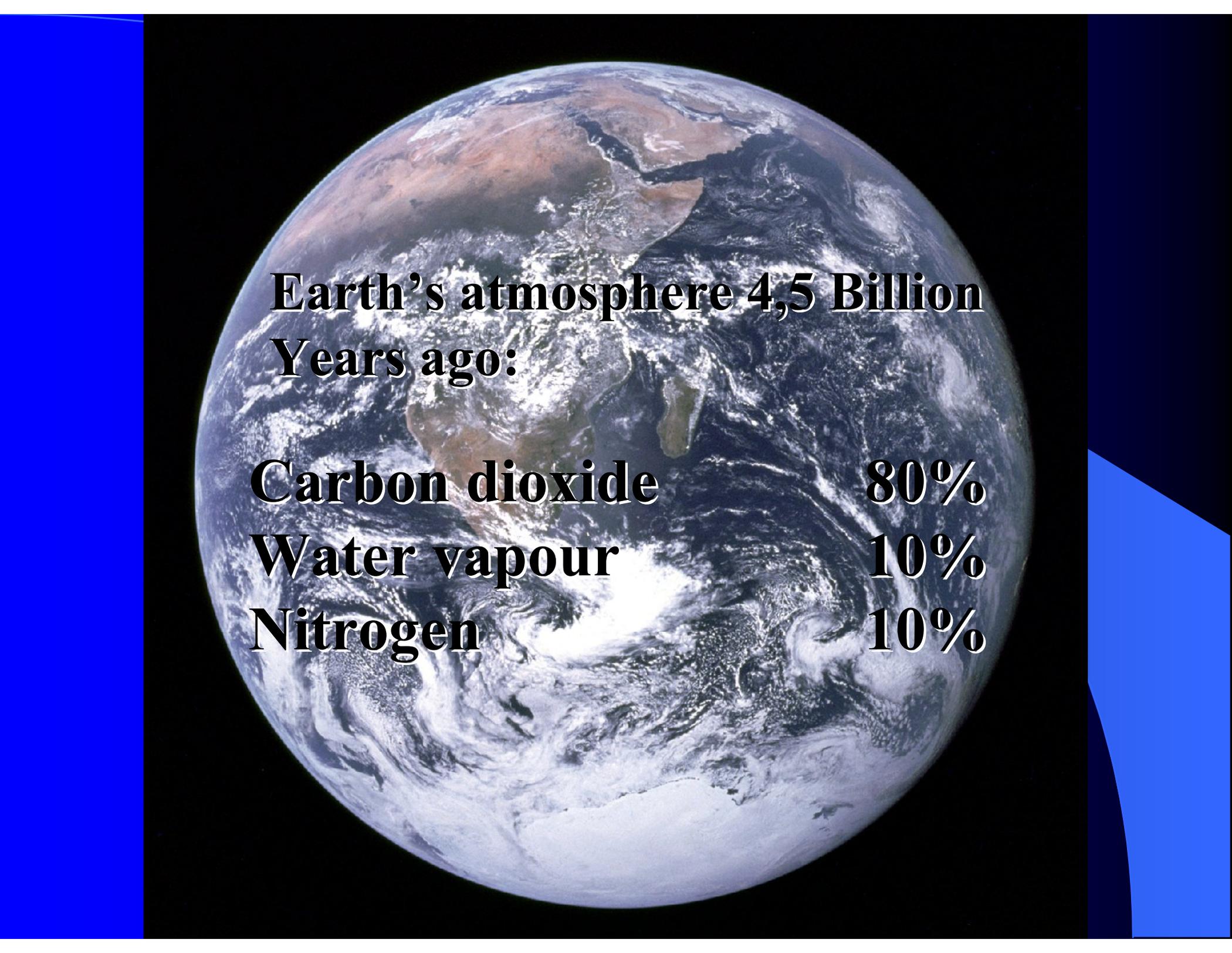


**Some interesting observations  
concerning CO<sub>2</sub>  
in the atmosphere**

**by  
Dr Fred Goldberg**

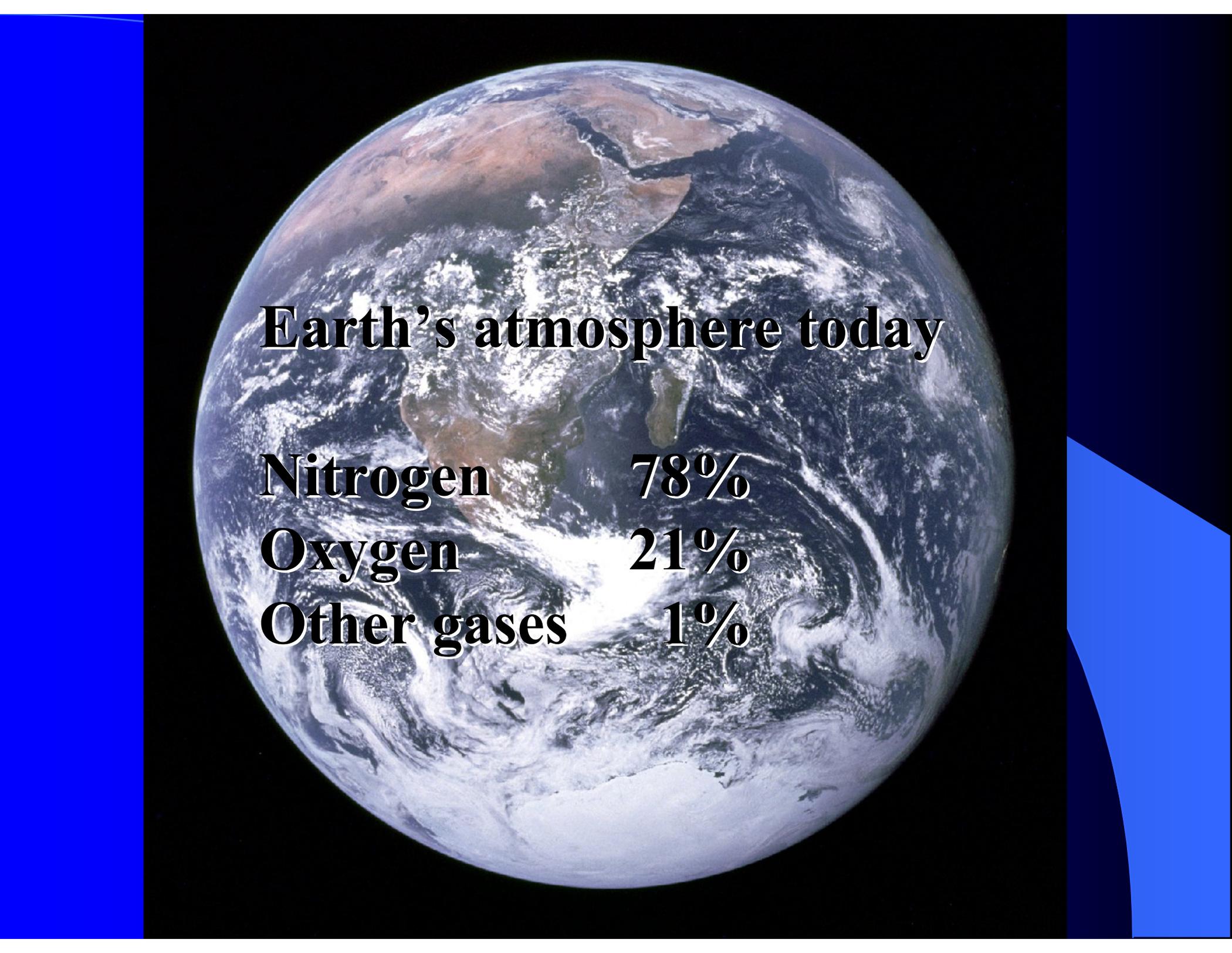


**Earth's atmosphere 4,5 Billion  
Years ago:**

