Tetrafluoromethane in the Global Atmosphere

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Tetrafluoromethane (CF_4) has been measured with high precision (<0.3%) and accuracy (~1%) *in situ* and in archived air samples from both hemispheres using the Medusa GC/MS developed for the Advanced Global Atmospheric Gases Experiment (AGAGE) program. CF_4 has increased from ~50 to ~77 ppt from 1978 to 2008 in the Southern Hemisphere and from ~46 to ~78 ppt from 1973 to 2008 in the Northern Hemisphere (Figure 1). Based on the SIO-2005 calibration scale, developed at the Scripps Institution of Oceanography, the abundance of this potent and long-lived greenhouse gas is ~7% lower than previously reported, but CF_4 is still by far the most abundant perfluorinated trace gas. Pre-industrial abundances of CF_4 were determined in air extracted from Greenland ice (12–19 kyr BP) and Antarctic firn.

It is known that CF_4 is released mainly from primary aluminum production and from semiconductor and flat panel display production. Its large pre-industrial abundance has been explained by emissions from fluorites and granites in the continental lithosphere. With the AGAGE 2-D 12-box model we determined that global anthropogenic CF_4 emissions peaked at ~19 Gg/yr in the early to mid-1980s (Figure 2) – along with strong increases in primary aluminum production. Emissions declined to ~12 Gg/yr in the mid-1990s, probably due to reduced emissions from the aluminum industry, and have been flat at ~11 Gg/yr since ~1990, reflecting a balance of improved technology versus increased production in the aluminum industry, and emissions from the electronics industry. Global emissions prior to ~1995 are clearly underestimated in the EDGAR inventory.

It is difficult to quantify the contributions of these different sources, particularly due to ill-defined emission factors and substantially increasing but poorly known aluminum production in Asia. High-frequency *in situ* CF_4 data from the new AGAGE-affiliated station in Korea (Gosan, Jeju Island, Seoul National University) will enable us to better quantify regional Asian emissions, and thus help to resolve the contributions to the global CF_4 flux from these important sources.

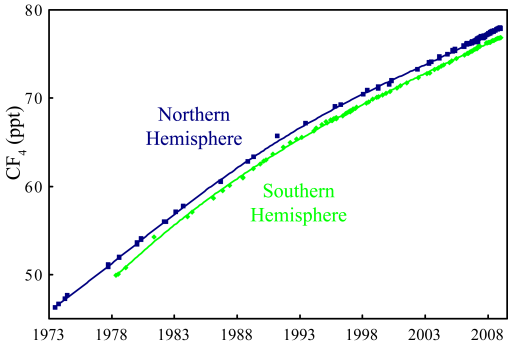

Figure 1. CF_4 (ppt) in the Northern and Southern Hemisphere from archive and *in-situ* measurements.

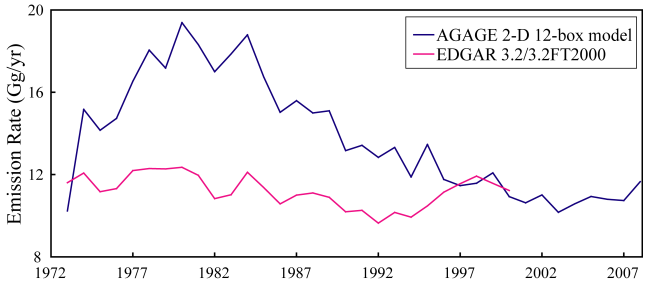

Figure 2. Global CF_4 emissions (Gg/yr).