Trends of Long-Lived Halocarbons, Nitrous Oxide and Sulfur Hexafluoride

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In the mid-1970s, the NOAA's Geophysical Monitoring for Climate Change (GMCC) program made a commitment to measure and monitor trace gases including carbon dioxide, methane, nitrous oxide (N_2O) and chlorofluorocarbons (CFCs). Over the next three decades GMCC grew into a division of NOAA ESRL, and many trace gas measurement programs evolved into separate projects with different instrumentation. Multiple measurements of the same gases at identical locations (e.g. using both *in situ* instruments and grab samples) can sometimes lead to confusion when determining what measurement to use for analysis. We present a statistical method developed to combine measurements from independent NOAA measurement programs to construct continuous, 30+ year hemispheric and global mean records for CFC-11, CFC-12, and N_2O; and 15+ year trends for Carbon Tetrachloride (CCl_4) and sulfur hexafluoride (SF_6). The combining technique takes advantage of co-located measurements and accounts for systematic differences between measurement programs. All data sets were placed on current NOAA scales for their respective gases. We also use two different statistical approaches to characterize uncertainties in hemispheric and global means. The combined data sets and uncertainties can be used in global growth rate and top down emission estimates of these important greenhouse gases.

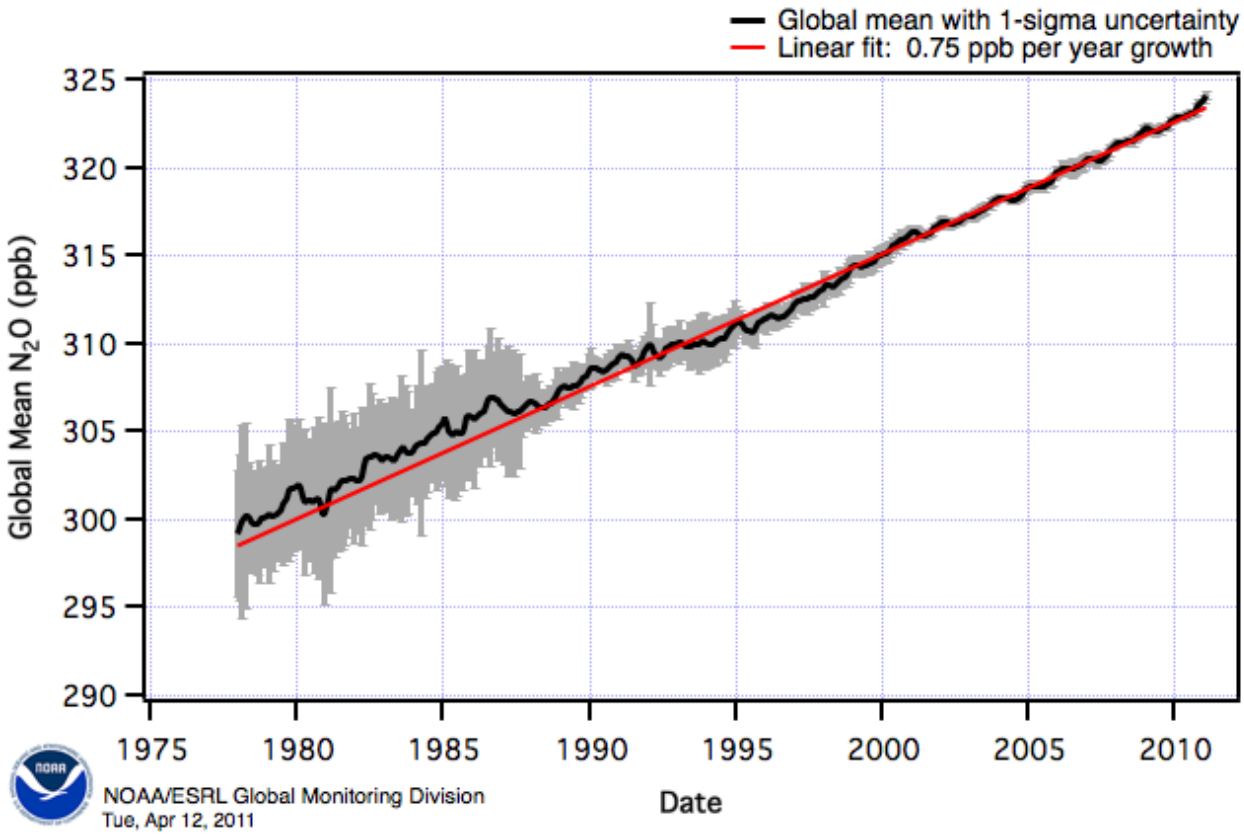

Figure 1. Nitrous oxide estimated global mean from 1977 to the present with 1-σ uncertainties (gray bars). The changing uncertainties illustrate poorer instrumental precisions in the 1970s and 1980s. Improvements in measurement techniques and technology, as well as more sampling locations have reduced the global mean uncertainty since the mid 1990s. The red line is a linear fit to the global mean data demonstrating a fairly constant annual growth rate of 0.75 ppb yr^{-1}.