

Northern Hemisphere Trends in Carbon Monoxide: Effects of Changes in Anthropogenic Emissions and Biomass Burning

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The magnitude and direction of changes in tropospheric carbon monoxide (CO) during the past century are still debated, however it is most likely there have been extended periods of increase and decrease, overlaid with much shorter-lived changes. Carbon monoxide has been measured in air samples collected by the NOAA Cooperative Air Sampling Network since 1988. The results provide a spatial and temporal picture of CO in the marine boundary layer and suggest a long-term decrease in the Northern Hemisphere (NH). We previously reported a decline in CO through the 1990s with the greatest changes occurring between 30°-90°N. Here we examine how changes in Fossil Fuel (FF) and Biomass Burning (BB) emissions have impacted CO in the NH boundary layer during 2000-2008. We compare the changes in measured CO mixing ratios to variations in emissions developed for MOZART, a 3-D CTM. The major sources of CO in the NH are roughly evenly distributed between fossil fuel combustion (FF), oxidation of methane and non-CH₄ hydrocarbons, and biomass burning (BB). Its primary sink is the Hydroxyl Radicals (OH). Only BB exhibits large inter-annual variation. A strong decrease in anthropogenic emissions from Annex_1 countries in the early 1990s contributed to a significant decline in CO. Continuing declines in their emissions during the late 1990s and 2000s added to the downward trend despite increasing emissions from developing nations. The NH decrease in background CO during 1990-2005 (i.e. change determined without the effects of the extreme NH fires of 1998 and 2003) compares well with FF emission inventories.

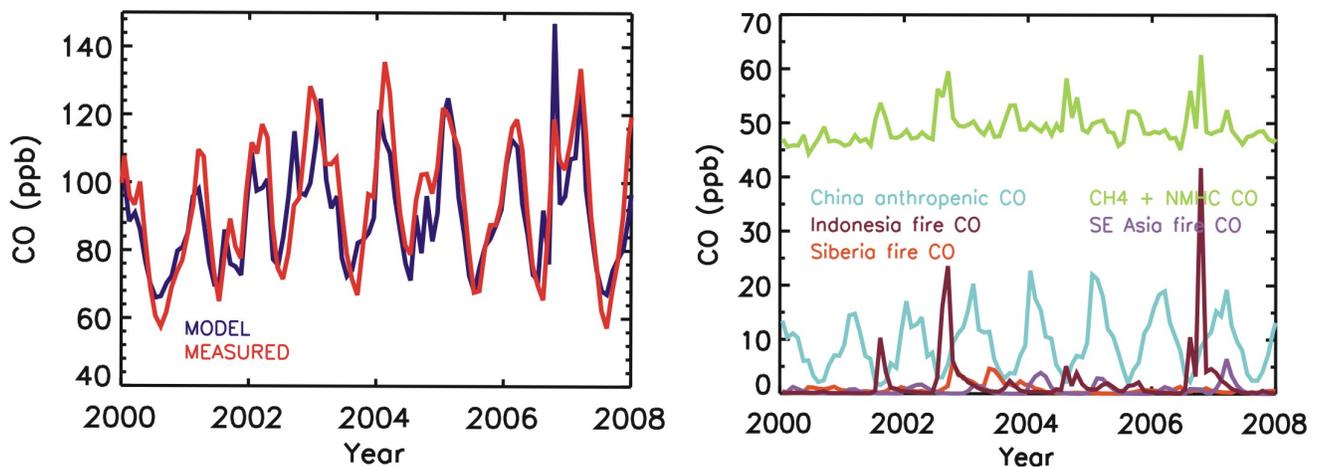


Figure 1. The LHS panel shows measured CO mixing ratios at Guam and the time series produced by MOZART. The results are presented as the smoothed fit to the data. The panel on the RHS shows the contribution of 5 major sources to CO at Guam.