Atmos. Chem. Phys. Discuss., 4, S3521–S3523, 2004
www.atmos-chem-phys.org/acpd/4/S3521/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of stratospheric water vapor trends: impact on stratospheric ozone chemistry" *by* A. Stenke and V. Grewe

A. Stenke and V. Grewe

Received and published: 1 February 2005

Point-to-point-reply:

General comments:

The reviewer suggested to include a section describing model deficits and strengths. The model climatology has been extensively validated, especially the model climatology in the Arctic stratosphere, e.g. Hein et al., 2001, and Austin et al., 2003. We included a short summary of the respective results to point out specific model weaknesses and strengths. Special effort is put on the modeled water vapor distribution.

Therefore, we included Figure 3 showing the modeled water vapor and methane distribution in the UT/LS region.

As the second major point the reviewer suggested to place more emphasis on the asymmetry between Arctic and Antarctic. Our model results indicate that the modeled water vapor perturbation affects the PSC activity in southern polar regions, but not in northern polar regions. We included a paragraph explaining these effects in detail (see below). Additionally, this major result of our study is highlighted in the abstract as well as in the conclusions. Within the conclusions section we added a paragraph discussing the potential response in the "real" atmosphere.

Finally, we restructured the conclusions section. We added a short discussion section to the result section comparing our model results with previous studies.

Specific comments:

- Page 6562 - modeled and observed water vapor trend over Boulder:
  We included a short paragraph discussing the results of Randel et al., JAS, 2004, in conjunction with the modeled water vapor trend.
- Page 6565 - notation OH-S:
  Notation OH-S changed to OH_{Sp}.
- number of chemical reactions:
  We removed the summary of atmospheric chemistry. The most important reactions are listed in the appendix. We refer to the respective reactions when the results are discussed.
- Page 6572:

ACPD

4, S3521–S3523, 2004

We included a more detailed explanation of the numerical effects leading to this unrealistic $ClONO_2$ increase. According to our knowledge this effect is caused by the semi-Lagrangian advection scheme and not by the chemistry module.

- Page 6575:
  We changed this misleading part. The original text implies that CHEM uses a constant temperature threshold for PSC formation which is lower than usually assumed. Therefore, we included a short description of the PSC parameterization in CHEM which is based on modeled temperatures and mixing ratios of H_2O and HNO_3.

- Page 6576:
  We revised the whole manuscript carefully. Hopefully, all ambiguous points are clarified now.

- Page 6578:
  We put a stronger focus on the differences between the Arctic and the Antarctic stratosphere which are associated with a different impact of the water vapor increase on the PSC activity in both polar regions. To explain these differences we included a new figure (Fig. 11) which shows the modeled zonal mean temperatures at 50 hPa, 80°N/S.

- Page 6579 - Figure 14:
  We excluded Figure 14. The linear relationship between ozone response and water vapor perturbation is still mentioned in the text. According to our opinion this result is worth mentioning. Additionally, it is confirmed by the results of Dvortsov and Solomon, 2001. Their model results also indicate that the ozone response is linearly related to the water vapor perturbation.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6559, 2004.