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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.

N. Bukowiecki et al.

nicolas.bukowiecki@psi.ch

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We thank Reviewer 1 for her/his efforts and her/his fruitful comments, which we have fully considered in our revised version of the paper.

Our detailed answers are listed below:

Main Text:

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

We have clarified this as follows: "Based on the length and geometric design of the

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inlet line, it is estimated that there is a considerable loss of particles with D>15μm in the sampling line."

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

The 4% mentioned in the manuscript were actually a typo. The correct number is 40 % of the ash mass estimated by Stohl et al. (2011) for the size range 2.8 to 28 μm. When considering the ash mass distribution used in their study, assigning 40 % to a 3 μm mode only, seems to overestimate the mass fraction in this size range. However, we "tuned" this fraction by comparison with in-situ PM10 observations from the Jungfraujoch, Zugspitze and the Swiss NABEL sites. We have to admit that a large uncertainty remains to how large this fraction really was (see also comment to referee 1). The number of particles in the simulation was mainly determined by the computer system resources. The larger the number of particles the more precise should the transport be described in the Lagrangian model. Basically, RAM restrictions determined the final number of 8 million particles.

"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? "

We have clarified this as follows: "The change in weather conditions coincided with a drop in SO2, while PM10 stayed constant. The changing levels of SO2 are linked to changing oxidation and neutralization states of the volcano related sulfur, which is discussed in detail in Sect. 3.1.2 (Processing of sulfur dioxide)."

"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

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fall-out of ash particle sizes?"

In April, FLEXPART simulated particles arrived at JFJ about 3 to 5 days after being erupted on Iceland. These transport times were rather similar for the episode in May (3.5-5 days). Within a period of 4 day particles of 3 μm should fall about 60 m while particles of 10 μm diameter will fall 950 m, therefore causing a strong separation in the mass distribution. The small settling velocity for 3 μm particles is also the reason that we neglected particle settling in our simulations.

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

We fixed this

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

We have clarified this as follows: “The shown number concentrations were corrected for sampling losses due to anisokinetic sampling and transport losses, but are still associated with an estimated uncertainty larger than +- 60 % due to a non-ideal inlet setup, see Appendix B”.

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

We have clarified this as follows: “To estimate the mass contribution of volcanic ash to total PM10 at the involved stations, titanium dioxide (TiO2) was used as suitable source specific tracer for the volcanic aerosol, because TiO2 in PM10 was highly enriched during the volcanic ash episodes. TiO2 in PM10 in Switzerland is predominantly of geogenic origin and concentrations are typically low.”"

References:

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

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We have updated the literature list and the discussions in the text

Figures:

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

We have carefully checked the figures and improved the readability to an optimal extent

"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 "

We have carefully checked the figures and improved the readability to an optimal extent. The Figures are now in Appendix A.

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

We have added a more detailed description to the figure caption.

"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?"

We have clarified this as follows: “The Grimm 1.108 showed disproportional losses in efficiency for sample flows larger than the standard operation flow rate due to pronounced eddy formation at the inlet tip,. . .”

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