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Atmospheric Chemistry and Physics Discussions

Interactive comment on "MIPAS observations of volcanic sulphate aerosol and sulphur dioxide in the stratosphere" *by* Annika Günther et al.

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We thank the reviewer Hugh Pumphrey for his helpful and constructive comments which we address in detail below.

The notation is as follows: P5L27 means page 5, line 27.

General remarks

- The subject is an advance in knowledge, appropriate to the journal, and should be accepted, subject to minor corrections.

- The written English is clear and unambiguous, but has a rather stilted style and a sprinkling of grammatical errors. I note a couple of these below, but this is not a full proof-read.

  Thank you for these corrections. We will try our best to improve the manuscript in this respect.

- The figures are generally clear and well made; I have only a few suggestions for corrections.

  We will take all those into consideration for the final version.

Specific corrections

- All pages: It grieves me to point it out, as, to me, the -f- spelling of "sulfur" is a horrid Americanism which grates on the eye. But the journal's English guidelines state that . . . it is our house standard to use the -f- spelling for sulfur (instead of sulphur) and related words for all varieties of English.

  Thank you very much for this reminder, we will use the "sulfur"-spelling in the revised version of the paper.

- P3L16: The authors note that they use only the second of the two measurement periods, but do not spell out why. Was it not possible to estimate SO_2 from the first period data? Were there no volcanoes of interest during that period?

  The SO_2 dataset by Höpfner et al. (2015) comprises retrieved sulphur dioxide profiles for both measurement periods. However, the first period is not considered within this study. We aimed at investigating two of the major mid-latitudinal eruptions (Kasatochi in 2008, and Sarychev in 2009) during the MIPAS measurement period from Jun 2002–Apr 2012. Volcanic eruptions during the first

period only injected SO_2 masses of below 100 Tg to 10–22 km (Höpfner et al., 2015). Furthermore, the much longer second measurement period (Jan 2005–Apr 2012) is characterised by a better vertical and horizontal resolution due to the denser vertical and horizontal limb sampling. Future work will be invested into the retrieval from the first period (Jun 2002–Mar 2004) in order to get an aerosol dataset covering the whole MIPAS lifetime.

The revised version of the paper will include the following sentences on P3L16: "Here we concentrate on the data from the second and longer measurement period (Jan 2005-Apr 2015), as the major mid-latitudinal volcanic eruptions between 2002-2012 occurred during this period. Furthermore, this measurement period is characterised by an improved vertical resolution, especially in the altitude region of the upper troposphere and lower stratosphere."

- P5L27 "The sulphur ... builds H_2SO_4" The wording of this sentence and the use of the word "builds" in particular seems rather odd. A possible alternative wording is "The sulfur released from volcanic SO_2 reacts with OH to form H_2SO_4."

  This will be changed in the revised version.

- P7, Figure 1: The vertical axis of the graph is not labelled and it is not clear to me whether it applies both to the refractive index curves and to the transmission curve.

  Thank you for making us aware of the missing label. The labels will be included in the revised version.

- P9L16–18: I would remove the comma after "Both" and insert one after "increasing temperatures".

  This will be changed in the revised version.

- Figure 3: The caption does not explain the difference between LPC 2m, LPC 1p and LPC 3m.

In the caption of Fig. 3, we will clarify that the colour coding for the LPCs means that different Laser Particle Counters have been used for the measurements. "... measured by Laser Particle Counters (LPCs). Different LPCs have been used (colour-coded)."

- Figure 5: It would be preferable to repeat the table of volcano names somewhere in this paper, rather than referring the reader to a different paper. Also, the levels in the filled contour plot are the rather odd choice of 100/7 units. The colour scale itself is a better choice than the dreadful "jet" scale that too many people still use. But I feel that there might nevertheless be a better choice. In particular, I feel that it would be better for the colours at the upper end to become paler (e.g. red $\rightarrow$ magenta $\rightarrow$ almost-white) rather than tending towards a purple colour which is very close to the blue at the bottom of the scale. In making any such change it should be ensured that adjacent colours are clearly distinguishable from each other. (This is currently the case except, perhaps, for the shades of blue around 200 ppbv.)

  A list of abbreviations is going to be added to the caption. Furthermore, the purple colours will be removed from the colour-scale in all contour plots, and we will consider updating the levels of the contour plots to match better to the values shown in the colour-bars.

- P13L2: "built" is rather an odd word choice. Maybe "produced" would be better.

  This will be changed in the revised version.

- P15, table 1: Pumphrey's two estimates for Sarychev are the wrong way round, and one of them is missing its error. It should be 571 ± 42 above 147 hPa, and 1160 ± 180 above 215 hPa.

  Thank you very much for this remark, will be updated in the revised version.

- P22L19: Remove comma after "Both".

This will be changed in the revised version.

- P24L11: “were” should be “where”.
  This will be changed in the revised version.
- P24L19: “hereby” should perhaps be “thereby”
  This will be changed in the revised version.

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