

Interactive comment on “Trajectory model simulations of ozone and carbon monoxide in the Upper Troposphere and Lower Stratosphere (UTLS)” by T. Wang et al.

Anonymous Referee #1

Received and published: 26 March 2014

Overview: This manuscript uses a domain-filling forward trajectory model to simulate ozone and carbon monoxide in the upper troposphere and lower stratosphere (UTLS). Chemical production and loss rates are based on results from a global chemistry/climate model. The goal appears to be examining the importance of specific processes in controlling the UTLS distributions of CO and O₃. They find that variability in tropical upwelling, on both seasonal and interannual time scales, are key for forcing variability in tropical UTLS chemical distributions. Overall, the paper is well written and understandable. I'd recommend publication after minor revisions. Suggestions for revision are given below.

C751

Suggestions: Title may want to specifically state "Tropical" UTLS.

line 22, page 5994; insert "the" in front of 370K

line 8, page 5995: states "re-entered the troposphere"....if you're concerned with the UTLS distributions, don't you need to only ignore parcels that can't impact the UT anymore? So, possible, a lower pressure level would be relevant?

line 9, page 5995; need a "the" in front of ~2200K

line 20, page 5995; change "waves" to "wave"

Question on heating rates: Does the reanalysis diabatic rates include some portion related to reanalysis increments? That is, if you did a radiative heating rate calculation with the gas and temperature profiles in the reanalysis, would you get the same diabatic heating rate that is stored in the reanalysis output? What causes the differences in Q shown in Figure 1? Do the four reanalyses have dramatically different temperature and ozone/ch₄/h₂o/n₂o inputs in their heating calculations?

Question on chemistry: When you pick out production and loss rates from WACCM and apply them to the reanalysis based trajectories, are you considering any variation in season, or with temperature? If the WACCM temperatures aren't the same as the reanalysis temperatures, does that introduce error? Just a bit more explanation of how the production and loss rates are applied to the trajectory model would be helpful. (Section 2.2)

line 2, page 5998; what kind of MLS climatology is used? (annual, monthly averaged, daily averaged, averaged over what time period?)

line 24, page 5998; change to "differences from MLS retrievals"

section 3.1, page 5999: Define "reasonable agreement". I would conclude a spread from looking at Figure 4.

Can you compare WACCM heating rates to those in the reanalyses? There seems to

C752

be a significant difference between the WACCM and trajectory runs at 68 hPa. Is that a consequence of a difference between upwelling computed in WACCM versus that in the reanalyses?

line 7-9, pg 6005; why do you suspect that the ERAi upwelling may be too strong? Please add a sentence summarizing Ploeger's conclusions.

line 26, pg 6005; change discussions to discussion

Summary and Conclusions: Could you add a few sentences as to how the trajectory approach presented here provides more information than analyzing an SD WACCM run?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 5991, 2014.