Recent accelerated growth observed for HCFCs in the atmosphere

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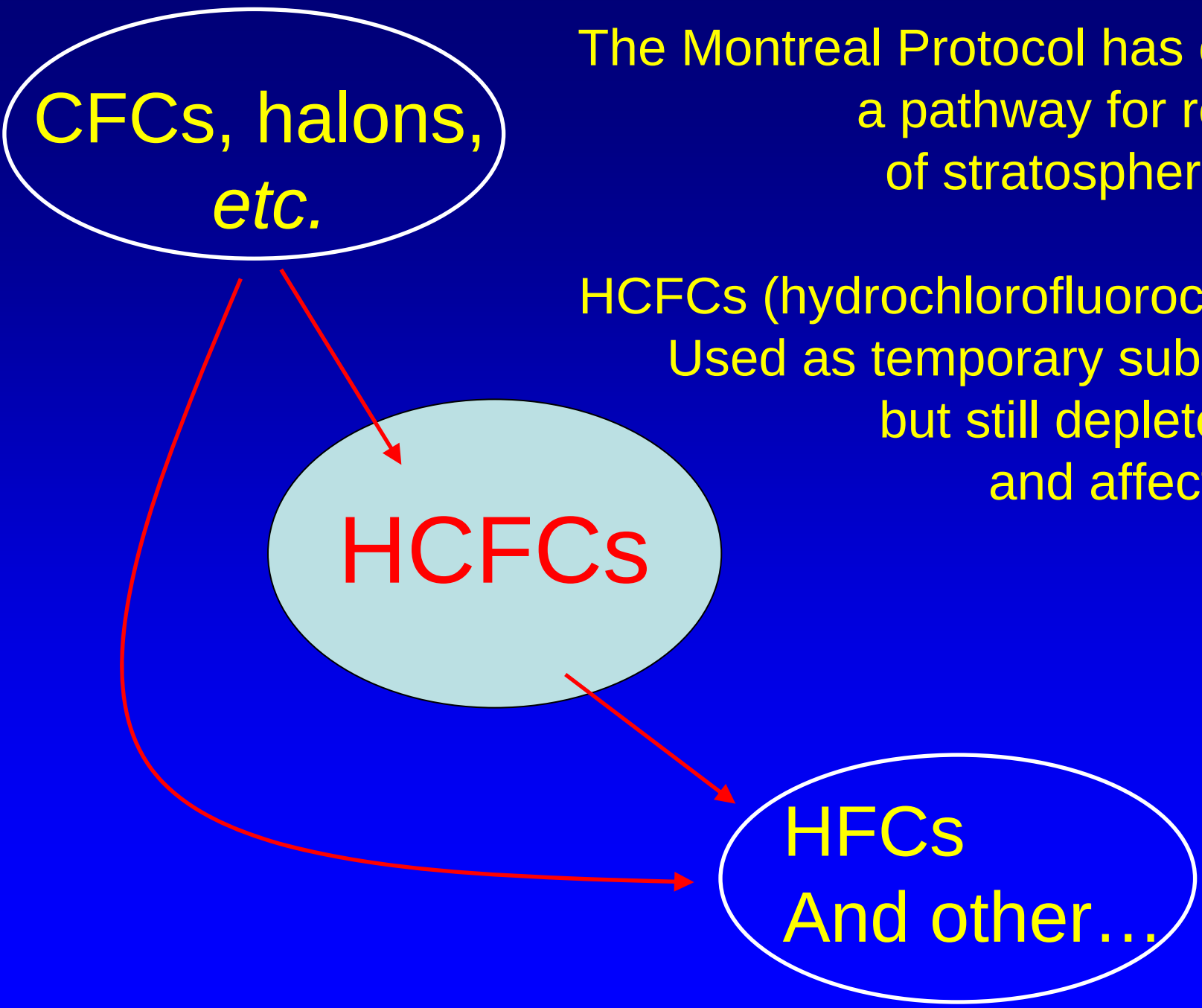
CIRES
STC

Air sampling at South Pole

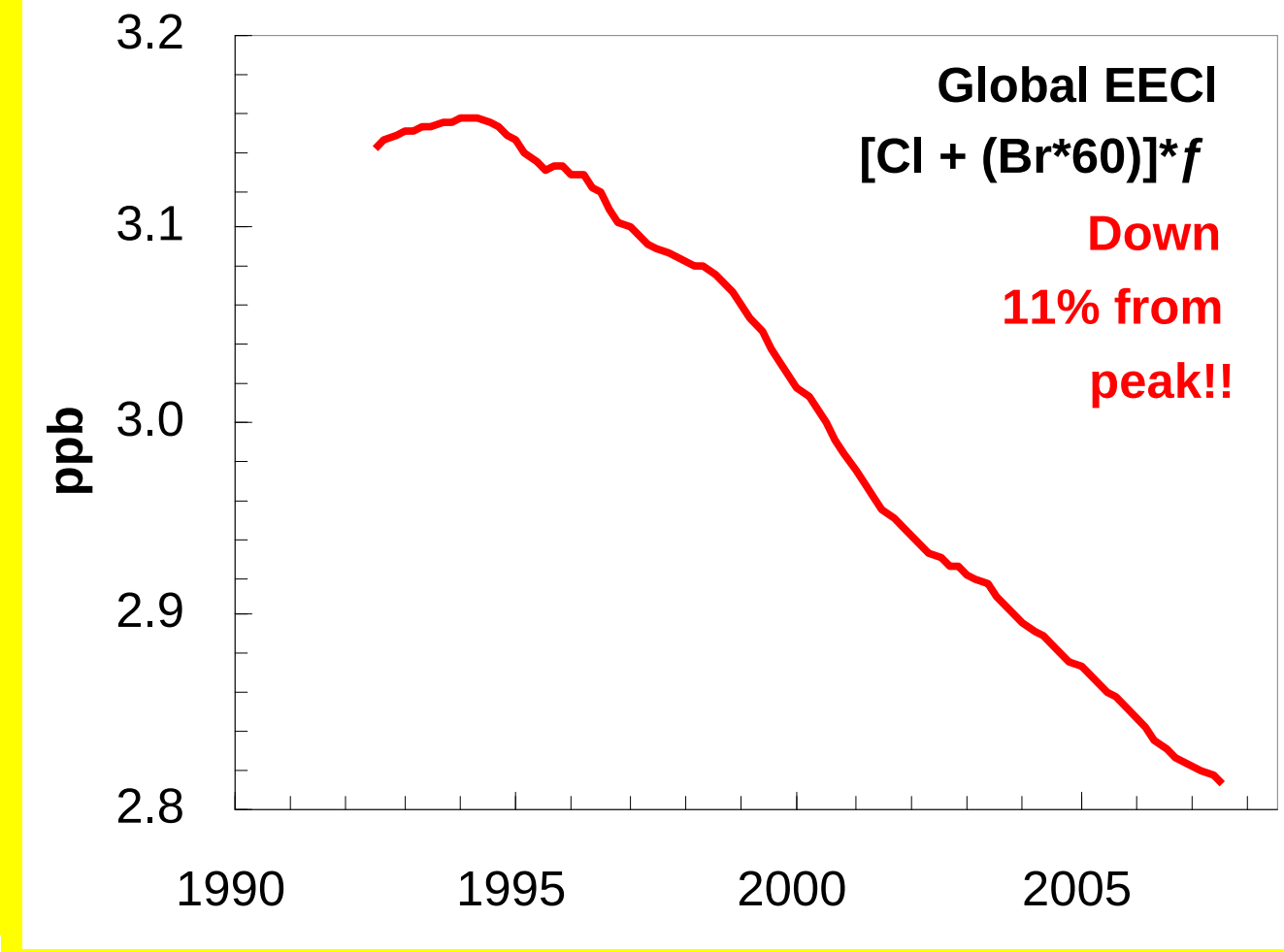


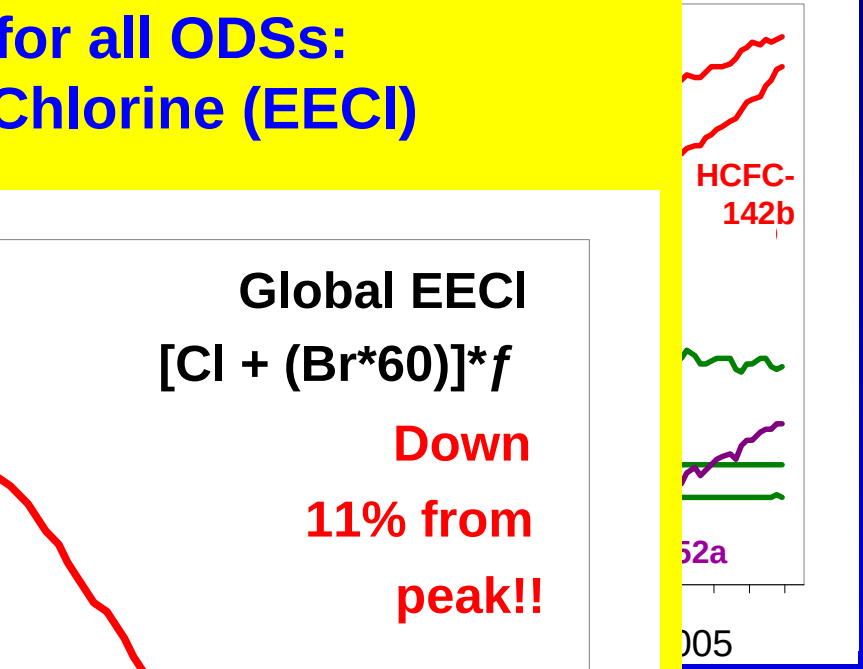
The Montreal Protocol has outlined a pathway for recovery of stratospheric ozone

