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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Monitoring of the Eyjafjallajökull volcanic aerosol plume over the Iberian Peninsula by means of four EARLINET lidar stations" *by* M. Sicard et al.

A. Omar (Referee)

ali.h.omar@nasa.gov

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Review of Monitoring of the Eyjafjallajokull volcanic aerosol plume over the Iberian Peninsula by means of four EARLINET lidar stations by Sicard et al.

General Remarks: This is a well written paper on the Eyjafjallajokull volcanic plume that reached parts of the Iberian Peninsula as observed by EARLINET lidars and AERONET sun photometers at four stations in Spain and Portugal. The authors show aged and appreciably weakened plumes with optical properties barely registering above background levels.

Reviews and Comments: A major strength of the paper is the use of multiple mea-

surements along with back trajectory analyses to track the plumes and characterize the optical properties of volcanic aerosol at the four stations. The paper's weakness lies in the inability to show convincingly that the observed lidar and sunphotometer derived optical properties, especially the aerosol optical depths and concentrations are well above background levels at the measured altitudes and do represent layers that are not usually found above these stations. Fortunately, this flaw is not fatal and can be addressed by auxiliary measurements in this region. It may be instructive to examine some CALIPSO - CALIOP observations of plumes in this region during the study period -May 5 to 8. In particular, a CALIPSO nighttime orbit that passes close to the IP stations on May 06 near 37.66 N, 7.31W shows some lofted layers with properties consistent with a volcanic plume (Note that while CALIPSO does not classify volcanic plumes, these plumes have properties akin to dust or polluted dust and are classified as such). There are similar weak plumes mixed with clouds on May 08. The horizontal context afforded by CALIOP observations enhance the argument that the observed weak layers are indeed plumes transported over a long distance and predicted by the trajectories shown in Fig. 2.

Abstract - part of last sentence should read '1.5 times higher' (you have omitted times)

Introduction - you do not cite any work that shows the greenhouse gas emissions decreased significantly during the air travel disruptions. The operative word 'significantly' denotes some quantified measure relative to the total global emissions of GHG. If you choose not to cite any work or quantify the GHG decrease relative to global output, then I suggest deleting the word 'significantly'.

In section 2.2 explain why the aerosol optical depth at Caceres is expected to be representative of conditions at Madrid though the distance of 250 km is larger than scales at which aerosols are expected to be homogenous . Furthermore, Madrid is a much larger metropolitan area than Caceres. Also, authors need to say something about why they chose to use AERONET Level 1.5 instead of 2.0 at some sites.

Section 3.1 - Part of the last sentence should read 'several days of unstable' [instead of 'instable']

Figure 2 is difficult to read. I do not know how much control you have over these plots but please try to improve the legibility of the axes labels, and the sharpness of the tracks. The labels for time and altitude are not legible. In addition, mark the location of the volcano on the maps to aid the reader verify the origin of the plumes. Finally, the plumes takes a shorter time to get to Granada (3 days) than say Evora (4 days) yet the authors use a standard 5 days for all sites. I suggest a number of days back that will ensure plume arrival at each site to exclude irrelevant tracks and regions (N. America, Africa etc). Section 3.2 Figure 3 is introduced but not sufficiently discussed. The authors should explain why the measurements are so discontinuous. For example, why does Barcelona have only a few hours of lidar measurements on the 5th and 8th of May?. Why are there no range squared corrected signals (RSCS) on May 6, 7 and sunphotometer measurements on May 6? Why are the measurements at Madrid so spotty? Have the authors excluded cloudy scenes? If so, I suggest including all measurements (both cloudy and clear) for completeness. You can then present a companion Figure without clouds if you so choose.

The authors state that the presence of clouds prevented further analyses. Are these clouds completely opaque and impenetrable by the lidar signal? If the volcanic aerosol (VA) is not embedded in the cloud, is it not possible to analyze a VA that is above or below a cloud? I suspect it is albeit with a degraded signal, higher uncertainties, and without a corresponding sunphotometer measurement. With reference to Table 2, discuss why there were no measurements at Barcelona on the May 5,6, 7 and Evora on May 8.

Section 4. Are these the only 3 cases with good quality inversions? If not say why the other good quality inversions are not included in these intercomparisons? Section 4.1.1 Authors give an explanation for low lidar ratios as being a result of dehydration of the air mass. These should lead to the size distribution shifting to smaller mean radii. Can

this be confirmed by the angstrom exponents and/or AERONET size distributions? Is a better explanation that the aerosol has lost a significant portion of its coarse component by sedimentation in transit and the effect of the remaining fine particles is dominant?

Estimating mass concentration: The paper Tesche et al.(2011) does not seem to be accessible. However, I find the paper Ansmann et al.(2011) to be quite adequate in explaining this method. I suggest omitting the reference to Tesche et al. (2011) since it is an extraneous reference.

Concluding Remark: In general, the AOT values are very low. If these led to air travel disruption in the IP the authors should point out this societal inconvenience and over-reaction by policy makers.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 29681, 2011.