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Atmospheric Chemistry and Physics Discussions

Interactive comment on "SO_2 and BrO observation in the plume of the Eyjafjallajökull volcano 2010: CARIBIC and GOME-2 retrievals" *by* K.-P. Heue et al.

Anonymous Referee #2

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The paper reports on aircraft and satellite measurements of SO2 and BrO in a part of the Eyjafjallajokull plume when it was over the UK and Ireland on 16 May 2010. The paper compares aircraft and satellite DOAS data, which is quite difficult because of the different foot print sizes and therefore different air masses involved. The aircraft data on the composition of the plume are very valuable and deserve a good discussion. But the paper addresses many different topics, and is a bit chaotic. Furthermore, the paper is quite long and has many figures. If possible, please reduce the size of the paper and/or number of figures.

Main comments:

(The pages are only indicated with the last 2 digits and the line numbers are those on the relevant pages of the screen version of the paper.)

(1) The error in the AMF for the CARIBIC DOAS measurements is stated to be smaller than 7 % (p. 38, l. 14); this value is surprisingly small. Is it only the noise or also the bias in the AMF modelling? What is the effect of errors in the input of the AMF calculations, e.g. the effect of clouds or vertical trace gas profile on the AMF error?

(2) The footprints of GOME-2 and the CARIBIC DOAS instruments are very different; please specify the difference. Therefore, the effects of clouds on the AMF will be very different. In Sect. 2.3, p. 43 it is stated that the same cloud and aerosol settings are used for GOME-2 and CARIBIC DOAS radiative transfer simulations. This seems unrealistic. Please explain.

(3) A quantitative comparison between GOME-2 and OMI SO2 data is missing. Only figures are shown. Since the same type of satellite remote sensing data is involved, a quantitative comparison is well possible. The few hours time difference should not be an obstacle. An option is to integrate the SO2 over the plume for both satellite instruments, and then compare SO2 columns.

Smaller and textual comments:

Abstract:

- please give quantitative results of the SO2 and BrO columns or concentrations measured in the plume

- p. 33, l. 14-15: please give the conclusion from your work: was the measured SO2 indicative for ash in the plume? Or can't you say anything about this because the particle counter failed?

Introduction:

- p. 33, l. 21-22: also the meteorological conditions, esp. wind, strongly influence the

affected region

- Eqs. R1-R6 should be introduced with a preceding sentence.

Sect. 2.2:

- Eq. 1: typo: the exponent (SCD x sigma) should be negative

- Acronyms like SCD and VCD should not be used as symbols in formulae. This holds for most equations in the paper.

- p. 37, l. 20: “Because of that ...”: sentence is unclear, please reformulate.

- l. 24: this time is not relevant here

- l. 24: optical density of the trace gases

- p. 38: Eqs. 3 and 4 should be put next to the relevant description. Now they are without context.

- The z-dependence of the AMF is not mentioned. In principle, the sensitivity to SO2 or BrO depends on height. How is this included in the calculations?

- p. 39, l. 22: similar SCDs: for which gas?

- P. 40, l. 27: errors > errors in the SCD

- What is the FOV (pixel size) of the CARIBIC DOAS observations, e.g. in Fig. 1?

Sect. 2.3:

- p. 42, l. 8: do you also have to assume the altitude of the SO2 plume?

- Eq. 5: symbols and not acronyms should be used in Equations

- p. 43, l. 3: LOS > VZA = viewing zenith angle

- l. 3: nadir = 0 deg ? it was 82 deg for CARIBIC DOAS. Please be consistent.

- L. 4: how is VCD_geom defined?

Sect. 3.2:

- p. 45, l. 15: please define SCD*.

- l. 17: where is the cloud information coming from?

- P. 46, l. 14-15: which MODIS observation? Is TAE=AOT?

Sect. 3.3.2: p. 48, l. 23: where do the high O3 values arise from?

Sect. 3.4: AURA > Aura (or EOS-Aura)

Conclusions: the last sentence is quite an abrupt end; please make a final conclusion.

Table 1: please also give the SCD and AMF errors in this table.

Fig. 1: explain the three rows of plots. To which viewing direction do the SCD values relate? Instead of hatching an entire box and making the spectrum less readable, please indicate the wavelength range in a more modest way. This also holds for Fig. 6.

Caption Fig. 13: the caption is wrong: this is not viewing direction, but flight tracks with SO2 data. Please mention that the figure contains CARIBIC DOAS measurements.

Fig. 15: the yellow points and curve are almost unreadable – please change color.

Figure captions: please specify the date and time of the observations in e.g. Fig. 6, 7, 9, 10 etc.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29631, 2010.