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Atmospheric Chemistry and Physics Discussions

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.

A. L. M. Grant et al.

h.f.dacre@reading.ac.uk

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Reply Referee 2 ————————- 1. The question of what is different in this paper from the others published on this eruption has been dealt with under the comments of Referee 1.

2. The referee is, rightly, concerned about errors. However, this paper is not about the lidar technique but uses the data to assess the NAME model. Whatever the short comings of previous papers it is not appropriate in this paper to discuss in detail the problems with obtaining ash concentrations from the lidar. We have added a short paragraph in the discussion section giving the estimate of the error in the ash concen-

trations provided in Marenco et al (2011) since we appreciate the errors had not been discussed in the original version of the paper.

3. The resolution of the model, although not necessarily the wind fields, is 200m so the thickness of the layers is surprising. Since, as discussed this affects the ratio between maximum concentrations and column mass loadings it is an important feature of the NAME simulations.

4. Introduction.

We appreciate the reference, but have not included it since the modelling results in Chazette et al (2012) do not provide information on fine ash fractions which is one of the main concerns of the present study.

5. Model

P9129 l24 Any comparison with the Chazette et al results really needs to be made with the results in Dacre et al (2011) since they are from the same period.

P9131 l 1-2. There is no specific requirement for precision (accuracy). Obvoiusly the less precise the measurements the more difficult it may be to compare spatial variations with those from NAME. The accuracy determines the accuracy with which, for example, the fine ash fraction can be determined. We have added a very brief discussion on this in the discussion section.

6. Lidar

The derivation of the lidar concentrations is discussed in Marenco et al (2011), which is referenced. To reiterate a previous answer, this is not a study about the technique but is using the lidar data to determine how well the NAME model can represent the structure of the ash cloud, and to determine the effective emission rate for fine ash.

P9132 l 24-28. There is no evidence of ice problems in the other data. Also the ash layers are lower on the other days.

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Results

7. The paper studies all of the days in this period to derive an overall view of the structure of the NAME cloud and emission profiles. While a case study of the effects of plume height might be interesting it is not appropriate in this paper.

8. P 9133 l 22-23 The derivation of the concentrations is given in Marenco et al (2011) as given in the section 3. Adding error bars would not add to the figures. The factor of two uncertainty is systematic and easily imagined. The curves are a fit to the data, not a prediction, and the scatter in the points gives the reader a measure of the uncertainty in the fits.

9. P9134 l 1-5. It is possible to calculate standard deviations but they are not very informative and add nothing to the discussion of the results.

10. P9135 l 6 Text changed.

11. P9135 l 11-14. This is correct. We haven't changed the text because in the context of this paper it is just a fact. What is relevant is the effect shear has on concentrations which is mentioned and discussed later in the paper.

12. P9138 l18 text changed.

13. P9138 l 19-23. The fine ash fraction is poorly constrained since the lidar concentrations are poorly constrained.

14. Similar comparisons have also been done by Dacre et al (2011) and Devenish et al (2012). These results are discussed, but at this point all that is being given is the reason for doing such a comparison so references are not really needed.

15. P9138 l 26-27. We don't understand the relevance of this comment. The agreement in concentrations is due to adjusting the NAME results as stated by the referee and in the text. The correlation in space is the point that is being made at here since it indicates the ability of NAME to capture the horizontal structure. This is discussed in

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some detail in the section.

16. P9141 l 2-4. This is just an introductory sentence. The section discusses one of the important consequences of this problem, the reduction of the maximum concentrations.

17. P9141 l 2-22. We have added the estimated accuracy in the section on the lidar (section 3) and also in the discussion section.

5. Conclusions.

We have added a discussion section (and reduced the conclusions section to a shorter list.) We hope that this shows better what the paper is different about this paper compared to others.

Recently an estimate of the total tephra erupted from the volcano has been published which allows comparison between the present results on emissions and those in Stohl et al (2011) and Kristiansen et al (2012). This has been added to the discussion.

We appreciate that the figures are rather small, but this is a consequence of the format of the discussion paper. In the two column format the figures are much clearer.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 9125, 2012.