**Carbon dioxide** 80%

**Water vapour** 10%

**Nitrogen** 10%

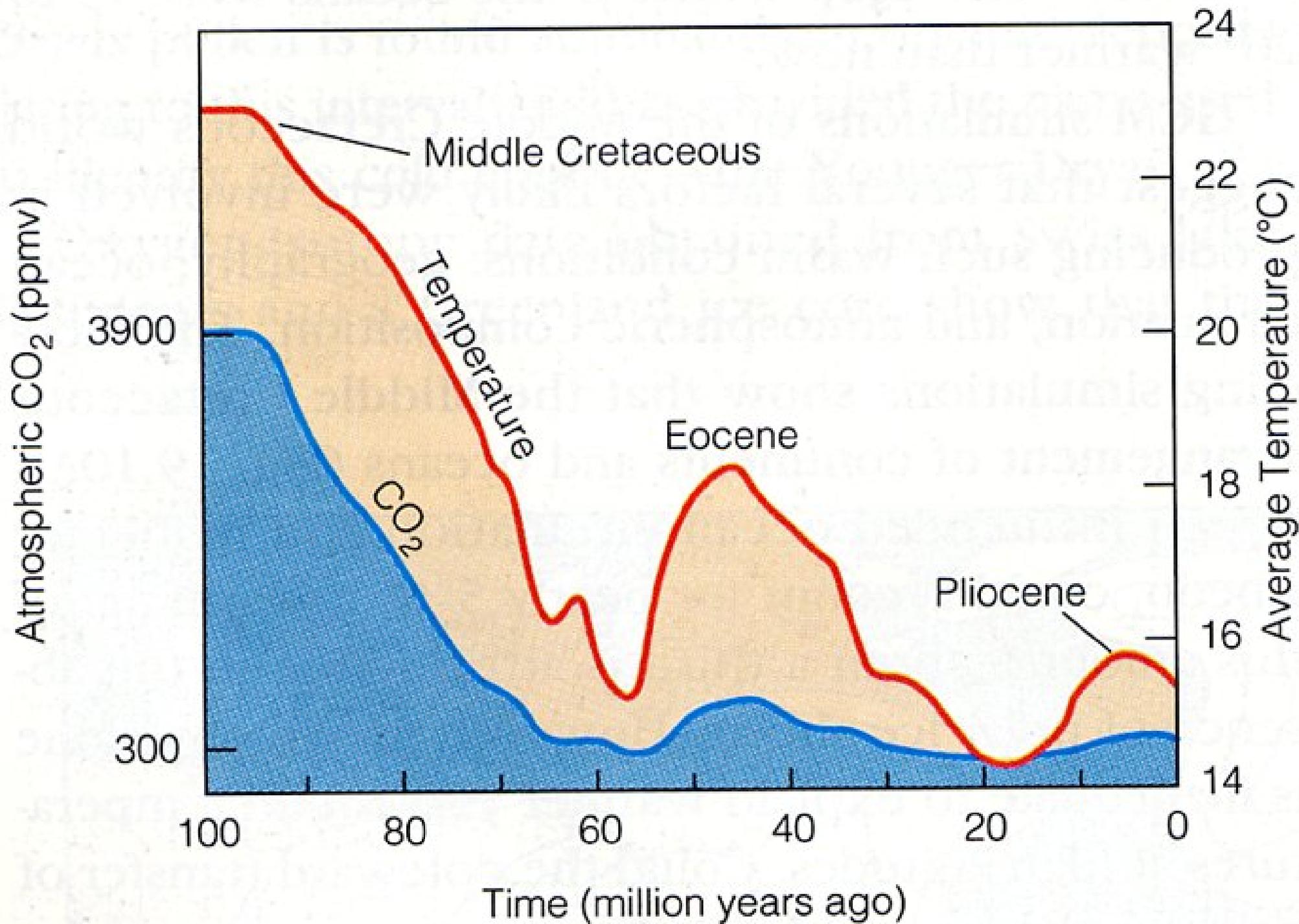


## Earth's atmosphere today

**Nitrogen**            **78%**

**Oxygen**             **21%**

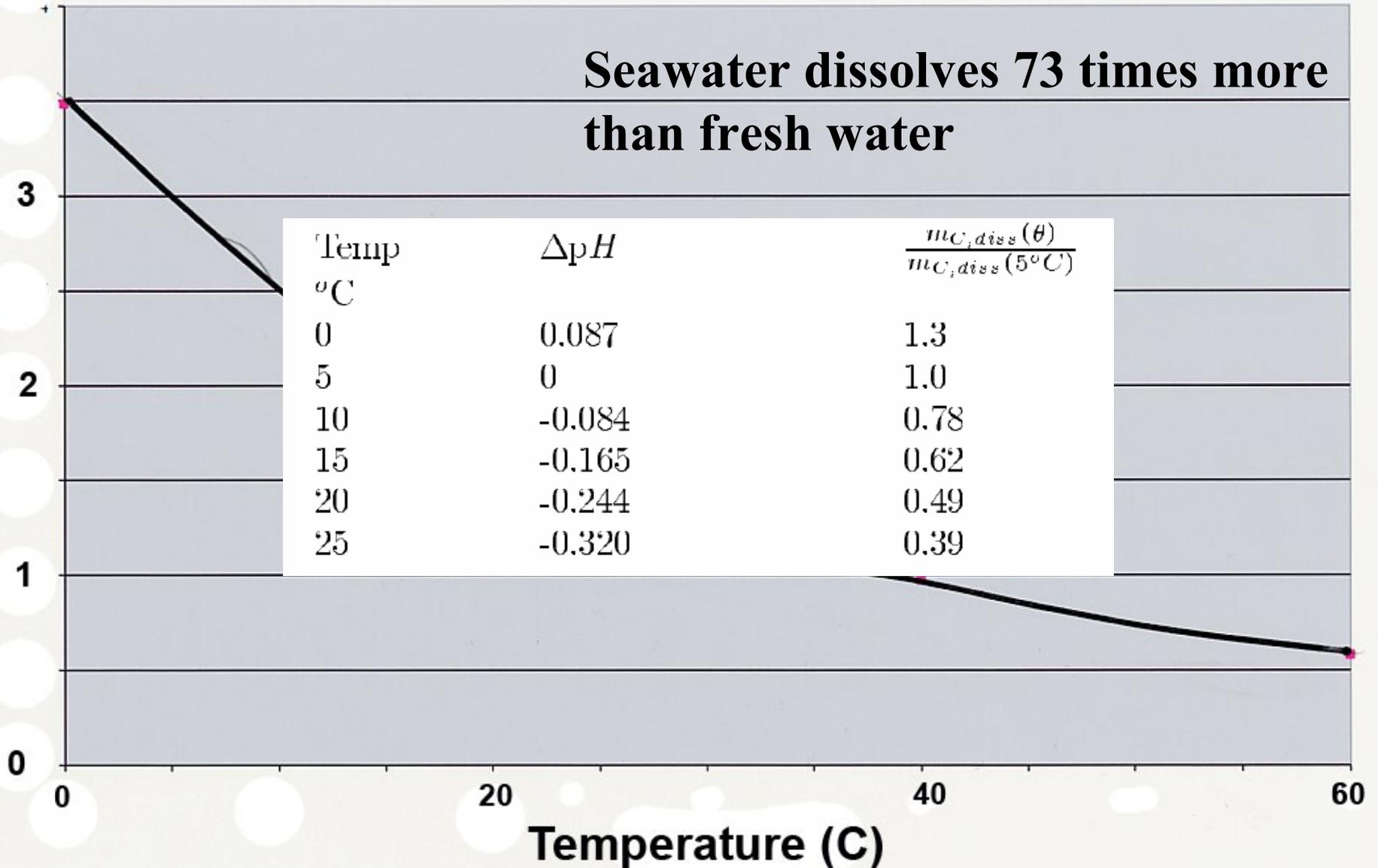
**Other gases**        **1%**



# Carbon dioxide solubility in water

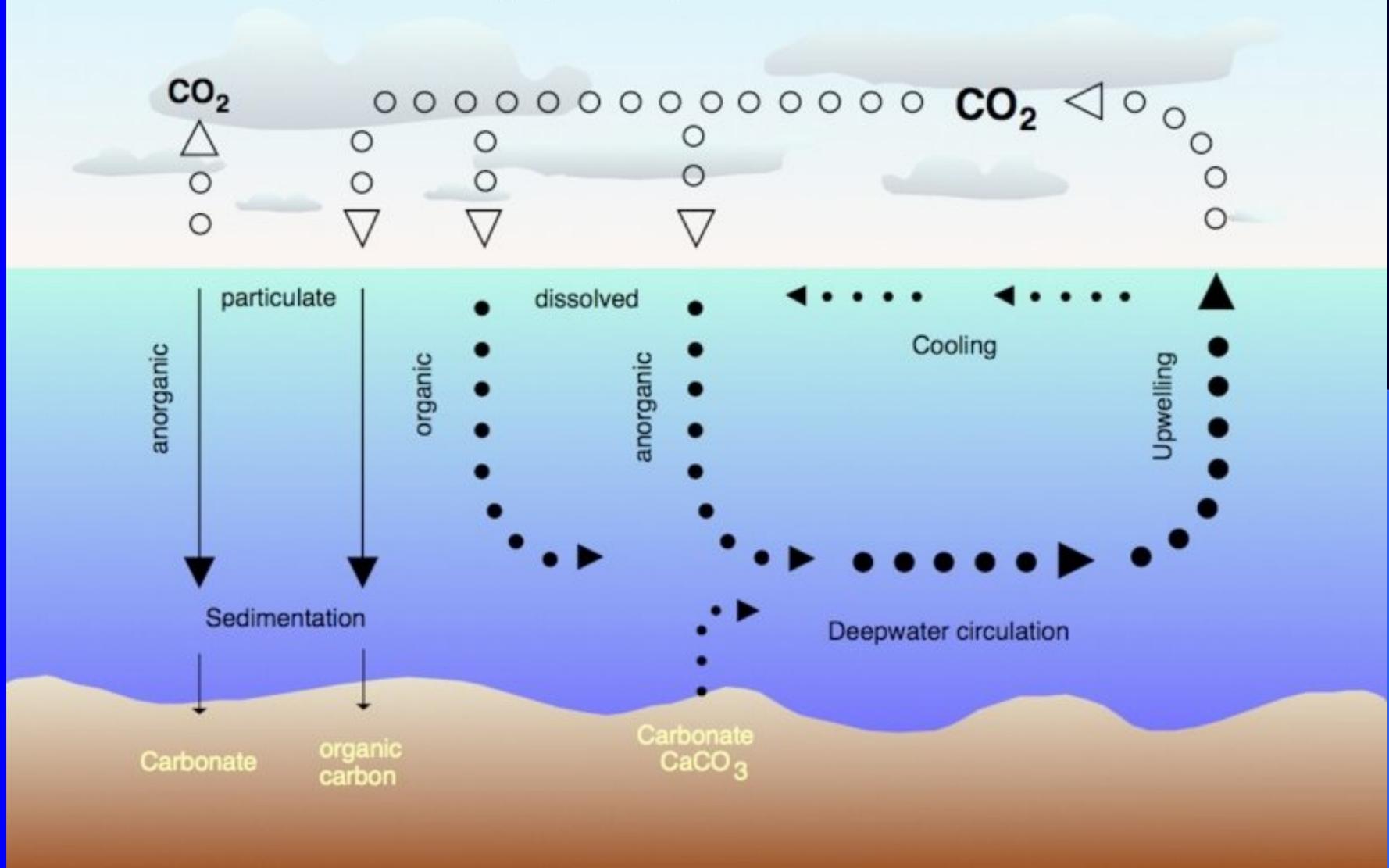
