(50-220415-A) **Improving Global Annual Emission Estimates for Long-lived Gases Derived from Atmospheric Data**

S.A. Montzka[1], B.D. Hall[2], F.L. Moore[3,2], L.M. Western[4], G. Dutton[3,2], E.A. Ray[3,5], R.W. Portmann[5], S.M. Davis[3,5], M. Chipperfield[6], W. Feng[7,8], D. Waugh[9], C. Orbe[10], and M. Krol[11]

[1]NOAA GML; 303-497-6657, E-mail: stephen.a.montzka@noaa.gov
[2]NOAA Global Monitoring Laboratory (GML), Boulder, CO 80305
[3]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309
[4]University of Bristol, Bristol, United Kingdom
[5]NOAA Chemical Sciences Laboratory (CSL), Boulder, CO 80305
[6]University of Leeds, Institute for Climate and Atmospheric Science, School of Earth and Environment, Leeds, United Kingdom
[7]School of Earth and Environment National Centre for Atmospheric Science, University of Leeds, Leeds LS2 9JT, United Kingdom
[8]National Centre for Atmospheric Science, University of Leeds, Leeds, United Kingdom
[9]Johns Hopkins University, Baltimore, MD 21218
[10]NASA Goddard Space Flight Center (GSFC), Greenbelt, MD 20771
[11]Wageningen University, Department of Meteorology and Air Quality, Wageningen, The Netherlands

Global total emissions magnitudes of long-lived anthropogenically-emitted gases are important for understanding how human behavior is altering global atmospheric composition. Measurement-based emission histories are provided for a broad range of ozone-depleting and greenhouse gases from GML's global atmospheric observing network. The accuracy and precision of measurement-based global emission estimates are limited, however, by interannual variability and long-term changes in non-emissive processes that affect trace gas abundances at remote sites. These processes include loss (oxidation by OH and photolysis in the stratosphere), transport, and mixing effects, and they have the potential to bias emission estimates for a wide range of gases including CO_2, CH_4, N_2O, CFCs, HCFCs, and HFCs, among others. Biases in emission changes on year-to-year timescales can be substantial, but this is also a very relevant timescale for supplying feedback to a broader community (e.g., international policymakers) on the effectiveness of any mitigation actions. In this presentation, I'll demonstrate the importance of quantifying the influence of non-emissive processes on trace gas abundances as a next step towards refining emission estimates, present examples of some progress being made to quantify these influences, and suggest how these methods might be improved in the future.

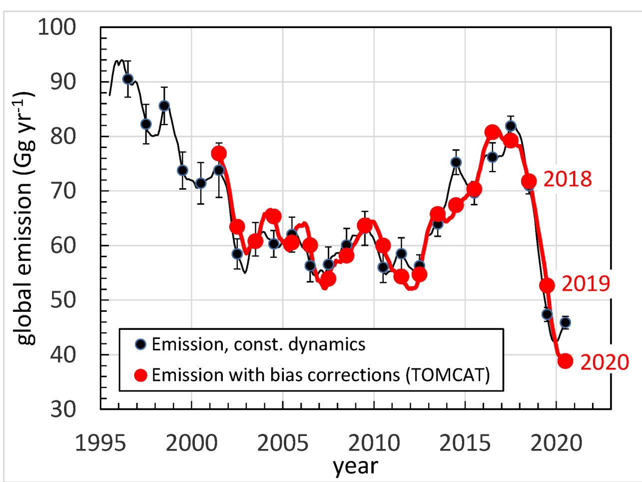

Figure 1. Global emission history of CFC-11 with (red points and lines) and without (black points and lines) bias corrections related to global atmospheric mixing processes captured in the 3-D model TOMCAT using reanalyzed meteorology. Uncertainties reflect the ability of the existing measurement network to accurately capture CFC-11's global mole fraction and measurement imprecision. These uncertainties are much smaller than those associated with CFC-11 global mean lifetime (+/- 10 Gg), and they represent a lower limit on discernable interannual emissions for CFC-11 from GML's measurement network over this period.