Twenty-Five Years of Airborne Observations of Ozone-Depleting and Climate-Related Gases in the Upper Troposphere and Lower Stratosphere

J.W. Elkins[1], F.L. Moore[2,1], E.J. Hintsa[2,1], J.D. Nance[2,1], G.S. Dutton[2,1], D.F. Hurst[2,1] and B.D. Hall[1]

[1]NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305; 303-497-6224, E-mail: James.W.Elkins@noaa.gov
[2]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309

Scientists started *in situ* airborne measurements of two strong ozone-depleting gases or chlorofluorocarbons, CFC-11 and CFC-113 in 1991 on the NASA ER-2 aircraft with a two-channel gas chromatograph, Airborne Chromatograph for Atmospheric Trace Species (ACATS). We broaden our list of gases to include more ozone-depleting and other climate-related gases. An improved 4-channel gas chromatograph that included N_2O, SF_6, CFC-11, -12, -113, halon-1211, CCl_4, CH_3CCl_3, CH_4, CO, and H_2 was added to the ER-2 aircraft in 1994. In order to study the stratosphere at higher levels to 32 km, we built a 3-channel balloon instrument called the Lightweight Airborne Chromatograph Experiment (LACE). As CFC replacements took hold, we added a 6-channel gas chromatograph-mass spectrometer system, PAN and other Trace Hydro-halocarbon Experiment (PANTHER), in 2001 to examine shorter-lived gases mainly in the upper troposphere. These airborne measurements were to complement our ground-based flask and *in situ* measurements from the Halocarbon and other Trace Species Network. This talk will show results from a tropical study, Airborne Tropical Tropopause Experiment (ATTREX) on the NASA Global Hawk aircraft and preliminary results from the Atmospheric Tomography Mission (ATom) conducted in August 2016 on the NASA DC-8 aircraft. A detrended, gridded, latitudinal distribution of SF_6 is shown in the figure below for the years of 1994 through 2014. Such a plot may be useful to atmospheric modelers trying to capture transport or calculate emissions.

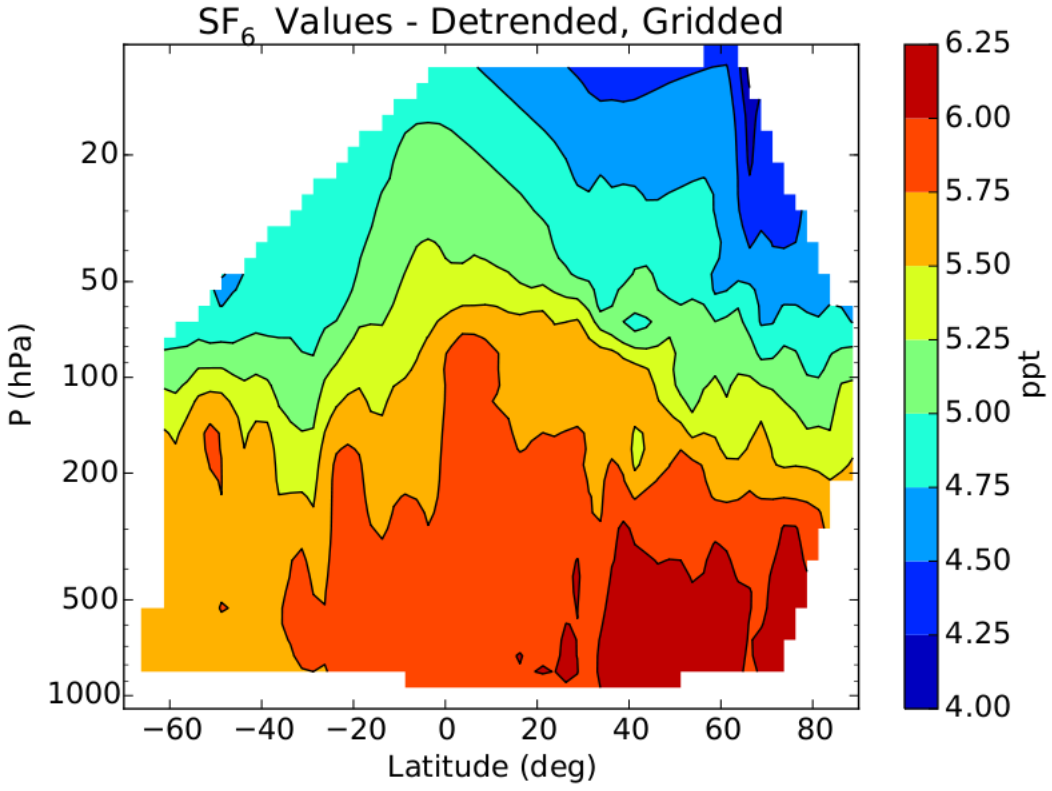

Figure 1. All airborne measurements detrended from 1994 forward for atmopheric SF_6. It was detrended using separate linear fits joining at an inflection point at year = 2006.5.