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Interactive Comment

Interactive comment on "Observationally derived transport diagnostics for the lowermost stratosphere and their application to the GMI chemistry and transport model" *by* S. E. Strahan et al.

Anonymous Referee #3

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Overall: This is an interesting paper on comparisons of chemical transport diagnostics with a model, and though much of it is outside my expertise, it does appear to push forward the sophistication of these types of comparisons. I recommend acceptance with minor revisions, listed below.

page 3: The TTL is usually referred to as the Tropical "Tropopause" Layer. Also, clear sky radiative heating rates generally become positive near 15 km, or about 355 K. Defining the base of the TTL at 13 km puts it below the climatological level of zero radiative heating.

page 4: It would not be essential to include this, but perhaps the earliest paper recognizing the special status of the LMS from a tracer perspective was Dessler, et al., J. Geophys. Res., 100, 23,167-23,172, 1995, a Tale of two stratospheres. However, I gather water vapor is not being calculated interactively here, so this reference is not directly relevant to these model runs.

caption to Figure 2: implies that the black line is derived from observations, whereas the text on page 8 implies that this is from the model. In any event, it's not clear that this is a good test of the model unless the model and measurements agree on the ML + Samoa average.

I also view the 2 month lag time in Boering [1996] as being somewhat dated. Ozone has a seasonal cycle at the tropical tropopause (also seen in this paper in Figure 6) which is probably due to some combination of increased high altitude convective detrainment, and upwelling, during NH winter. It is likely that these seasonal dynamical variations also partially drive the CO seasonal cycle. 2 months might be an accurate annual mean lag, but there is likely to be a substantial seasonal cycle in the size of this lag. The model probably has a seasonal variation in the size of this lag since it has a nice seasonal cycle in ozone at 380 K. Might want to check what the seasonal variation of this lag is in the model.

Figure 6: A tropical ozone climatology from SHADOZ (20S-20N) suggests a value a bit lower than 50 ppb for 13 km (Folkins et al., J. Geophys. Res., 111, D23304, doi:10.1029/2006JD007325); The MLS ozone for 350 K, 6-20 N appears to be biased high relative to the ozonesondes, even allowing for NH versus SH differences, especially considering SHADOZ probably has a continental bias.

Last sentence: some of this seems overly optimistic and not fully supported by the paper. For example, if one is referring to fire emissions in the extratropics that reach the stratosphere, then one would be referring to the ability of the model to convectively transport tropospheric air directly into the stratosphere, potentially involving pyrocumu-

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lonimbus. I am not sure the model could reproduce these types of unusual events, that might have less impact on the mean tracer distributions of the model. Also, modeling the ability of the breakdown products of a VSLS species like CHBr3 to reach the stratosphere requires modeling the chemistry of these species in the TTL, possible adsorption of any ice soluble species like HBr onto ice crystals, and the potential irreversible removal of these species from the TTL within falling ice crystals before they reach the lowermost stratosphere (It's unlikely the Br they contain reaches the stratosphere with 100% efficiency). It is not clear that the model can deal with these microphysical processes, especially since water vapor is not being interactively modeled here, I don't think.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 1449, 2007.