

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

A. Mortier et al.

augustin.mortier@ed.univ-lille1.fr

Received and published: 6 February 2013

Thank you very much for your comments and remarks that will improve the quality of the paper. They have been taken account. Here are the answers to the different questions asked.

- P 31037, line 9 and after : AODs are more frequently given at 550 nm, and as lidar measurements are made at 532 nm, this may be even more directly comparable, why is the sunphotometer AOD given at 440 nm ?

We agree with that comment. Values in the text are now given at 532nm. The Fig 1. has been replotted in accordance.

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-P 31038 : lines 1 to 6 : how do these values compare with results from in situ and other observations ?

Near the observing site (<5km), a station is measuring continuously PM10 and PM2.5 No PM increase could be observed and linked to an ash intrusion (over the usual PM variability).

- P 31039, lines 2-5 : mention that trajectories were examined over the whole troposphere (no a priori lidar information)

The Lidar information has in fact been used to specify final altitudes of the back-trajectories over Lille when layers were detected (16 to 18).

-P 31040, line 12: the afterpulse alone is not the reason for preventing to get useful data. Saturation and geometrical factor are additional sources of problem in the signal near the emitter.

In our case (one telescope for both emission and reception) the geometrical factor can, theoretically, be corrected since ground level (even if not accurate...), because emission and reception are on the same way. Because of the very low overlap near the ground (and the relative clear low atmosphere in Lille), no saturation should occur.

-P 31040, line 20 : the free troposphere is extending from the boundary layer top height to the tropopause height. The discussion here is a little bit confusing due to a mixing of case study and general statements.

As said in one remark of referee #1, the description of fig. 5 (line 25, same page) was not enough detailed. Therefore, we provide, in the new version of paper, a more detailed description of Quick Look, particularly for the first period (April). This add-on follows the general patterns and would facilitate the separation between the general patterns that we wanted to remind, and the case study.

-P 31040, line 24 : “generally very clean” is not quantitative, what error value is expected ? give a reference.

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In Johnson et al., 2011, for example, a climatology of extinction from CALIOP show that the extinction level in the range 8-10km is in average below 0.001km⁻¹ (A global comparison of GEOS-Chem-predicted and remotely-sensed mineral dust aerosol optical depth and extinction profiles, JOURNAL OF ADVANCES IN MODELING EARTH SYSTEMS, VOL. 4, M07001. doi:10.1029/2011MS000109, 2012, Fig. 4). Similar results in the free troposphere (10-6m⁻¹) are presented in the book from Weitkamp, C., Lidar : Range-resolved Optical Remote Sensing of the Atmosphere, Springer, p133, 2005

-P 31042, line 12 : what is the residual error on signal after the correction of afterpulse has been performed ?

During daytime, corrected lidar signal can present negative values due to noise at about 10 km. This range is higher during nighttime (15 km)

-P 31043, line 24-25 : after overlap factor correction is performed ?

The extrapolation is done on the corrected signal (non linearity, after pulse, overlap and square range). A precision has been added on the extrapolation method as recommended by the referee #1.

-P 31045, line 7 : a LR value of 48 sr on 17 April does not appear to be consistent with what is written in page 31038 line 12.

The value of 54 sr written in page 31038 line 12 is the one derived by AERONET the same day. It is relevant for the whole SZD. Considering the coarse mode only, a value of 47 sr has been derived from AERONET, which is very close to the value of 48sr retrieved with the Lidar inversion. A precision on that point has been added in the paper.

- P 31046, lines 16-21 : changes in scattering properties with relative humidity as referred to are relative to more hydrophilic aerosols than ashes. The plume may not be pure ash, but the index would change. Need to adjust the discussion to the particle

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under study.

The result of about 50% is obtained in case of urban aerosols and give an idea of the biggest error possible. Ashes being less hygroscopic than urban aerosols, as well as dust (Kaden, N., 2008), the bias, although difficult to estimate, could be therefore much less important.

-P31048, line 25 : why consider a constant modal radius ? What is the impact of changing its value ?

Close to the end of the event (19 mai), the VSD exhibits a coarse mode (centered about 1.5-1.7 microns) (P31050 line 15), which is close to the values calculated at the beginning of the event. The VSD being not provided for each day during ash intrusion, a constant modal radius has therefore been considered in this paper for the AMC estimation. Following a remark of the referee #1, an additional table is provided in the new version of the paper. In this table, are presented the different uncertainty sources and their impact on AMC estimation. Among these parameters, the modal radius uncertainty is about 15% yielding to 20% variability on AMC. (Cf : P31049, lines 8-9)

-P31048, line 6 : back to the previous question on the impact of relative humidity.

The impact of humidity on extinction has been discussed before. At the AMC level, humidity can introduce errors by affecting radius and refractive index. The added table 2 (in the answer to referee #1) give an idea of the impact by changing one of these parameters.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 31031, 2012.

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