Recent Trends in Global Concentrations and Emissions of Hydrochlorofluorocarbons and Hydrofluorocarbons

S. Montzka[1], B.R. Miller[2], L. Hu[1], C. Siso[2], B. Hall[1], J.W. Elkins[1], M. McFarland[3] and S. Andersen[4]

[1]NOAA Earth System Research Laboratory, 325 Broadway, Boulder, CO 80305; 303-497-6657, E-mail: stephen.a.montzka@noaa.gov
[2]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309
[3]Dupont Chemicals and Fluoroproducts, Wilmington, DE
[4]Institute for Governance & Sustainable Development, Washington D.C.

Atmospheric observations allow an objective and independent assessment of policy control measures related to ozone-depleting substances and greenhouse gases. Currently there are uncertainties regarding use and emission of hydrochlorofluorocarbons (HCFC) and hydrofluorocarbons (HFC) and how these chemicals will affect future stratospheric ozone depletion and climate. Here we resolve some of this uncertainty with updated measurements of these compounds from NOAA's cooperative flask sampling network. The results suggest that summed global HCFC emissions were increasing at ~8%/y in the mid-2000s. This increase did not continue after 2007 in part because of the 2007 Adjustments to the Montreal Protocol that accelerated the HCFC phase-out in developed countries and set caps beginning in 2013 on global HCFC production and consumption. The observations indicate that global HCFC emissions were stable at approximately 775 $MtCO_2$-eq/yr during 2007-2012, well in advance of the 2013 cap on global HCFC production. These measurements also allow climate impacts associated with current uses of HFCs to be estimated and the future climate benefits of potential controls to be assessed. Summed global emissions of HFCs used as ODS substitutes totaled approximately 500 $MtCO_2$-eq/yr in 2012 and had increased at an average rate of ~7%/yr from 2007 through 2012. These HFC emissions amount to approximately 1.5% of fossil-fuel-related emissions of CO_2 in recent years and are estimated to arise in approximately equal amounts from mobile air conditioning, commercial refrigeration, and all other applications.

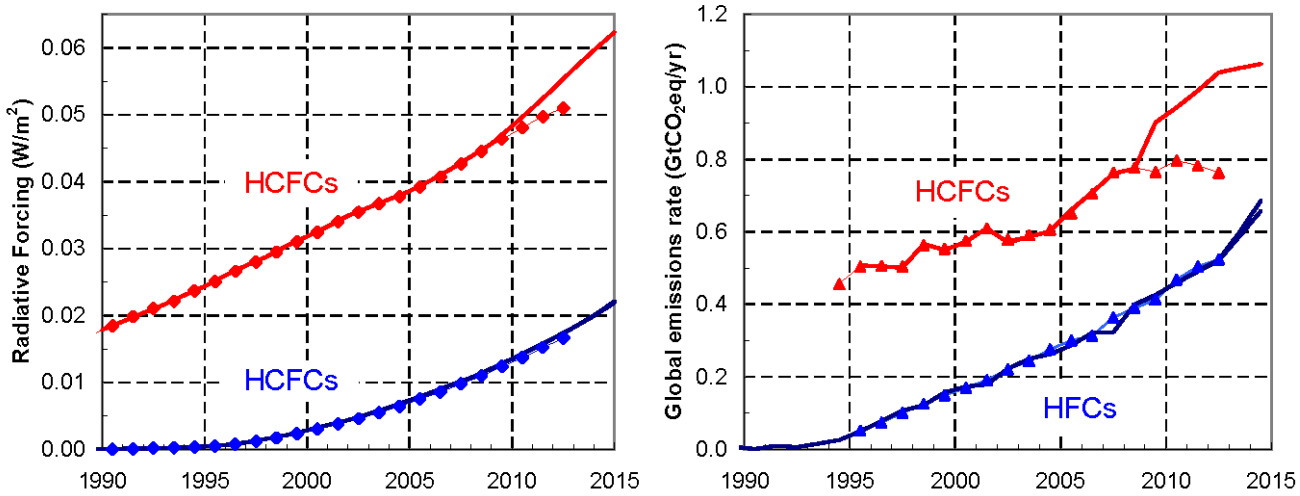

Figure 1. Direct radiative forcing (left panel) and global CO_2-eq emissions (right panel) derived from the sum of HCFCs (observations as red points, scenarios as lines; HCFC-22, -142b, -141b) and HFCs used as substitutes for ozone-depleting substances (observations as blue points, scenarios as lines; HFC-134a, -152a, -143a, -125, -227ea, -365mfc, -32). Measurement-derived values are compared to scenarios developed elsewhere (for HCFCs from the WMO Ozone Assessment report, Daniel *et al*., 2011; for HFCs from Velders *et al*., 2009). CO_2-eq emissions are derived by weighting mass emissions by 100-yr Global Warming Potentials (Daniel *et al*. (2011).