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# AGAGE and CSIRO Measurements of Recent Global Methane Growth

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May 2009

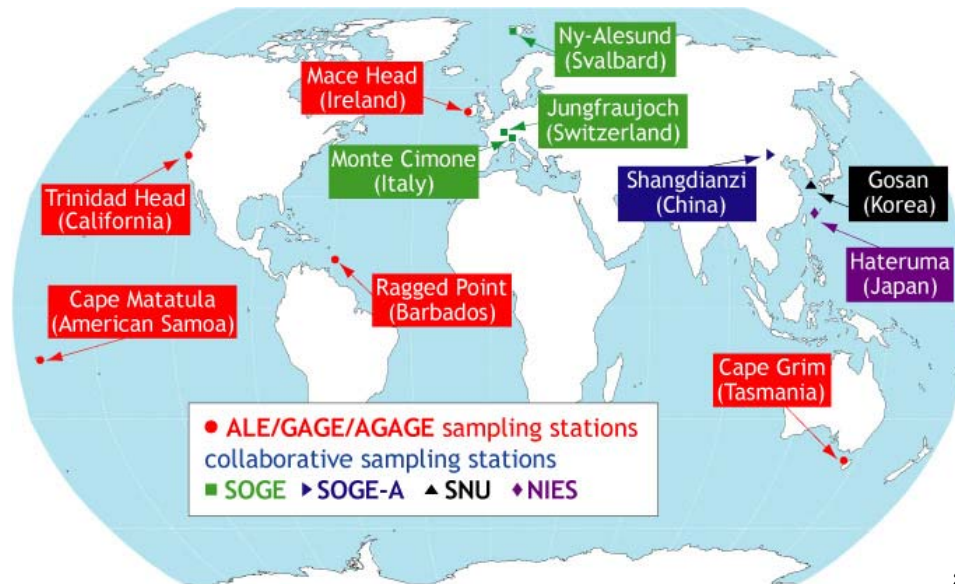


Massachusetts Institute of Technology

# AGAGE network

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- Advanced Global Atmospheric Gases Experiment
- High frequency measurements of ozone depleting species and non-CO<sub>2</sub> GHGs

