Comments on "Simulation of isotopic composition of stratospheric water vapor - Part 1" by R Eichinger

This paper describes the implementation of water and methane isotopes into the chemistry-climate model EMAC and presents a preliminary comparison with some satellite and balloon-borne datasets.

This is not a very ambitious paper: 1) no particular science question is being addressed, this is left for future studies; 2) the satellite-model comparison remains rather crude compared to the state of the art, without any account for intrument sensitivity or cloud masking.

But it's a serious and well-written paper. So I have only minor comments in section 1, but also optional suggestions in section 2.

1 Minor comments

- p 23810 l 2: remove coma. Beware of similar coma problems at other places.
- p 23810 l 14: What does MESSy stand for?
- p 23810: is it the first general circulation model that is used for looking at the stratosphere or TTL region? Add some review of previous studies on the subject, and cite for example [Schmidt et al., 2005].
- p 23810 l 16: "Depending on the" -> "When used with"
- p 23813 l 5: "condensation" -> "condensation to liquid"?
- p 23822 l 19: "it" -> "if"
- p 23826 l 27: you cannot cite a paper in preparation
- p 23827 l 22: "however" seems out of place

2 General suggestions

If the authors want to give more added value to the paper beyond the simple description of a technical achievement, here are some suggestions:

- Improve the model-data comparison technique by taking into account instrument sensitivity (through averaging kernels), spatio-temporal sampling, and cloud masking (e.g. [Risi et al., 2012, Yoshimura et al., 2011]...). This would allow to investigate in more detail and more convincingly the sources of model-data and data-data differences. This extension of the work is suggested in p 23831, and it's not so difficult to actually do it.
- Investigate in more detail the sources of model-data disagreement, if these persist after using the more rigorous model-data comparison methods above. In particular, what explains the phase shift of the δD tape recorder? What does it say about the model physics? Was this problem already noticed in other models? What does it say about the potential of water isotopic observations to address questions about the stratospheric water budget?

Références

[Risi et al., 2012] Risi, C., Noone, D., Worden, J., Frankenberg, C., Stiller, G., Kiefer, M., Funke, B., Walker, K., Bernath, P., Schneider, M., Wunch, D., Sherlock, V., Deutscher, N., Griffith, D., Wernberg, P., Bony, S., Jeonghoon Lee, D. B., Uemura, R., and Sturm, C. (2012). Process-evaluation of tropical and subtropical tropospheric humidity simulated by general circulation models using water vapor isotopic observations. Part 1 : model-data intercomparison. *J. Geophy. Res.*, 117 :D05303.

[Schmidt et al., 2005] Schmidt, G., Hoffmann, G., Shindell, D., and Hu, Y. (2005). Modelling atmospheric stable water isotopes and the potential for constraining cloud processes and stratosphere-troposphere water exchange. *J. Geophys. Res.*, 110 :D21314, doi :10.1029/2005JD005790.

[Yoshimura et al., 2011] Yoshimura, K., Frankenberg, C., Lee, J., Kanimatsu, M., Worden, J., and Röckmann, T. (2011). Comparison of an isotopic atmospheric general circulation model with new quasi-global satellite measurements of water vapor isotopologues. *J. Geophys. Res*, 116 :D19118, doi :10.1029/2011JD016035.