

Recent Increases in Global HFC-23 Emissions and the Contribution of HFCs and HCFCs to Radiative Forcing

S. Montzka¹, L. Kuijpers², M. Battle³, M. Aydin⁴, K. Verhulst⁴, E. Saltzman⁴, D. Fahey¹, B. Miller⁵, L. Miller⁶, C. Siso⁵ and B. Hall¹

¹NOAA Earth System Research Laboratory, 325 Broadway, Boulder, CO 80305; 303-497-6657, E-mail: stephen.a.montzka@noaa.gov

²Eindhoven Centre for Sustainability, Technical University Eindhoven, Eindhoven, Netherlands

³Department of Physics and Astronomy, Bowdoin College, Brunswick, ME 04011

⁴Department of Earth System Science, University of California, Irvine, CA 92697

⁵Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309

⁶Science and Technology Corporation, Boulder, CO 80305

Trifluoromethane (HFC-23) is an unintended by-product of chlorodifluoromethane (HCFC-22) production and has a 100-yr global warming potential of 14,800. Firm-air and ambient air measurements of HFC-23 from three firm sampling excursions to Antarctica between 2001 and 2009 have been used to construct a consistent atmospheric history for this chemical in the Southern Hemisphere. The results show continued increases in the atmospheric abundance of HFC-23 and they imply substantial increases in HFC-23 global emissions since 2003. These emission increases are coincident with rapidly increasing HCFC-22 production in developing countries and are observed despite efforts in recent years to limit emissions of HFC-23 through the Kyoto Protocol's Clean Development Mechanism. These results will be considered along with new NOAA measurements of additional hydrofluorocarbons (HFCs) from archived air, firm air, and ongoing flask-air measurements. Summed together, hydrochlorofluorocarbons (HCFCs) and HFCs accounted for 2.2% of the direct radiative forcing from all anthropogenic, long-lived gases in 2008, but they accounted for ~9% of the increase in total forcing from trace gases during 2003-2008. The increase in radiative forcing from HCFCs and HFCs was slightly larger than attributable to N₂O global mixing ratio increases over this same period.

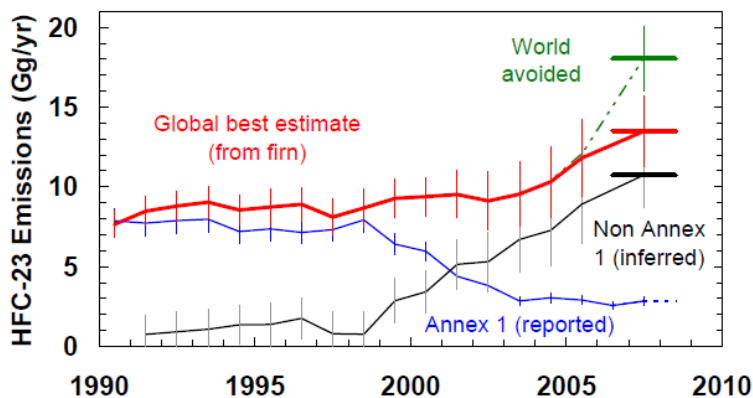


Figure 1. Global HFC-23 emissions derived from Antarctic firm air and ambient air measurements compared to augmented emissions reported to the UNFCCC by developed countries (blue line). The difference is attributed to developing countries (black line). HFC-23 emissions avoided through Clean Development Mechanism (CDM) projects of the Kyoto Protocol have been added to global emissions (green dashed line) to provide a picture of the 'world avoided' by these activities.

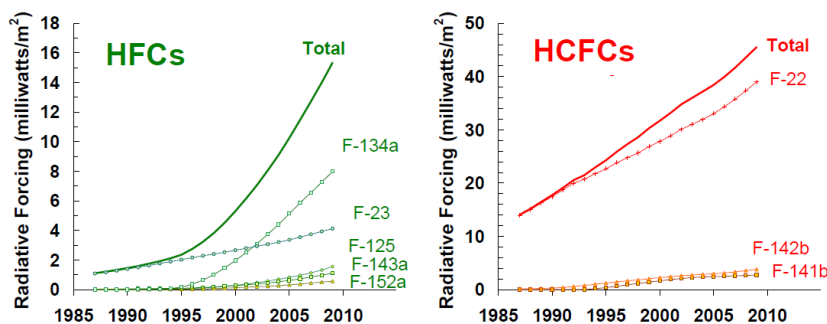


Figure 2. Radiative forcing from HFCs and HCFCs in recent years based on samples regularly collected at remote sites throughout the globe, archived samples from the Northern Hemisphere, and firm-air collected in Antarctica.