For how much longer will there be an Antarctic ozone hole?  
Impact of unexpected chlorine emissions

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Chlorine and bromine-containing ozone-depleting substances (ODSs) are controlled by the 1987 Montreal Protocol. In consequence, atmospheric equivalent chlorine peaked in 1993 and has been declining slowly since then. Consistent with this, models project a gradual increase in stratospheric ozone with the Antarctic ozone hole expected to disappear by ~2050. However, the decrease in polar ozone depletion will not smoothly follow the decline in stratospheric chlorine due to dynamical variability. Using a 3-D atmospheric chemistry transport model (CTM), forced by realistic meteorology, we investigate how early we may see a year without an Antarctic Ozone Hole, as determined by different common metrics (e.g. minimum column ozone, mean column ozone, hole area, ozone mass deficit). While all metrics show the same trend there can be large variations which shows the pitfalls in quoting a specific ‘return to 1980 date’. Similarly we assess how much longer the Arctic will be susceptible to large chemical depletion under cold conditions.

The discovery of the slower-than-expected decline of atmospheric CFC-11 by Montzka et al (Nature, 2018) has raised a number of important questions related to the possible source(s) of new emissions, possible role of other atmospheric processes in the observed trends and the overall implications for the Montreal Protocol and ozone recovery.

We have used box model to interpret the observed variation in CFC-11 in terms of production for emissive or non-emissive (e.g. foam) uses. With certain assumptions, we project these scenarios forward in order to test the possible impact on ozone recovery within 3-D CTM simulations. A typical scenario of non-emissive production, which is addressed by policy action over the next 10 years, will not reverse ozone recovery but will delay it (by whatever metric) by about 10 years.