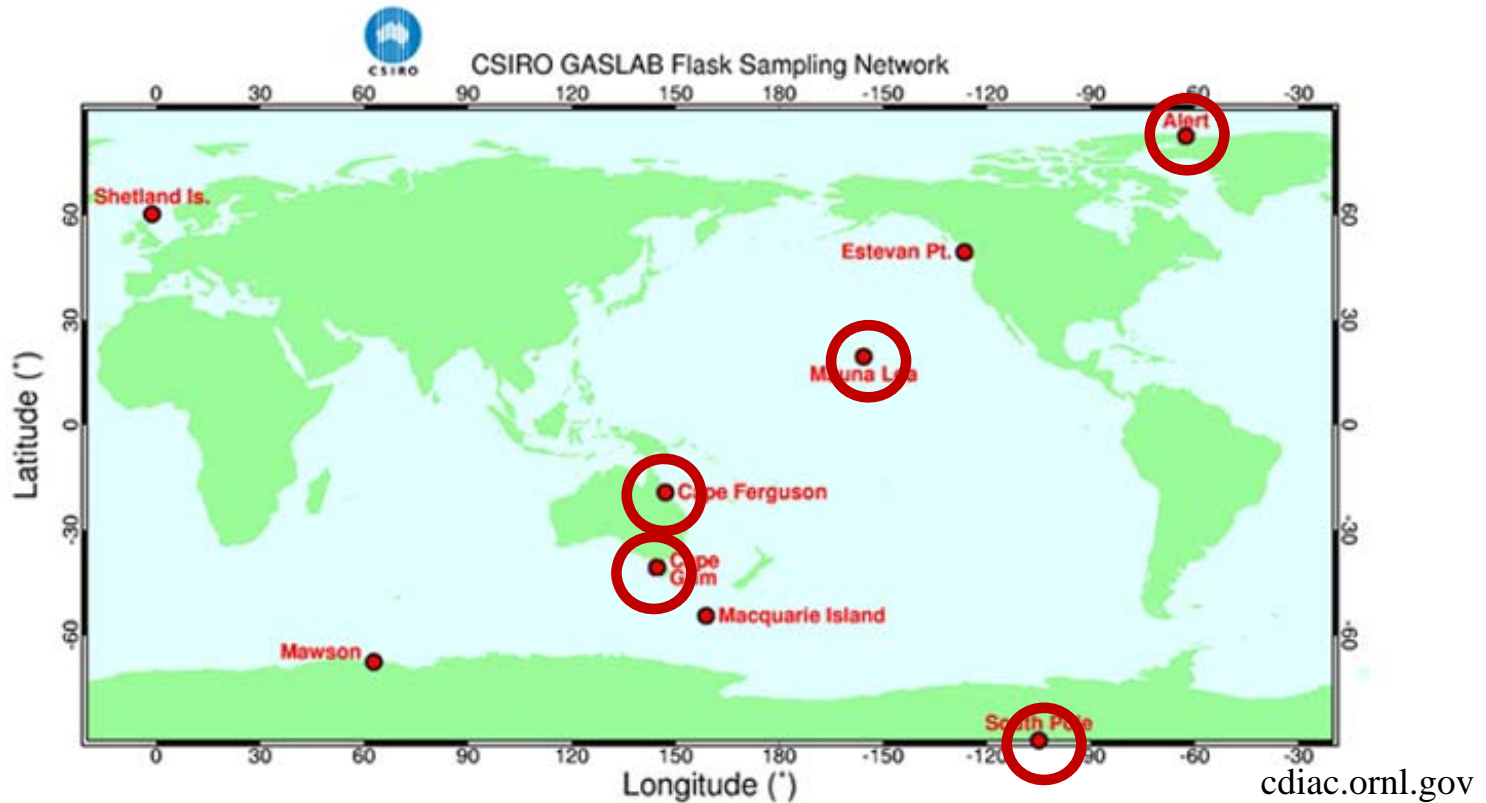


[agage.eas.gatech.edu](http://agage.eas.gatech.edu)

