

Variabilities of Atmospheric HCFCs and HFCs Over the United States and Their Implied Emissions for the Years of 2008 – 2014

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Hydrochlorofluorocarbons (HCFCs) are transitional substitutes for chlorofluorocarbons (CFCs) with relatively lower ozone depleting potentials. The consumption of HCFCs has been controlled under the Montreal Protocol since 1996. By 2014, the consumption of HCFCs within the U.S. had declined by roughly 90% relative to its peak during 1998 – 2002. Hydrofluorocarbons (HFCs) were initially considered as long-term substitutes for both CFCs and HCFCs. Although they do not deplete stratospheric ozone, they are potent greenhouse gases. In this study, we have analyzed atmospheric data of HCFCs and HFCs from more than 20 ground-based, tall towers, and aircraft sites within the U.S., for the period of 2008 – 2014 when uses of HCFCs were phasing down and applications for some HFCs underwent rapid expansion. These atmospheric observations show continued increases in background atmospheric mole fractions of HCFCs, but considerable decreases in enhanced mole fractions observed in the U.S. boundary layer relative to the remote atmosphere (Figure 1). In the meantime, significant increases have been observed over the U.S. in the enhancements of certain HFCs (HFC-125, HFC-143a, HFC-32, HFC-365mfc and HFC-227ea) that are used as replacements for HCFCs (Figure 1). The magnitudes of their relative increases in the atmospheric enhancements seem to be consistent with the relative increases of reported emissions of HFCs by the U.S. Environmental Protection Agency (EPA) Greenhouse Gas Inventory (GHGI) over a similar period. In this presentation, we will further discuss emission estimates of HCFCs and HFCs derived from inverse modeling of these atmospheric observations and compare them with emissions reported by the EPA's GHGI.

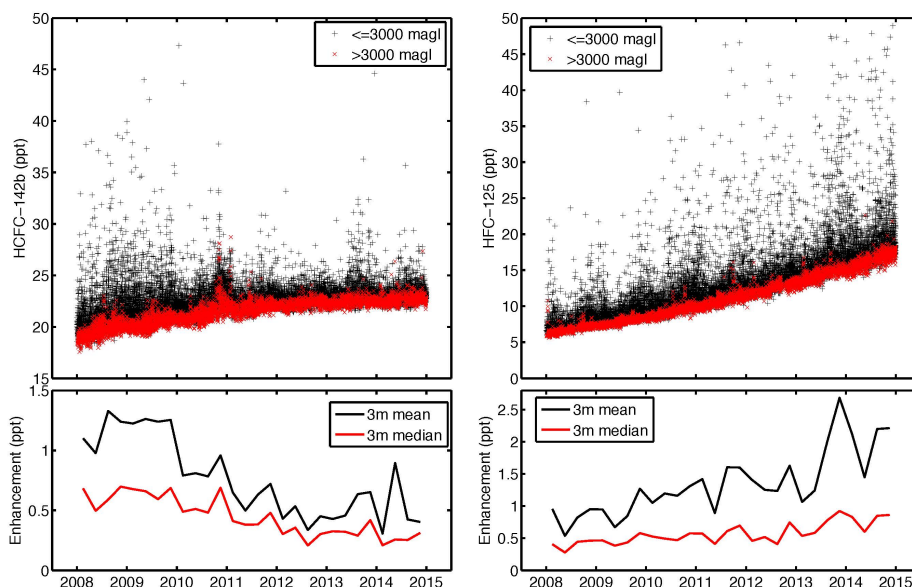


Figure 1. Observed atmospheric mole fractions of HCFC-142b (upper left) and HFC-125 (upper right) within 3000 magl (black) and above 3000 magl (red) at sites in the contiguous U.S.. The three-monthly mean (black) and median (red) enhancements for observations made within 3000 magl relative to the free troposphere (3000 – 6000 magl) are shown in the bottom panels for HCFC-142b (bottom left) and HFC-125 (bottom right).