g/litre

Seawater dissolves 73 times more than fresh water



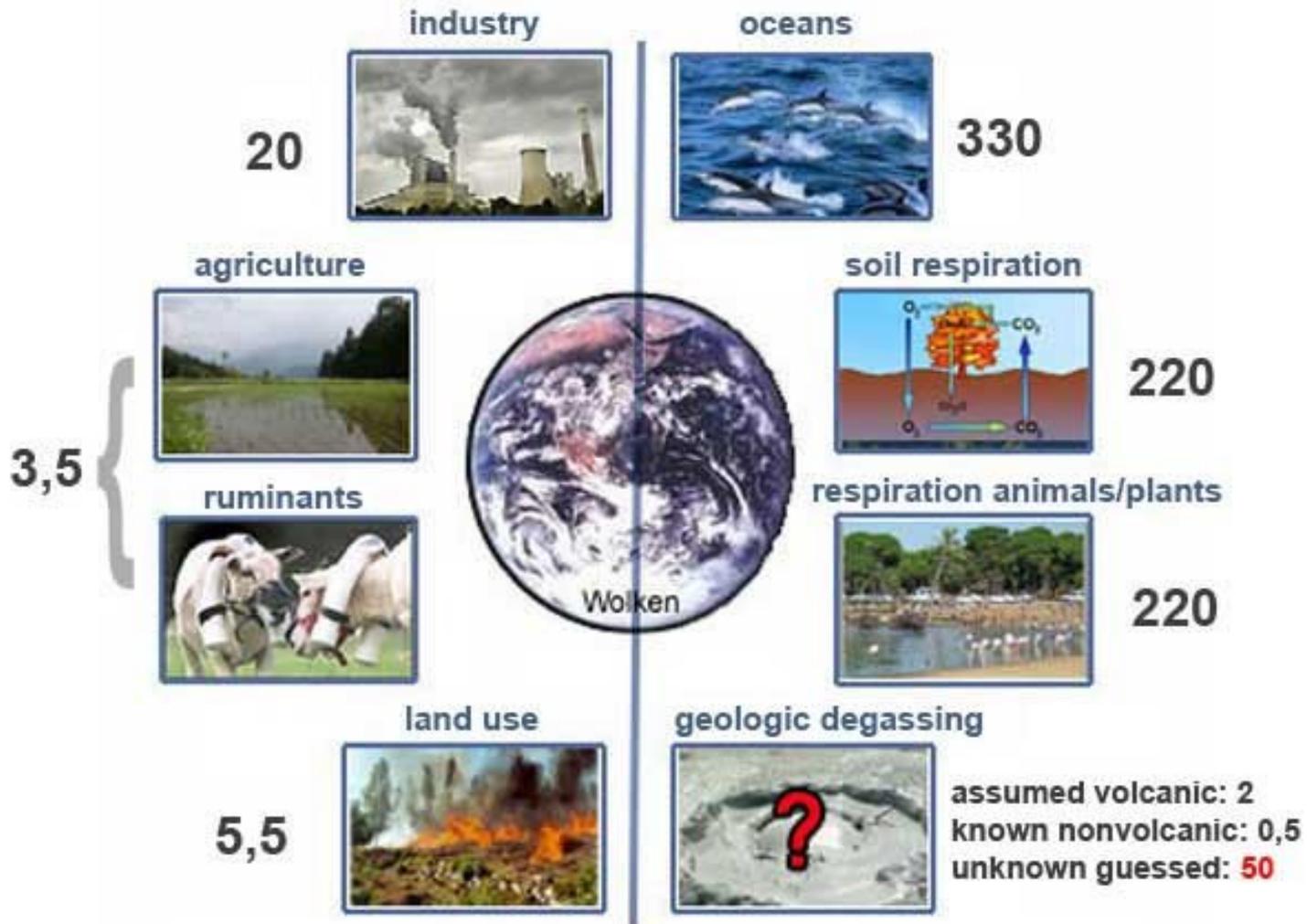
Fred Goldberg 2007

# Biological and physical pumps of carbon dioxide



# Human

# Nature



29

CO<sub>2</sub> emissions per year (GT)