HCFCs (hydrochlorofluorocarbons): Used as temporary substitutes, but still deplete ozone and affect climate

Is the Montreal Protocol working?
Most ODSs are decreasing, replacements (HCFCs) are increasing

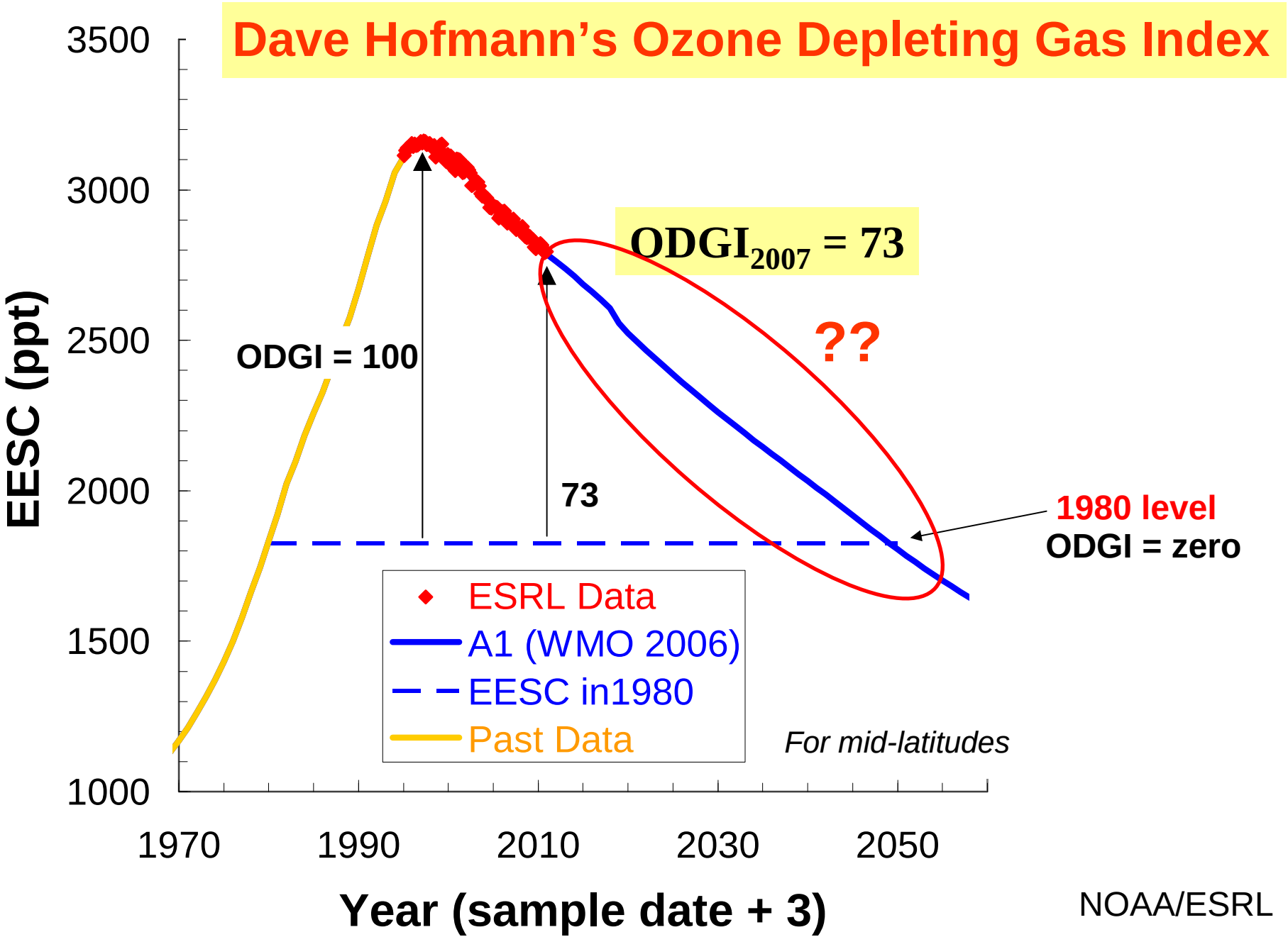
Summarizing trends for all ODSs: Effective Equivalent Chlorine (EECl)





NOAA global surface means

Gauging progress in the return of EESC to 1980 levels:

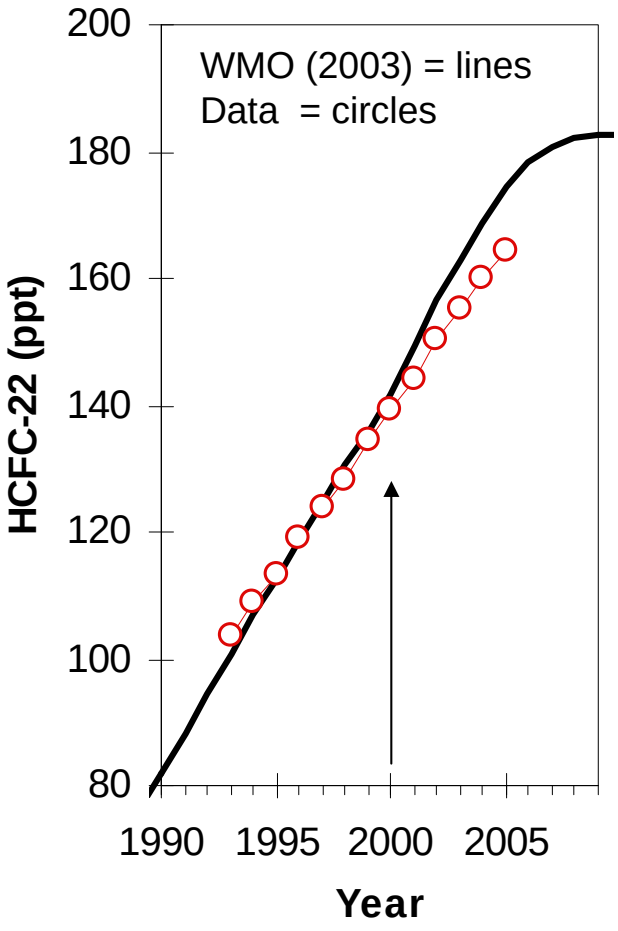


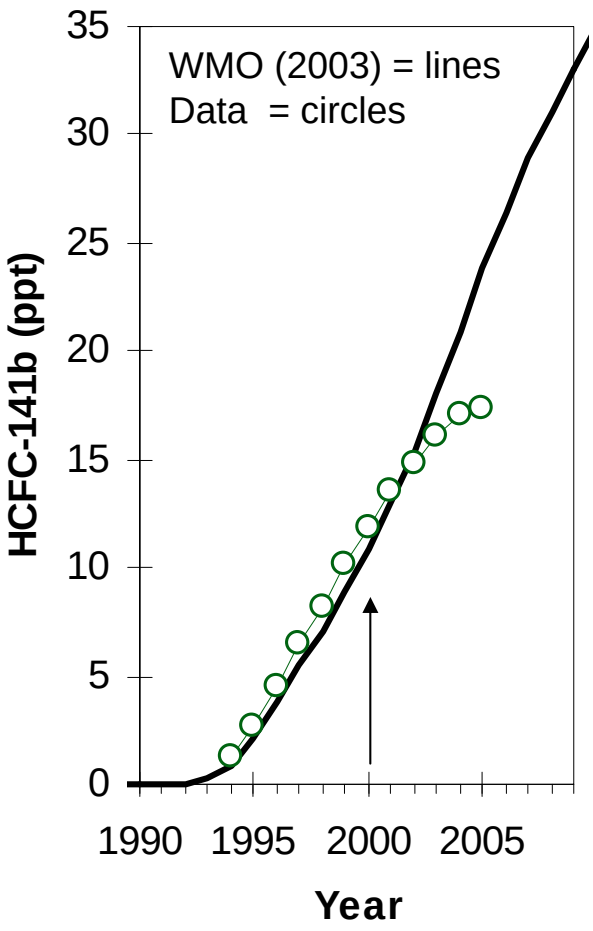
HCFCs as of 2004:

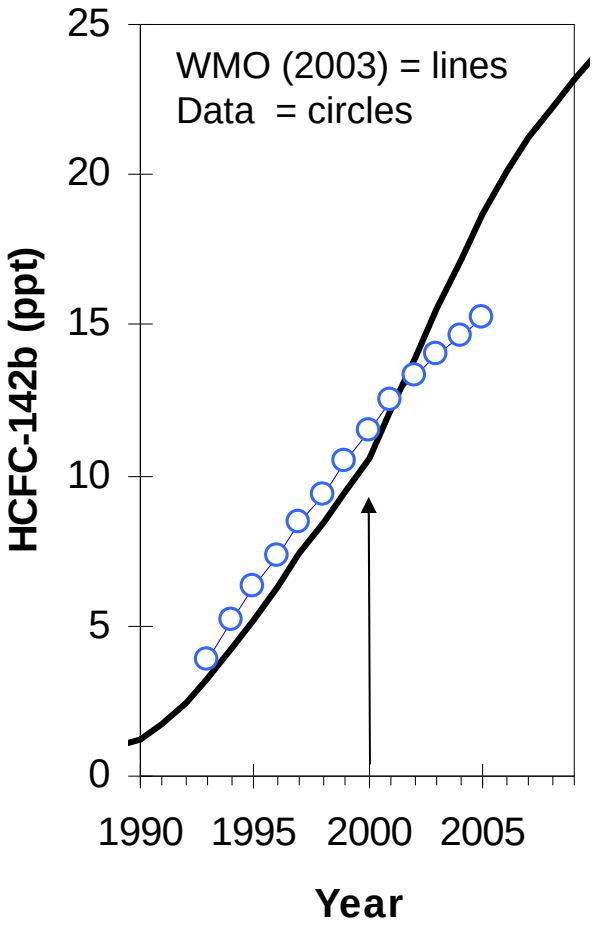
Global atmospheric increases for HCFCs had slowed:

* Rate of Cl increase in 2004 was 6 ppt/yr (compared to 9 ppt/yr in 2000)

* Increases were less than projected 4 years earlier in WMO(2003):



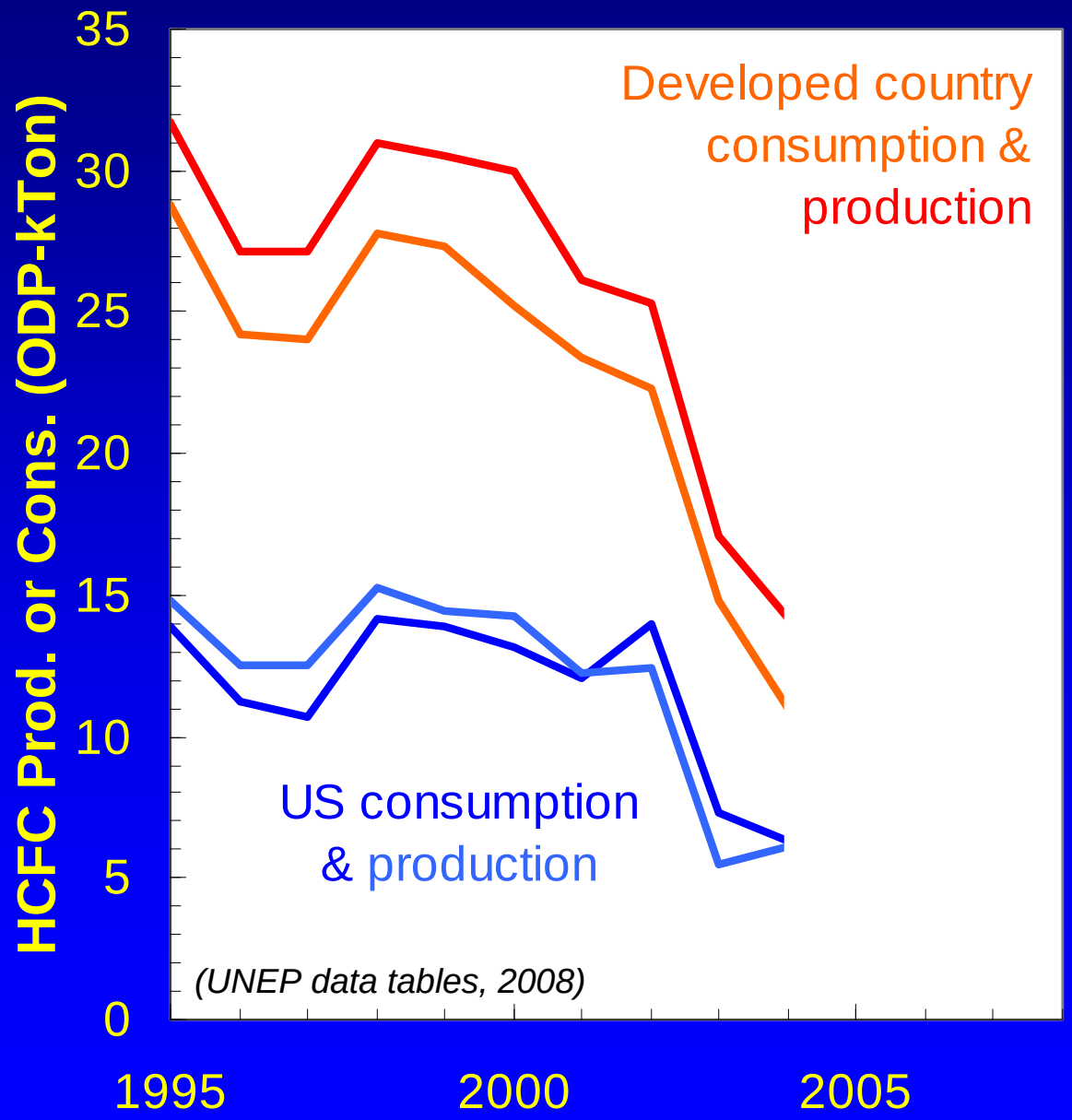




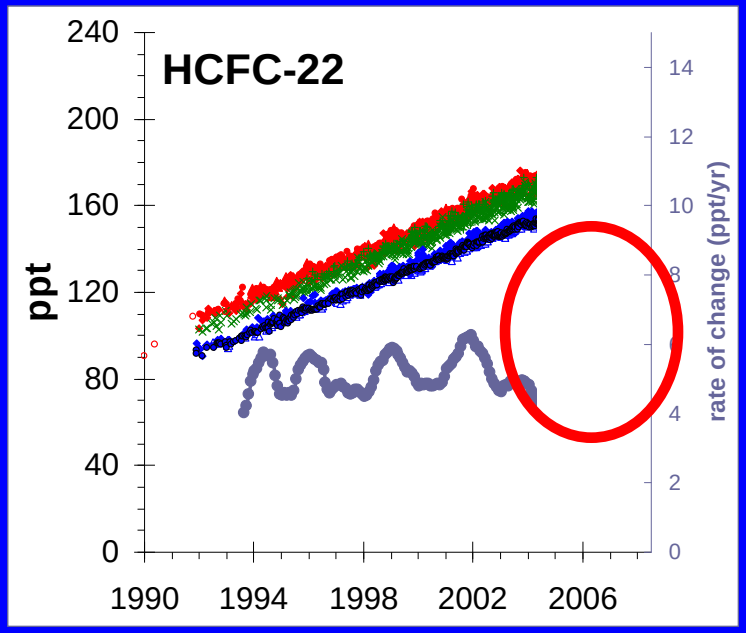
(NOAA and AGAGE data in WMO, 2007)

