

Interactive comment on “Horizontal and vertical structure of the Eyjafjallajökull ash cloud over the UK: a comparison of airborne lidar observations and simulations” by A. L. M. Grant et al.

Anonymous Referee #2

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This review is late. The reviewer apologizes to the authors.

The paper of Grant et al. presents a study on the comparisons between airborne lidar measurements and the Lagrangian particle trajectory model NAME following the eruption of the Icelandic volcano Eyjafjallajökull on April-May 2010. The comparisons have been performed for the period of May. Many previous works deal with this topic as can be seen in the special issue of JGR (for example). The new inputs are not clear and have to be better highlighted before publication.

Moreover, the paper uses lidar data already published but the discussion about the error sources is very tenuous and incomplete in previous papers. The importance of

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lidar data in the paper requires a complete discussion on the main error sources before the publication.

Abstract

The new insights of the paper have to be better highlighted including the main results with their errors.

Note that the difference between the depth of the ash layer derived from the model and the lidar is not surprising considering the vertical resolution of the wind field and the numerical dispersion. It is not a main result of the paper.

1. Introduction

Note that the ash cloud was also observed close to Paris on April 2010. Comparisons between lidar and model were also performed.

Chazette, P., Bocquet, M., Royer, P., Winiarek, V., Raut, J.-C., Labazuy, P., Gouhier, M., Lardier, M., and Cariou, 2012: J.-P.: Eyjafjallajökull ash concentrations derived from both lidar and modeling, *J. Geophys. Res.*, doi:10.1029/2011JD015755.

2. Model

P9129, I 24: similar particle size was considered in Chazette et al. (2012) using the transport model POLAR 3D.

P91131, I 1-2: what is the required precision on lidar data for such an assessment?

3. Lidar

The method for retrieving the profile of aerosol extinction coefficient is not clearly explained. It is very important because lidar measures optical parameters and the ash mass concentration is derived from them.

With an airborne configuration, the inversion is unstable and may lead to serious uncertainties. An additional constraint is required to stabilize the inversion, itself associated

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with some uncertainties.

With the lidar used in this study, the total backscatter cannot be retrieved without combination of the two elastic cross-polarizations, and a calibration is required before retrieve the extinction coefficient.

All the main uncertainties on the lidar-derived optical parameters have to be discussed, as the uncertainty due to the conversion towards mass.

P9132, l 24-28: to move on the results. Why ice nucleation was not a problem for the other days? Is-it due to the level of the depolarization ratio derived from the lidar?

4. Results

P9133, l 7-21: what is the effect of the plume height on your calculations? A sensitivity study on a case-study with different levels of plume will be interesting.

P9133, l 22-23: how the concentrations are obtained from the lidar data? Add the error bars on the profiles on Figure 2.

P91134, l 1-5: It is possible to calculate a standard deviation between the observations and the template.

P91135, l 6: replace "Figures 4a-j show contour plots of ash concentrations obtained from NAME, averaged" by "Figures 4a-j show contour plots of ash column integrated mass loading obtained from NAME".

P91135, l 11-14: The location is linked to the transport and this discussion highlights or not the existence of a vertical wind shear.

P91137, l 25: correct "en route".

P9138, l 18: for this, you must show that the mass derived from lidar is obtained with the required precision, else α_{p} is bad constrained.

P 9138, l 19-23: similar comparisons have been done on Chazette et al. (2012).

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P 9138, l 26-27: the not-so-bad-agreement seems normal because it has been adjusted with the lidar data (at least a correlation exist).

P9141, l 2-4: this is a normal finding when comparing a model with lidar observations. This has been repeated several times in the text.

P9141, l 2-22: what is the uncertainty on lidar-derived ash mass concentration? This is the first element to give to the reader before results on the comparison between Model and data.

5. Conclusion

P9141, l 24: remove "the".

The conclusion has to highlight the new insights of the paper comparatively to previous findings. What do we learn more when we read this paper?

Figures

In general, the figures are too small and difficult to read.

Figure 1: . . . heights of ash layers observed by the lidar onboard FAAM aircraft.

Figure 2: label the figures with a, b, c and d.

Figure 3: increase the text size on the figure.

Figure 4: it is very difficult to read because close to stamp format.

Figure 5: . . .do not account for fall out. . .

Figures 5, 6 and 7 are very difficult to read, and make difficult the comprehension of the text.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/12/C3746/2012/acpd-12-C3746-2012-supplement.pdf>

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