

## ***Interactive comment on “Transport analysis and source attribution of seasonal and interannual variability of CO in the tropical upper troposphere and lower stratosphere” by Junhua Liu et al.***

**Anonymous Referee #1**

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The authors use MLS CO data to evaluate the GEOS-Chem model and use the model to interpret the MLS observations. This manuscript requires clarification on several points before I can recommend it for publication. Here are my concerns:

A) It is not clear what conclusions are new in this analysis. Much of what is presented seems to have already been shown by Liu et al. (2010), Duncan et al. (2007), Liu et al. (2007) and Schoeberl et al. (2006). In the introduction, the authors state that the present work “builds on our earlier study”, but they don’t even discuss the findings of that study. I recommend that the authors discuss the conclusions of Liu et al. (2010) and clearly state how the work in the current paper is different and new. The two papers

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have very much the same “look and feel”. In fact, the first sentences (i.e., the purposes of the manuscripts) of the two abstracts are very similar.

B) The importance of the main findings is not discussed. Is it important from a chemical or climate perspective for a model to simulate CO well in the UTLS? What are the implications of too slow transport through the UTLS? Are there consequences for other important trace gases?

C) There is no discussion on the limitations of the data for the purposes of this manuscript. For instance, does the data’s vertical resolution influence what can be concluded on vertical transport through the UT/LS? Please include a discussion on the precision of MLS and the statistical significance of the averaged data. Here are some examples of my recommends to address this concern, which generally apply to all figures:

Figure 1. Add uncertainties to the MLS data. Add a discussion on the number of points that went into the average and the statistical significance. Are these monthly averages? The data and model are clearly correlated for the most part, but can you present the correlation and bias? A few paragraphs on just how the model was sampled should be added to the paper somewhere, including a little more mention of the averaging kernels.

Figure 4. Do you interpolate the data between the pressure levels: 215, 147, 100 and 68 hPa? Where does the structure between pressure levels originate? Does the data from adjacent pressure levels actually “overlap” when one considers that the data’s vertical layers are  $\sim 4$  km? Does this limit your ability to make conclusions about the model’s performance in the UTLS?

D) Overall, the manuscript is far too long as there is too much discussion of details that may only be of interest to very few people. For example, is vertical transport in your model with GEOS-4 and GEOS-5 meteorological fields of interest to the general science community or to a small group of users of the fields?

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