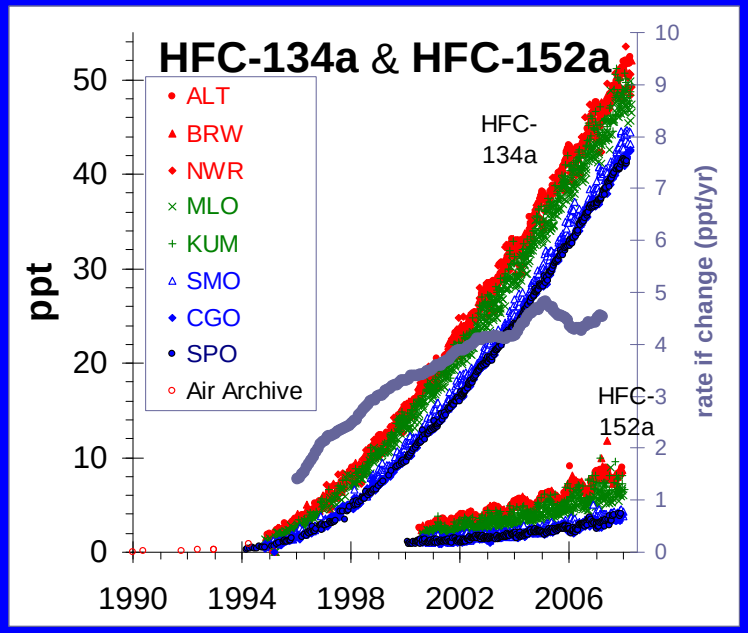
HCFCs as of 2004:

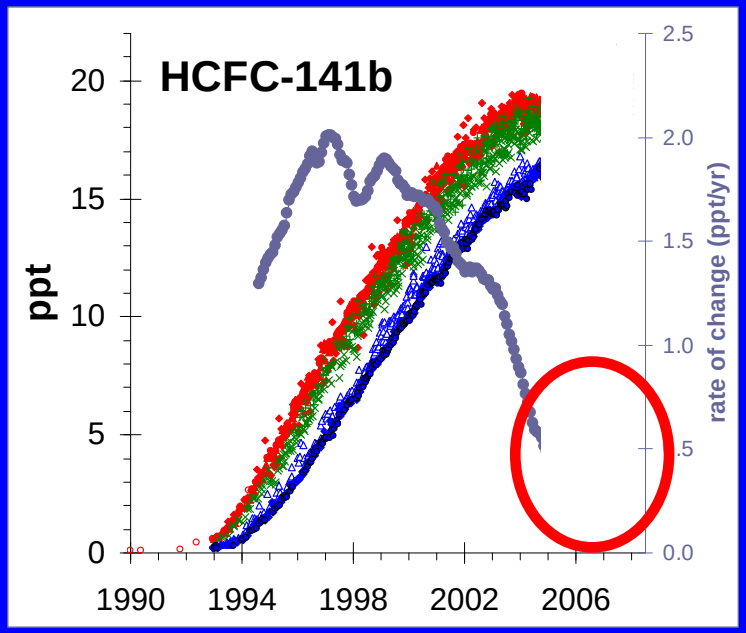
Developed country consumption AND production on the decline:

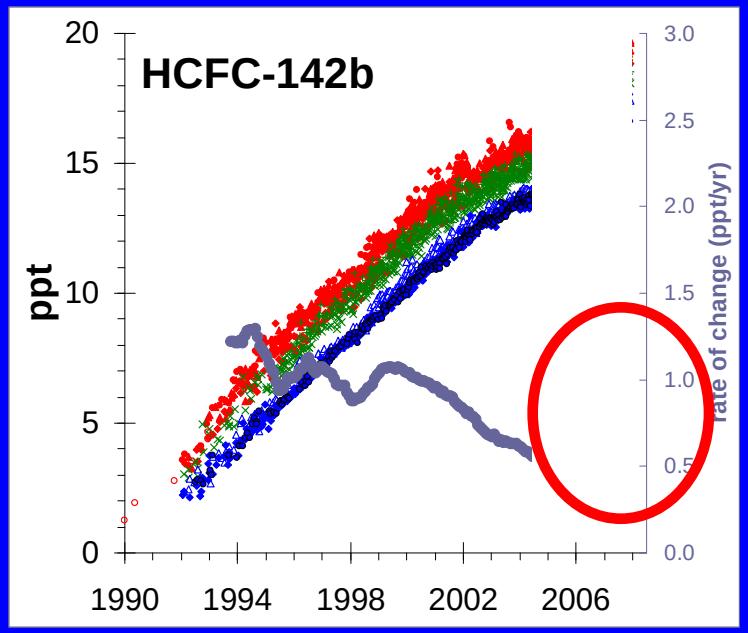


Recent changes in global HCFC mixing ratios and growth rates









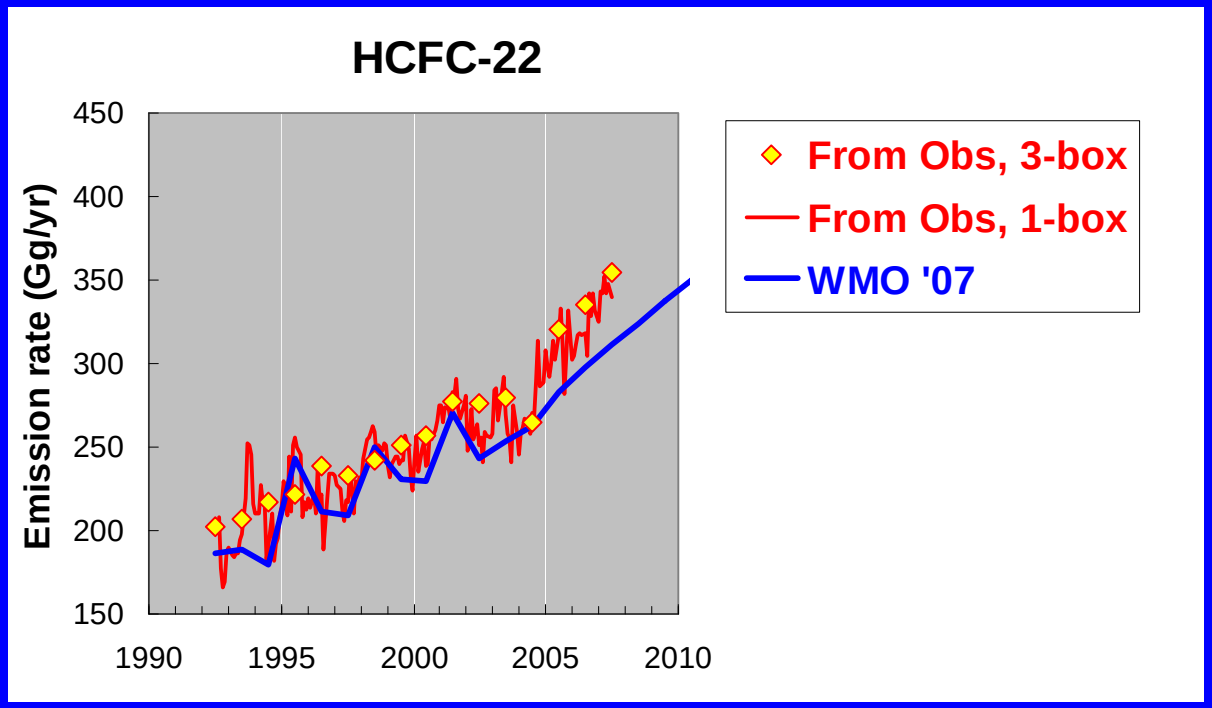
Accelerated growth rates for the 3 abundant HCFCs

As of 2004 after 2004 (WMO 2007)

Cl from HCFCs:

in 2004
+5.9 ppt/yr

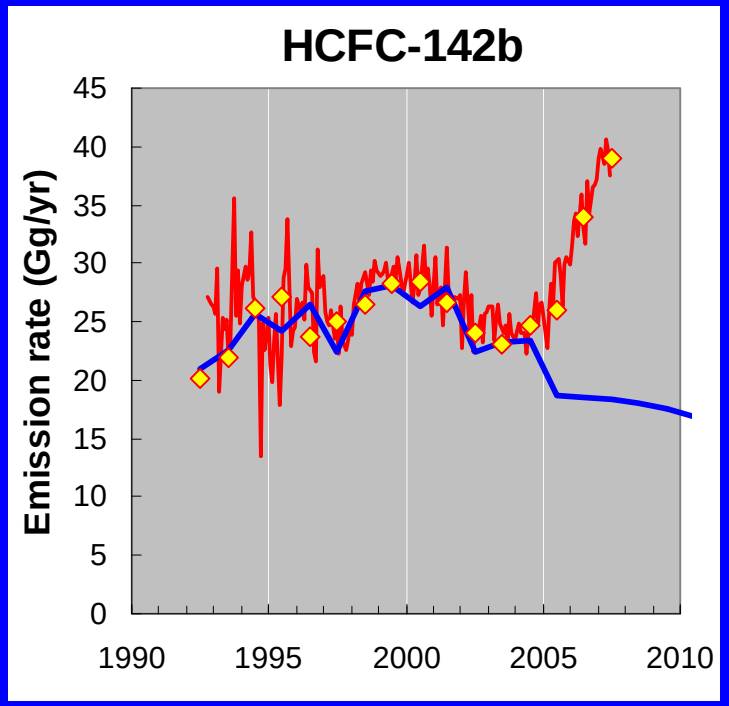
in 2007
+9 ppt/yr

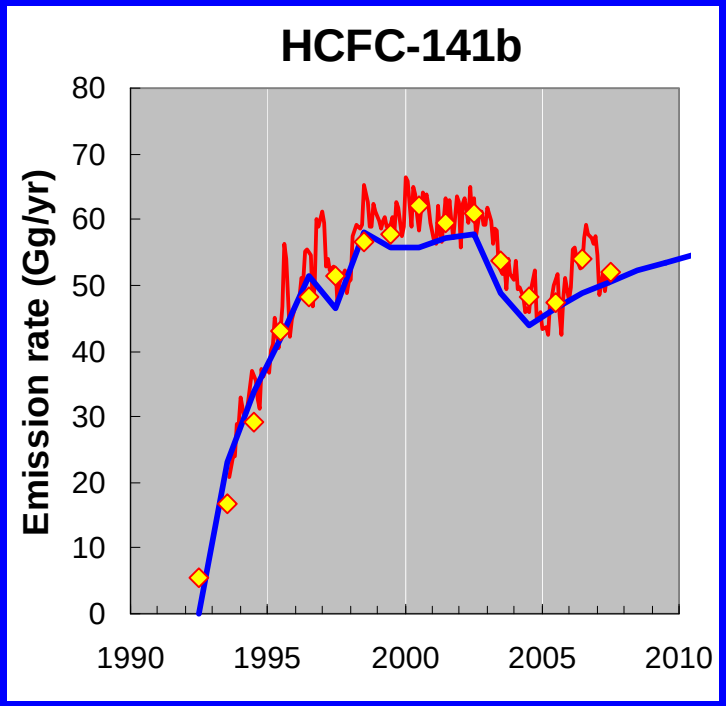


Implications: Changes in Emissions

* derived from global changes and box models
* compared to recent WMO (2007) scenario Ab projection…

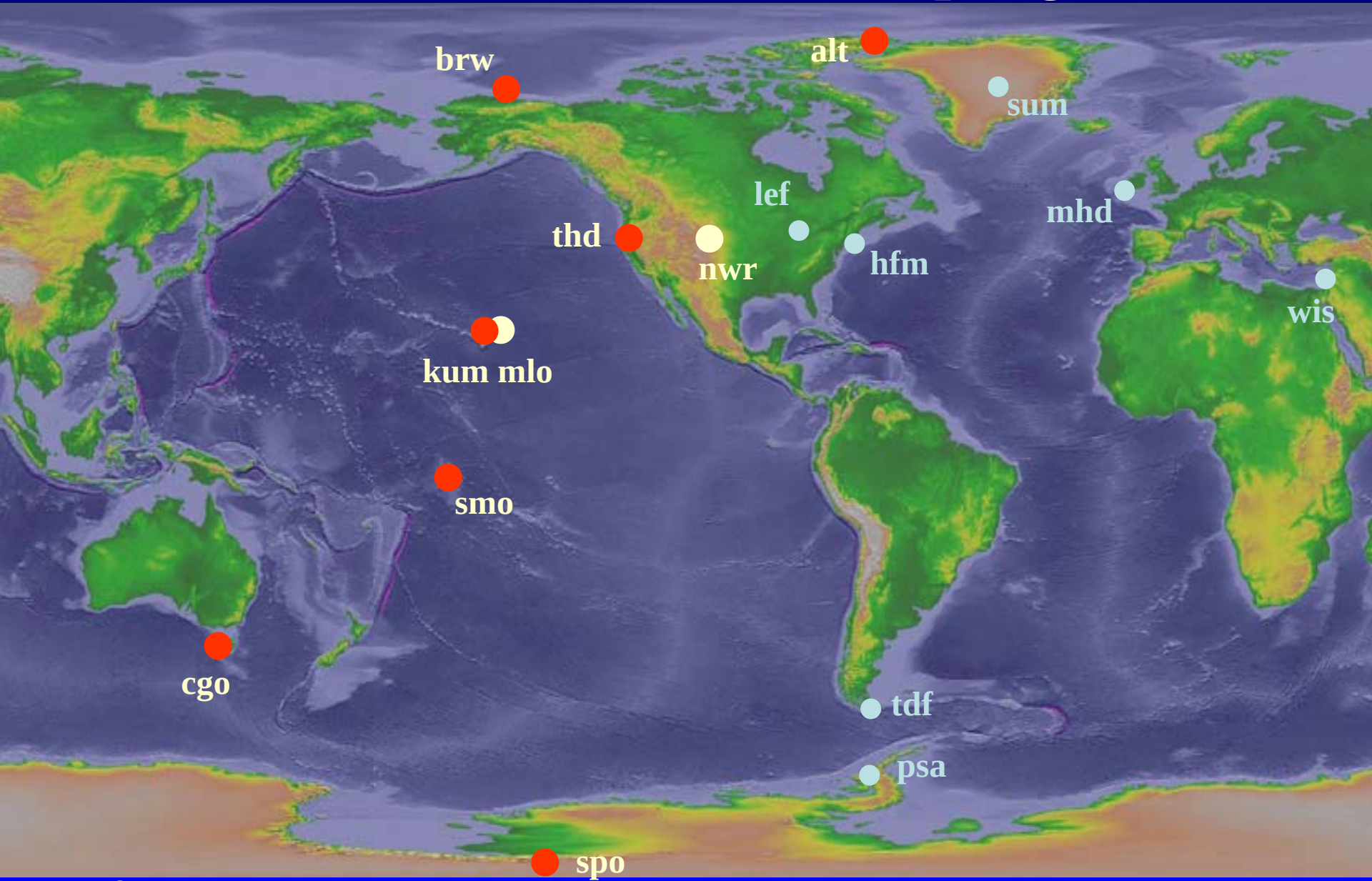
→Substantial emission increases recently!





