al. (2012), J. Geophys. Res. 117, eid: D00U13, doi: 10.1029/2011JD016780.

Turnbull et al. (2012), J. Geophys. Res. 117, eid: D00U12, doi: 10.1029/2011JD016688

These references have been added where needed.

Anonymous Referee #2 Received and published: 21 January 2013

GENERAL REMARKS

The manuscript by Pappalardo et al. presents a survey of observational data from the lidar network EARLINET which were collected during the Eyjafjallajökull volcanic eruption in spring 2010 and the subsequent spreading of the volcanic ash plume across Europe. Stations all across Europe are included and the resulting data set permits the investigation of the distribution of volcanic ash in the free troposphere and its entrainment into the boundary layer over Europe in all four dimensions including time. An aerosol mask is presented for aerosol type determination based on single-wavelength backscatter coefficient data. Although some of the EARLINET stations are equipped with much more advanced lidar instruments, the limitation on single- wavelength backscatter signals allows the inclusion of daytime data from all stations in order to increase spatial coverage of the dataset. The European stations are grouped in five clusters from Central to Eastern Europe and to the Eastern Mediterranean Sea for investigating the temporal evolution of plume dispersion. A set *of observational parameters is presented (center of mass, base and top of the identified volcanic layer) which is analyzed for all five EARLINET station clusters in order to provide a consistent picture of plume evolution in the free troposphere. The study presents a world-wide unique data set of high quality and of outstanding relevance for further investigations on volcanic plume dispersion processes and transport model evaluation. The data analysis is thorough and scientifically sound and undoubtedly deserves publication in ACP after consideration of minor revisions. Mainly, improvement is required for the organization of the manuscript and the presentation of the material.*

Major points for reorganizing the manuscript are the following:

1. *The last paragraph of the abstract (page 30206, lines 25-28) is a repetition of material given earlier. This paragraph can be removed.*

The sentence has been modified as follows in order to remove repetition but leaving the message about the importance of this study:

The 4D distribution of volcanic aerosol layering and optical properties on European scale here reported provides an unprecedented data set for evaluating satellite data and aerosol dispersion models for this kind of volcanic events.

2. *Section 3 should be split up and included partially in the introduction and partially in the EARLINET section as follows. The first two paragraphs of section 3 may be moved to the introduction starting from page 30207, line 25. After the description of volcanic aerosol in the troposphere and stratosphere in general and the characteristics of the Icelandic volcanoes, the introduction may continue with the description of observational details. The material given from page 30213, line 25 should then be merged with the material in the introduction on EARLINET observational data.*

Section 3 has been completely removed following both reviewers' comments. Part of the text was moved to Section 1 (the volcanic event), Section 2 (EARLINET quick report of the event), and Section 5 (now section 4) (fair agreement with EURAD).

3. *Section 2 should be partially shortened and merged with material from section 3. The overall features and achievements of EARLINET which are listed on page 30210 from line 8 to line 20 should be restricted to applications which are relevant for the presented study. The last paragraph of section 2 contains already presented material and should be shortened or removed. The material presented in section 3 from page 30212, line 22 to page 30213, line 24 should be moved to section 2. Then all observational data from EARLINET on the evolution of the volcanic ash plume are presented in a single section.*

Done. In particular:

Page 30210 lines8-20: the main activity of EARLINET about lidar measurements on continental scale is here shortly reported. We reduced the text. However, this part is not restricted only to the volcanic particles because also the other aerosol types observations are important for the aerosol typing methods applied within this paper.

Lidar observations within the network are performed on a regular schedule since May 2000, allowing the collection of long-term data set for climatological studies (Matthias et al., 2004a). In addition to the routine measurements, further observations are devoted to monitoring of special events such as Saharan dust outbreaks (Ansmann et al., 2003; Mona et al., 2006; Papayannis et al., 2008; Rascado et al., 2009; Wiegner et al., 2011), forest fires (Müller et al., 2007; Amiridis et al., 2009), photochemical smog (Carnuth et al., 2002) mixed with biomass burning particles (Mamouri et al., 2012), and volcanic eruptions (Pappalardo et al., 2004a; Wang et al., 2008; Mattis et al., 2010).

The last paragraph: removed.

Section 3 from page 30212, line 22 to page 30213, line 24: text from page 30213 line 5 until the end was moved to section 2. Text about the volcanic plume as from the dispersion model has been moved to Section 5 (now Section4) together with new figures and discussion as suggested by reviewer 1.

4. *The description of the aerosol mask requires some clarification. It is highly recommended to summarize the mask features in an additional table which makes it much easier for the reader to revisit the aerosol mask characteristics when looking at Figures 2-5. It should also be discussed how the vertical separation of different aerosol types was obtained. In particular, the sharp separation of volcanic ash and mineral dust as presented in Fig. 3 is questionable.*

The aerosol masking methodology and its application to the whole Eyja EARLINET database are highly complex. We do not aim to describe here in details the methodology, which instead is fully described in Mona et al., 2012. At the beginning of section 4, four cases as examples of masks reporting different main conditions are reported. The mask features are already summarized in the related text where we comment the fig 2-5 (now fig. 1-4). Additional table would probably only make heavier the paper. Concerning the sharp separation between dust and volcanic particles (ash + no-ash volcanic particles), the reviewer is right. Distinguishing between different types of aerosol located close-by in the vertical column or sometimes mixed is really challenging. Of interest is the description in Mona et al., 2012 of the aerosol typing in a case of Saharan dust and volcanic co-presence at Potenza site. There it is described how the dust/volcanic aerosol mixing and separation are identified.

A sentence about this point is added in the revised paper:

Aerosol typing in situations with different long-range transported aerosols is really challenging. In such cases advanced lidar observational capability and climatological analysis available at EARLINET sites could permit the aerosol typing. In particular, intensive properties and their temporal evolution are used here for discriminating different aerosol types such as dust and volcanic particles. A detailed example of aerosol typing for mixing situations is described in Mona et al., 2012.

5. *The appendix may be moved to supporting information or to the EARLINET website because this material is of relevance mainly for those who want to work with the data.*

Done

SPECIFIC COMMENTS

1. *Figures 6-10 require revision of the way the material is presented. Currently it is difficult to take the message from the figures. Furthermore, the meaning of numbers on the x-axis is not clear. It is also recommended that all figures should start at the same day in hours since April 15, 0000 UTC. Actually, Fig. 8 starts with respect to 14 April.*

Figures 6-10 (now 5-9) are larger in the revised version of the paper.

The use of scale in hours from the beginning of studied event was chosen following the typical scale used in geophysics. However information about the time and date is provided on the top of the panels and fig 2-5 (now fig 1-4) in the revised paper have together with date/time time-scale the indication of the hours since 15 April 0000UT.

Thanks for the comment about fig 8. We correct the axis in the revised paper.

2. *It might be worthwhile to include a column on plume age after emission or atmospheric transport time in Table 1. This information is actually missing.*

The plume age is not reported in table 1 (neither in table 2) (now table 2 and 3) because its estimation is not trivial. Apart for some easy cases as could be the Hamburg case (eruption phase just started and transport almost direct toward the lidar site), typically volcanic particles emitted in different moments of the eruptive phase coexist in the vertical sounded atmosphere. Only specific integrated studies with transport model could permit a detailed investigation of the transport, ageing, mixing and modification of aerosol optical properties (see for example Villani et al., 2006).This could be object of further investigation in conjunction with modelers.

MINOR POINTS

1. *Affiliations: please remove detailed street names from affiliations 20 and 31.*

Done

2. *Page 30208, line 28: split “onboard” into separate words “on board”.*

Done