

Trends in ozone-depleting substances and the ODGI

Chlorofluorocarbons

Halons

**Chlorinated and
Brominated chemicals**

Hydrochlorofluorocarbons

Hydrofluorocarbons

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C. Siso, L. Miller, B. Miller, J. Elkins,
J. Butler, D. Hofmann,
J. Daniel, S. Solomon
Support personnel
Station personnel**



**Air sampling
at South Pole**

Measuring Atmospheric Halocarbon Trends at NOAA/ESRL

Ozone-depleting substances and substitute chemicals

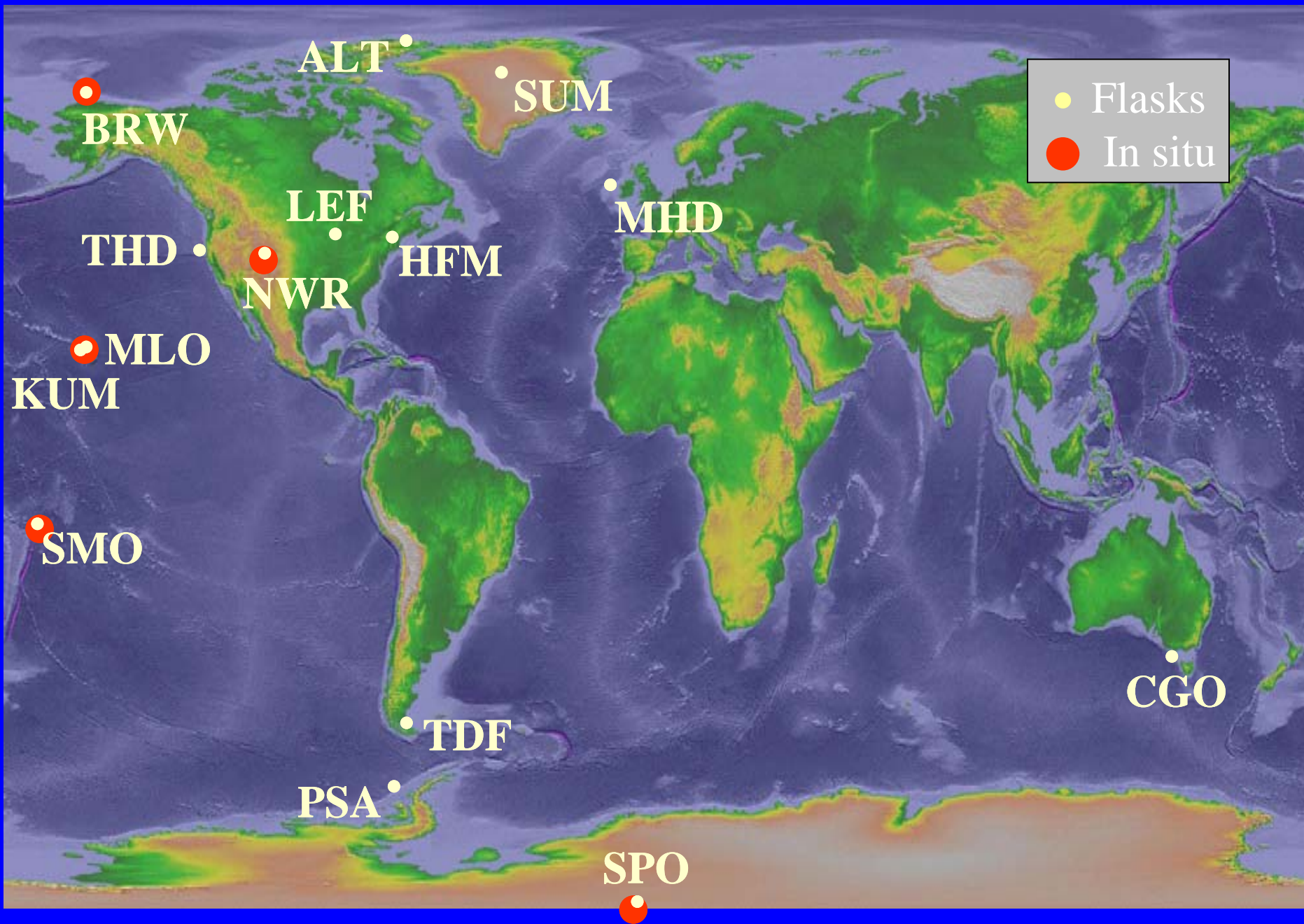
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With global sampling networks, custom instrumentation,
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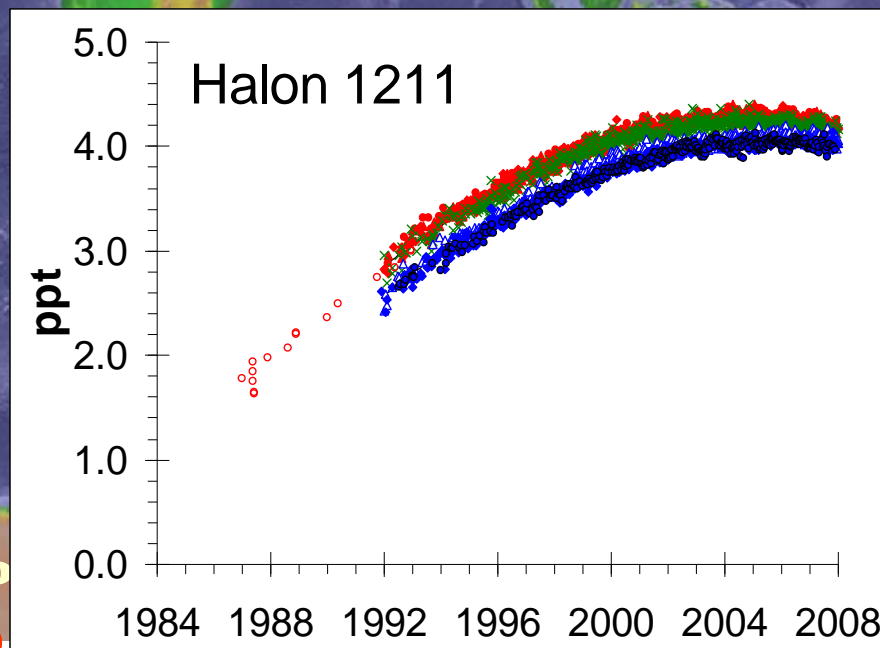
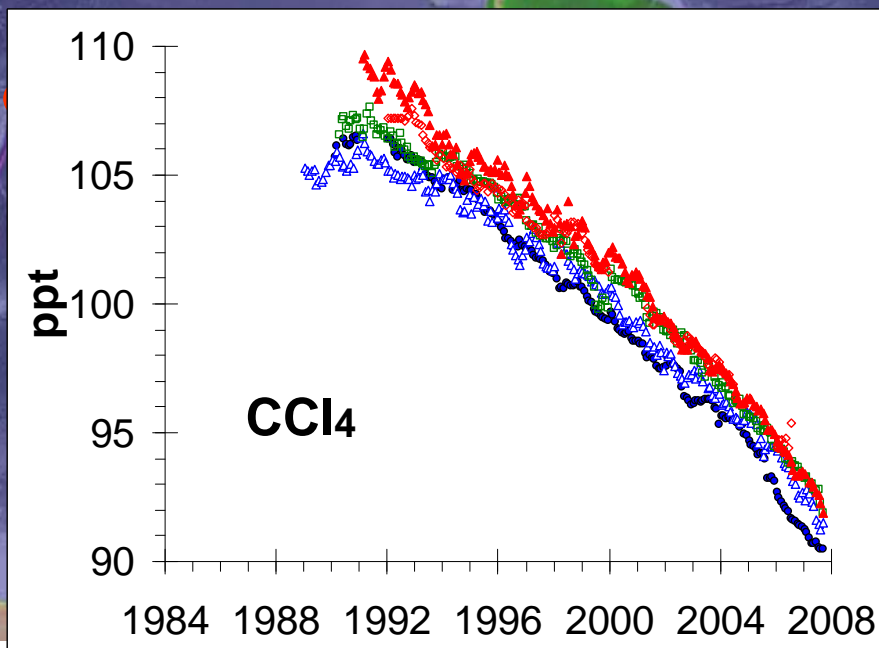
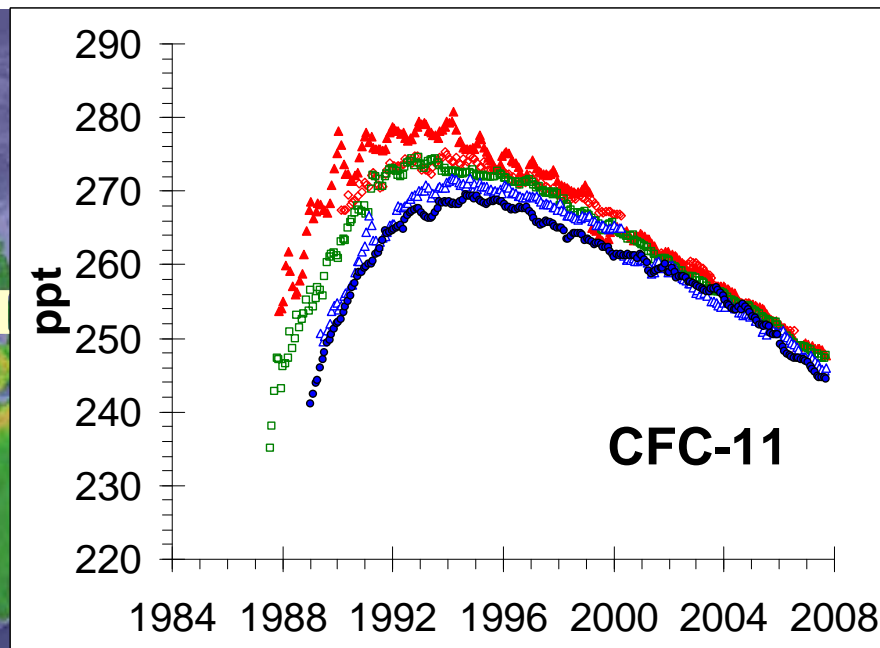
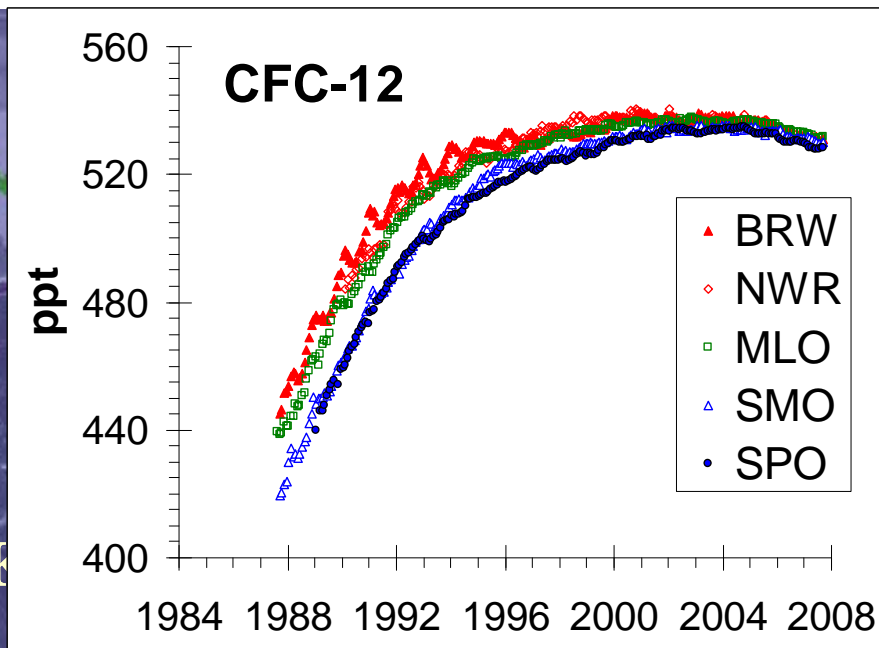
**** Guiding ozone layer recovery & monitoring compliance:**

