Trends of Halocarbons and Implications for Total Chlorine

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Throughout the 1990s, global growth rates of all major chlorofluorocarbons (CFCs), excluding CFC-12 (CCl_2F_2), steadily declined as a result of the Montreal Protocol. Recently, CFC-12 has reached zero growth and continues to decline. These chlorine-containing compounds have a variety of uses that take advantage of their inertness and low toxicity. However, their inertness has allowed these gases to survive in the atmosphere for decades, thus allowing them to be transported into the stratosphere where they continue to play a major role in ozone destruction.

Developed countries responded to the Montreal Protocol by reducing and ultimately eliminating production of CFCs and other halogenated gases and solvents. By 1994, total atmospheric chlorine peaked and is now decreasing. Early and rapid decreases in total chlorine were a result of the swift decline of methyl chloroform (CH_3CCl_3). However, in recent years methyl chloroform's decline has slowed to its present-day global growth rate of –4.7 parts per trillion (ppt) per year. As methyl chloroform's contribution to total chlorine diminishes, CFCs will be increasingly important to the steady decline of reactive chlorine. The CFCs are the major source of reactive chlorine to the stratosphere; in 2003 they accounted for 63% of the total chlorine budget.

The CMDL Halocarbons and other Atmospheric Trace Species (HATS) in situ programs have been monitoring the concentrations and growth rates of CFC-11 (CCl_3F), CFC-113 (CCl_2FCClF_2), CFC-12, methyl chloroform, carbon tetrachloride (CCl_4), and nitrous oxide (N_2O) since 1987. The Chromatograph for Atmospheric Trace Species (CATS) has been making continuous hourly air measurements at the NOAA baseline sites. An update on current trends of these gases is presented.

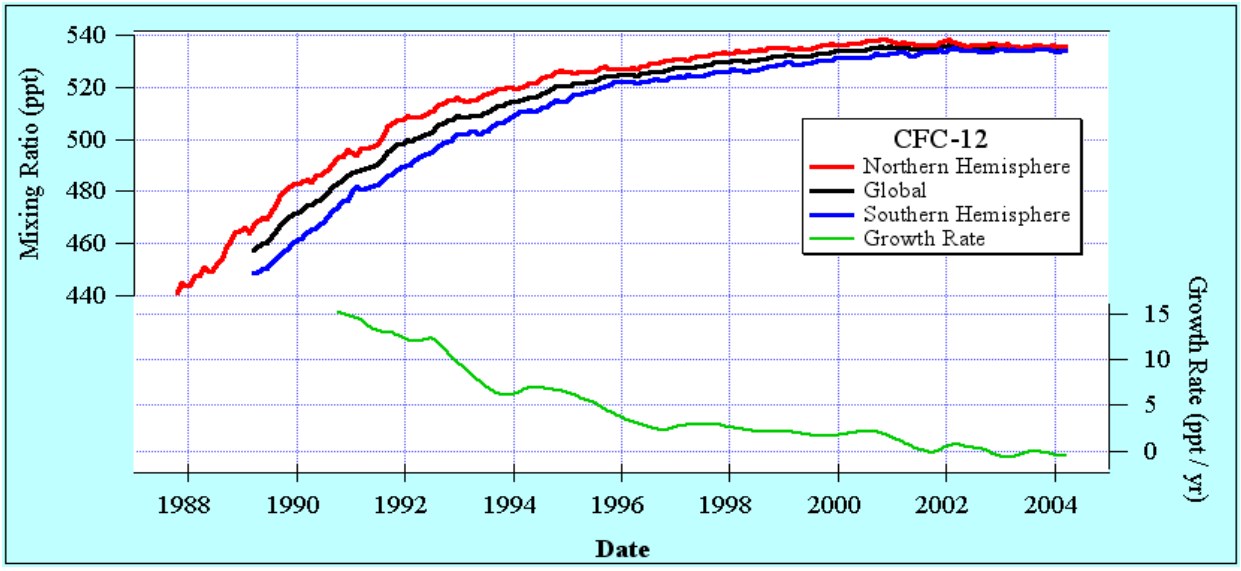

Figure 1. The CMDL/HATS in situ program has been measuring CFC-12 since late 1987. As of mid-2003 the CFC-12 global growth rate (green line) has reached zero and continues to slowly decrease.