

Interactive comment on “

Seasonal variation of trans-Pacific transport of carbon monoxide (CO) in the upper troposphere: MLS observations and GEOS-Chem and GEM-AQ simulations” by J. J. Jin et al.

Anonymous Referee #2

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General comments:

The authors examined the seasonal variation of trans-Pacific transport of CO in the upper troposphere (UT) using six years of MLS CO measurements at 215hPa in conjunction with two global 3-D chemical transport models (GEOS-Chem and GEM-AQ). They compared model results of UT CO concentrations and variabilities with MLS measurements and discussed the discrepancies. Contributions of various source regions

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and types were quantified using GEOS-Chem tagged CO tracers simulations. The role of convective transport was investigated by conducting a sensitivity experiment where convective transport is switched off in the model. The authors showed that MLS CO measurements can be used to improve our understanding of trans-Pacific transport of CO in the UT and may help identify the weaknesses (e.g., convective transport) in chemical transport models. This paper is overall well organized and contains original contributions. However, I found it difficult and time-consuming to read through the paper because of grammar errors, typos, and, in many places, poorly structured sentences (see below for examples). I suggest the paper be carefully edited by the authors (e.g., second author) prior to publication on ACP.

Specific comments:

The introduction section lacks a brief discussion of transport mechanisms responsible for the export of Asian CO in different seasons.

The term "biomass burning over Southeast Asia" (or something similar) is used throughout the paper. But it is often not clear which biomass burning area the authors meant since there are two distinct areas of biomass burning in the region (continental SE Asia, peak in March; Indonesia, Sept-Nov). The different seasonality of biomass burning in these two areas should be pointed out. See, e.g., P3225,L22; P3226,L2; P3231,L26-27. Furthermore, some plots showing distributions of biomass burning (as well as fossil fuel) CO emissions would help the discussions.

Based on the comparison of model upper-tropospheric CO morphologies with those of MLS measurements, this study concluded that the deep convection parameterization (Zhang and McFarlane, 1995) in GEM-AQ needs to be improved. On the other hand, the authors mentioned in section 2 that GEOS-4 (also Zhang & McFarlane convection) features stronger convection than GEOS-5 (Relaxed Arakawa-Schubert convection scheme) does. Would GEOS-Chem simulations driven with GEOS-4 lead the authors to draw the same conclusion with regard to the weakness of the Zhang and

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McFarlane (1995) deep convection scheme? See also P3230,L7-10.
P3220, L23: tRopospheric
P3221, L11: air pollutants in the FREE TROPOSPHERE;
P3221, L14: likely because of..
P3223, L23: Deep convection IN GEOS-5 is parameterized according to...
P3224, L2: It is more appropriate to cite here Bey et al. [2001a].
P3224, L8: Do you mean "the lower and middle troposphere" by "the lower and free troposphere"?
P3226, L5: occur
P3226, L22: as INDICATED by
P3227, L13-17: Does this apply to the 215hPa level only, or all levels?
P3229, L11: "updrafted" – uplifted?
P3229, L22-24: rewrite this sentence.
P3230, L1-3: "... convective parameterization, which is need to loft surface biomass emissions to the UT in models" – rewrite this sentence.
P3230, L18: "Archived monthly mean OH is used to calculate CO production and loss rates" – Are these monthly mean OH archived from the full-chemistry runs for the same years (i.e., 2005-2006)?
P3230, L18: NMHCs; as different CO TRACERS.
P3230, L24: Fig. 5 shows seasonal...
P3231, L7: This suggestS
P3234, L6: This is due to LARGE-SCALE upward transport of HIGH CO emissions

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during

P3234, L28: the Inter-Tropical Convergence Zone

P3235, L13-17: "air pollution", "Asian pollution" — here and elsewhere, do you actually mean Asian CO?

P3236, L6: "it contribute" – they contribute

Fig.1 caption: "the locations of the SLIDES shown" – slices?

Fig. 4 caption: tagged CO TRACERS

Fig. 6: Is there a specific reason for using NCEP winds instead of GEOS-5 assimilated winds? The latter would be more consistent with the GEOS-Chem (GEOS-5) simulated CO.

All figures except Fig.4: the character font sizes in the figures are way too small, at least in the print version.

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