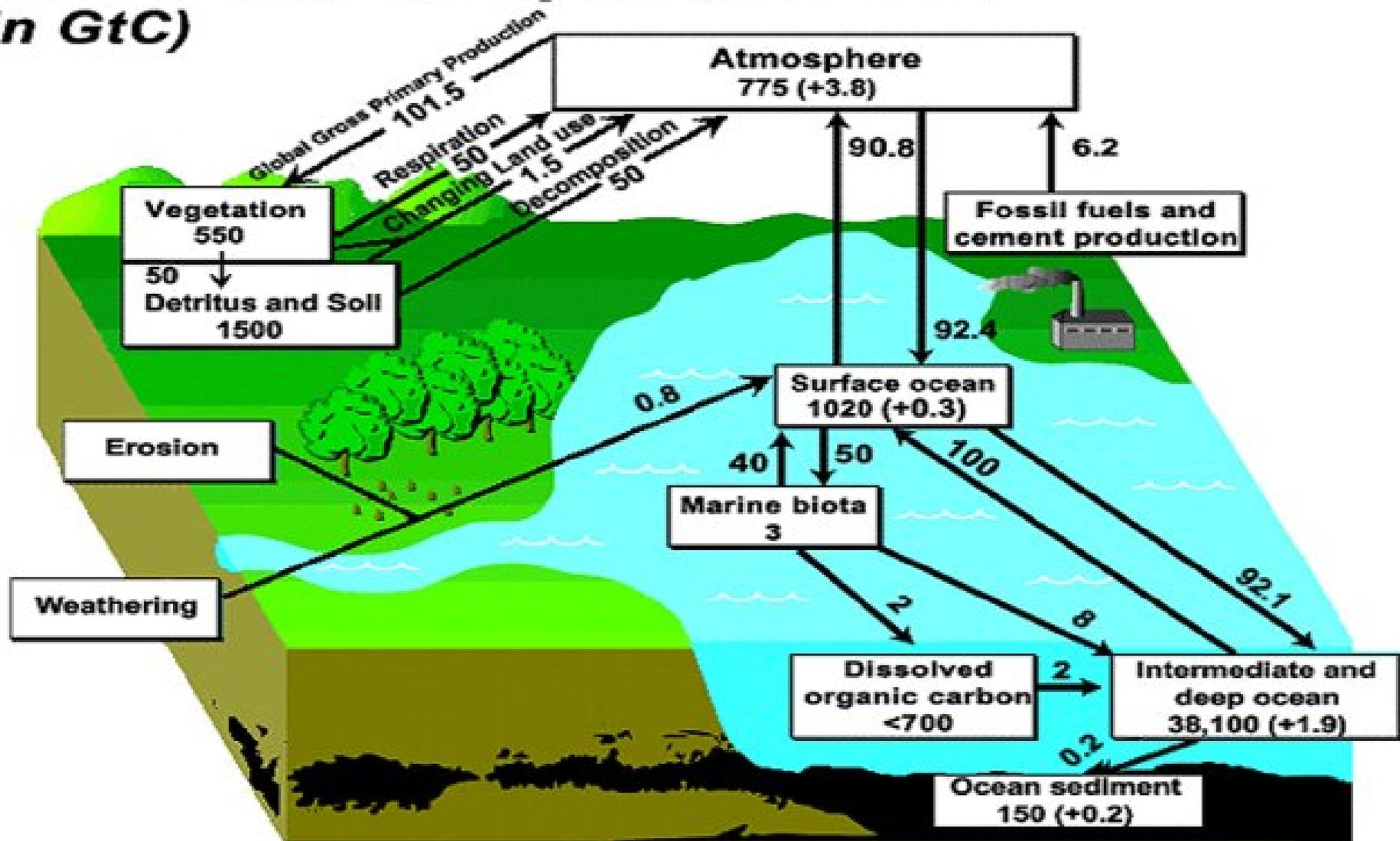
> 772

sum = ~ 3% CO<sub>2</sub>

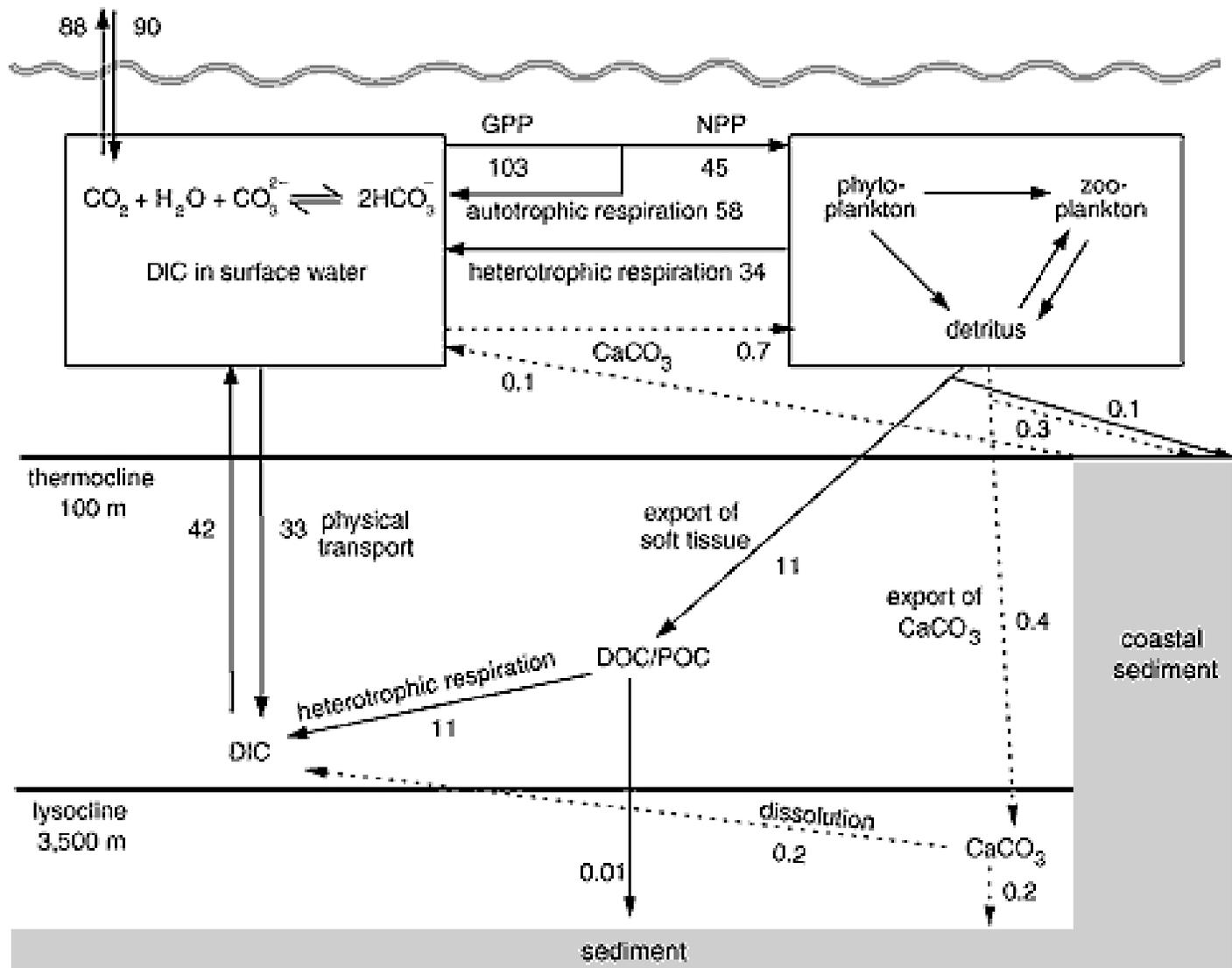
~ 97% CO<sub>2</sub>

# Global Carbon Cycle (1992-1997)

(in GtC)



### c) Carbon cycling in the ocean



<b>Total amount of CO<sub>2</sub> in the atmos.</b>	<b>775 Gton C</b>
