Atmos. Chem. Phys. Discuss., 12, C7505–C7510, 2012
www.atmos-chem-phys-discuss.net/12/C7505/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of Eyjafjallajökull volcanic aerosols over Southeastern Italy" *by* M. R. Perrone et al.

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Received and published: 26 September 2012

Dear Referee #3, many tanks for reviewing the manuscript and for your comments and suggestions which have contributed to improve the manuscript. Point by point answers to your comments are reported below.

"General comments"

*** . . ...The paper should be re-organised and focused on the integration of different measurements and comparison/validation of the model.

The paper has been re-organized to focus on the integration of different measurements and then, to contribute to the validation of FLEXPART. The title has been changed with the following one:

“Integration of measurements and model simulations to characterize Eyjafjallajökull volcanic aerosols over south eastern Italy”

*** When discussing the agreement between model and measurements, the authors use too often words as “satisfactory”, “reasonable” and “similar” without quantifying. Actually sometime the agreement is a bit doubtful (see the following specific comments on the figures)

The agreement between model and measurements has been quantified

*** The authors also use “for selected hours” without explaining the selection criteria.

The word “selected” has been replaced with “different”

"Specific Comments"

1) The Abstract is too long and too detailed i.e. time of arrival etc. It should be optimized.

The abstract has been optimized as it turns clearly out from the marked-copy where all changes are highlighted.

2) Introduction: Lines between line 27 page 15303 and line 3 of page 15304, are no relevant.

O.K. Lines have been deleted.

3) Comparison measurements/model:

A – In the body of the paper, the authors refer to the FLEXPART model to confirm their measurements; however, in section “Introduction” and “Conclusions” they state that the measurements are of use to validate the model. I think the "interplay" model/measurement deserve to be clarified.

The paper has been re-organized. Backtrajectories and other published studies have mainly been used to support the arrival of volcanic particles over south eastern Italy.

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Then, Section 3.5 focuses on the comparison/validation of FLEXPART simulations.

B - Based on the FLEXPART model, the authors note that the concentration modeled over Puglia is lower than the concentration over other parts of Europe. An interesting issue here would be to present and discuss the characteristics of the aerosols and the statistics of the aerosol concentrations in different time of the day, month, year in the area, especially concerning surface measurements.

This subject has been afforded in the revised manuscript. To this end, a new table (Table 1) has been added and yearly-means of PM10 mass concentrations have been provided in Table 2, in addition to the site-type description.

4) In Table 1, I acknowledge an increase of the PM10 concentration from 19th of April to the 20th of April; however, this increase is not striking and sites show maxima in different days. I believe that it could be of use to discuss the sites according to geographical position or characteristics i.e. urban, rural etc and discuss the statistics as request in comment 3B) above.

The following sentences have been added in the manuscript: "The largest PM10 mass concentrations have been monitored on 21 April at all sites (within experimental uncertainties), with the exception of site A, the site furthest in the north, where the largest PM10 level was reached on 20 April. These results suggest that the PM10 enhancement was very likely due to a large-scale pollution event, consistent with the arrival of volcanic particles (section 3.1). PM10 levels larger than corresponding yearly- means were reached at most of the sites on 20 or 21 April. The inhomogeneous structure of the volcanic particle cloud was likely responsible for the variability of the PM10 enhancement found at different sites. Enhanced PM10 mass concentrations were found all over Europe when the volcanic ash cloud was present (e.g. Schäfer et al., 2011; Emeis et al., 2011). PM10 averaged values reported in Table 2 show that the mean PM10 mass concentrations in the Apulia region increased by 4, 9, and 5 μg/m3 (or 22, 50, and 28%) on 20, 21, and 22 April, respectively, relative to the mean PM10 level on

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19 April. The PM10 enhancements at site I (ïĄ¿500 m away from the lidar site) ware 4, 6, and 5 μg/m3 on 20, 21, and 22 April, respectively."

5) HYSPLIT. The authors show the back trajectories from HYSPLIT in figure 1, for different days but some features of the results have not been discussed. As an example, Figure 1a. 20th of April: it is a bit strange that only the 500 m back trajectory arrives from Island. Could the authors please comment this?

