

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

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The magnitude and direction of long-term changes of carbon monoxide (CO) in the NH are still debated; although it is most likely that there have been extended periods of increase and decrease, overlaid with much shorter lived changes. The most compelling evidence for a long-term trend results from a comparison of column measurements above the Swiss Alps in the early 1950s and in the mid-1980s. These suggested an linearized increase of $\sim 1\%$ CO yr⁻¹ (1). Measurements above Europe and Russia show increasing abundances in the 1970s and 1980s, after which CO decreased through the mid-1990s (2).

CO has been measured in air samples collected by the Cooperative Air Sampling Network since 1988. The results provide a spatial and temporal picture of CO in the marine boundary layer. Figure 1 shows trends determined for the high and low Northern Hemisphere (HNN, 30°-90°N; LNH, 0°-30°N) and the global mean. The primary sources of NH CO are fossil fuel combustion (FF, 30%), CH₄ oxidation (25%) and biomass burning (BB, 25-35%); its major sink is OH (90%) (3). NH FF emissions of CO have decreased by $\sim 1.6\%$ yr⁻¹ through the 1990s (4). Extreme periods of biomass burning occurred in 1998 and 2002-2003, increasing emissions 50-75% above average (5).

In this paper we examine how changes in FF and BB emissions have impacted CO. The effects of wildfires in 1994, 1998, and 2002-03 are clearly evident in the zonal time series. The background decrease in CO (that calculated without effects of the 1998/2003 fires) is consistent with decreased FF emissions. Rates of decrease in the high latitudes are greatest in winter when the signature of anthropogenic emissions from the extra-tropics is maintained. Year to year variability in CO emissions from BB is large, and extremes in seasonal burning can dramatically enhance zonal CO for a year or more.

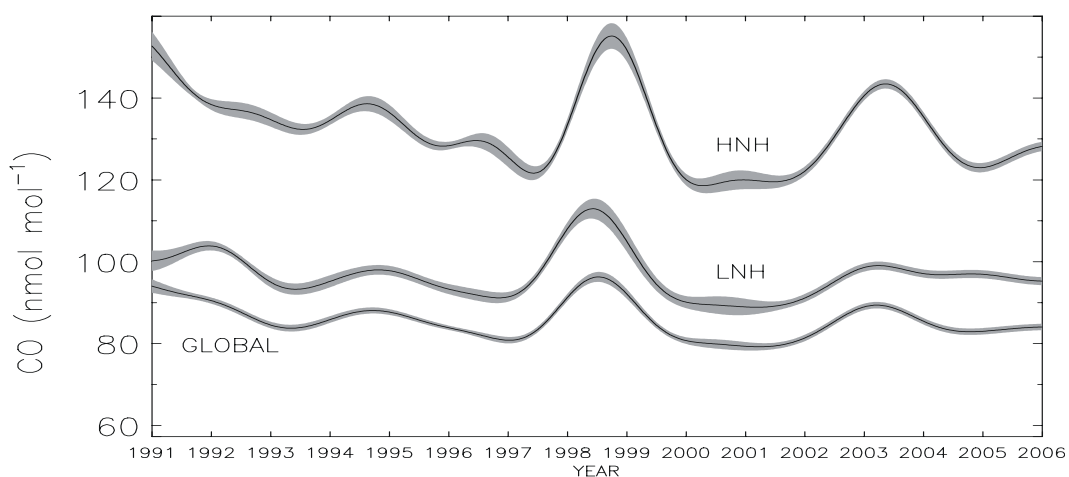


Figure 1. Zonal time series for the HNN, LNH and global mean. The HNN is derived from 12 sites, the LNH from 11, and smoothed in time and space as described in (5a). The thick black lines represent the trend plus 1σ .

References. (1) Zander et al., JGR, 94, 1989; (2) Mahieu et al., J. Atmos. Chem., 28, 1997; Yurganov et al., Rec. Devel. Geophys.2002. (3) Logan et al, JGR, 86, 1981; pers. comm., 1995; (4) EDGAR 32FT2000; (5) A. Novelli et al., JGR, 108, 2003, B. Kasischke et al, 19, GBC, 2005