Evidence for Long-Term Changes in Carbon Monoxide

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Future changes in the abundance of atmospheric carbon monoxide (CO) have the potential to exert significant effects on the Earth's radiative balance. Although CO is not considered a greenhouse gas, the photochemically driven cycle of CO provides it with an indirect greenhouse effect similar in magnitude to that of nitrous oxide (~10% that of CO_2). This presentation will examine CO trends over the past 150 years as derived from ice core data, total column measurements, and recent global surface measurements. Determination of recent CO trends is complicated by the limitations of available measurement techniques. Nonetheless, measurements made during the past 20 years suggest a strong anthropogenic influence on tropospheric CO, particularly in the Northern Hemisphere. Recent measurements show a high degree of interannual variability which dramatically impacts short-term growth rates (Figure 1). Long-term changes are more difficult to quantify with the available data. Human activity affects the three major sources of CO: combustion of fossil fuels and biomass and methane oxidation; all have increased over the past 150 years. Natural events such as volcanic eruptions and inter-annual changes in atmospheric dynamics also influence CO source and sink strengths. Reaction with the hydroxyl radical (OH) accounts for 90% of its destruction and is found to efficiently scavenge large pulses of CO to the atmosphere. Long-term trends may be small (relative to the increase in emissions) - suggesting tropospheric CO is strongly buffered by OH.

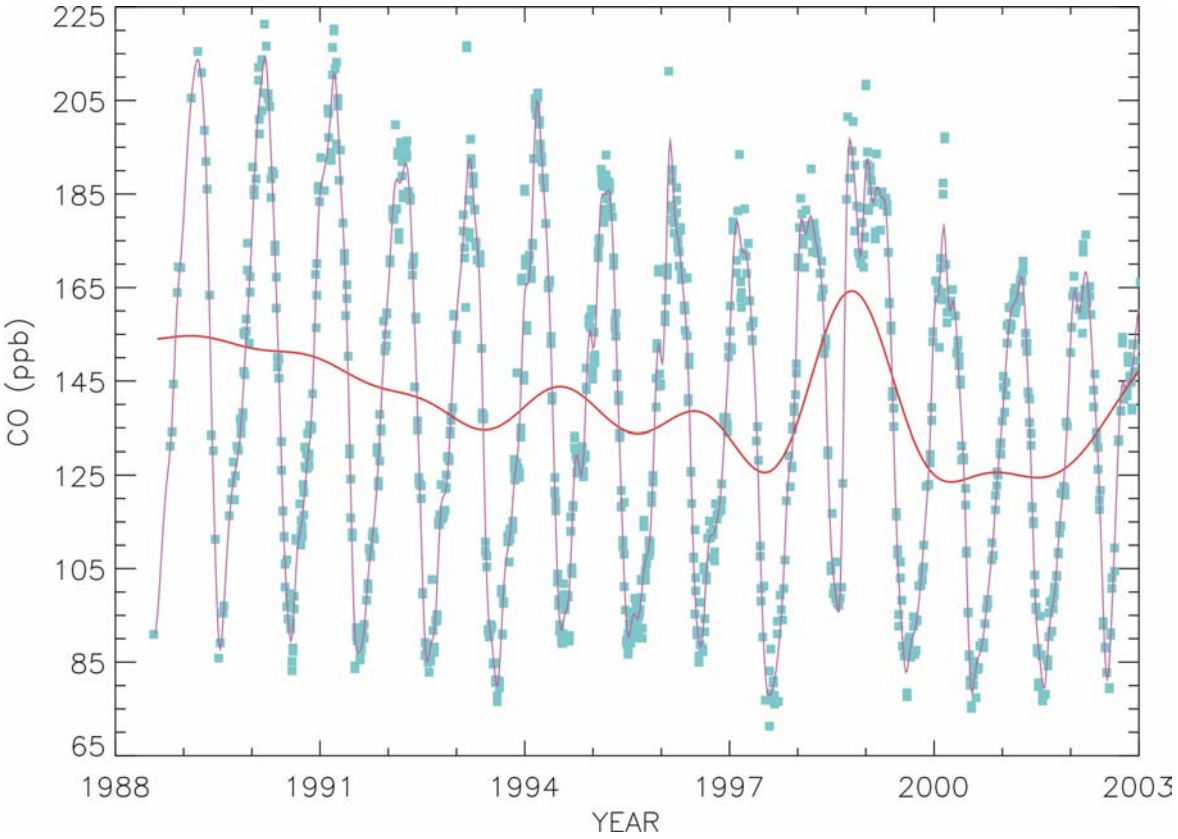

Figure 1. Time series from Pt. Barrow, AK. The data show a general decline in CO during the 1990s overlaid with short periods of enhancement. Higher CO in 1994, 1996, and 1998 reflect emissions from boreal wildfires.