<b>Biomass absorbs</b>	<b>101 Gton C</b>
<b>The seas dissolves</b>	<b>92 Gton C</b>

**25 % of all CO<sub>2</sub> in the atmos. is  
consumed each year**

**Antropogenic addition is today 8 Gton C**

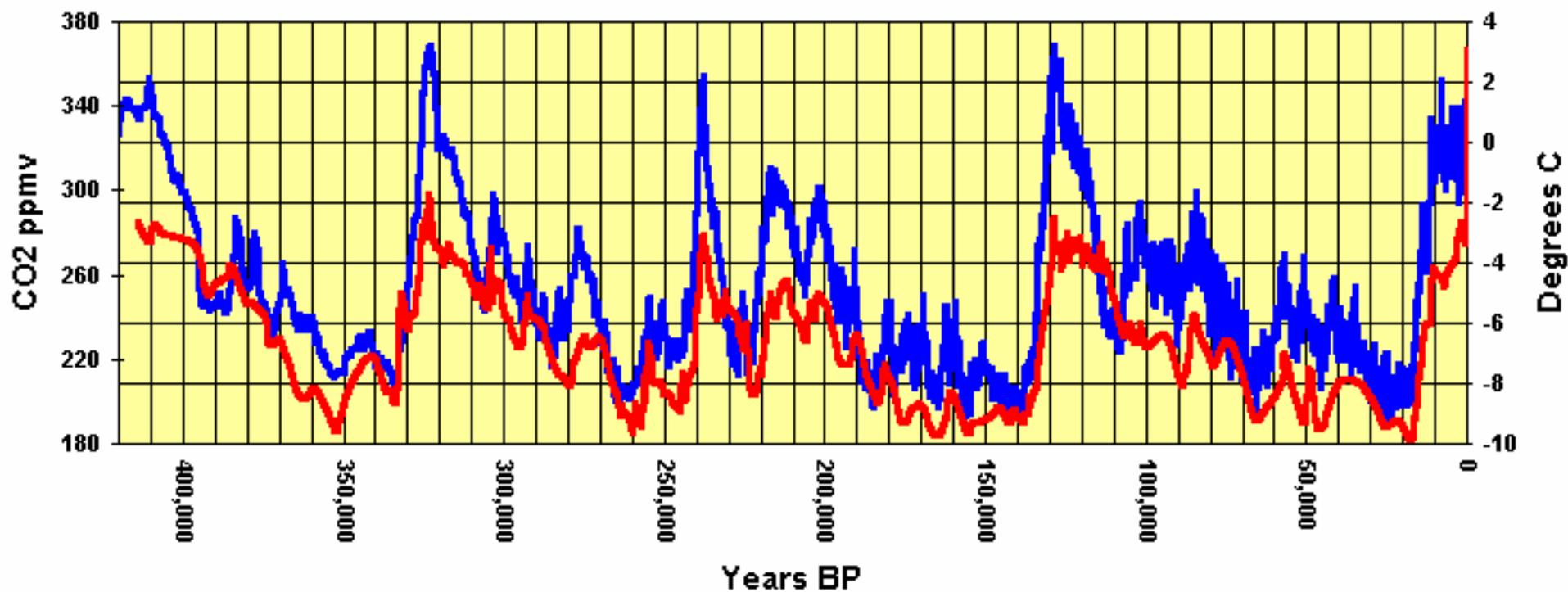
**This is 1 % of the natural amount of CO<sub>2</sub>  
in the atmosphere**