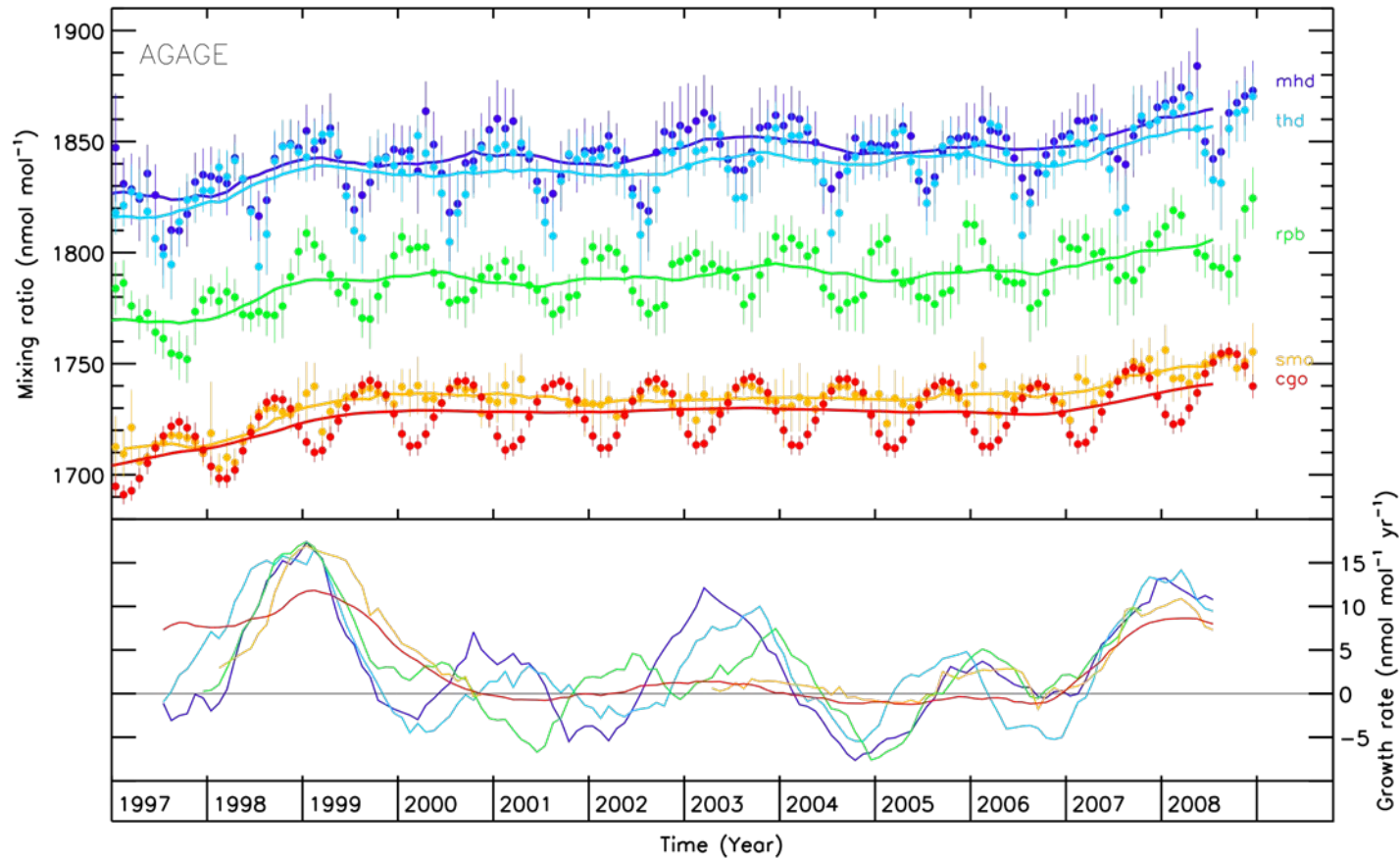


# CSIRO flask network

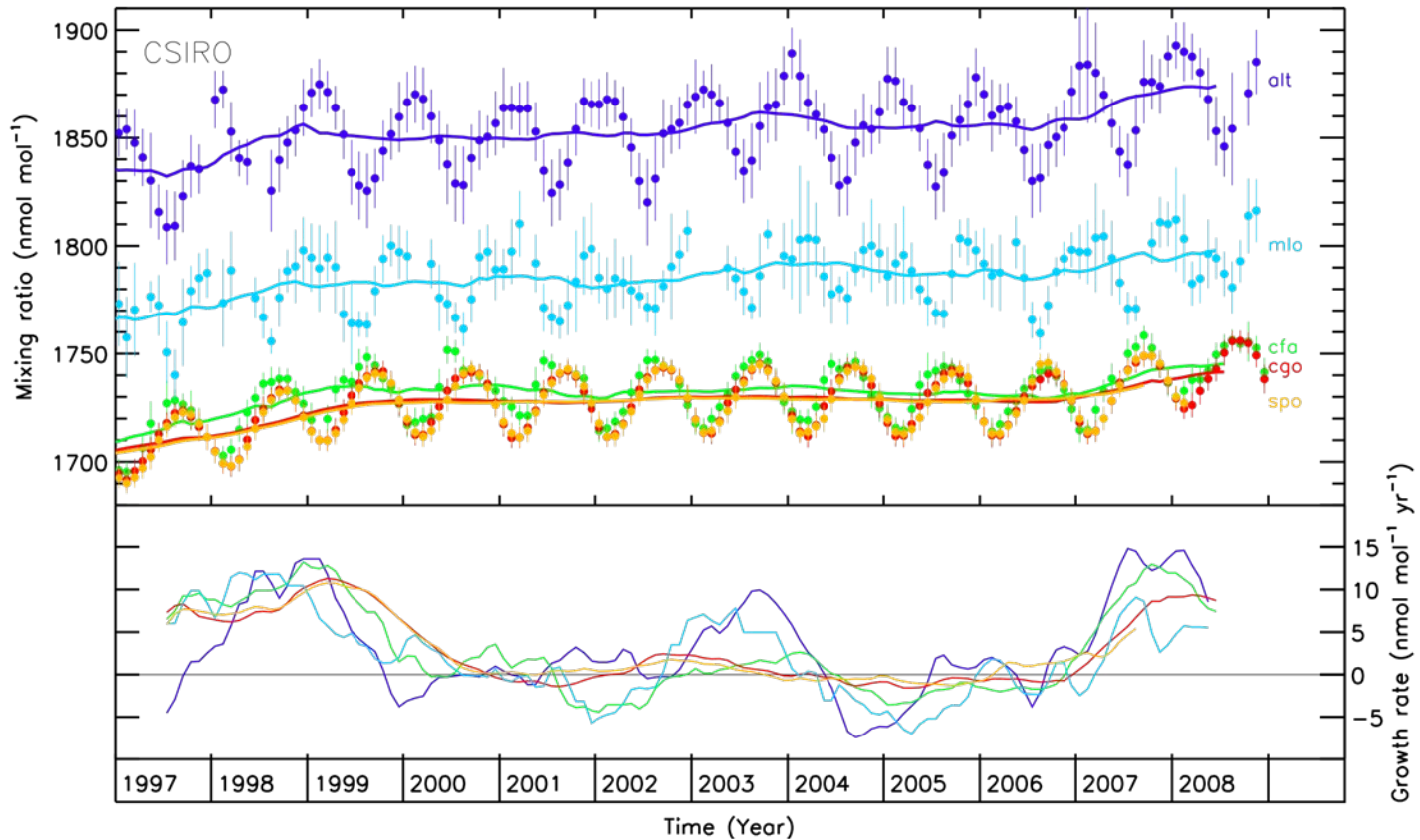
- ~4 flasks per month analysed at CSIRO



# Renewed CH<sub>4</sub> growth: AGAGE

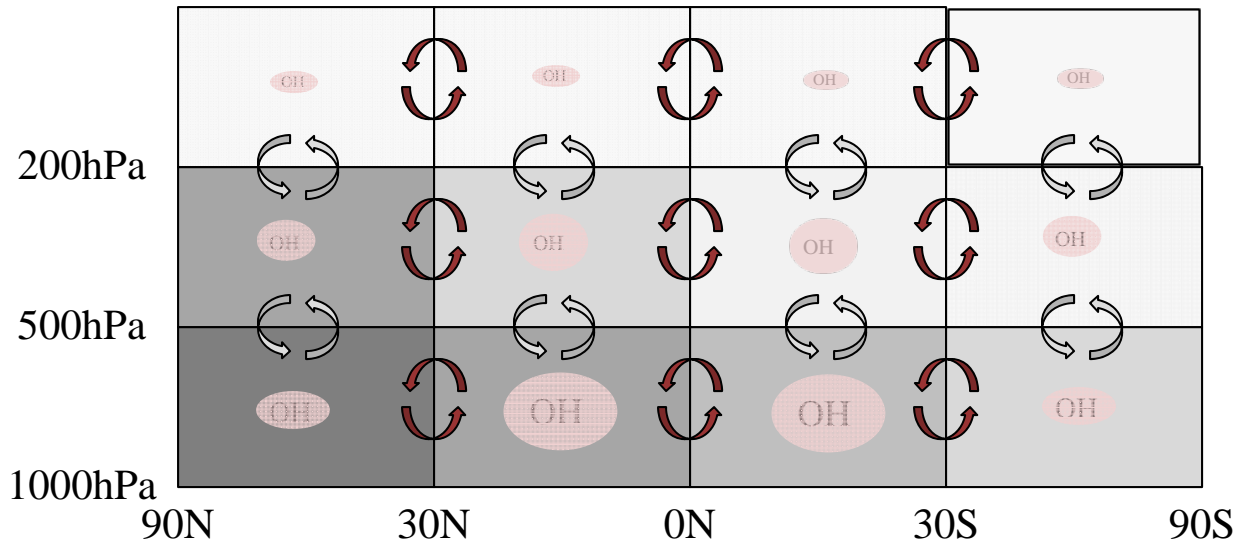


# Renewed CH<sub>4</sub> growth: CSIRO



# Box model inversion

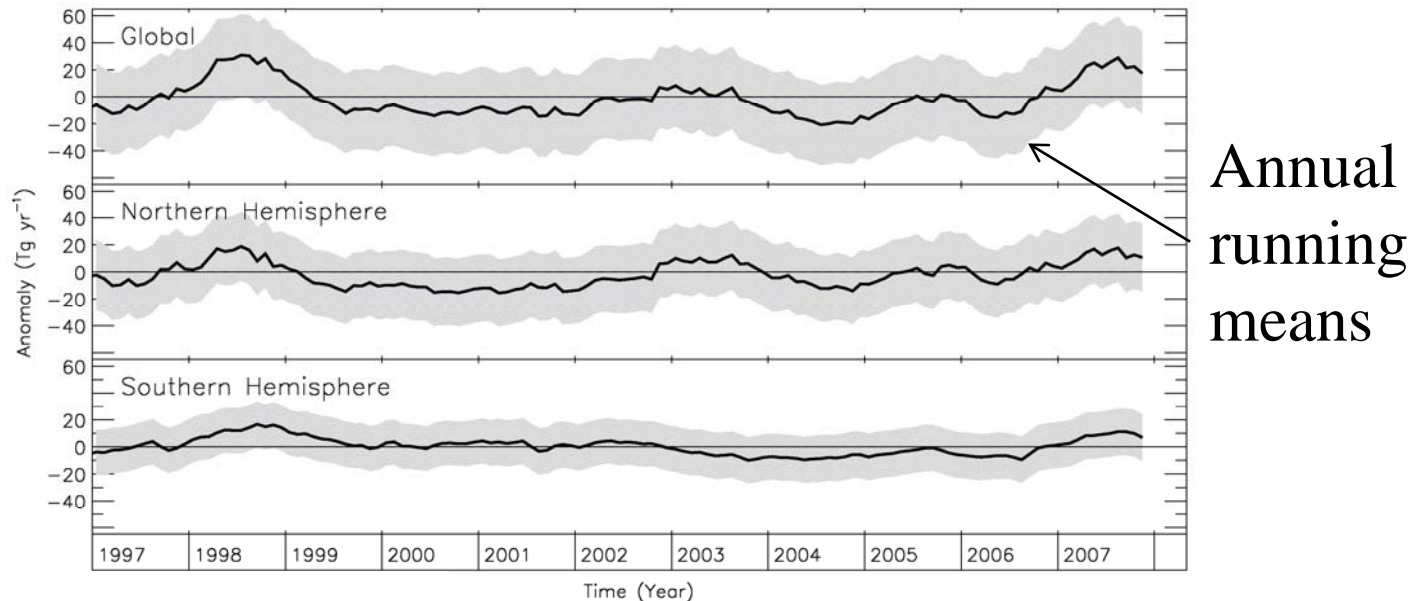
