(8-240325-A) **Refining Understanding of Atmospheric Trends and Variability for CFC-113 and CFC-113a**

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Global emission trends for CFC-113 ($CCl_2FCClF_2$) derived by different networks from mole fractions routinely measured in the remote atmosphere have diverged in recent years. While one result suggests unexpectedly large emissions and emission trends in light of the internationally mandated phase-out of CFC production since 2010, the other does not. Being able to accurately and routinely determine atmospheric abundances for CFC-113, a potent ozone-depleting substance and greenhouse gas, is important for discerning underlying causes of unexpected changes and for accurately estimating environmental impacts; It is also critical in the communication of scientific results to policymakers world-wide so that they are able to craft effective and efficient mitigation responses to unexpected events.

Here we demonstrate an approach for quantifying the abundances of chemicals that coelute from a chromatography column and that have no unique ions in their mass spectra. This new approach has enabled independent measurements of CFC-113 and CFC-113a ($CCl_3CF_3$) since the fall of 2023 with minimal modification of our routine instrumental analysis method, and it is potentially applicable to other co-eluting chemicals, particularly isomers. Initial results for CFC-113 and -113a provide a reassessment of the atmospheric decline and global emission rate of CFC-113 over the past decade, suggesting that its decline and emission reductions have been slightly faster than estimated from past NOAA measurements. The results also suggest approaches for minimizing this interference on other instruments, and they confirm the rapid increase reported previously (Laube *et al*., 2014, DOI: 10.1038/NGEO2109; Western *et al*., 2023, https://doi.org/10.1038/s41561-023-01147-w) in the atmospheric abundance of CFC-113a. Co-variations between the atmospheric mole fractions of CFC-113a and other gases are measured at particular sites (*e.g.*, Mauna Loa, Hawaii) and point to the likely regions where CFC-113a emissions are currently substantial and contributing to its rapid global increase in the remote atmosphere.

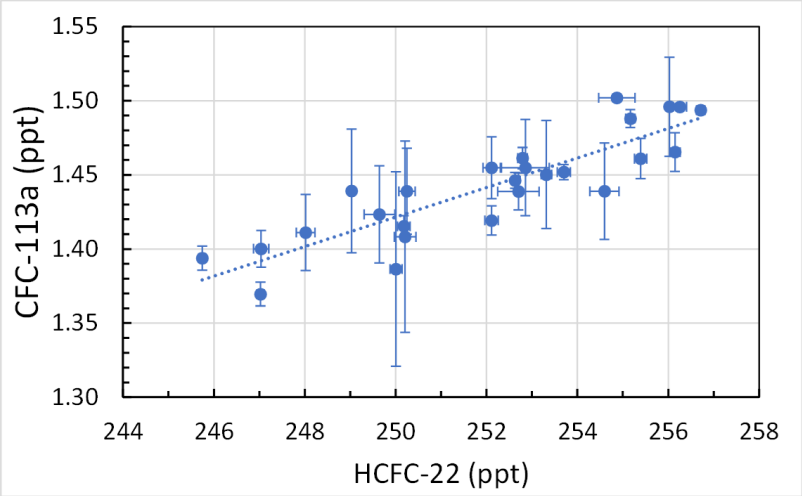


**Figure 1.** Mole fractions of CFC-113a and HCFC-22 measured in air from flask pairs collected automatically at 5:00am local time at the Mauna Loa Observatory during November and December of 2023. Error bars indicate differences (as 1 standard deviation) in mean mole fractions determined in the individual flasks that were sampled simultaneously; the dashed line represents a least-squares linear fit ($r^2$ = 0.65).