**This means that annual human  
emissions  
are consumed  
by natural forces in 16 days**

**How is the level of CO<sub>2</sub> established  
in the atmosphere?**

# Antarctic Ice Core Data 1

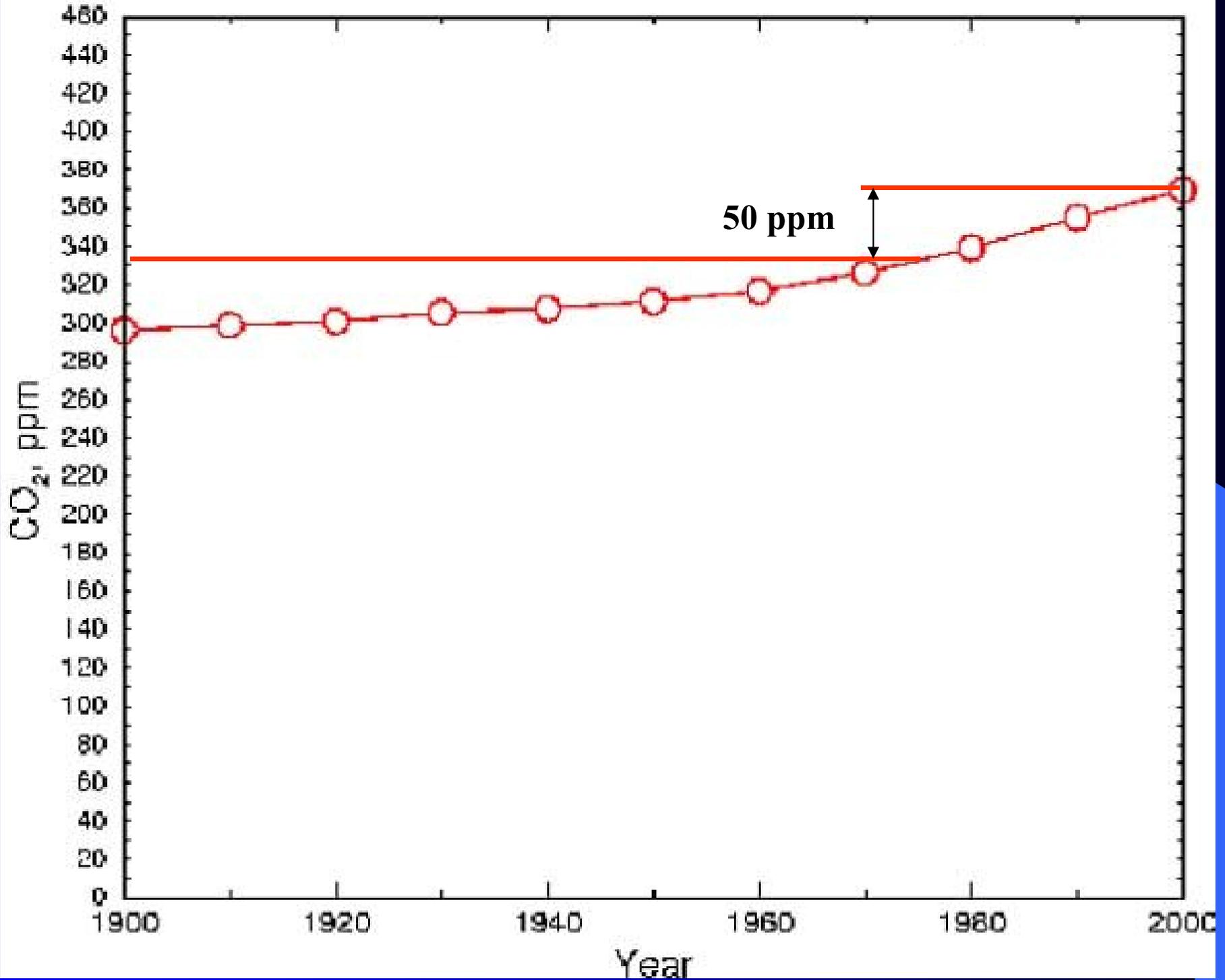
— Temperature Variation — CO2 Concentration