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- Seasonally varying transport parameters from climatology + CFC inversion
- OH from methyl chloroform inversion

# Constant OH: Hemispheric emissions

- Inter-annually repeating OH



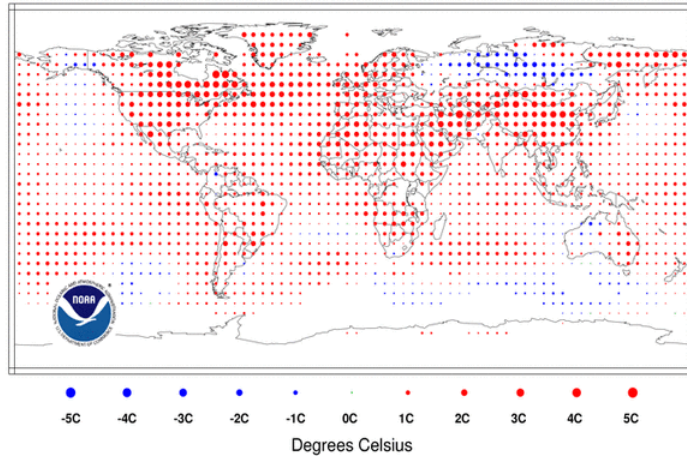
- ~ **40** Tg/yr increase from 2006 – 2007 (5-6%)
- ~ **22** Tg /yr NH (5%), ~**18** Tg/yr SH (10%)

