**Atmospheric
Chemistry
and Physics
Discussions**

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Comment

Interactive comment on "
**Carbon monoxide and related trace gases and
aerosols over the Amazon Basin during the wet
and dry seasons"** *by* **M. O. Andreae et al.**

M. O. Andreae et al.

m.andreae@mpic.de

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Response to Anonymous Referee #1

(Referee comments in italics, our response in plain font)

We thank the reviewer for the positive and constructive comments. Our responses are
given below:

Minor Comments: Page 8110, line 5: Use "that" instead of "which"

Done

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Section 2.3: What are the detection limits for the flask samples?

Since CO and SF6 mixing ratios are always far above the detection limits, no effort was made to determine the detection limits. The measurement precision, which is a more useful metric of analytical performance in this case, is stated in the text.

Section 2.5: I got a bit confused in the description of WRF-CHEM and WRF-GHG. Does WRF-GHG contain any chemistry, or is it purely a tracer model?

WRF-GHG is purely a tracer model, which does not take into account chemical reactions. This is stated on p. 8119, line 9.

Why were different physics and PBL schemes used?

This allows assessing the impact of different subgrid transport parameterizations on the simulated transport. Different physics and PBL schemes were used because additional meteorological testing was conducted for WRF-Chem after the WRF-GHG configuration was finalized. The grid configurations were also different for WRF-Chem and WRF-GHG. The outer WRF-Chem grid was expanded to include the cross-Atlantic transport of biomass burning emissions from southern Africa, and the inner grid had a 35 km resolution covering South America, while WRF-GHG used a 30 km grid covering South America and a 10 km domain over the Amazon region. Thus, the resulting meteorology is different. This information was added in section 2.5.3.

In the full chemistry simulations, what chemical mechanism is used?

In the full chemistry simulations (WRF-Chem and CCATT-BRAMS), the RACM chemical mechanism was used (Stockwell et al., 1997). This information was added in section 2.5.3.

The authors state that the biogenic emissions are based on the MEGAN 2000 climatology. Did these have a diurnal variation?

The MEGAN 2000 climatology does not include diurnal variation in emissions. In WRF-

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Chem they are combined with the anthropogenic emissions and a Gaussian diurnal cycle with peak at 15UTC (11LT) is applied. In CCATT the diurnal cycle of biogenic emissions follows exactly the same shape as the solar radiation cycle. This information was added in section 2.5.3.

Page 8120, line 25: The plane reached a ceiling of 4500 m. What has the height of the PBL?

PBL heights over the Amazon forest show a pronounced diel variation. At night the PBL height is about 100 m, and in the afternoon it reaches about 1100 m (Fisch, G., Tota, J., Machado, L. A. T., Dias, M., Lyra, R. F. D., Nobre, C. A., Dolman, A. J., and Gash, J. H. C., The convective boundary layer over pasture and forest in Amazonia: Theoretical and Applied Climatology, 78, 47-59, 2004.)

Page 8122, lines 20, 29, and figure 3: I am assuming that concentrations of the SF6 should be pptv; however line 20 uses ppbv. Can this be reviewed and corrected?

The errors have been corrected.

Page 8127, line 27-28: Does this also indicate that other anthropogenic sources (e.g., urban areas) didn't impact the Basin either?

There was no indication that anthropogenic sources influenced the regional concentrations of CO in significant amounts outside of the immediate urban plumes. More on this issue can be found in: Kuhn, U., Ganzeveld, L., Thielmann, A., Dindorf, T., Welling, M., Sciare, J., Roberts, G., Meixner, F. X., Kesselmeier, J., Lelieveld, J., Ciccioli, P., Lloyd, J., Trentmann, J., Artaxo, P., and Andreae, M. O., Impact of Manaus City on the Amazon Green Ocean atmosphere: Ozone production, precursor sensitivity and aerosol load: Atmos. Chem. Phys., 10, 9251–9282, 2010.

Page 8133, second paragraph: Can uncertainties in the simulation of the PBL account for the observed uncertainties?

We assume the reviewer refers to the paragraph starting with "Simulated CO during

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the ...", which discusses the tagged tracer simulations and reveals a bias in the GEMS reanalysis used as lateral boundary condition. We don't think that uncertainties in the simulation of the PBL can explain differences between STILT (or WRF-GHG) and observations during periods of low contribution from biomass burning, as during these periods there is little variability in CO and vertical gradients are small. Furthermore, differences due to PBL transport would be expected to be limited to the lowest 2 km, however model-data differences are seen throughout the profile between surface and 4 km altitude. Therefore we argue in second paragraph on page 8134 that differences in transport are more related to plume rise parameterization.

Page 8134, The authors address the model and the flight data comparison. Did they see any improvement in the simulated surface concentrations?

In general the simulated surface concentrations (WRF-Chem and CCATT-BRAMS) are too low relative to flight measurements, likely due to a combination of excessive vertical transport from deep convection and/or overly strong photochemistry. We do not have other surface measurements for comparison.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/12/C3922/2012/acpd-12-C3922-2012-supplement.pdf

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 8107, 2012.