The following sentences have been added in the manuscript:

". . ..The arrival over the monitoring site of this study of air masses which had previously travelled across Iceland started on the afternoon of April 20. Figure 1a shows the 8-day back-trajectories ending at the Physics Department of the Salento University on April 20 at 18:00 UTC. The backtrajectory ending at ïĄ¿0.5 km a.s.l. has crossed Iceland before reaching the monitoring site. The backtrajectories ending at ïĄ¿2 and 3 km a.s.l., have their origin over Central Europe. However, they have travelled over European regions known to have been affected by volcanic ash before reaching Lecce and as a consequence, may have been responsible for the advection of volcanic particles at altitudes larger than few kms a.s.l.. Figure 1b shows the pathway of the backtrajectories arriving over Lecce on 21 April at 06:00 UTC. Both the 2 km- and the 3 km-arrival-height backtrajectories have travelled across Iceland before reaching Lecce. Figures 1c and 1d show the pathways of backtrajectories arriving over Lecce on 21 April at 18:00 UTC and on 22 April at 12:00 UTC. Air masses from northern Europe at lower altitudes and from north-western Africa at higher altitudes were transported to Lecce on April 23. Thus, the transport of volcanic particles to south-eastern Italy was most likely on 20, 21, and 22 April according to HYSPLIT back trajectories.

6) Figure 5. I am not sure about the "similarity" between FLEXPART MA and AOT from lidar and from AERONET.

The sentence has been replaced with the following ones:

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"Ash total column mass concentration values vary significantly with time and reach rather low values after midday of 22 April. Accordingly, we have found that AOT values also were quite dependent on monitoring time and reached rather low values after midday of 22 April. Ma and AOT reach high peak values at different times. Uncertainties in the model simulations which grow as the ash cloud is transported far from its source and over complex topography (e.g., the Alps) (Kristiansen et al., 2012) are expected to lead to some discrepancies between the model and measurements for the diluted ash cloud over Southern Italy. Kristiansen et al. (2012) found a time delay between the modelled and measured PM10 peak values at the Jungfraujoch station (Swiss Alps). However, one must be aware that changes of the contribution by volcanic and non-volcanic particles have contributed to the variability with time of the AOT, while Ma was only due to volcanic ash."

7) Figure 11. Where are the dotted and dashed lines in the legend? What are the values shown within the figure? I imagine they are mean daily values.

Dotted and dashed lines have been deleted.

8) Figure 12. 8a) In figure 12a, I can see high values of PM10 around 00:00 of 19th April; and in figure 12b I note high values of PM10 during 19th April. This is connected to my comment in 3)A about the need to have information of the annual/daily statistics on concentrations at each site.

See the answer to your comment in 4)

8c) Figure 12b. How is the high value of SO2 explained at 00:00 on the 20th, at least 18 hours before the arrival of the volcanic plume?

The following sentences have been added:

"Figure 10b reveals that a fast increase of PM10 and SO2 mass concentrations occurred at $\sim$ 06:00 UTC on 20 April and that high peak SO2 mass concentrations were reached earlier at site G than at site C, even though site G is further south than site C.

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The advection over south eastern Italy of an inhomogeneous cloud of volcanic particles has likely been responsible for these results. Volcanic particles were detected at the CNR-IMAA Laboratory which is $\sim$ 150 km away from site G, since the night of 19 April (Madonna et al., 2010; Mona et al., 2012) and backtrajectory pathways reveal that the backtrajectory ending on April 20, 06:00 UTC at 100 m a.s.l. had crossed the CNR IMAA Laboratory area before reaching site G."

"Technical corrections":

Pag.15306 line 18. AOD is not defined. Sometime the authors use AOT, Aerosol Optical Thickness and sometime AOD Aerosol Optical Depth

AOD has been replaced with AOT

Pag 15302 end line 13. "has allowed" should be "have allowed" or "allowed" Figure 1 a,b,c and d. The x axis labels are too close. The figures come from the HYSPLIT run at the web site but something must be done.

Done

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/12/C7505/2012/acpd-12-C7505-2012-supplement.pdf

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