**** Understanding the underlying causes of observed global changes:**

NOAA halocarbon surface sampling network



NOAA halocarbon surface sampling network



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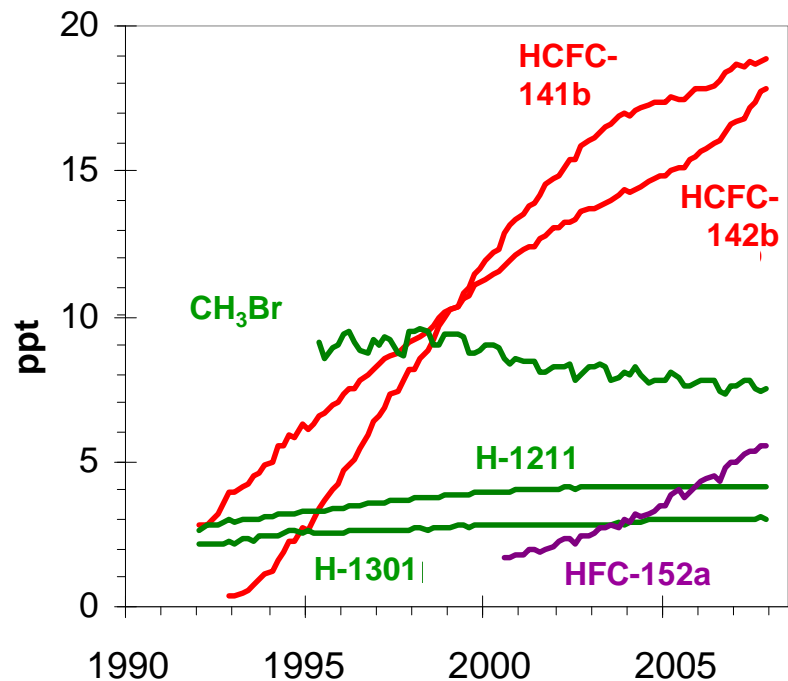
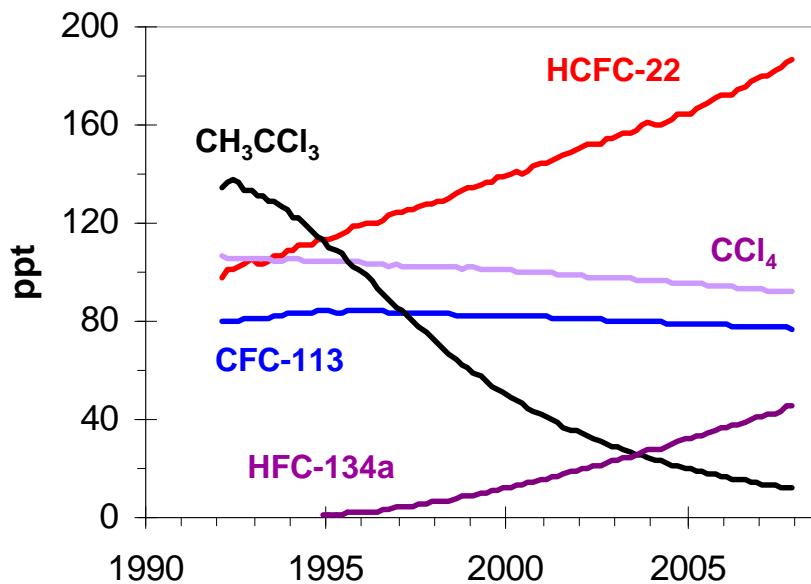
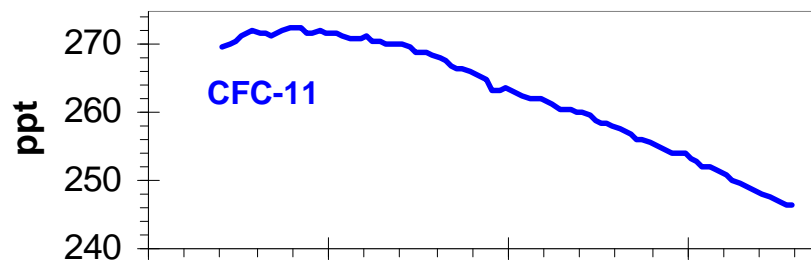
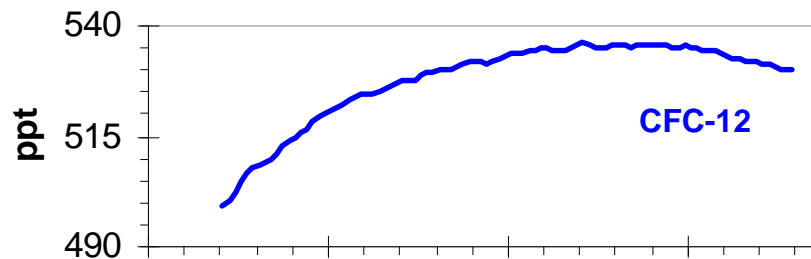
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***Is the Montreal Protocol working? Is ozone recovery proceeding as expected?
When will halogen levels return to 1980 levels?***

