Anonymous Referee #2

We highly appreciate the thorough review and the constructive comments of the reviewer that helped to significantly improve the paper. Following the suggestions, we included a comparison of the modeled CO fields to long-term measurements at four NOAA surface sites. Please find a detailed response below.

This is a very good and thorough assessment of the interannual variability of CO above the Pacific Ocean and the USA. In general I think the paper could be published after a minor revision, but I have one major reservation regarding model verification that needs to be addressed, as follows:

Monthly average model output is compared to monthly average MOPITT retrievals above the North Pacific and the USA and the correlations have high r-squared values, and the model has a slight high bias (although not statistically significant). While this result is encouraging the model and MOPITT may agree for the reasons that are not necessarily correct. The model averages are for all conditions, while the MOPITT retrievals are only valid for clear-sky conditions. We know from studies like Crawford et al. [2003] that Asian CO export is often associated with cloudy conditions, consistent with the concept of Asian export in warm conveyor belts that traverse the Pacific and reach the USA. So it seems likely that MOPITT misses the detection of many strong Asian pollution export events and the CO retrievals are likely to be biased low.

I would like to see a comparison between MOZART and monthly average CO at Mauna Loa, Cheeka Peak and Mt. Bachelor. This comparison would give a better indication if the model is biased high or low and would also show if the model provides an adequate quantification of interannual CO variability in the lower troposphere.

Crawford J, Olson J, Davis D, et al., Clouds and trace gas distributions during TRACE-P, JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES Volume: 108 Issue: D21 Article Number: 8818 Published: NOV 4 2003

CO observations for Mt. Bachelor and Cheeka Peak only cover parts of the time period of interest and, while extremely valuable data sets, are of limited power for evaluating the modeled interannual variability discussed in this study (please see below). However, following the reviewer's suggestion we added model evaluation at four NOAA surface sites (Mauna Loa, Cold Bay, Sand Island and Point Arena) for which a continuous data series for 2000-2006 is available. Please see revised manuscript Sections 2.4 and 3.1 and Figures 3 and 5.

To fully address the reviewer's comments we show below the comparison of MOZART simulations to monthly mean CO observations at Cheeka Peak and Mt. Bachelor. We like to acknowledge Dan Jaffe for providing the observational data set. The model represents the Cheeka Peak observations well, and while reproducing the seasonality at Mt. Bachelor reasonably well, shows an overall low bias. While the coarse model resolution certainly can explain some of the bias, model uncertainties in transport and chemistry or uncertainties in timing and magnitude of emission are additional reasons.