# What changed in 2007?

- Anomalous high temperatures over boreal wetlands

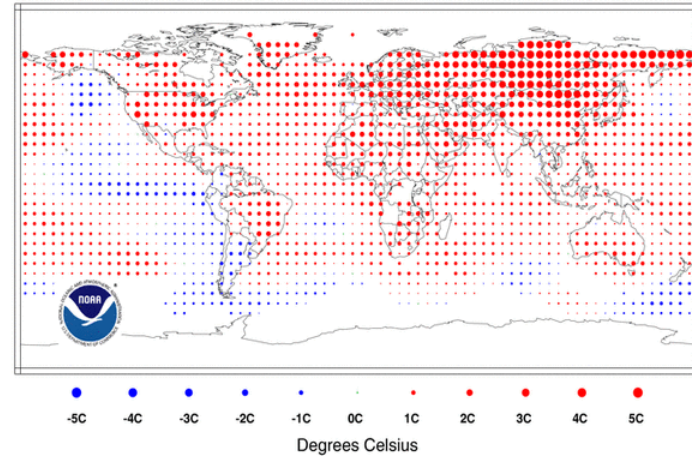
Jan-Dec 2006 Temperature Anomalies

(with respect to a 1961-1990 base period)  
National Climatic Data Center/NESDIS/NOAA



Temperature Anomalies Jan-Dec 2007

(with respect to a 1961-1990 base period)  
National Climatic Data Center/NESDIS/NOAA



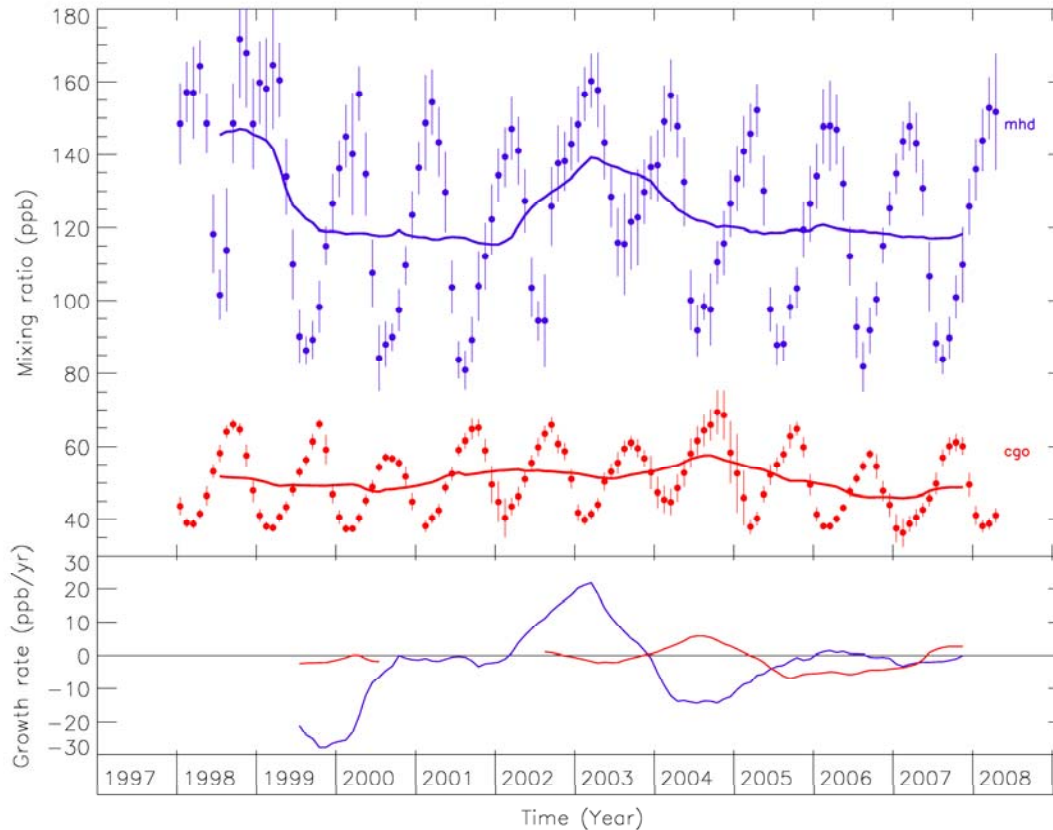
- Wetland emission ~ temperature (and other factors)? / Melting permafrost??