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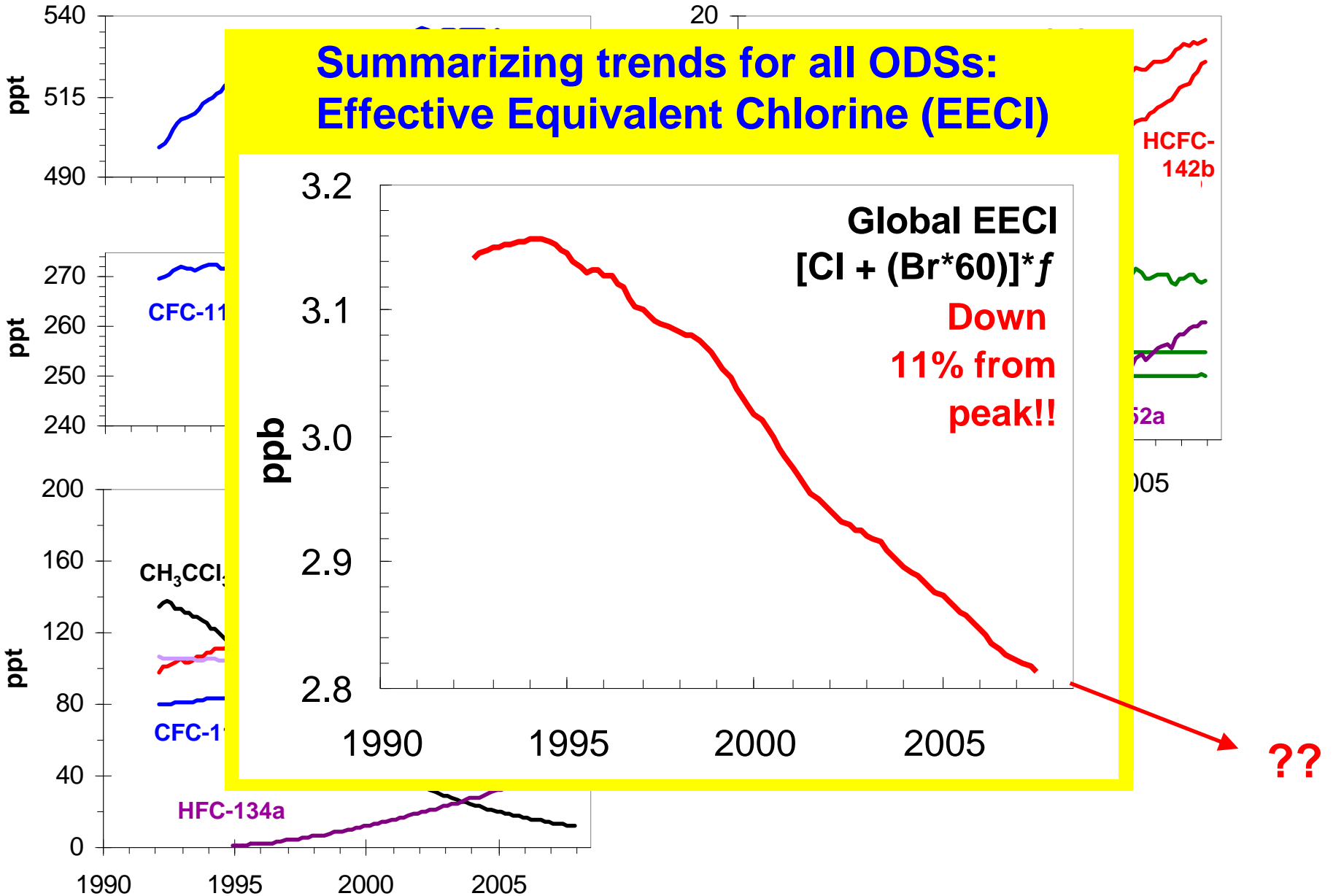
Is the Montreal Protocol working?

Most ODSs are decreasing, replacements (HCFs) are increasing



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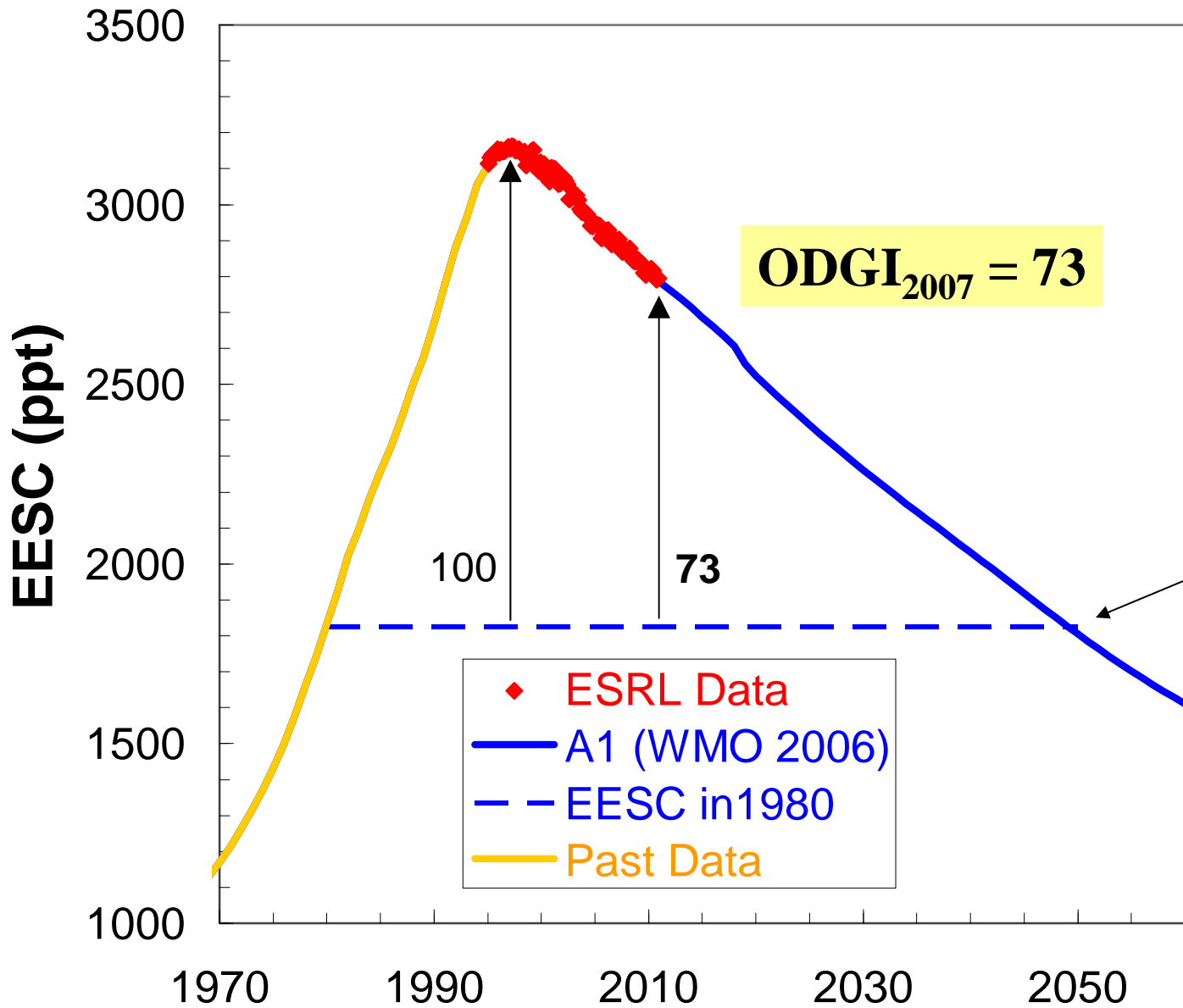


Effective Equivalent Stratospheric Chlorine Projections

(WMO, 2007)

For mid-latitudes

The Ozone Depleting Gas Index



ODGI₂₀₀₇ = 73

1980 level

Year (sample date + 3)

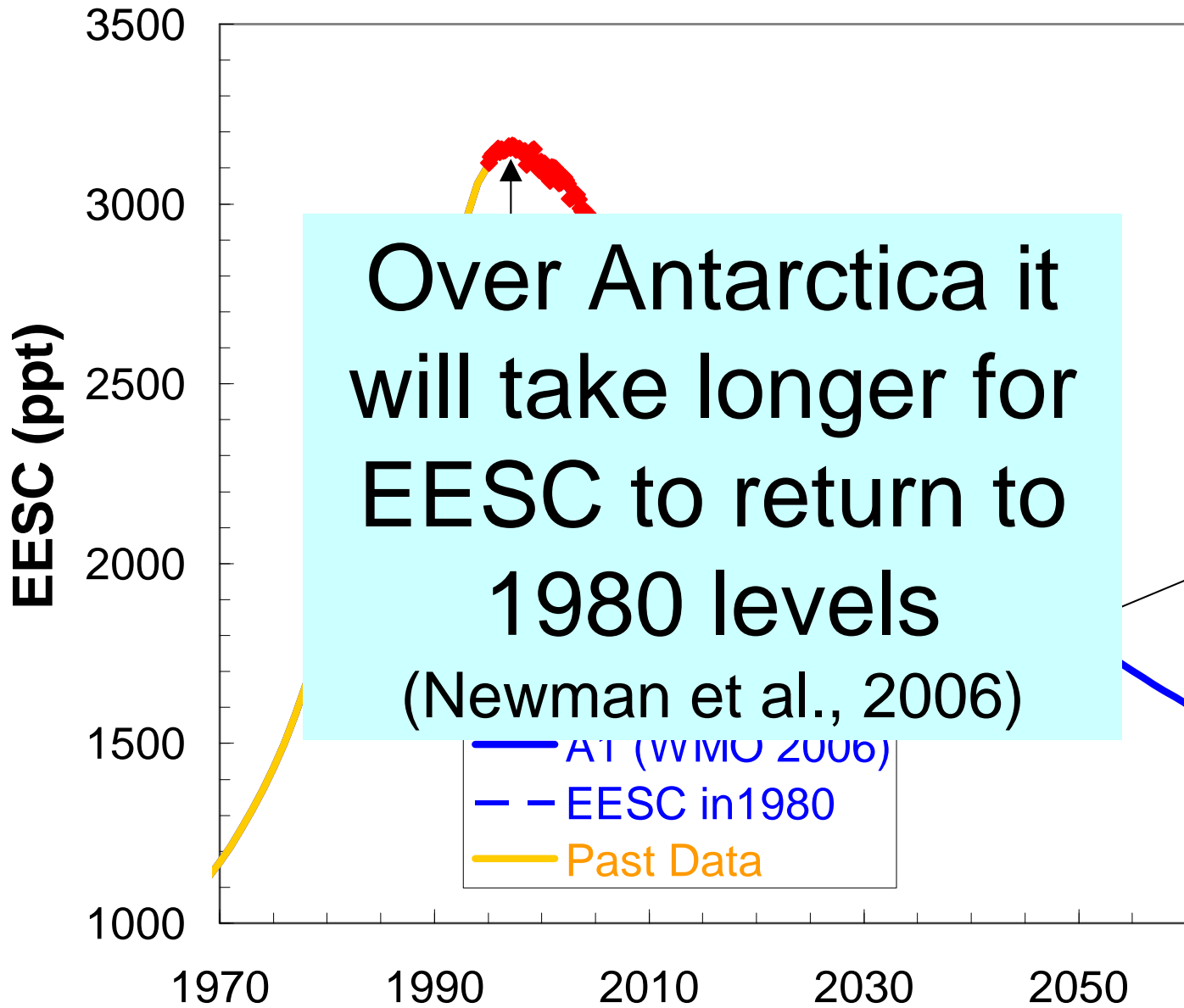
NOAA/ESRL

Effective Equivalent Stratospheric Chlorine Projections

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The Ozone Depleting Gas Index