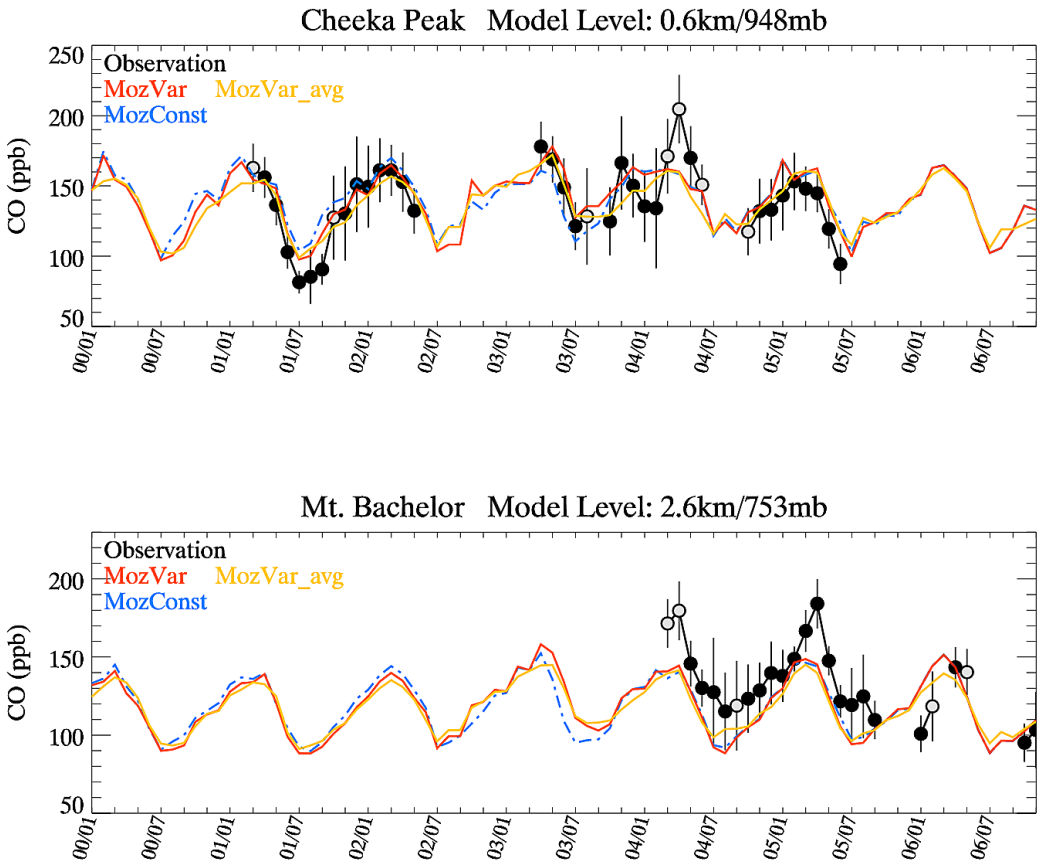

Figure: Time series of modeled and measured CO at Cheeka Peak and Mt. Bachelor for 2000-2006. Monthly mean and standard deviation of hourly observations is shown in black with those monthly averages where the temporal coverage is less than 75% highlighted as gray circles. Modeled CO mapped to the location and altitude of the site is shown in red (MozVar) and blue (MozConst). MozVar results averaged over a 10 deg x 10 deg region surrounding the site are plotted in yellow.

Minor comments:

The current title gives the impression that the study is mainly focused on the INTEX-B mission. Readers who are not specifically interested in INTEX-B may overlook this paper based on the title. I think the title would give a better reflection of the contents of the analysis, and would also appeal to a broader audience if it were modified to:

Variability of springtime transpacific pollution transport during 2000-2006: The INTEXB mission in context to previous years.

We appreciate this suggestion and have changed the title accordingly.

page 17819 line 4-6

These lines mention the importance of transport between Asia and North America and how increasing Asian emissions might offset emission controls in the US. These issues are supposedly supported by Park et al., 2005. However, this paper does not discuss transpacific transport, nor does it discuss Asian emissions offsetting North America emissions. This reference needs to be removed and a more relevant reference needs to be used such as:

Jacob D. J., J. A. Logan, and P. P. Murti, Effect of rising Asian emissions on surface ozone in the United States, Geophys. Res. Lett., 26, 2175-2178 (1999).

Park et al. [2005] has been taken out and Jacob et al. [1999] added as reference. In addition, Zhang et al. [2008] and Zhang et al. [2009] are added as references.

page 17825 line 8

r is the correlation coefficient. r-squared is the square of the correlation coefficient, also known as the coefficient of determination.

"correlation coefficient" has been changed to "squared correlation coefficient". This change was also made in the caption to Figure 6.

page 17828 line 21

“and about 1/3 of that found for US”

Shouldn’t this be 2/3?

The reviewer is correct, this should read 2/3.

page 17829 line 8

Here you state that BB tracer is about 10% of the CO budget, but from Table 1 it appears that the BB tracer is closer to 20%.

Table 1 lists the emission strength while in this discussion we refer to contributions of individual tracer concentrations to the tropospheric CO budget over the two regions PAC and US. This contribution is in the order of 10% and can be estimated from values listed in Table 2: The MTB (mean tropospheric burden) of the BB tracers over PAC is 3.80 Tg, which is about 12% of the total CO burden (30.73 Tg). For US the contribution is about 11%.

page 17830 line 18

I don’t like the term: “natural” variability. It would be better to be more specific and say, meteorological variability.

Based on comments from Reviewer 1, this Section has been taken out. The term "natural variability" was also used in the Introduction and has been changed to "meteorological variability".

page 17830 lines 24-25

Please clearly state just the trend in MOZConst. Is it 0.31 +/- .1 Tg yr-1?

Based on comments from Reviewer 1, this Section has been taken out.

page 17833 lines 5-6

would sound better as: terms are seen for the CO-CHEM contribution, which due to the high latitude, is up to 6% smaller....

This has been changed.

Figure 1

The MOZART data are difficult to see in my printed version. Please use color.

This figure has been changed and model data are now color-coded in blue.

Figure 2

The panels are too small, please enlarge.

Also, does white mean very low CO or missing data? It would be helpful if missing data were shaded gray.

We reduced the extent of region shown which will allow for the relevant features to be shown more clearly. We also shaded data gaps in gray.

Figure 4

I find this figure difficult to interpret. Please provide additional explanation.

The figure caption as well as the description of Figure 4 (revised Figure 6) in the text have been revised.

Figure 3

In my printed version I can barely, if at all, see the MozConst values. Please sue color Also, in the caption, should convoluted be convolved?

The Figure has been revised and colors been added. Also the Figure caption has been corrected.

Figure 5

In my printed version I can barely, if at all, see the MozConst values. Please sue color.

We did not use color because the different gray shades are solely used to give a vague distinction for different types of CO tracers. But we revised the gray shades in Figure 5 (now revised Figure 7) to bring out MozConst values more clearly.

Figure 6

The gray bars are hard to see, please use color.

The modified Figure 6 (revised Figure 8) now uses a darker gray shade, which should allow for the graph to show up more clearly.

Figure 7

Please enlarge by 20%, the text is difficult to read.

The figure (revised Figure 9) has been revised and the font size of the labels increased.

Figure 8

The panels are very small and hard to see, please increase by a factor of 2.

The layout of the figure (revised Figure 10) has been changed and the size of the individual panels has been increased.