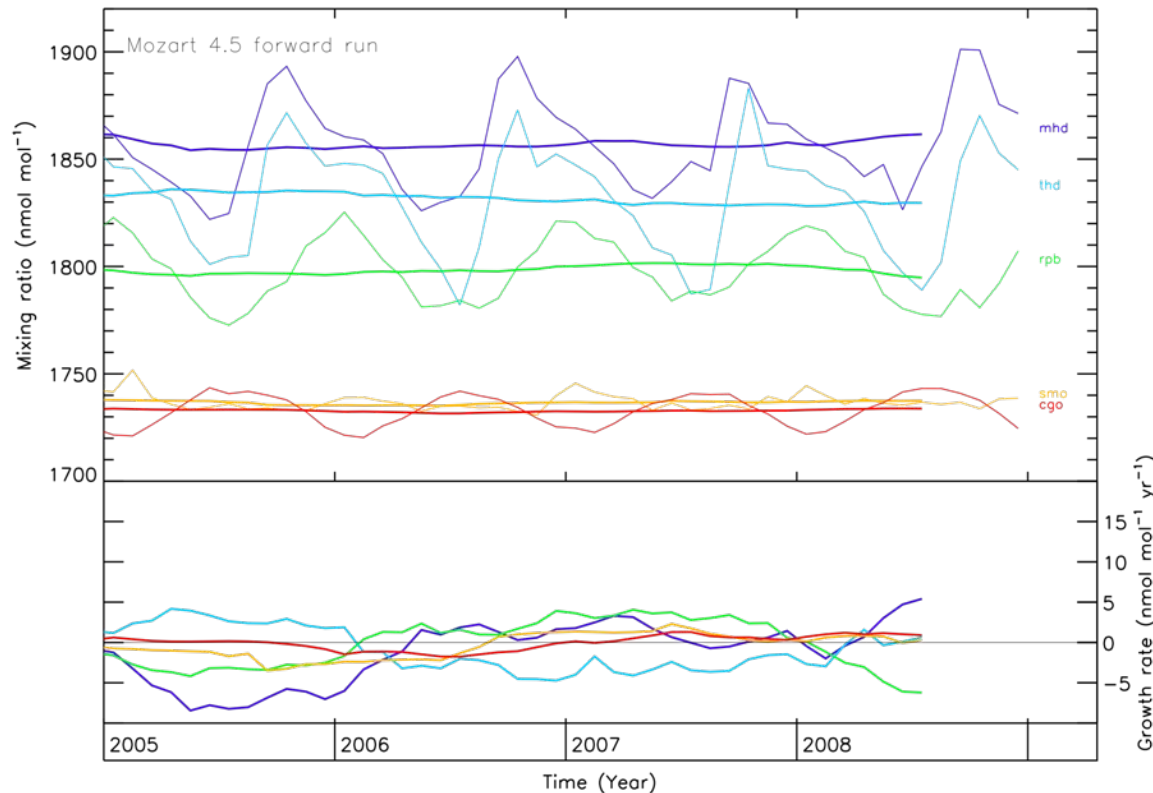
# What changed in 2007?

- Biomass burning? CO increase?



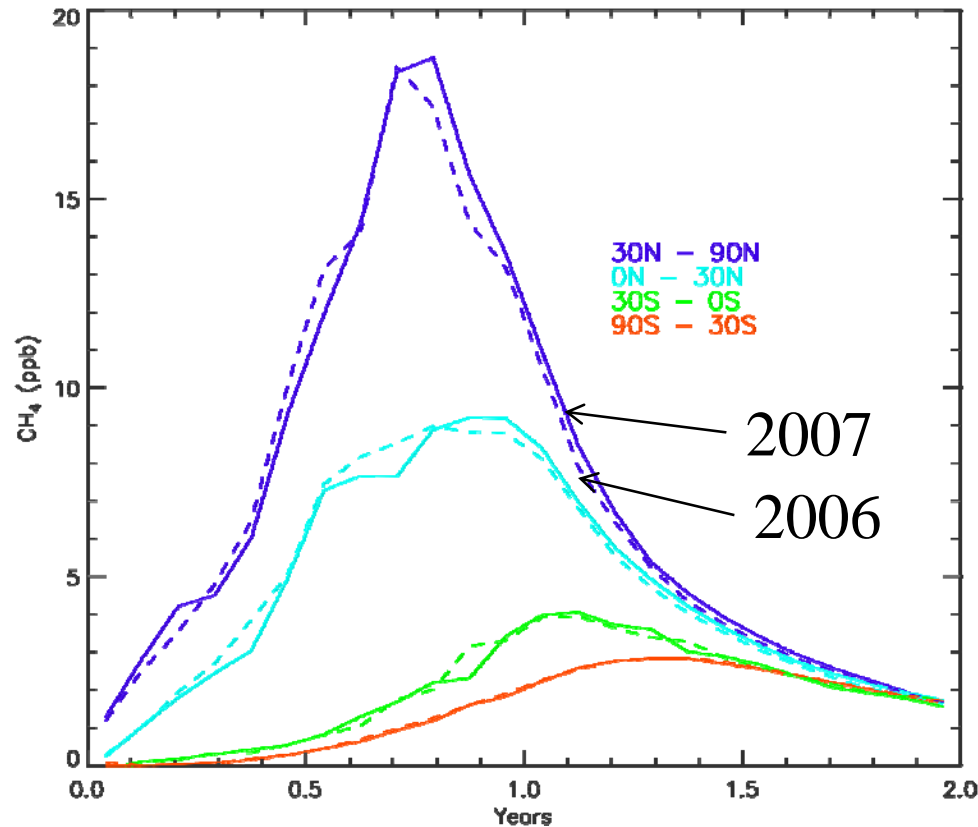
# Influence of inter-annually varying meteorology