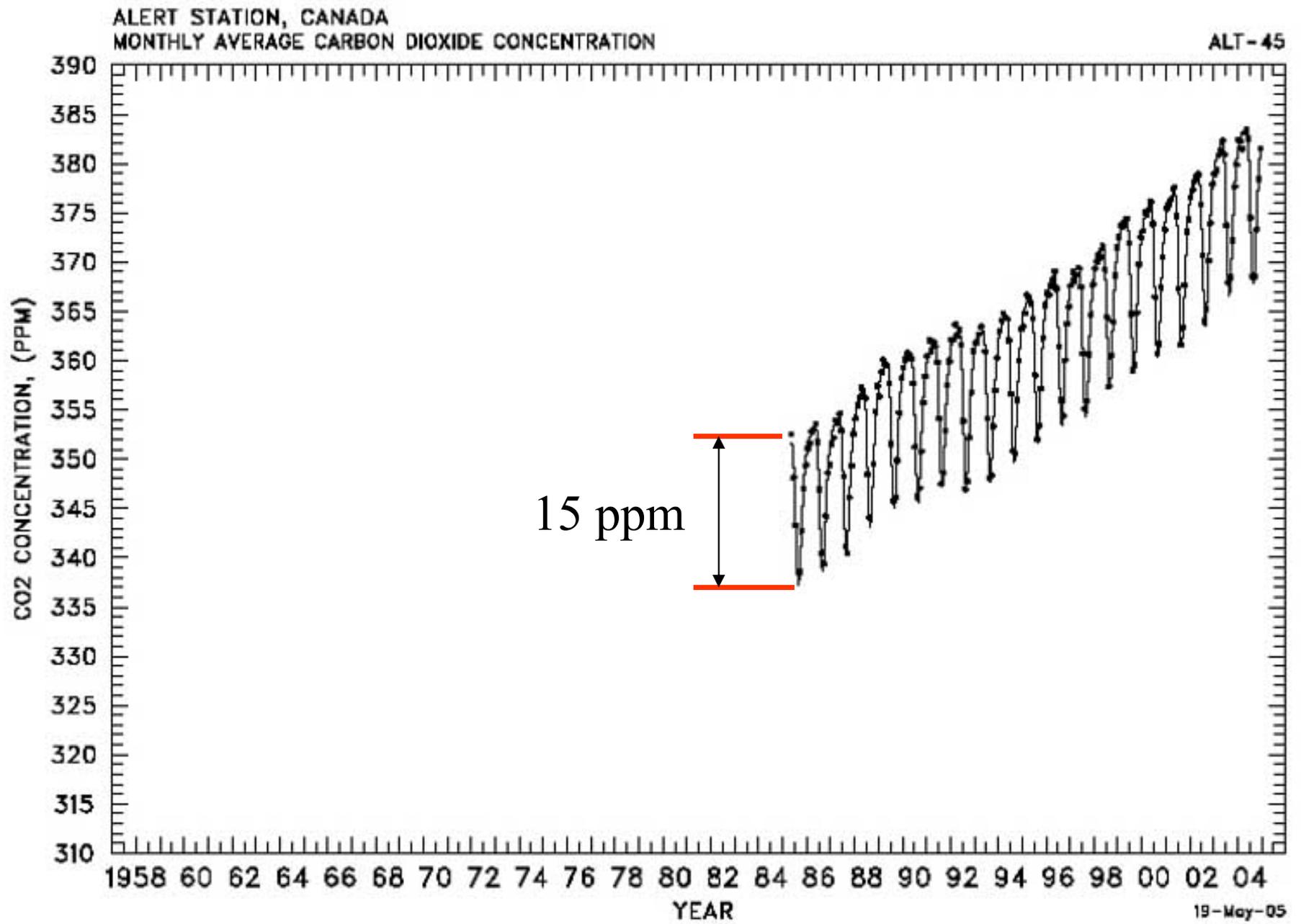


Vostok Ice Core

Courtesy J.R. Petit

# Global Carbon Dioxide Levels

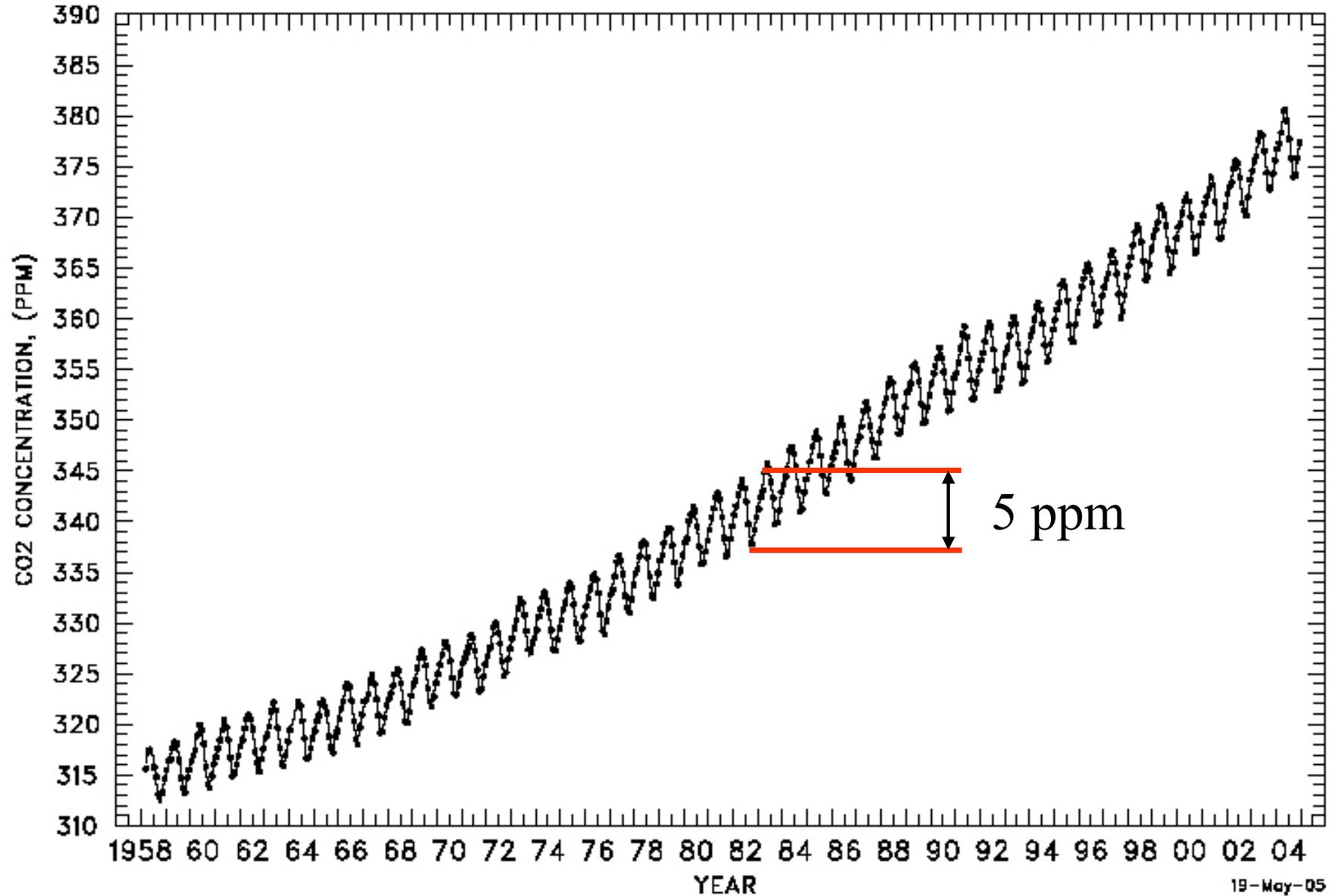




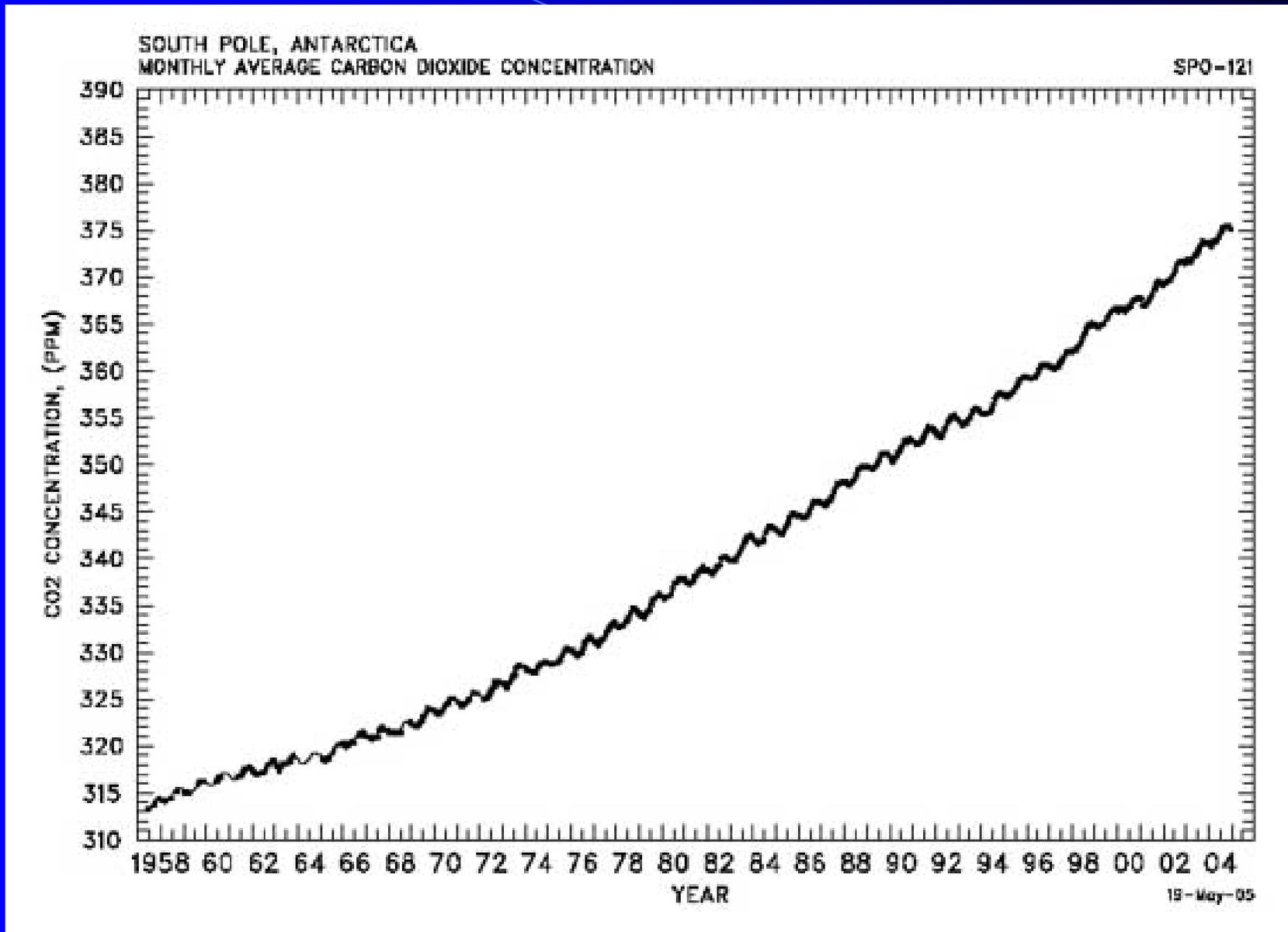
