Biogeosciences Discuss., 8, C1402–C1407, 2011
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Biogeosciences Discussions

Interactive comment on "Monitoring presence and streaming patterns of Icelandic volcanic ash during its arrival to Slovenia" *by* F. Gao et al.

Anonymous Referee #1

Received and published: 3 June 2011

The paper provides measurements from several instruments, with the aim to identify and monitor the ash plume of the Eyjafjoll volcano over Slovenia, during the eruption of April-May 2010. There is a strong general interest on that subject for its environmental and economic impact, so this kind of paper are welcome. The Abstract and Introduction clearly present the paper, but there are some phrases unclear and I've also suggested a couple of recent paper in this topic. I've also to say that although some local data clearly shows the presence of the plume(like the F- detected presence and X-Ray spectra analysis) other measurements seem to be less effective (i.e. PM10 and SO2) for that purpose. Sometimes the information extracted from the data appears redundant (i.e. the graphs and the discussion about peaks in lidar data) and looks like, somewhat, pushed beyond instrument limits (i.e. the airborne measurements of aerosol mass concentration) and without proper uncertainties. The authors should dis-

card or explain these inconsistencies: only in this way the paper could be accepted. Some detail on above statements, are in what follows:

Abstract

- In the last sentence the authors gives the impression that the performed trajectories simulations are done by a local model, but in the 5th paragraph seem clear that this is not case: please clarify.

1 Introduction

- In the last sentence: the same comment in Abstract.

2 Synoptic situation

- Row 3, p.3866: why from 15 April if the explosive eruption starts on 14?

- Row 13-15, p.3866: The precise timing isn't very clear, i.e. if the arrival of the ash is between 16-17 or 17-18 of April, perhaps a satellite image will be helpful.

- Row 18-19, p.3866: again it's important to clarify when the precipitation occur also with the hour detail (see below comments on paragraph 3.1).

3.1 Ground based measurements

- Row 21, p.3867: The PM10 measurements are performed at two different altitude but there is no evidence in the text or graphs on how and if these are combined and why. The information of the positioning of the instrument (urban area, etc..) is also omitted.

- Row 25, p.3867: The authors evidence an increasing value of PM10 since the 16 April, a date which is pre-ash plume and also few ashes should be present at ground level before the rain event.

- Row 7, p.3868: The Nova Gorica data are not presented: why?

- Row 8, p.3868: The increment in SO2 start from 11 April so can be hardly attributed to the ashes.

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- Figure 2: Because routinely measured, some sort of average lines would have been helpful: see Flentje et al. (Atmos. Chem. Phys., 10, 10085–10092, 2010) for example.

- Figure 3: Some sort of magnification should be employed in order to better show F-bars.

- Also following the authors statements about typical local concentrations, the measurements of PM10 and SO2 seems inconclusive and not very useful for the purpose detection and monitoring the ashes over Slovenia.

- The latter part of ground based measurements, involving composition analysis, it's more convincing in order to confirm and monitor the presence of the ash cloud over Slovenia, but the actual timings are not clear in the synoptic situation: seems that the rain events starts more likely the 18, but in this case the F- presence in 17 April data it's unclear.

3.2 Lidar-Based remote sensing

- Lidar measurements are performed by systems that should have scanning capabilities, but seems that during this campaign both are used as zenith pointing backscatter lidar. In literature you will find that the aerosol backscatter is the main optical variable that generally can be extracted from signals with lidars in this configuration: all analysis and considerations should be done by using this parameter, not the extinction.

- For the inversion procedure the Klett method is adopted but it's not clear if the single component solution or the two component solution (Fernald) which seems more appropriate especially for 355nm.

- Even if the used lidar ratio came from measurement of aerosols with the same origin (Ansmann, 2010), these have been done hundreds kilometer away, before the Alps and only a couple of days after the main explosive event.

- The cited paper also claim the presence of a considerable amount of large and very large particles in the measured layer, but these particles shouldn't be effectively present

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six days after the explosion. In that respect, the differences from the measurements reported in the cited paper can be seen directly: Ansmann find low dependence on lambda values for the optical parameters (AE), but the author's data would exhibits (more or less) a color ratio not far from 1, for any reasonable choice of lidar ratio values.

- The presence of turbulence (Row 20-21, p.3870), especially in the low level layer, should have also caused the mixing with local aerosols.

- Because the small signature of molecular scattering in 1064nm signal, a time series (although not very extended) of the range corrected signal(RCS), would clearly show the presence and evolution of the ash layer (with a proper cloud screening).

- Figures with lidar vertical profiles, shouldn't contain data before the complete overlap and so those have to be modified accordingly. In that respect, the lower aerosol layer can't be visualized in Otlica because the first useful altitude will be around 2km a.s.l.

- Figure 4 and 6: Both should evidence the reference value zone used for inversion: for example for 355nm at the end-altitude, the extinction value is 0.1km-1, so probably extinction will reach a background value at an altitude higher than that. The ever growing x-axis isn't the best solution to clearly present data and should be avoided.

- No information is given about the range resolution and molecular data used of both lidars.

- Uncertainties in data reflects the lidar ratio variation only: are you sure that this is the dominant one? What about the magnitude of statistical errors and other systematic errors?

- Considerations and related figures about both lidar data peaks, appears to be not very useful to the discussion because the evolution of the layer is enough evidenced by vertical profiles (and time series of RCS, if inserted).

3.3 Airborne Measurements

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- The 3016 IAQ seems not specifically designed for airborne operation (IAQ stand for Indoor Air Quality) and the instrument datasheet report that aerosol mass concentration (AMC) can only measure approximately: are you sure that in the ash layer can be correctly sampled with this instrument at aircraft speed, PTU operational conditions and for this kind of aerosol?

- How about the hypothesis on particle density to determine the AMC? Probably only particles number density should be shown an commented.

- In general in order to have a reliable and effective quantitative analysis, dedicated instruments and peculiar analysis are employed for airborne measurements: see for example Schumann et al., Atmos. Chem. Phys., 11, 2245–2279, 2011.

- Can you give more information on adhesive tape used? It's a special one? It appears a non conventional one to me: usually some kind of filters are employed.

- Row 17-18, p.3872: "Every 300m. . .": unclear.

- Row 4, p.3873: wrong unit.

- Any visual proof (i.e. a photo) of the ash layer is available? For similar concentration the plume was found to be visible (see again Schumann et al.).

- Figure 8: like the lidar ones, x-axis should be not cumulative.

5 Simulation of air flow trajectories

- The first important explosive activity started on 14/04 at 19:00UTC and trajectory analysis should be done accordingly.

- Row 28, p.3875: "Simulation show that, occasionally,. . .": unclear.

- In general I think that back-trajectories analysis, starting at locations, time & altitudes where the measurements are done and ending where & when explosive eruption happen, should provide, within its limits, the proper information on air masses provenience:

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Interactive Comment

other speculations, presented in this paragraph seems to be less relevant for this purpose.

6 Discussion and conclusions.

- What about the linear regression with Otlica data (a location that is also nearer to the flight path)?

Interactive comment on Biogeosciences Discuss., 8, 3863, 2011.