

## ***Interactive comment on “Four-dimensional distribution of the 2010 Eyjafjallajökull volcanic cloud over Europe observed by EARLINET” by G. Pappalardo et al.***

### **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

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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.
  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.
  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

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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.

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.

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.

#### 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.

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.

#### MINOR POINTS

1. Affiliations: please remove detailed street names from affiliations 20 and 31.
2. Page 30208, line 28: split “onboard” into separate words “on board”.

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3. Page 30209, line 1: insert line break after “sea.”
4. Page 30210, line 25 to page 30211, line 1: Please rephrase this sentence. Actually grammar and structure sound somewhat odd.
5. Please check the spelling of the word “homogeneous” throughout the manuscript.
6. Page 30228, line 14: Please rephrase “ . . . for all Southern European stations.”

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30203, 2012.

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