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Interactive comment on “Sulfur dioxide (SO₂) as observed by MIPAS/Envisat: temporal development and spatial distribution at 15–45 km altitude” by M. Höpfner et al.

Anonymous Referee #1

Received and published: 8 July 2013

Referee Comments

"Sulfur Dioxide (SO₂) as observed by MIPAS/Envisat: temporal development and spatial distribution at 15-45km altitude"

by Hoepfner et al

The paper describes a new dataset on 10 years of global stratospheric SO₂ measurements from the MIPAS instrument. The emphasis of the paper is largely on the background SO₂ distribution but volcanic injections necessarily also feature. Due to the low S/N of the background SO₂ signature, the spectra have to be averaged as monthly,

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[Interactive Discussion](#)

[Discussion Paper](#)



zonal means. A limited number of comparisons are made with other measurements, which serves to highlight the uniqueness of this product, and also model results. The authors include a full error analysis and further attempt to fit their observations to various time-dependent forcings.

The paper is well-written and the results of scientific significance. I only have minor (mostly pedantic) comments, corrections and suggestions.

General Comments

a) Given the constant 10 pptv assumed for the a priori, could this have an affect of inflating the retrieval results at 45km? It would depend on how the authors handle the SO₂ profile above 45km during the retrieval itself, eg a fixed a priori value of 10 pptv at 46km and above, or a more gradual adjustment which depends on the state vector.

b) For the 'htang' error, I assume this refers to the registration of the MIPAS spectra within the ECMWF T(p) fields so is a linear addition of both $(dR/dT) \times (dT/dz)$ and $(dR/dp) \times (dp/dz)$ errors (where R is the radiance spectrum).

c) Section 5.4 (Internal Variability): could some of this be due to an offset between results for the P1 and P2 measurements? It is not clear whether the analysis in Eq (3) and (4) is strictly for adjacent months in time, or just for adjacent months within the dataset which would include spanning the P1-P2 boundary.

d) I'm assuming that Fig 7 is missing a legend that explains that the colour codes are reversed for the southern hemisphere. Otherwise 'blue' is always DJF so the comment on p12404, l5 identifying 'blue' with winter would only apply to the northern hemisphere and, more importantly, Fig 7 would show simultaneous distributions in the poles rather than a 6 month phase shift, which would lead to many more questions...

e) Figures generally are a little small in the printed version - try to use the full width of the page.

Typographical/grammatical 1) p12392, l16: 'of the order of' rather than 'in the order
C4566

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of'. However, 'order of' usually refers to factors of 10, so 'in the range 100-400 pptv' is probably best.

2) p12392, l18, comma after 'extent' (to match the comma after 'possibly').

3) p12393, l7: change 'interrupt' to 'interruption'

4) p12393, l12: 'operated alternately' strictly means between just two options. Perhaps 'occasionally operated' or 'periodically operated' is better.

5) p12394, l19 and l21: I think 'required' is meant, not 'requested'

6) p12395, l17: 'altitude-constant' suggests a constant altitude. Perhaps 'altitude-independent' or simply 'constant' or 'single' would read better.

7) p12399, l6: change 'less extend' to 'lesser extent'

8) p12402 l15: Suggest: 'The MIPAS observations show this maximum to be very..' ('observations' rather than 'observation', and insert 'to be').

9) p12402, l24: hyphen after 'middle-' seems redundant since one would not hyphenate 'middle latitudes'.

10) p12404, l23: suggest '...eruptions visible...' (delete 'being')

11) p12406, l3: I do not understand 'merely probable'. Do you mean 'possible', ie that the following seems a plausible explanation, or 'probable', which implies a higher degree of certainty.

12) p12410, l9: 'constantly zero'? Earlier you said 10pptv.

13) Fig 1: It would have been helpful to have the NESR contribution also shown on these plots.

14) Fig 6: Lat/time variations would probably appear clearer expressed as percentage variations about the mean for each altitude, rather than on an absolute scale.

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15) Fig 12: what is the scale for the black bars?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 12389, 2013.

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C4568