

Answers to the 2nd review on the ACPD paper (acp-2017-470)

Changing transport processes in the stratosphere by radiative heating of sulfate aerosols

Ulrike Niemeier and Hauke Schmidt

Max Planck Institute for Meteorology, Bundesstr. 53, 20146 Hamburg, Germany

We thank the reviewer for the helpful comments. We followed the advices, added citations to the question on numeric diffusion and added significances to the right plot in Fig. 4.

Citations of the text are written in *italic* and changed or new text is highlighted in blue.

1 Line 74: The phrase 'related to' is not the best choice of words here. Maybe use 'consists of'?

We followed the reviewers advice.

2 Line 159/160: 'Numerical diffusion is reduced.' Is that shown somewhere? Can a reference be added?

We added citations for an applied and theoretical approach: (see [Land et al. \(2002\)](#) for an applied and [Quarteroni et al. \(2010\)](#) for an theoretical approach). The impact is also described in Bunzel and Schmidt (2013).

3 Line 213: 'caused by the absorption of LW' is it only LW or also SW that is absorbed? Previous work by Ferraro indicates that it's both.

Yes. Sulfate is absorbing in the near infrared and infrared, as we mention in the introduction. The near infrared is part of the SW band in the model. We deleted the LW in the text.

4 Rightmost panels of Figure 4 could use significance testing.

Done

5. Line 377: From the Figure in supplement it looks like the differences in temperature anomalies are greater than 1 K (2 more contours which seem like 1K contours); Similarly, for vertical velocity it's a bit hard to tell with current contours, but there seems to stronger vertical wind at 30 hPa in 10Tg60.

We changed the text to:

Zonal wind and temperature profiles are similar to the 8Tg results (see also Figure 1 in the supplementary material), while the model resolution without internally generated QBO used in Geo10 simulates easterly winds in the tropics and subtropics. The temperature anomaly is about 1 to 2 K higher in 10Tg60 than in Geo10, but the residual vertical wind velocity is similar at the height of 50 hPa, the level of the concentration maximum (Fig. 4) and slightly higher in 10Tg30 above 35 hPa, the region of highest mass mixing ratios (Figure 2 in the supplementary material).

References

- Bunzel, F. and Schmidt, H.: The Brewer-Dobson Circulation in a Changing Climate: Impact of the Model Configuration, *J. Atmos. Sci.*, 70, 1437–1455, doi:<http://dx.doi.org/10.1175/JAS-D-12-0215.1>, 2013.
- Land, C., Feichter, J., and Sausen, R.: Impact of vertical resolution on the transport of passive tracers in the ECHAM4 model, *Tellus B*, 54, 344–360, doi:10.1034/j.1600-0889.2002.201367.x, 2002.
- Quarteroni, A., Sacco, R., and Saleri, F.: *Numerical Mathematics (Texts in Applied Mathematics)* 2nd Edition, Springer, Berlin Heidelberg, doi:10.1007/b98885, 2010.