Ambient Mixing Ratios and Emissions of Chlorofluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs) and Hydrofluorocarbons (HFCs) in the Pearl River Delta Region, China

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By using a Gas Chromatography-Mass Spectrometry system, the ambient mixing ratios of seven halocarbon species, including CFC-11,-12,-113, HCFC-22, -141b, -142b and HFC-134a, were analyzed from 167 air samples collected in 2010 from the Pearl River Delta (PRD) region of southern China. Results indicate that, compared with the observations in 2004, the CFC concentrations in PRD have declined, similar to the corresponding Northern Hemisphere (NH) background levels (enhancement from 10-11%), suggesting small local emissions of CFCs existing in PRD. Though the concentration variations of the three CFCs are relatively low (Relative Standard Deviation (RSD) from 10–18%), they still exceed the variability of the remote atmosphere in China (RSD from 0.48–0.78%). Therefore, CFC concentrations in PRD were still being influenced by some bank emissions in 2010. In contrast to the CFC levels, the concentrations of HCFC-22, -141b, -142b and HFC-134a have increased rapidly in the past few years, rising far above the NH background levels (enhancement from 40-336%). Their temporal variations are also evident (RSD from 32–69%), suggesting significant regional emissions. Correlations between the mixing ratio of each species and HCFC-22 were examined, and then the emissions of seven halocarbons in PRD were quantified, respectively, based on the interspecies correlation between other species and HCFC-22. Results reveal that the mass of HCFC-22(9.72Gg) accounts for about 43% of total emissions, followed by CFC-12(1.50 Gg), HFC-134a(1.19Gg) and HCFC-141b(1.08 Gg), while the emissions of CFC-11(0.84Gg) and HCFC-142b(0.55Gg) are relatively low. The interspecies correlation method may be a useful tool for assessing regional halocarbon emissions.
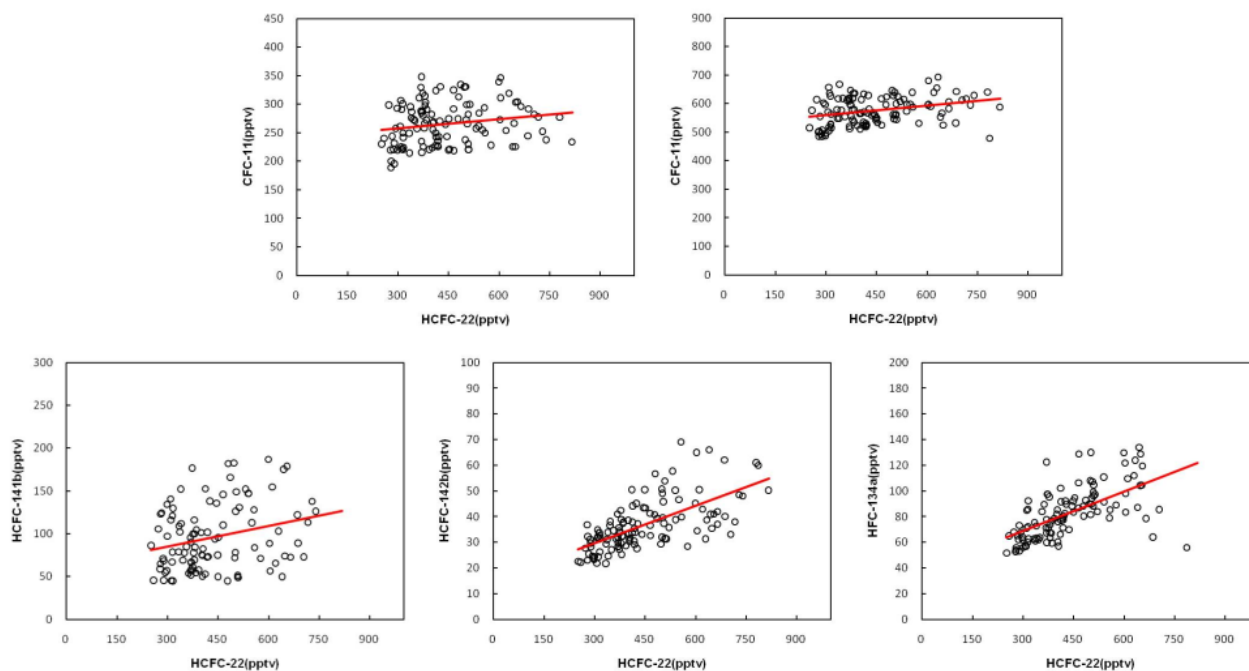
Figure 1. Other species and HCFC-22 relationship of the data set. Regression lines are indicated by the red solid lines. Statistical outliers were removed prior to performing the regressions.