142b emissions in 2007 are TWICE those in recent WMO scenario

The halocarbon surface flask sampling network

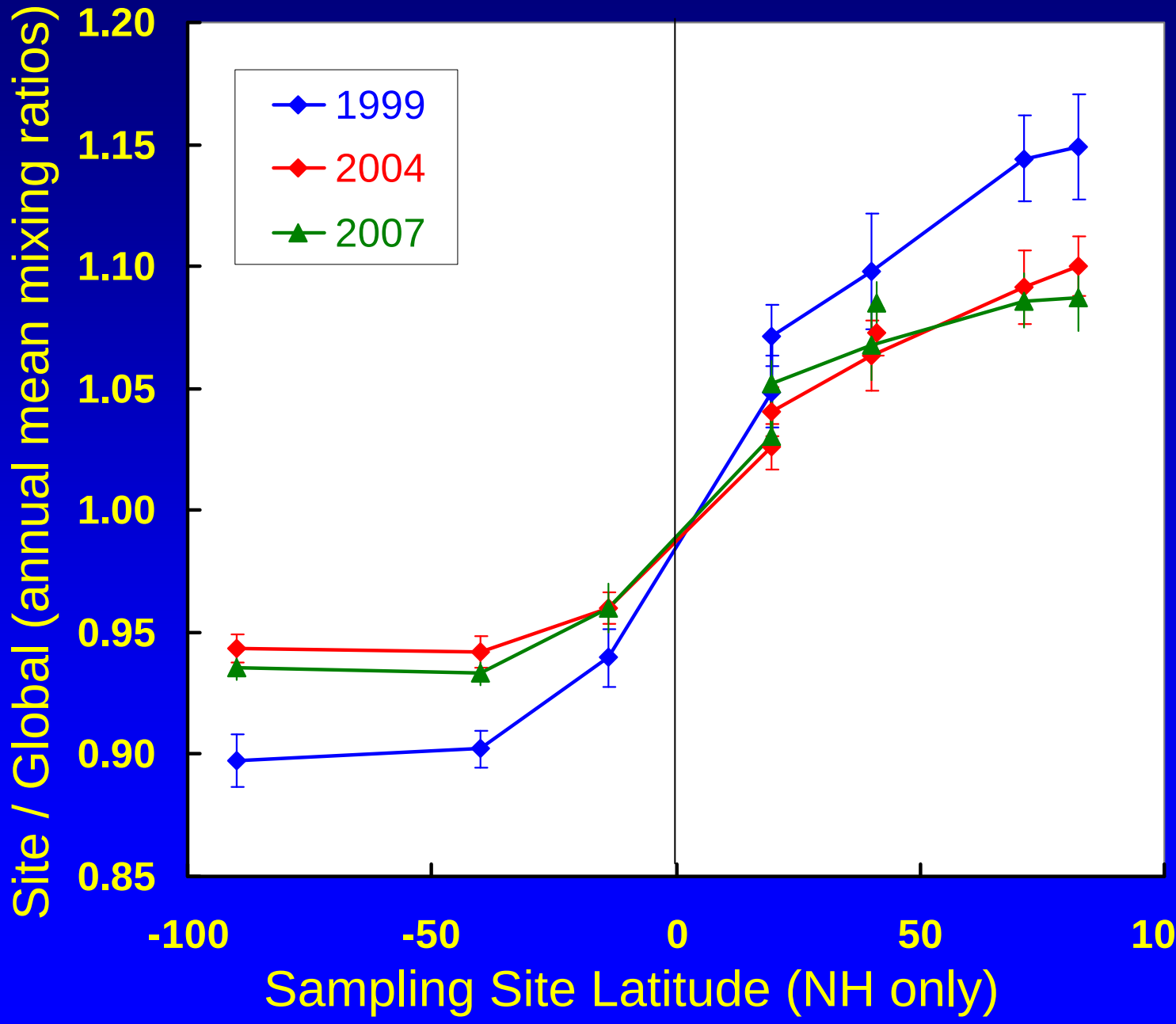


High Altitude

Marine Boundary Layer

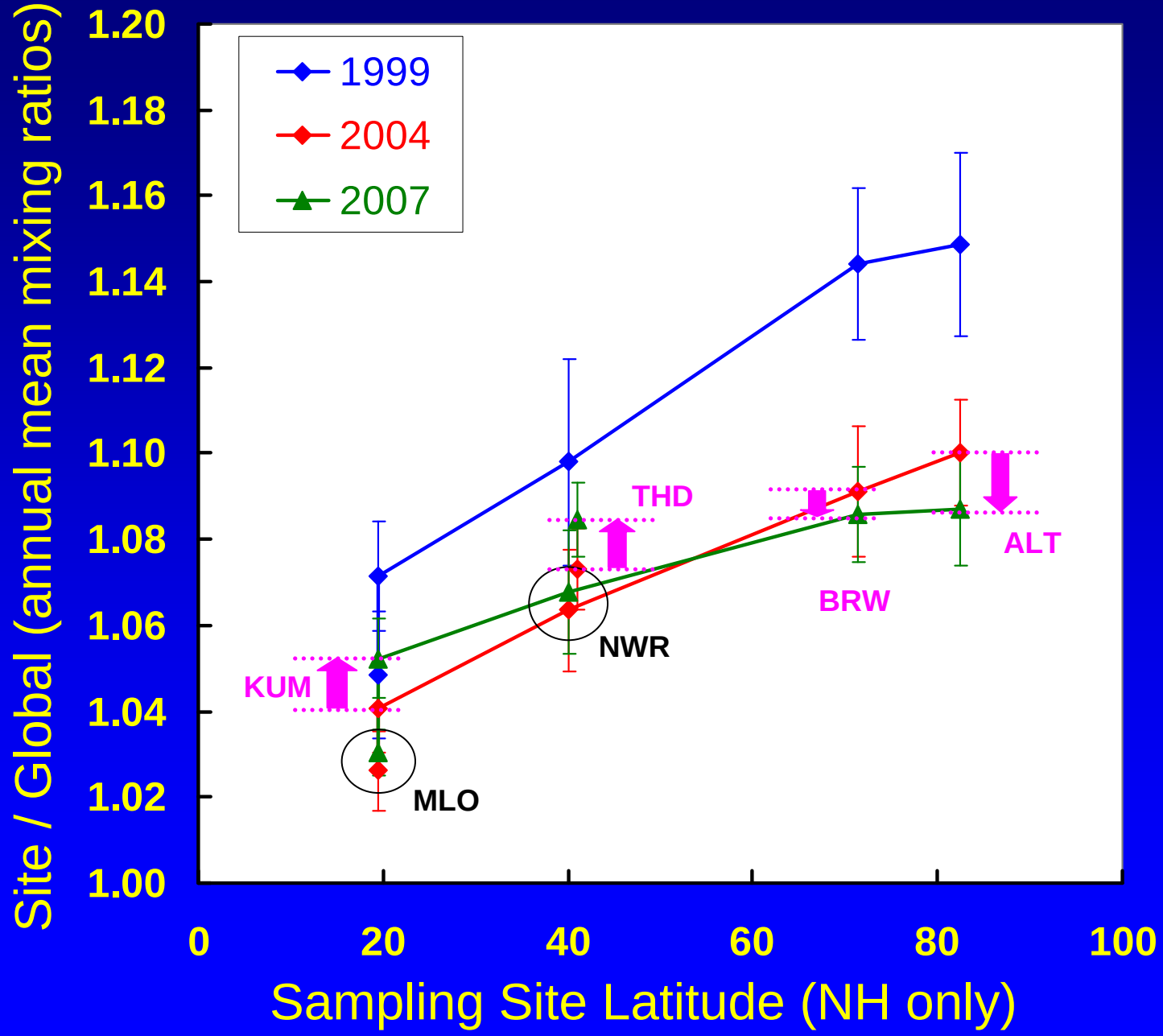
Not used; non-background

Atmospheric Distribution Changes for HCFC-142b



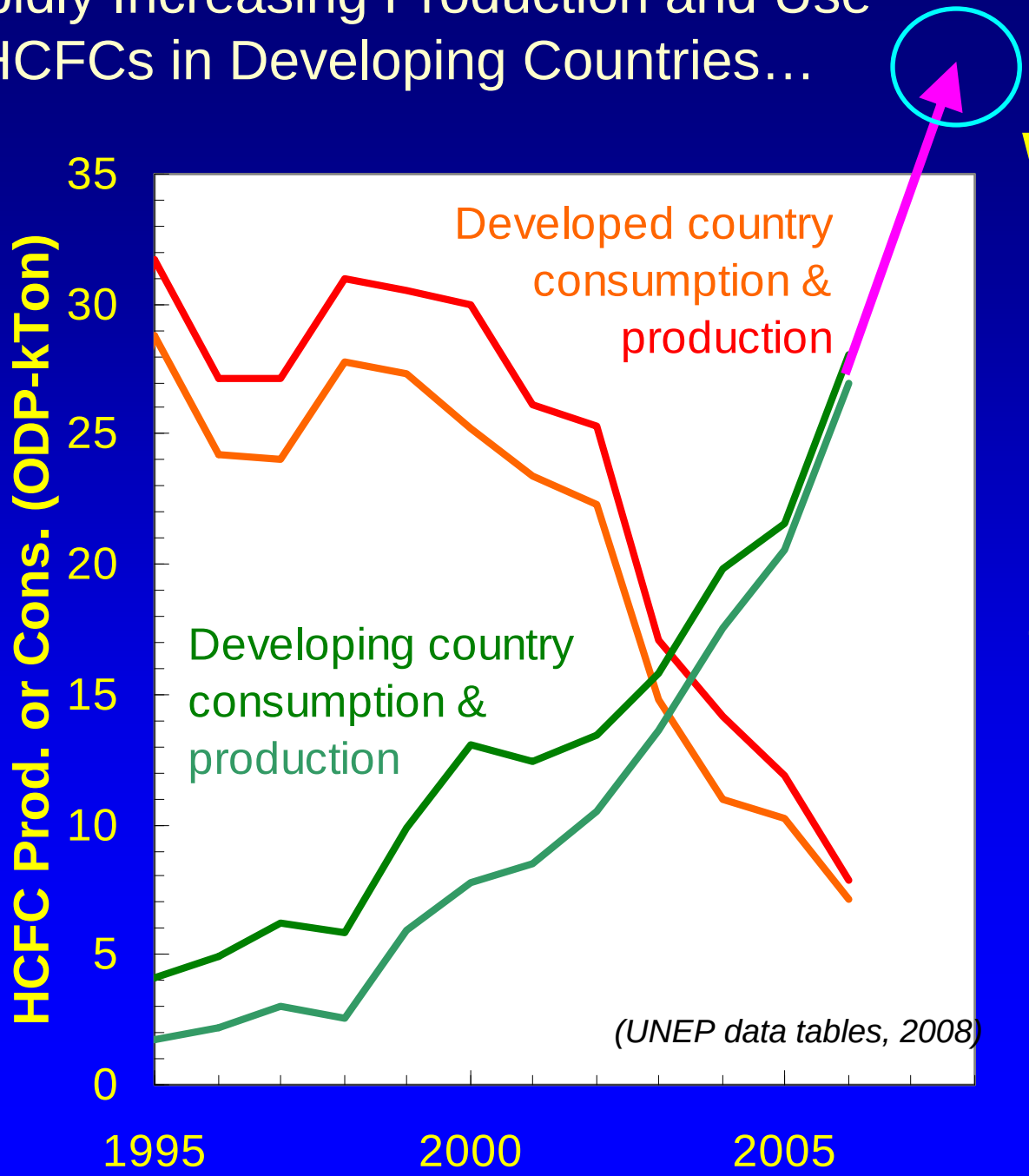
Global rate of increase was comparable in 1999 and 2007

