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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ground-based and airborne in-situ measurements of the Eyjafjallajökull volcanic aerosol plume in Switzerland in spring 2010" *by* N. Bukowiecki et al.

Anonymous Referee #2

Received and published: 2 August 2011

General comments:

This is a very interesting and valuable paper describing and interpreting in detail ground-based and airborne in-situ measurements, which have been performed in Switzerland during the eruption of the Eyjafjallajökull in spring 2010. Moreover, the results of these measurements are supplemented and completed by the results from model calculations with the Lagrangian particle dispersion model FLEXPART. By using a large variety of different measurement methods the authors were able to achieve an outstanding comprehensive data set concerning the properties and dispersion of the volcanic plume in Switzerland.

Most of the ground-based in-situ data of this paper were gained from the research station Jungfraujoch. The measurements at this station can benefit from the fact, that due to its altitude of 3580 m a.s.l. there is no direct impact from major anthropogenic pollution sources. Therefore, and in view of the long year measurement experience of the research station Jungfraujoch, the effects of the Eyjafjallajökull plume passing this station could be studied in depth. For the measurements of aerosols a scanning mobility particle sizer (SMPS), optical particle counters (OPCs) and a beta attenuation meter were used, for example. Additionally air and snow samples were analyzed and characterized by SEM, ICP-MS and IC. This gave an independent method for the determination of the size distribution of the particles and offered the possibility of comparisons with the OPC-data. Moreover in this way an analysis of the composition of the particles was possible, proving that the particles had a similar composition as the ash particles found on Iceland. Additional to the particle measurements trace gas SO2 measurements were performed.

The authors were able to present an in depth interpretation of the data and a thorough discussion of the accuracy of the measurements and possible constraints. This is of interest not only for the ground-based measurements, but for the measurement flights as well. The influence of the dispersion coefficient of the particles as well as potential sampling losses during the aircraft measurements are discussed in detail. It can be regarded as a special highlight that the research aircraft DIMO, which was used for the airborne investigations of this paper, was one of the first aircrafts in Europe performing active research flights after the start of the Eyjafjallajökull eruption.

This paper shows, how ground-based in-situ data, aircraft measurements and dispersion modeling were successfully combined to characterize and map the volcanic plume in Switzerland in two periods in April and May 2011 in a comprehensive way. It gives very clear information and allows important insight into the properties and dispersion of the Eyjafjallajökull aerosol plume in Switzerland. Moreover this paper reveals, how these methods can be combined in order to give valuable information to decision mak-

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ers during a volcanic eruption period.

In view of the high quality of this paper I strongly recommend this paper for a publication in ACP and refer to only minor, mostly editorial comments.

Specific comments:

Main Text:

P12954, L25: Can the estimation of a considerable loss of particles with D>15 μm be explained in more detail?

P12958, L11: Can the assumption be justified that only 4% of the total erupted mass was in the 3μm mode? Can it be explained, why 8 million model particles were released?

P12959, L25: Can it be explained in more detail, why SO2 drops with changing weather conditions after the first peak but increases again in the second peak although the weather conditions remain mainly the same?

P12960, L11: "suggesting that the gravitational settling of larger particles as a function of the distance from the eruption source was a dominant parameter influencing the coarse mode size distribution.": Can it be explained if the ash plume travelled the same distance to Switzerland in April and May 2010, respectively, thus causing the same fall-out of ash particle sizes?

P12962, L26: (Haynes, 2011) is missing in the references.

P12964, L22: Can it be explained in more detail, why the uncertainty is larger than +-60 % ?

P12966, L 11: Can a reference be given, why TiO2 was used as a source specific tracer for the volcanic aerosol?

References:

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It should be checked, if the references can be updated by publications, which were released in the meantime concerning the issues of this paper

Figures:

In general: The figures of this paper demonstrate important results. However, the readability of every figure should be checked by the authors.

Figures: 17,18,19 : It might be difficult, but maybe the graphs of these figures can be zoomed or some graphs might be taken out to enhance the readability of these figures

Figure 18: Can the inset of Fig. 18 be explained in more detail?

Figure 21: (right hand side, above) Is the strong difference between the two instruments understandable concerning the dependence of the sampling efficiency on the volumetric flow rate?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 12949, 2011.