

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

Anonymous Referee #4

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This study uses a domain-filling, forward trajectory calculation model to examine simulated water vapor distributions and compares with satellite observations. Deficiencies are found with the various reanalyses based output, with CSFR giving a wetter stratosphere than MERRA and ERA-Interim giving a drier stratosphere than MERRA. ERA-Interim is also found to be colder than MERRA. There are also differences in the pattern of dehydration between the various reanalyses.

Overall, the paper is clear and concise, and covers a topic of interest to people doing climate research involving the stratosphere. Only minor corrections are needed. Specific comments are detailed below. _____

Abstract line 6-8 “We find that ERAi temperatures are cold biased compared to Singapore sondes and MERRA. . .” Cold biased at what levels?

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Abstract, line 13: States “The models’ lower stratospheres. . .” Which model or models? Are you really saying that the trajectory calculation using all reanalyses produces a lower high latitude stratosphere that is too dry? Is this a problem with high latitude descent, or rather a consequence of inadequate methane oxidation in the trajectory model? (Is the oxidation derived from the 2D model accurate?)

Abstract: line 17-18 “The models tend to reproduce the observed weakening of the 100-hPa annual cycle in zonal mean water vapor as it propagates to middle latitudes.” . . . Rather than weakening, isn’t “reduction in amplitude” a more accurate description?

Page 8434: line 24. Change affect to effect.

Page 8435: line 21/22. . .can you provide a reference for “standard advection schemes excessively diffuse the strong water vapor gradient at the tropopause.”?

Page 8436: line 9, change “the excessively” to “an excessively”

Page 8437: Line 14-16: Is this saying that using 6 hour MERRA winds/temperatures results in greater dehydration than using daily averages? Why?

Page 8438: Line 5, change to Figure 1a-b (there is no c), however it might be useful to include one that shows what the difference in the profile looks like between the sondes and the reanalyses. Are there the same number of observations for each curve in Figure 1a, so that this shows that the most probable values is similar between MERRA, CSFR and the sonde, but the warm tail is different from all the reanalyses and sondes, and the cold tail only ERA-Interim is different from the sonde station? Is it possible to assess how much the difference between obs and the reanalyses in the warm tail could bias any water vapor results obtained from the trajectory model?

Page 8441: last paragraph: It seems like there could be information learned from how the authors “adjusted the gravity wave, supersaturation and convection scheme to improve MERRA’s agreement with MLS.” Are there competing effects between these

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adjustments? Could you at least state what you deemed the optimum values you determined for the adjusted parameters?

Figure 4: Please label the a,b,c,d (it looks like there are 3 figures for a, and then one each for b,c &d.

Figure 5: It would be useful to include shading or some means of showing the spread in the MLS measurements that went into the averages plotted here.

Page 8442: line 15-20...is the descent not adequate, or is the methane oxidation scheme not adequate? There isn't CH₄ from MLS, but it may be possible to look at with HALOE, or with the derived methane product that Ken Minschwaner has developed with MLS data and presented in a poster at the 2011 AGU meeting.

Figure 8: caption, change to "observations by number of months indicated"

Page 8444: line 23...Please include a sentence on how you adjust to the MLS means (simple shift...a multiplicative scaling...?)

Page 8445: line 24...I'd suggest changing "our data" to "our model output", as this really gets to the problem discussed in prior papers that trends at NH mid latitudes do not agree with what would be deduced with trends in tropical tropopause temperatures (and brought about the ideas that possibly cloud physics changing may play a role (a la Steve Sherwood).

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