Atmospheric Distribution Changes for HCFC-142b



NH only…

Rapidly Increasing Production and Use of HCFCs in Developing Countries…



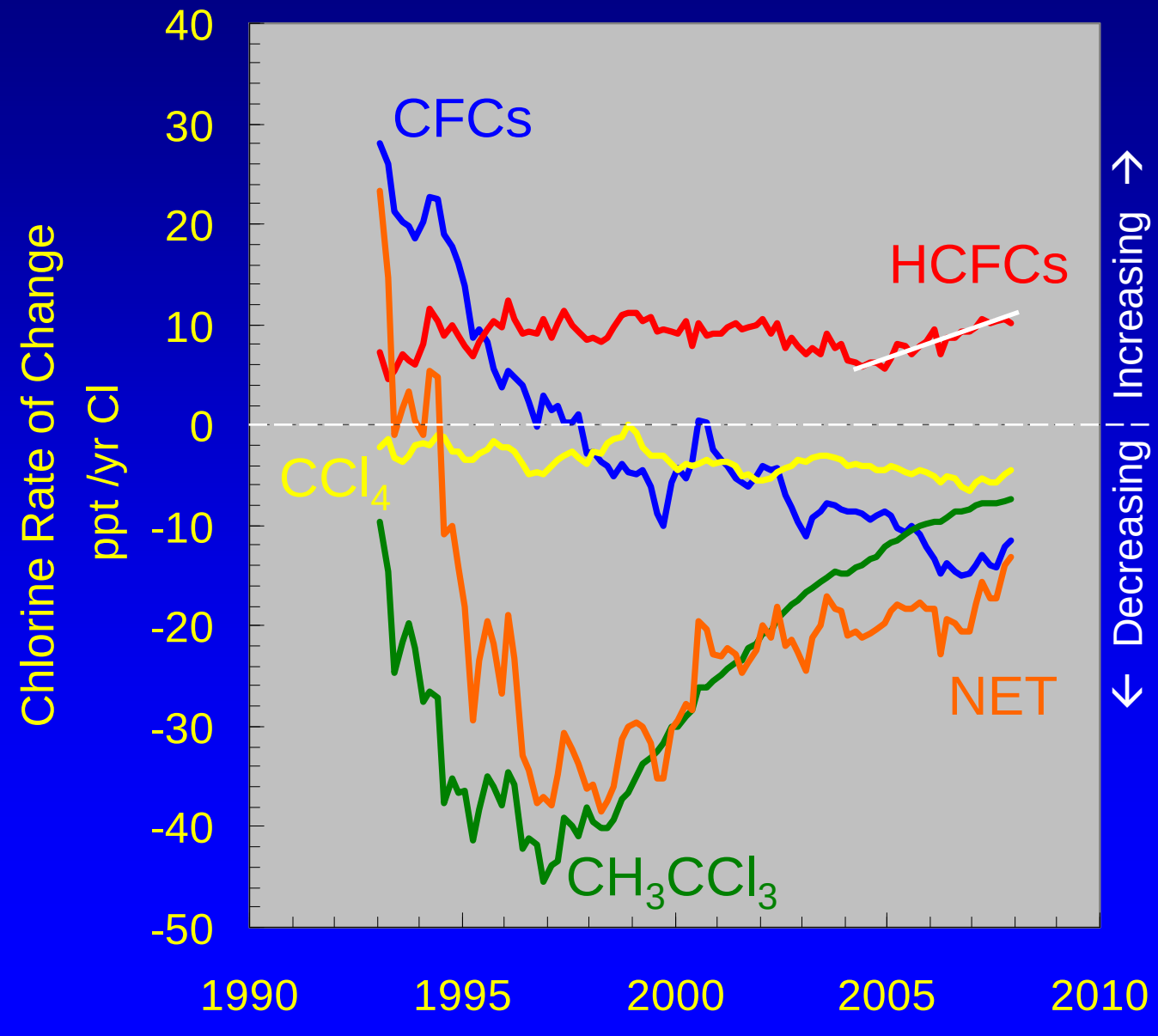
2008??
Where will we be in 2013?

In 2006:
80% of global HCFC production was from developing countries

50% of global cons. from China.

Developing country consumption & production of HCFCs is capped in 2013.

Implications: Changes in Total Atmospheric Chlorine From Ozone-depleting Gases:

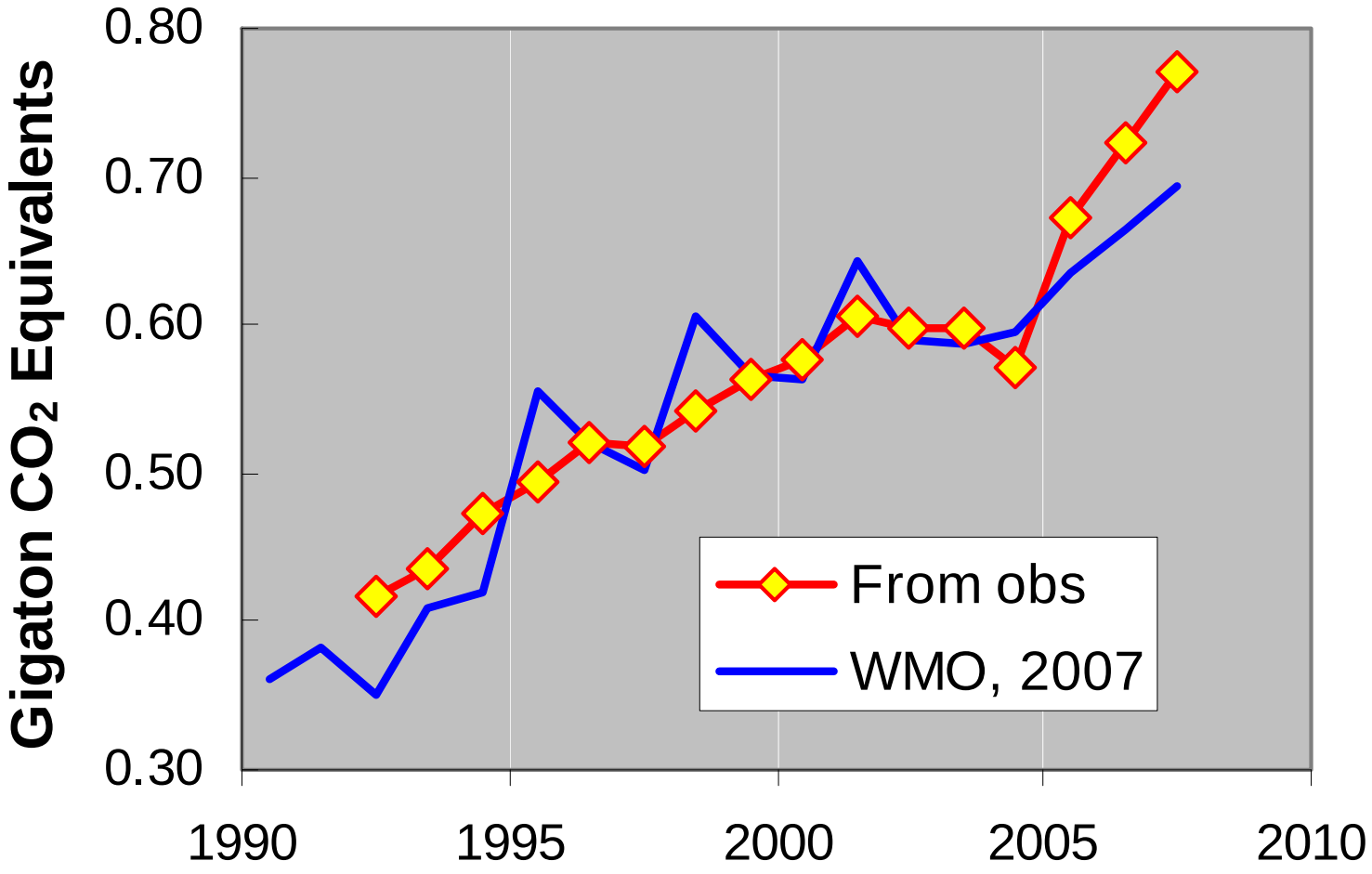


Only HCFCs continue to add more chlorine to the atmosphere each year…

Declines in Cl from CFCs have recently become larger than from CH_3CCl_3

HCFC Emissions

(Direct GWP-weighted)



A 35% increase since 2004

Global fossil-related CO_2 emissions ~25-30 Gt/yr

Conclusions:

The ODGI better conveys the progress we are making to reduce the atmospheric abundance of ozone-depleting gases…
Thanks Dave!