Over Antarctica it will take longer for EEESC to return to 1980 levels
(Newman et al., 2006)

— AT (WMO 2006)
- - EEESC in 1980
— Past Data

1980 level

Year (sample date + 3)

NOAA/ESRL

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Ozone-depleting substances and substitute chemicals

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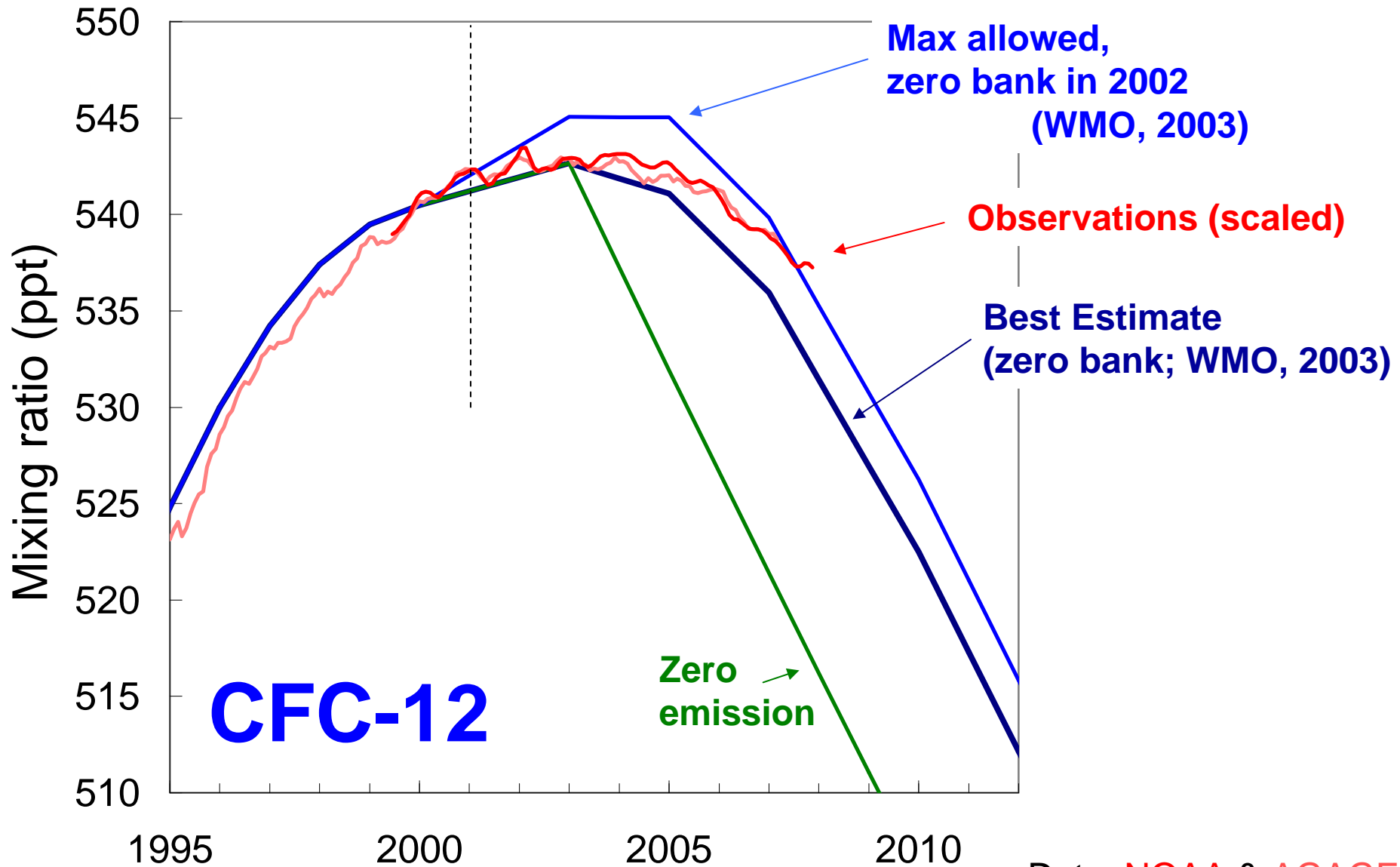
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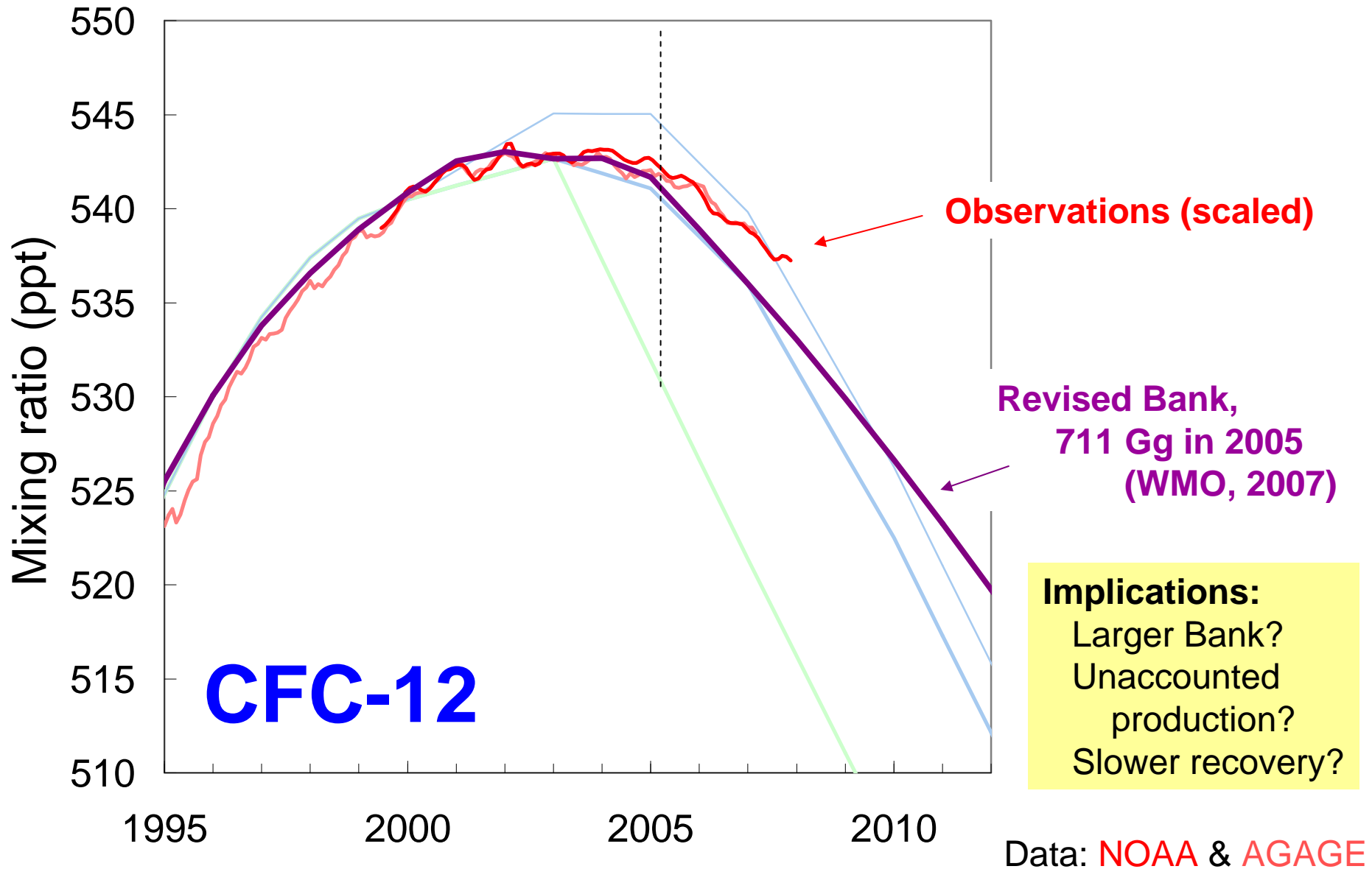
How are banks affecting ODS emissions and abundances?