- MOZART 4.5 + NCEP reanalysis + GFED v2



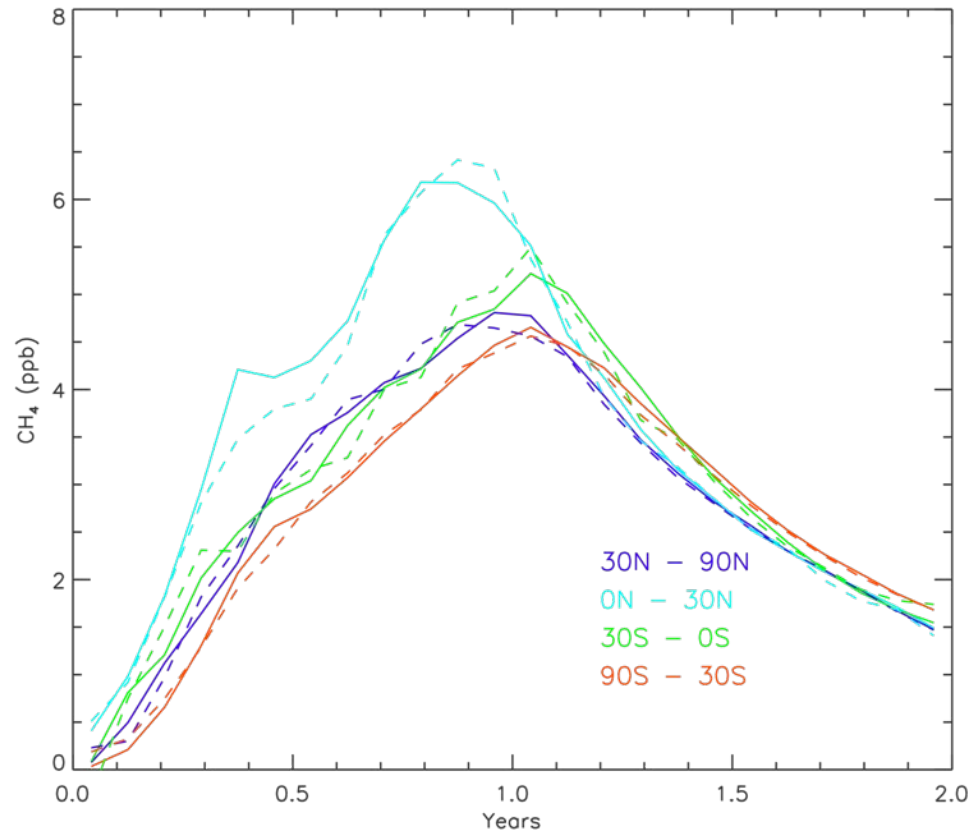
# Sensitivity to Northern emissions

- 10% emissions increase 30N – 90N (1 year pulse)



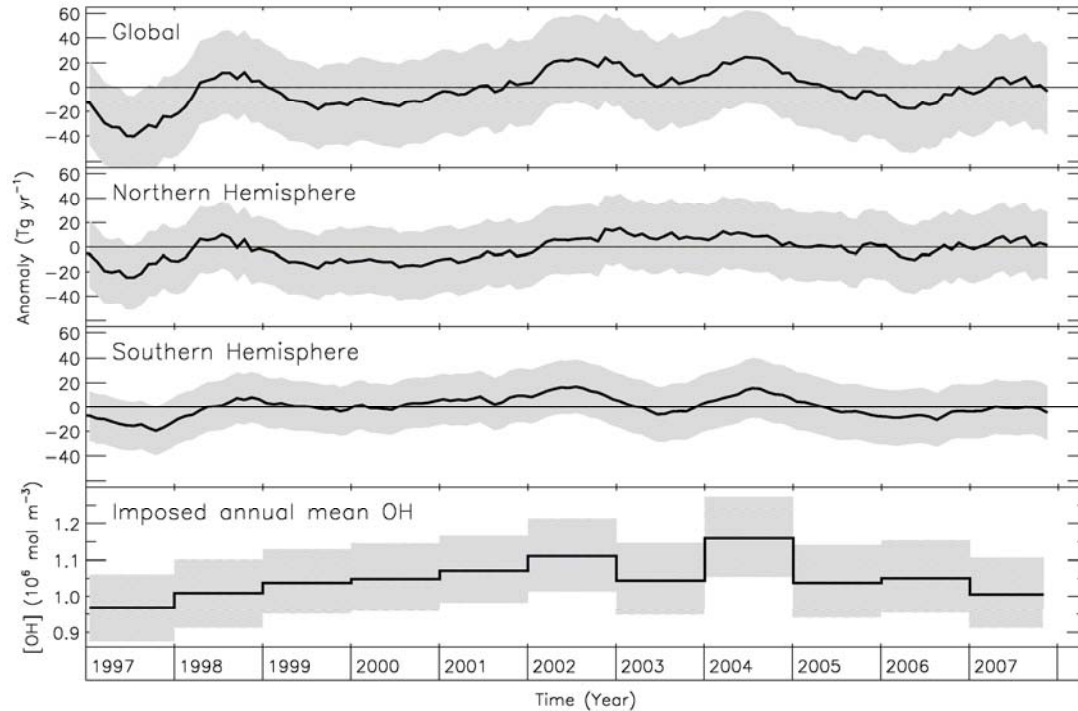
# Sensitivity to tropical emissions

- 10% emissions increase 30N – 30S (1 year pulse)