HCFC abundances have increased at accelerated rates since 2004.

HCFCs are the one remaining compound class offsetting declines in Cl from other ODSs.

Emissions of HCFCs have increased by up to 70% since 2004 (for HCFC-142b).

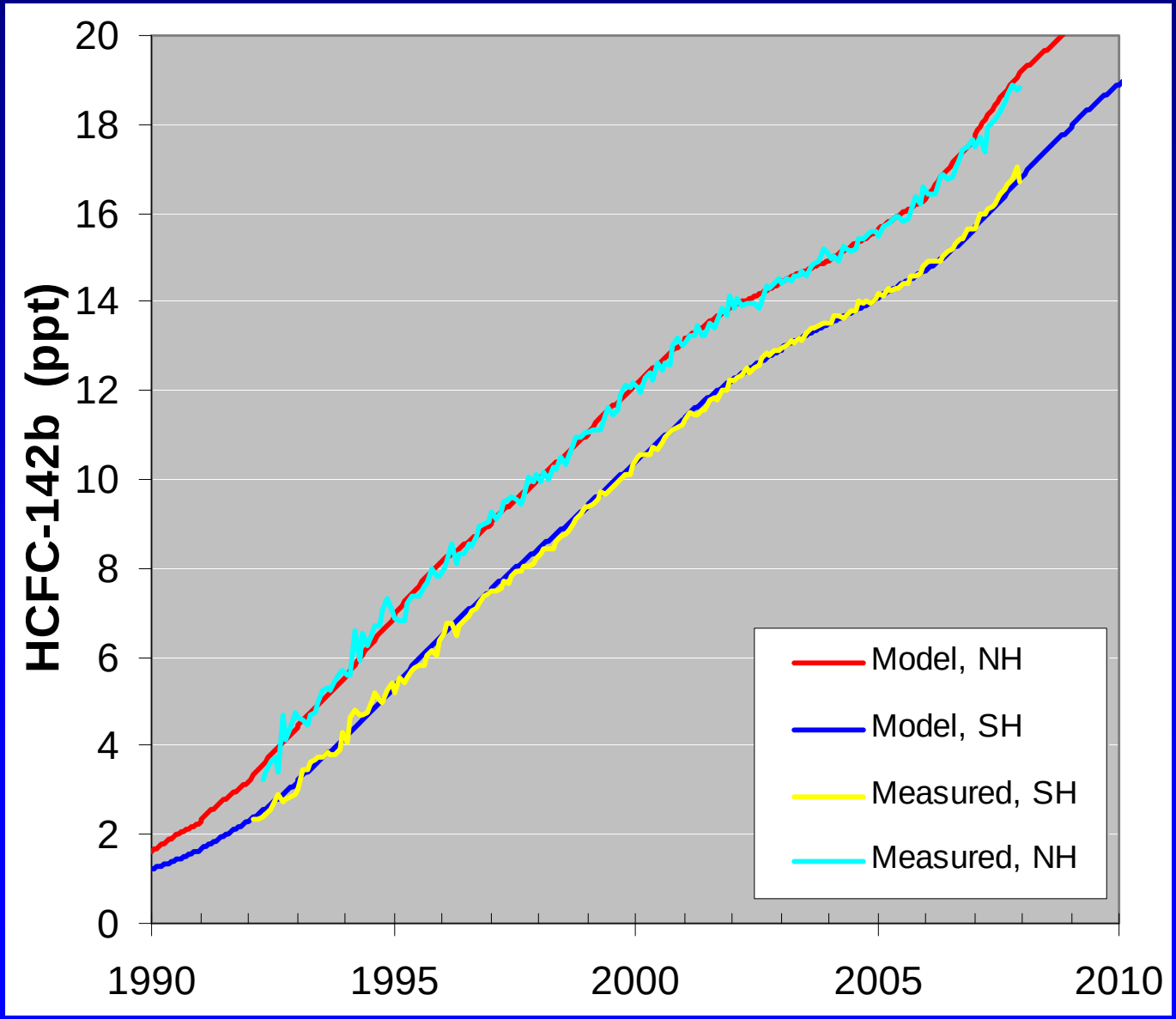
The atmospheric data point to enhanced emissions since 2004 in the lower latitudes of the NH, concurrent with substantial increases in HCFC production and consumption in developing countries.

→ In contrast to years before 2004, developing nations are now determining changes in the abundances of HCFCs across the globe.

Understanding the cause of the changes since 2004

→ Source driven (emissions changes are a factor of 2 for HCFC-142b)

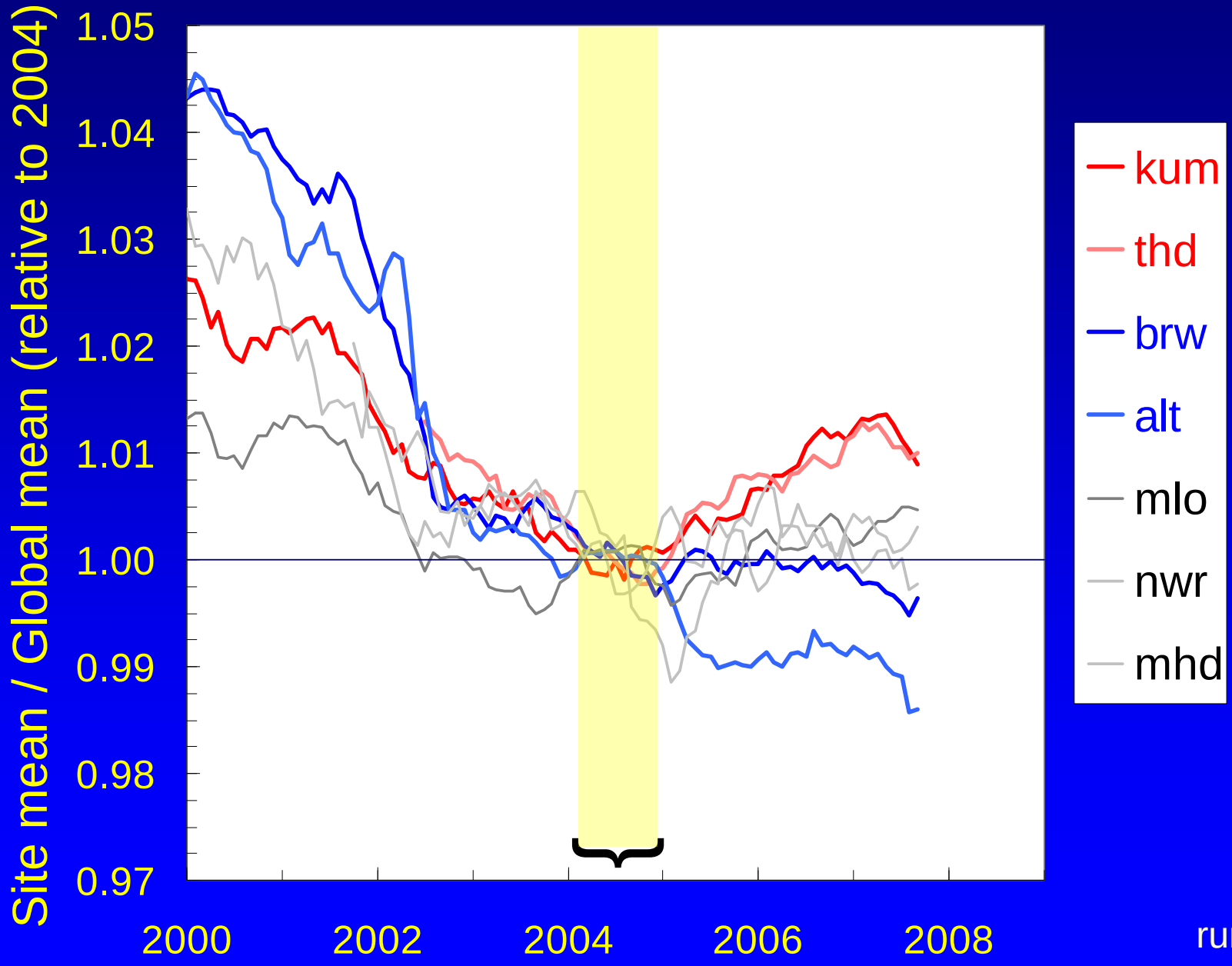
→ Where is the enhanced source? Northern *vs.* Southern Hemisphere?



Simple 3-box model calculation:

Most of the record is well simulated with a fairly constant 95% of emissions in NH.

Changes in the distribution of HCFC-142b relative to 2004



12-month
running means