** Understanding the underlying causes of observed global changes:

Refining future projections with observations



Refining future projections with observations



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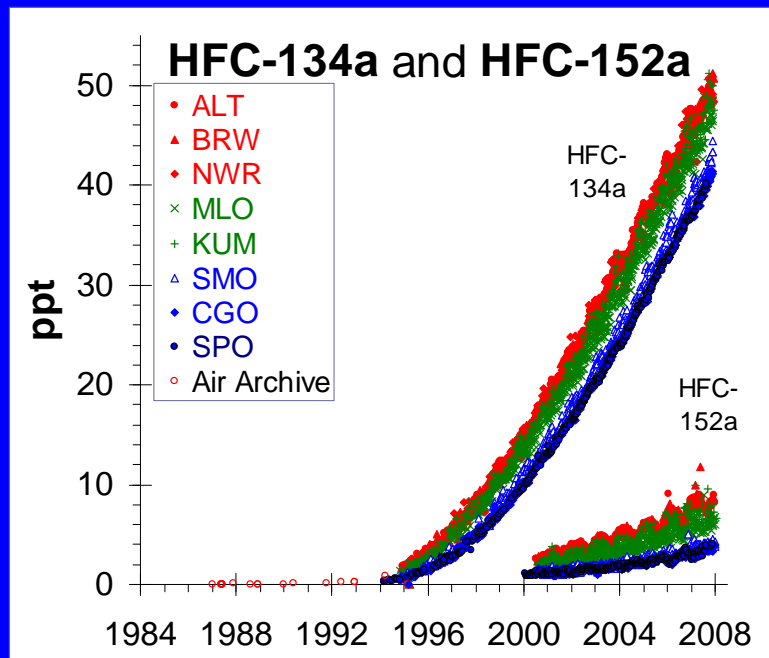
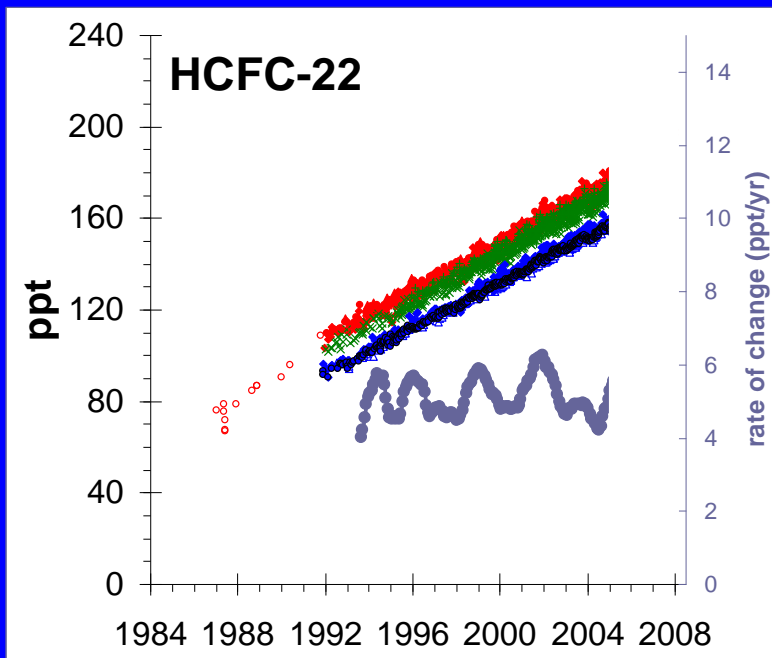
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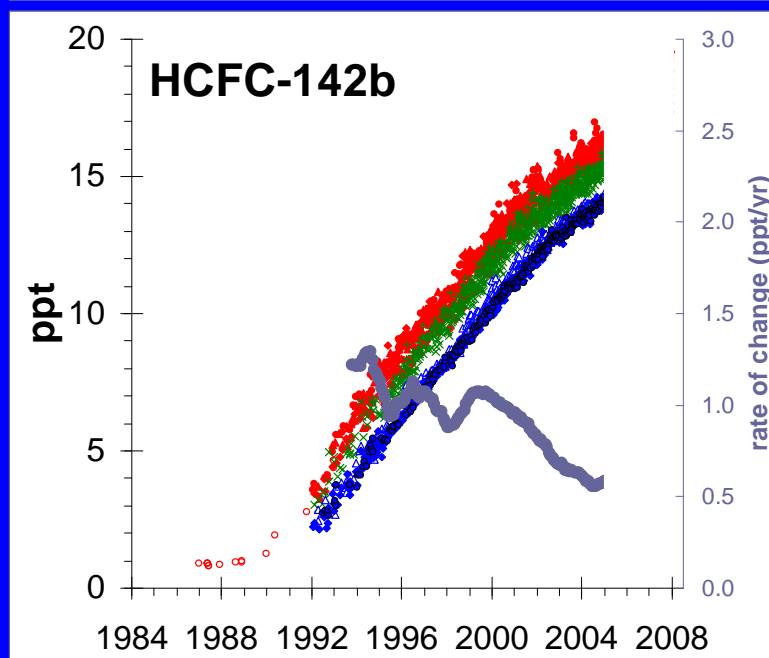
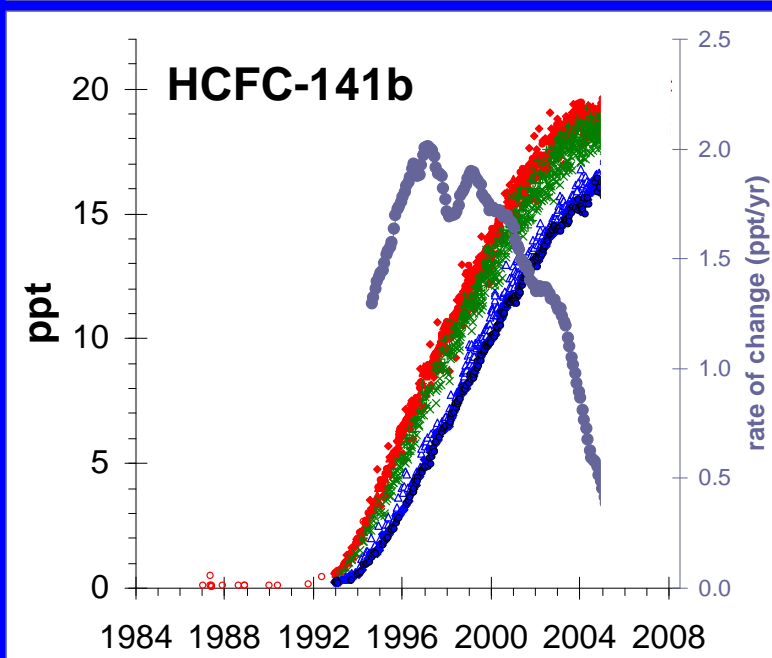
How are HCFCs abundances changing in light of recent regulations?

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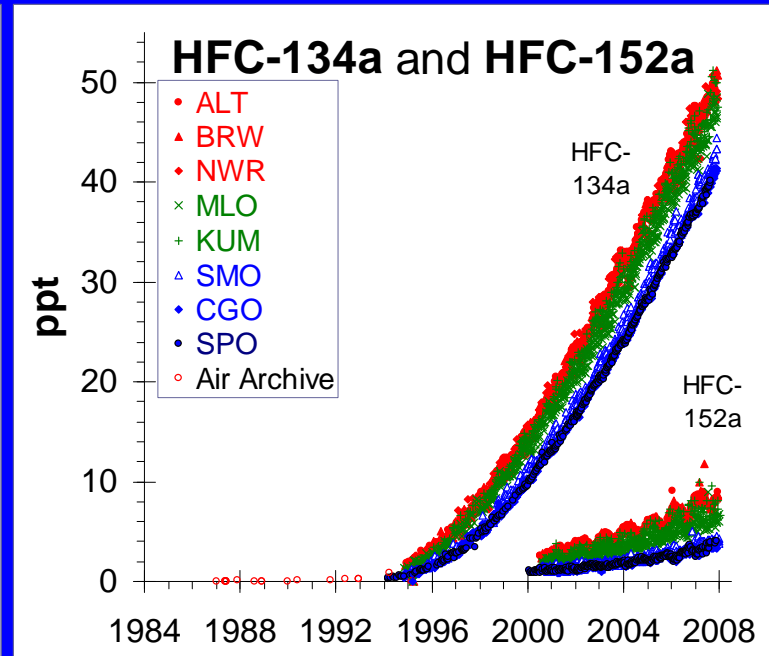
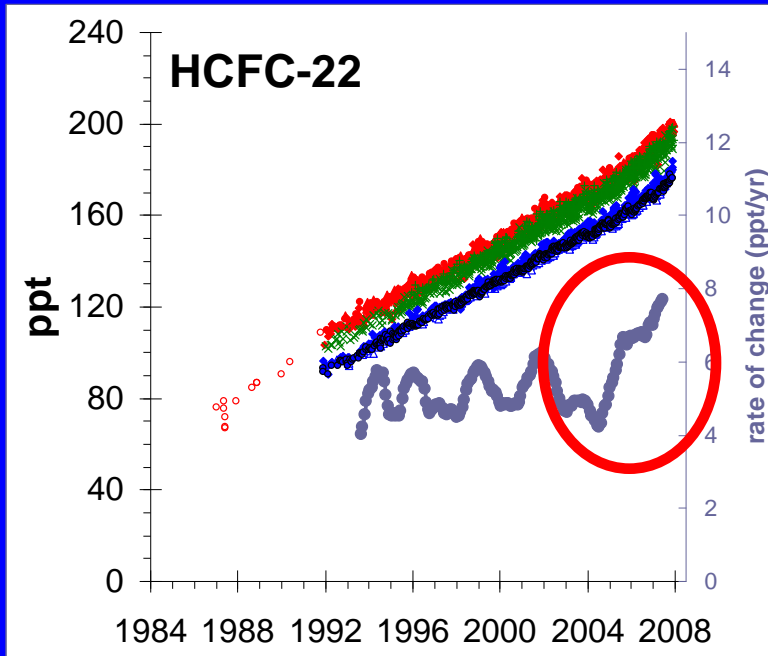
Recent changes in global HCFC mixing ratios and growth rates



