

Interactive comment on “Model analysis of the factors regulating the trends and variability of carbon monoxide between 1988 and 1997” by B. N. Duncan and J. A. Logan

Anonymous Referee #1

Received and published: 3 June 2008

General Comment: This paper examines possible reasons for a decrease in boundary layer carbon monoxide observed during the late 1980s and 1990s. Understanding changes in CO is important due to the reaction of CO and OH, which in the remote atmosphere is the major sink for both species. The few measurements made before the mid-1980s suggested that in the Northern Hemisphere CO was increasing, causing concern that OH would subsequently decrease. Soon after reports of an increase, global measurements indicated a decrease in CO. This was assumed to primarily reflect decreasing emissions in the industrialized north. Measurements in South Africa showed no long-term trend. The reasons for these changes have not been examined quantitatively.

This manuscript provides a detailed investigation of why CO decreased in the Northern Hemisphere during the 1990s. The modeling allows for the separation of changes in sources, chemistry and the effects of transport. While the approach used is not unique the application details described here can provide a model for future investigations of CO over other periods of time. This is a very good paper and suitable for ACP. The manuscript is well organized and very clearly written.

Specific Comments:

P.3, I.20-28; P.5 Fossil fuel emissions. National emission statistics from China are known to be low. Was this corrected for?

It would be quite useful to this reader if a table of the annual emissions from all sources was provided in Table 1.

P.5, Fossil Fuel emissions. During 1988-1997 did CO emissions change in other parts of the world? CO₂ emissions from India increased by 75% between 1988 and 1997 (CDIAC) and we might expect CO emissions also increased dramatically.

P.5-6. Overhead ozone column. The description of the ozone trend calculation is not clear. The text states effects of the solar cycle and QBO are not included, yet it also seems to conclude that much of the trend in the tropics is due to the solar cycle. Please clarify.

P.8. Trends in Model CO. Can model trends be compared to measured trends? Some comment/discussion of this point is needed.

P. 12, I.23-29. Episodic Events. The model used in this study did not fully account for changes in OH relating to the Mt. Pinatubo eruption in 1991 because it did not include the scattering effects of volcanic aerosols. The authors state the eruption had little effect on their trend calculations in the HNH. However the impact would have been greater in the mid- and tropical latitudes. This should be presented more quantitatively (for example, how would CO respond if model OH was overestimated by 5-8%

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(Dlugokencky et al., 1996)).

P.13. Transport. Does the simulation provide some information about the possible effects of ENSO phases since you have a run without ENSO meteorology and another with it?

P.14: Summary. Although the paper focuses on changes in the High Northern Hemisphere, trends from the three other zonal averages are presented. A concluding statement about these should be included.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9099, 2008.

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