# OH decrease?

- Methyl chloroform inversion:  $4 \pm 14\%$  OH drop in 2007



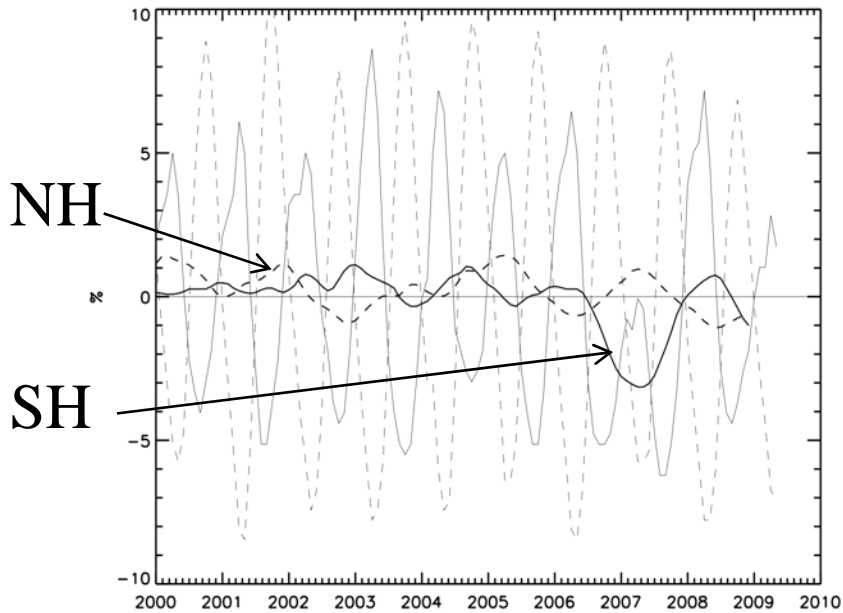
- $\text{CH}_4$  increase: **20Tg/yr** global, **13Tg/yr** NH, **7Tg/yr** SH



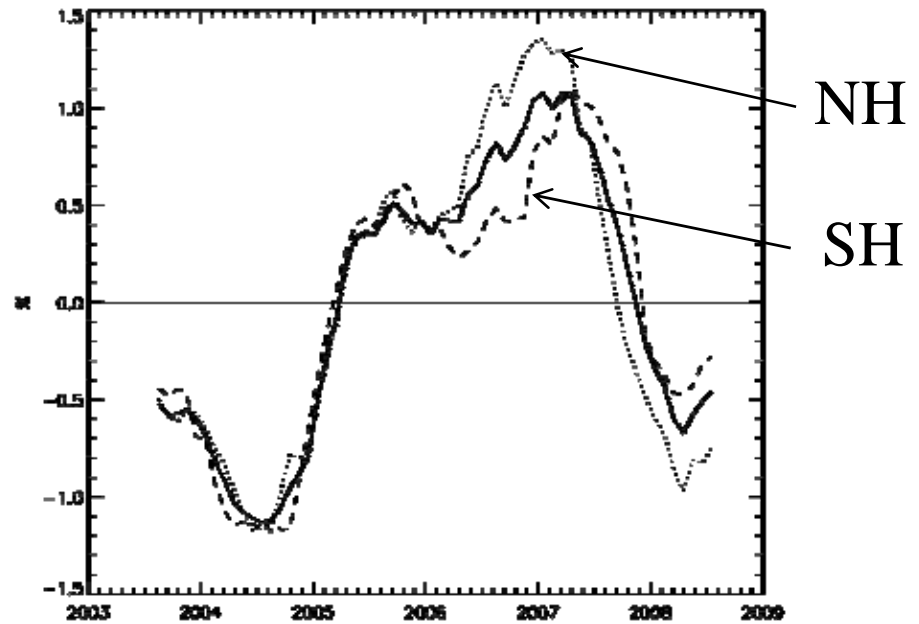
# OH decrease?

- Potential causes: CO  $\uparrow$ , (CH<sub>4</sub>  $\uparrow$ ), stratospheric O<sub>3</sub>  $\uparrow$ , H<sub>2</sub>O  $\downarrow$ , tropospheric O<sub>3</sub>  $\downarrow$ ...

Total column ozone (% change)



Specific humidity (% change)



NIMBUS-7/METEOR-3/EP/OMI data from [climexp.knmi.nl](http://climexp.knmi.nl)

NCEP reanalysis: weighted by OH concentration

# Conclusions

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- 2007 – present: renewed global methane growth following almost a decade of relatively stable levels
- If no OH change, then substantial emissions increase required in both hemispheres
- Changes in meteorology or biomass burning emissions do not appear to be responsible
- A small (and NOT statistically significant) drop in OH is inferred, but the cause of such a drop is unclear