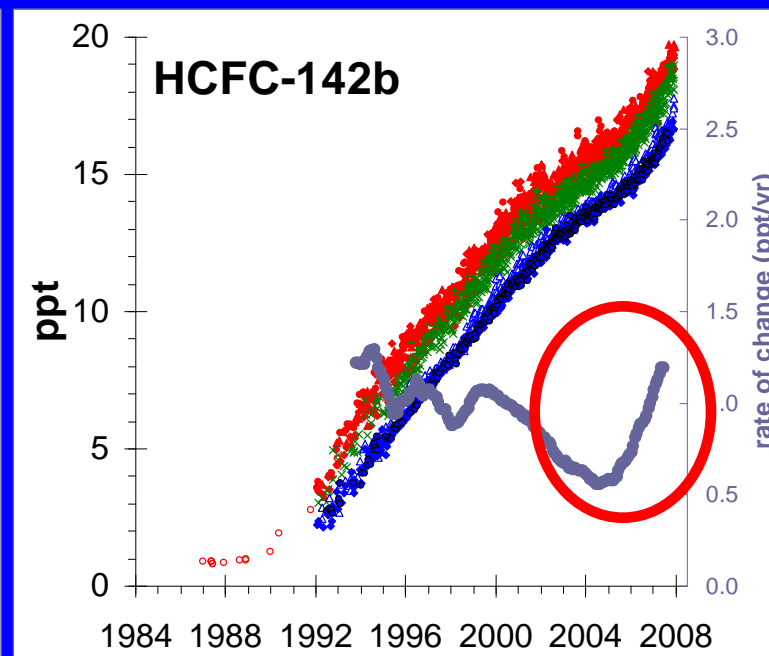
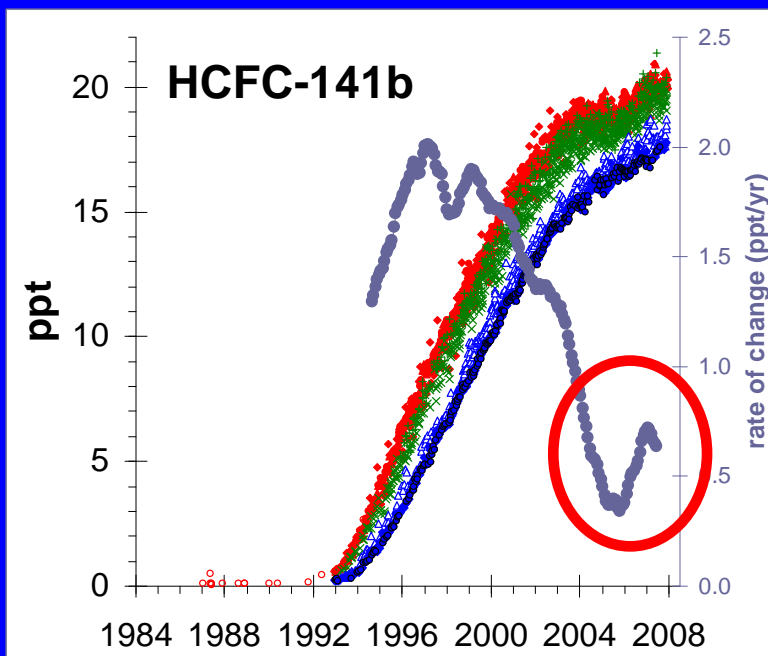
As of 2004
(WMO 2007)



Recent changes in global HCFC mixing ratios and growth rates



Accelerated growth rates after 2004 for the 3 abundant HCFCs, but not for HFCs

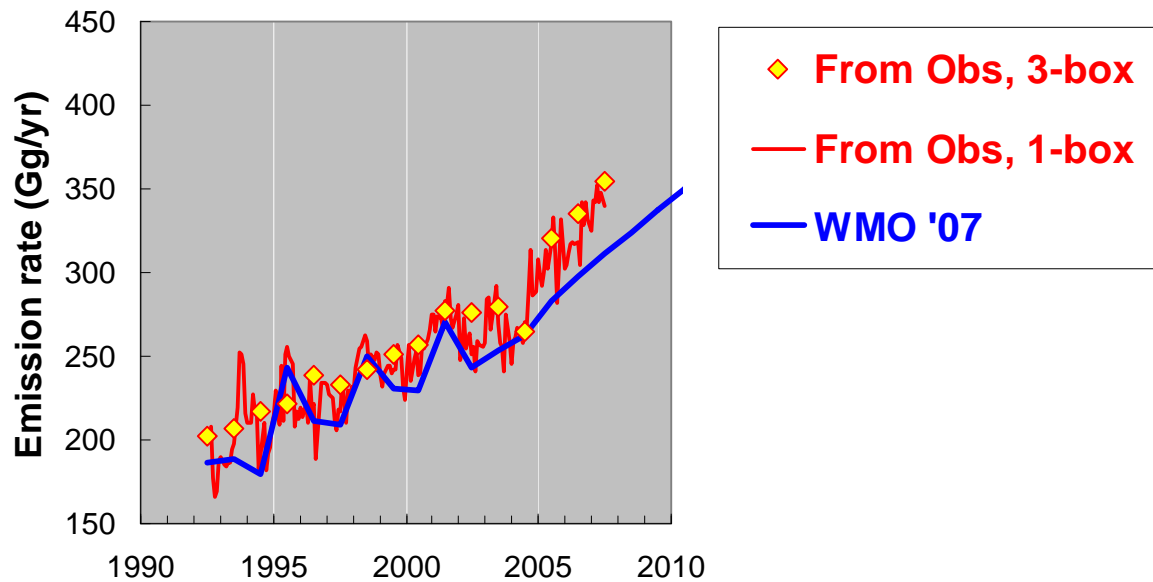


CI from HCFCs:

in 2004
+5.9 ppt/yr

in 2007
+9 ppt/yr

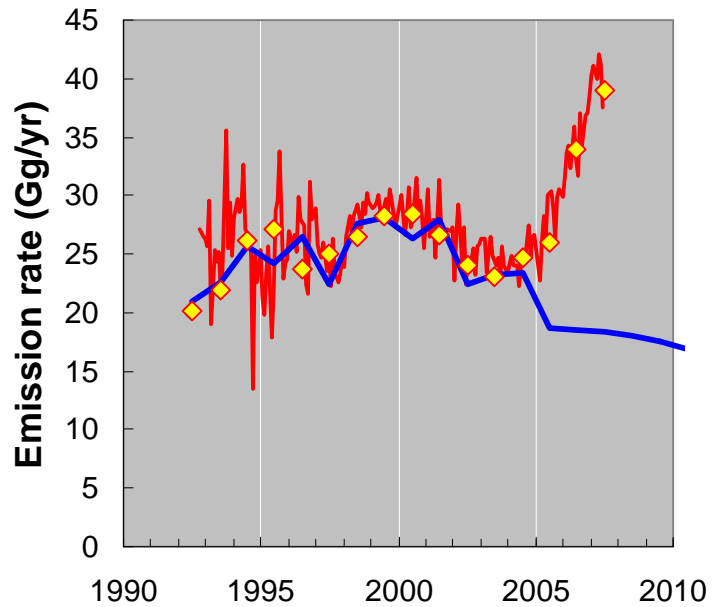
HCFC-22



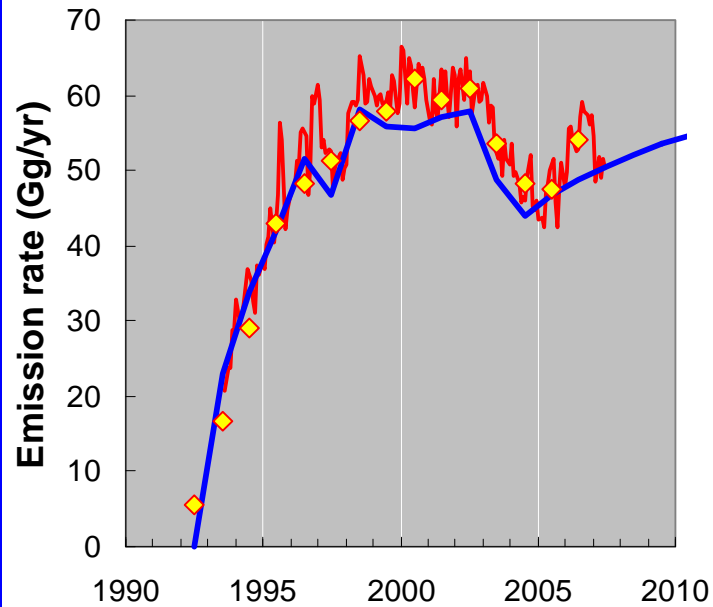
Emissions derived from global changes compared to recent WMO(2007) scenario Ab projection...

