Atmos. Chem. Phys. Discuss., 11, C3531–C3533, 2011
www.atmos-chem-phys-discuss.net/11/C3531/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sulphur dioxide as a volcanic ash proxy during the April–May 2010 eruption of Eyjafjallajökull Volcano, Iceland" *by* H. E. Thomas and A. J. Prata

Anonymous Referee #2

Received and published: 18 May 2011

General comments

This paper presents some interesting work that is of great relevance to the work of Volcanic Ash Advisory Centres (VAACs) who provide advisories on the presence of ash to the aviation industry. It discusses the major challenge of accurately observing ash. The paper uses the recent, high impact eruption of Eyjafjallajokull and is therefore of current interest. It's well written and presents ideas that are of current consideration to VAACs.

Specific comments

1. In the introduction please explain why "SO2 clouds may also be associated with

very fine ash particles" or provide a reference.

2. Under the heading "Ash retrievals" you write "the refractive indices of the ash are predetermined", please explain how these are predetermined. What composition is the ash? Is this known or is it an assumption that has a significant impact on results?

3. In the same paragraph, please explain how and why the satellite data are "atmospherically corrected".

4. Under "SO2 retrievals" it would be useful to describe what information can be obtained from CALIPSO's lidar. This also applies to section 3.4 (7 May) when you write "this layer shows a low attenuated colour ratio (ACR) and also low depolarisation". These terms need explanation including how they infer information on ash / SO2.

5. In section 3.2 (15 and 16 April) you write "this conservative estimate of the cloud dispersion could have benefited from the additional information provided by the satellite data". You need to make it clear that the London VAAC did use satellite data to provide information on the cloud dispersion but that satellite observations have their limitations. The VAAC provides forecasts so the satellite data can only help with the present situation and forecasts can be adjusted from this point forward. It would be useful to provide some discussion on the detection limits of the satellite instruments. You have mentioned that infrared SO2 retrievals are limited to the upper troposphere and lower stratosphere due to water vapour, but not the limitations of the ash retrievals (e.g. particle size, thermal contrast, water/ice). Can low concentrations of ash be detected? There may be cases where the model predicts ash, but none is observed - can you be sure that no ash is present?

6. In section 3.3 (4 May) you write "using SO2 retrievals to locate the cloud where ash retrievals may fail"; this illustrates my point above.

7. In section 4 (Conclusion) you write that "We have shown that although for the majority of the eruption the gas and ash are collocated". I am not sure that you have shown

this, because you only illustrate a few cases. Perhaps you should write something along the lines of "We found in our studies that the majority of the eruption the gas and ash are collocated ..."

8. Also in section 4 you refer to failure of the ash algorithm. This links to my earlier point that the limitations of ash detection need to be outlined. Why was ash not detected? Is it due to limitations of the method or is there little or no ash to detect?

9. In the final paragraph of the conclusion, you write that it is important to monitor both ash and SO2, do you suggest that VAACs should assume that fine ash may be present in a SO2 cloud even if no ash is detected? This is a very interesting problem. It is safest to say that ash may be present in SO2 plumes, but this may lead to an overestimation of the plume coverage.

Technical corrections

1. I suggest that "constant" rather than "consistent" may be a better word to use in section 3.4 (7 May) in the sentence "These data demonstrate that although wind direction is fairly consistent ..."

2. The caption for Fig 8 contradicts the text. I think that it should say "The windfield data shows a stronger southerly component at higher altitude ..."

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 7757, 2011.