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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of stratospheric water vapor and trends using three reanalyses" *by* M. R. Schoeberl et al.

Anonymous Referee #2

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General Comments

The study by Schoeberl et al. deals with an interesting question regarding stratospheric water vapor, namely the question which processes controls the entry level of stratospheric water vapor and how well these processes can be described based on current meteorological analyzes. The study is well designed, the science is sound, and the paper is well written.

The study is based on computing domain filling trajectories. Here I suggest to extend the discussion (even acknowledging that the method has been discussed in a previous paper) – it is not clear from the discussion here why the forward calculations should be superior, in principle, to backward calculations. Does this judgement not depend

merely on the question that is being asked? I.e. where the air masses end up rather than asking where they are originating from?

I also suggest considering whether information from high vertical resolution reconstructions should not be degraded using the MLS averaging kernels, when compared to (low vertical resolution) MLS observations. At least the issue should be discussed.

Further, an important finding of the paper is that the Brewer-Dobson circulation is to rapid in ERA-interim. This finding is at least qualitatively consistent with an independent study based on a different methodology published recently in JGR (Ploeger et al., 2012). I think it is worthwhile to discuss in how-far these two studies agree or whether possible discrepancies exist.

I have also a list of minor comments (see below) that I think should be taken into account when revising the paper. I recommend publication of the revised version of the paper in ACP.

Comments in Detail

p. 8434., l. 24: It might be worth distinguishing here between the impact on the upper stratosphere (where enhanced water vapor impacts gas-phase chemistry) and the polar lower stratosphere (where enhanced water vapor impacts heterogeneous chemistry). However, recent studies (e.g., Vogel et al., 2011) find only a very moderate increase of polar ozone loss due to enhanced stratospheric water vapor.

p.8434. l. 26: distinguish between forcing of stratospheric temperatures and surface temperature forcing.

p. 8435., l. 6: I would not use the expression “difficult time” here.

p. 8435., l. 13: it is not quite clear what is meant by “continuous release”. I suggest

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mentioning the release frequency (once per hour?) and the length of the trajectories used.

p. 8426., l. 3: mention which diabatic terms are taken into account. Just clear sky heating?

p. 8438, l. 1: quantify (roughly) what the offset is in ppmv.

p. 8440., l. 1–5: Suggest discussing here as well the impact of the time resolution of the analyzes (6h versus 24h).

p. 8441., l. 15: Antarctic dehydration is real so it should not necessarily lead to a dry bias.

p. 8445., l. 26: I find the use of the term "models" confusing here. You are *not* talking about the water vapor from the reanalyzes here, correct. What you mean is the water vapor reconstruction using a certain "model", i.e. a certain reanalysis.

References: titles should not be capitalized; also check spelling of names. E.g. Voßsing should be Vössing.

Fig 2: Color bar difficult to read.

Figs. 4 and 5: Caption uses (a), (b) etc to identify panels but these labels are not visible in the plots.

References

Ploeger, F., P. Konopka, R. Müller, S. Fueglistaler, T. Schmidt, J. C. Manners, J.-U. Grooß, G. Günther, P. M. Forster, and M. Riese (2012), Horizontal transport affecting trace gas seasonality in the Tropical Tropopause Layer (TTL), J. Geophys. Res., 117, D09303, doi:10.1029/2011JD017267.

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Interactive Comment

Vogel, B., T. Feck, and J.-U. Grooß (2011), Impact of stratospheric water vapor enhancements caused by CH4 and H2O increase on polar ozone loss, J. Geophys. Res., 116, D05301, doi:10.1029/2010JD014234.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 8433, 2012.