Substantial emission increases recently!

HCFC-142b

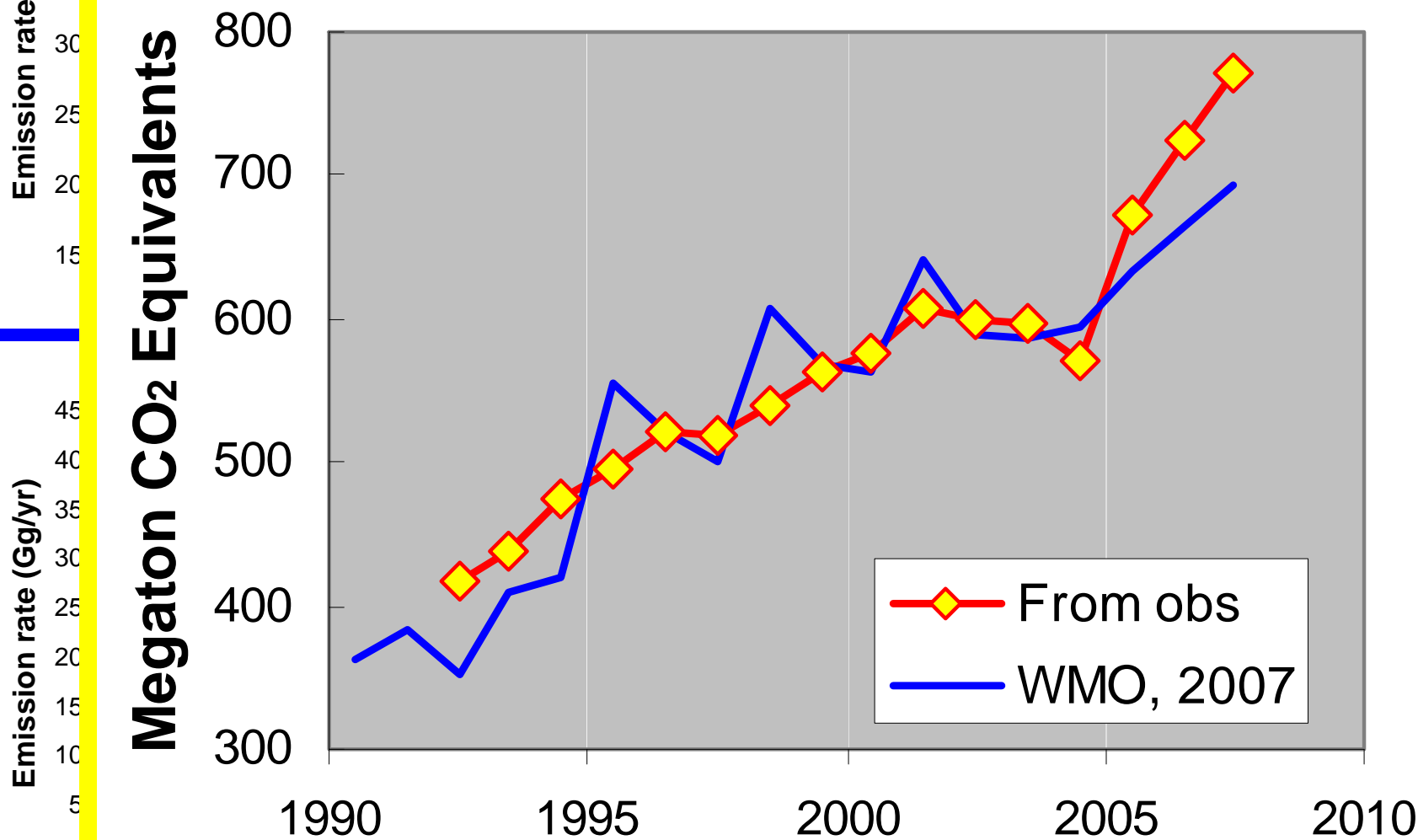


HCFC-141b



HCFC 22

HCFC Emissions (GWP-weighted)



...
on
!

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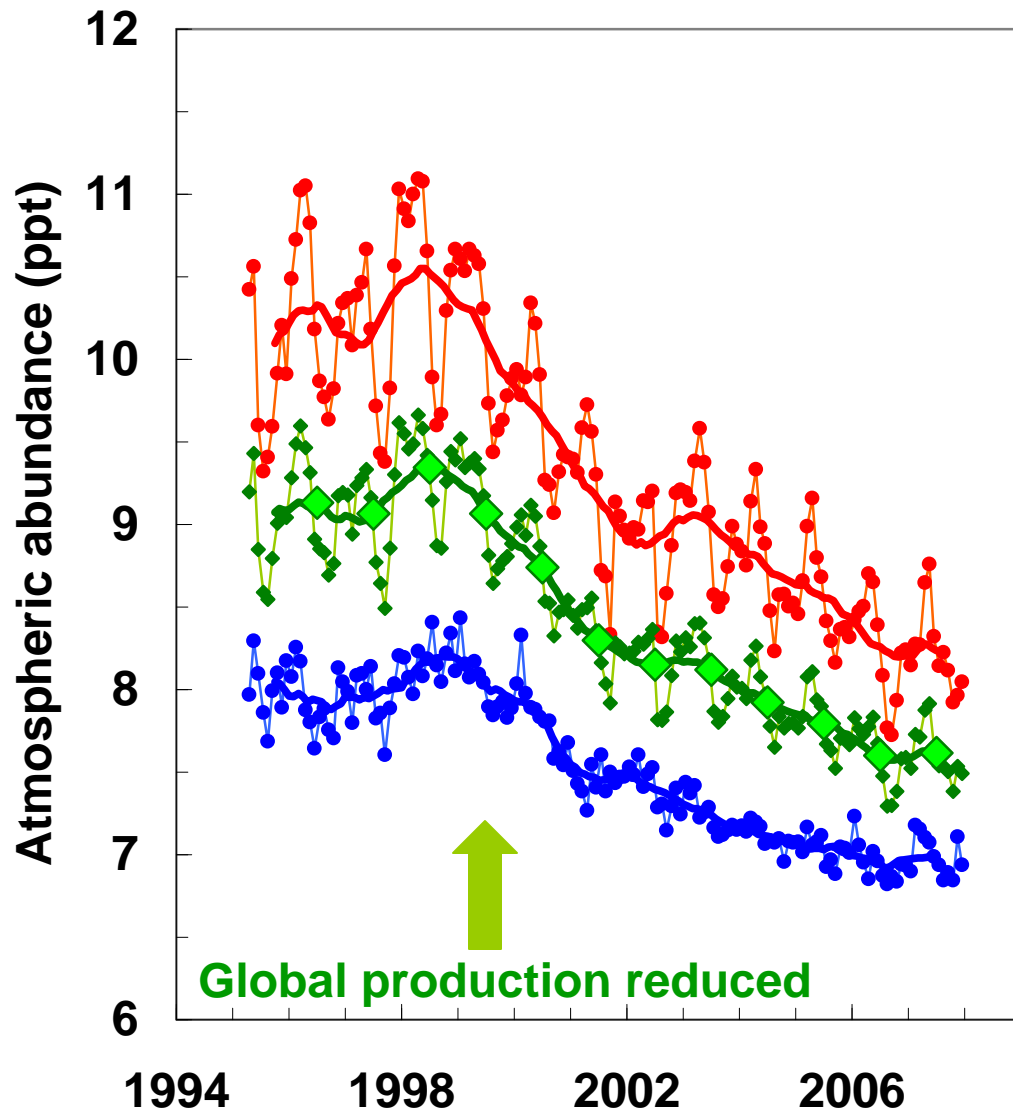
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How are CH₃Br abundances influenced by exemptions & non-regulated use?

**** Understanding the underlying causes of observed global changes:**

Atmospheric Observations of CH₃Br*



- Despite large natural sources, *CH₃Br has declined globally* nearly every year since production decreases began (1999).
- Northern Hemisphere declines are twice those in the SH.
- Despite exemptions and non-regulated consumption, overall *the decline has been faster than expected*.
- Observations allow an estimate of the $[\text{Anthropogenic/Total}]_{1997}$ source fraction: 30 (20-40)%.

