

Increasing CFC-11 Emissions and other Unusual Atmospheric Changes: How Delayed Will Ozone Recovery Be?

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Surprising changes have been measured in our observational network for some ozone-depleting substances (ODSs) in recent years that are relevant for stratospheric ozone recovery. Concentrations of dichloromethane, an ODS not controlled by the Montreal Protocol, doubled over the past decade. Concentrations of methyl bromide, a controlled ODS, increased in 2016 for the first time in nearly two decades. Methyl chloride concentrations also increased in 2016, suggesting a natural cause for the methyl halide changes. Is this a trend in natural emissions responding to climate change, or something else?

The most surprising and concerning ODS trend in recent years, however, is the slowdown in the decline of atmospheric CFC-11 concentrations. The decline in CFC-11 concentrations was expected to gradually accelerate after production reported to the United Nations Environmental Programme for all uses became negligible in 2007, or three years before the phase-out required by the Montreal Protocol. Since 2012, however, CFC-11 concentrations have declined at a rate that is half as fast as was measured during the preceding decade. A large reservoir of CFC-11 still exists in foams and is slowly leaking to the atmosphere, but an increased emission from this reservoir or bank is unlikely. In this presentation, we will show the evidence indicating a significant increase in global CFC-11 emissions since 2012 (of up to 13 ± 5 Gg/yr or 25% of the 2002-2012 mean) and discuss evidence suggesting that this emission increase is more likely associated with new production inconsistent with Montreal Protocol controls as opposed to faster releases from the CFC-11 bank.

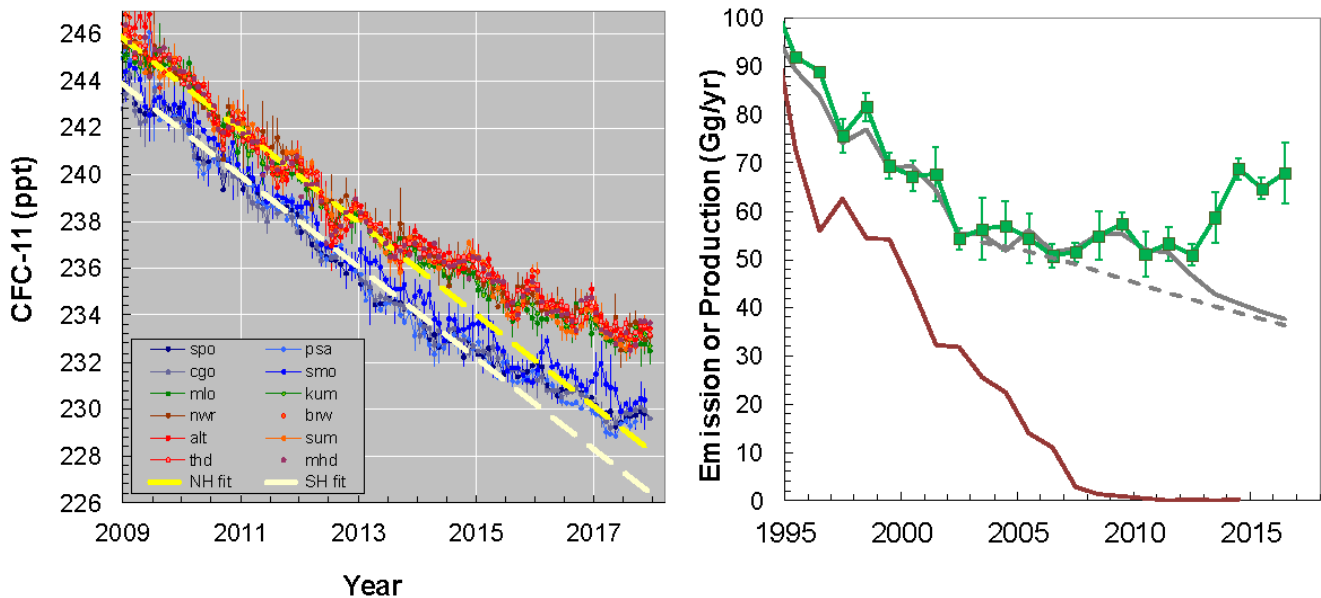


Figure 1. Left: CFC-11 atmospheric mole fraction over time measured at Northern Hemisphere sites (red and green points) and Southern Hemisphere sites (blue points). Fits to hemispheric mean data during 2002 to 2012 are extrapolated to 2018 (yellow- and white-dashed lines). **Right:** Reported production (brown line) and emission derived from atmospheric data (green points) along with emission projections based on WMO scenarios (grey solid line; Carpenter and Reimann et al. 2014) and a constant release rate of 3.3%/yr from the CFC-11 bank after 2002 (gray dashed line).