Atmos. Chem. Phys. Discuss., 3, S2704–S2706, 2003
www.atmos-chem-phys.org/acpd/3/S2704/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The isotope composition of water vapour: A powerful tool to study transport and chemistry of middle atmospheric water vapour" *by* Ch. Bechtel and A. Zahn

Ch. Bechtel and A. Zahn

Received and published: 8 February 2006

First I (A. Zahn) have to apologize for the very late answer to the reviews and the comment by T. Röckmann. This extreme delay emerged from a chaining of circumstances. The first author (C. Bechtel) who developed the 1D model moved to a company and thereafter was not willing to help with any modification of the model code. This work was taken over by P. Franz (with help by T. Röckmann) only about 1.5 year later. In the end, both left Germany to New Zeeland and the Netherlands, resp., which caused further delay.

In the meantime, both the model and the paper were significantly improved.

We thank the two reviewers for their positive comments.

To review 1 by David Johnson:

We agree with almost all comments addressed by David:

1) The photochemical model by Johnson (2001) is now cited and commented.

2) A discussion of the three isotope exponent is added (section 3, line 165).

3) The findings by Johnson et al (2000) are considered.

4) The data by Johnson et al (2001) are also shown. On the other hand, we chary question the given systematic uncertainty of 40 permil. There is no process known (and hard to imagine) which could cause (even largely averaged) values between -160 and -100 permil in d17O between the tropopause and 25km altitude.

5) The averaged values in the ACPD version are not discussed anymore.

6) The Jonhson et al (2001) observations are cited in the caption.

To review 2:

We thank for this very comprehensive and mature review and agree with all comments addressed:

Specific comments:

Title is changed.

The calculated profiles of H2O, CH4, and H2 are shown and discussed.

H2 is explicitely modeled, in contrast to the previous version.

Fig. 4 (now 5): fluxes also in Mt H2 equivalents.

A discussion of the three isotope exponent is added (section 3, line $\sim$165).

The updated NASA-JPL 2003 reaction rates are used. The reaction CH3O2 + NO ->

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CH3O + NO2 is implemented as some further NOx reactions. Possible MIF due to the reaction H+O2+M suggested by Savarino and Thiemens (1999) is not considered, because relevant KIEs were not measured yet.

CH4 photolysis is of very minor importance because of which the reaction CH4 -> CH + H2 + H is not implemented.

Table 4 now contains all measured isotope fractionation factors and a further table is added which contains all considered isotope exchange reactions.

Technical corrections:

Almost all suggestions made by the reviewer were considered and implemented.

To the comments by T. Röckmann:

All comments by Thomas are considered in the new version of the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 3991, 2003.