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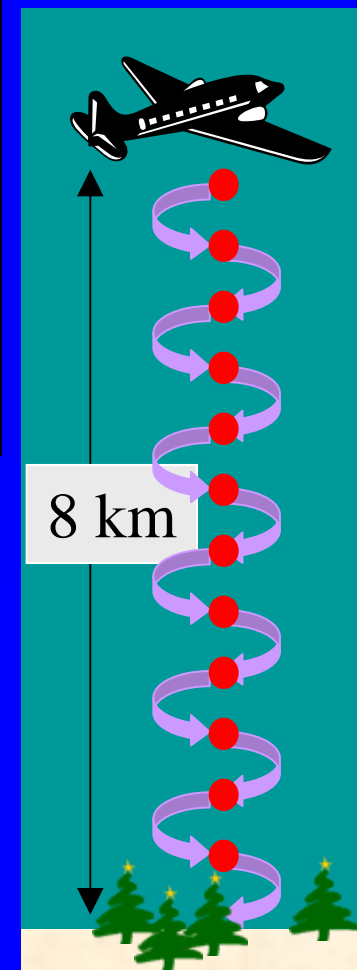
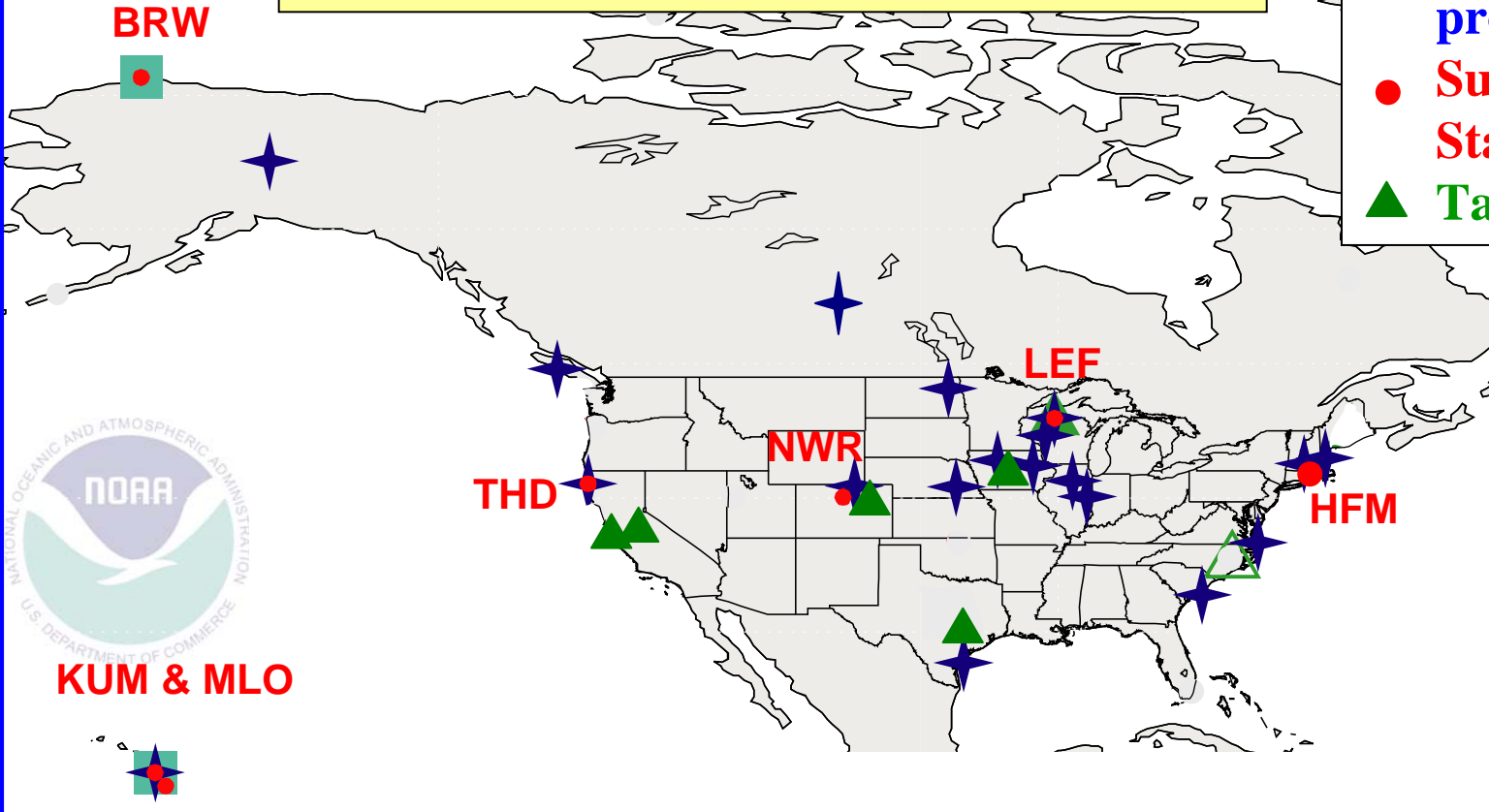
Related to sources:

Quantifying sources on global *and* national scales.

Quantifying other gases (VSLS) and other processes (ocean, land, biosphere).

Regional-Scale Measurements

- ✦ Aircraft profiles
- Surface Stations
- ▲ Tall Towers



Regular ongoing aircraft profile sampling and ~daily flask samples at non-remote, tall tower locations...

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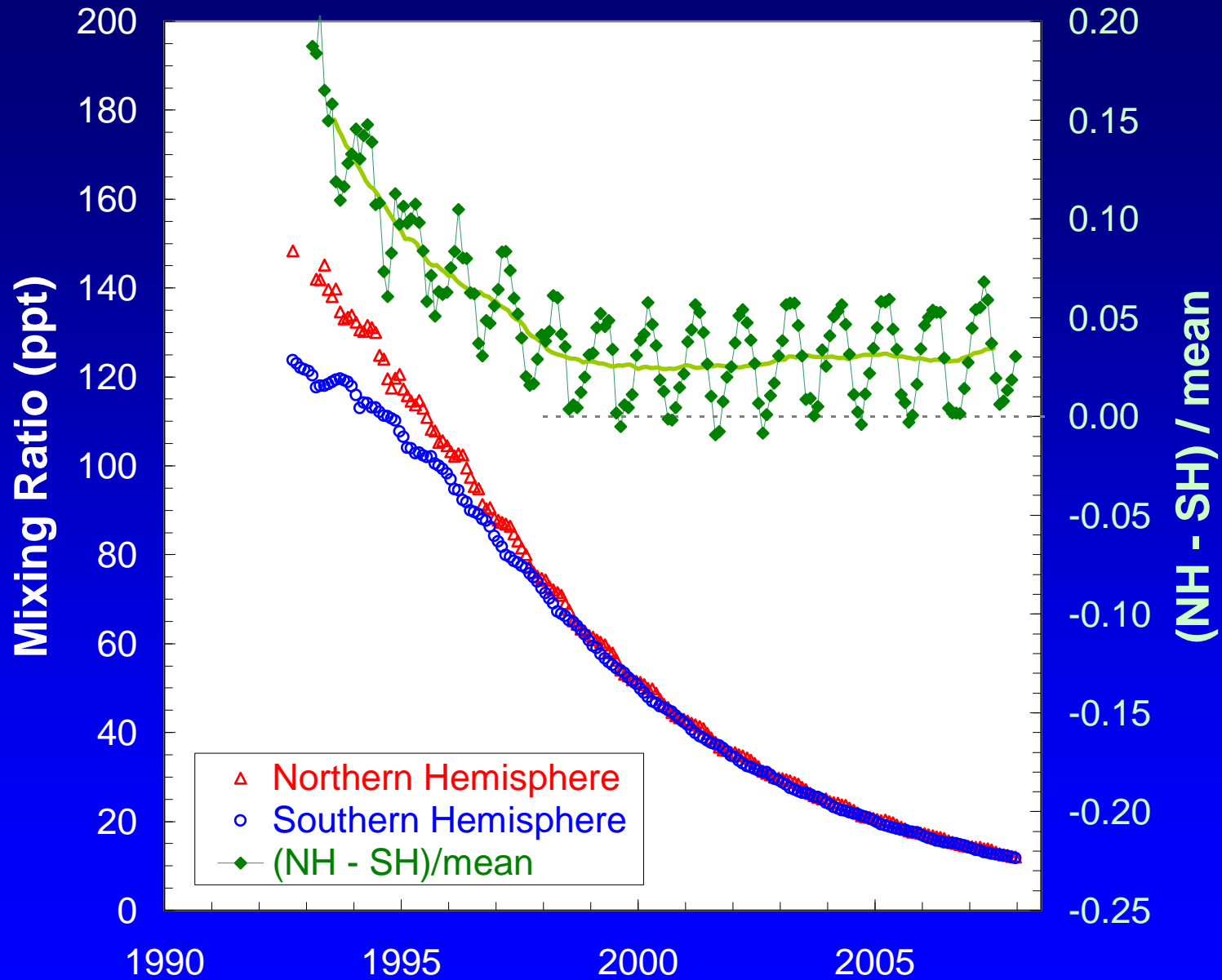
Quantifying other gases (VSLS) and other processes (ocean, land, biosphere).

Related to sinks:

Assessing abundance and variability of atmospheric hydroxyl radical (OH)

Assessing the magnitude of land sinks on continental scales.

CH₃CCl₃ from the NOAA surface flask network



Measuring Atmospheric Halocarbon Trends at NOAA/ESRL *Research Quality Data Provide Substantial Benefits...*

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