**Alert Station – Ellesmere Island - Canada**

MAUNA LOA OBSERVATORY, HAWAII  
MONTHLY AVERAGE CARBON DIOXIDE CONCENTRATION

MLO-145



Mauna Loa



**South Pole**

# CO<sub>2</sub> increase per year

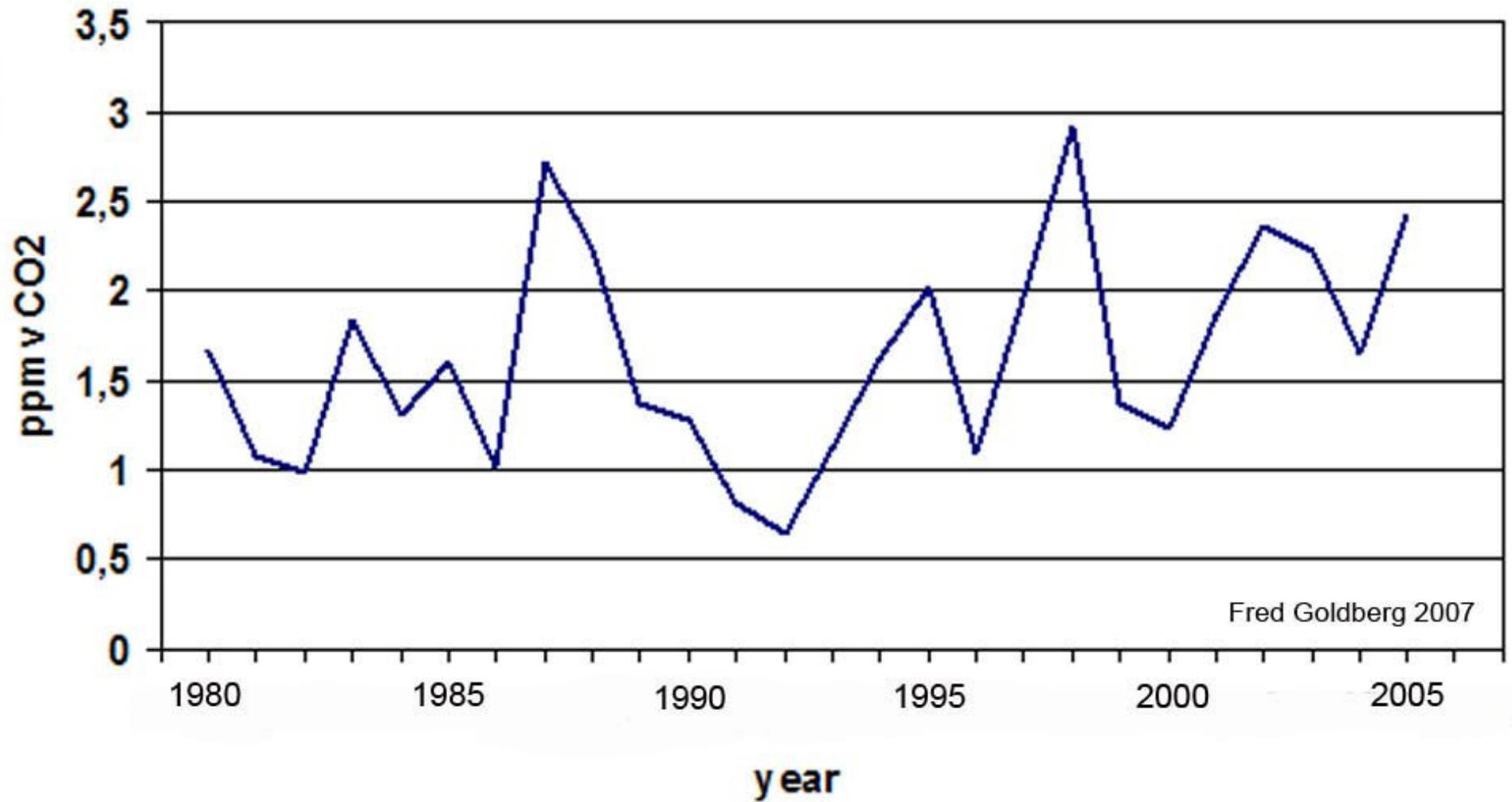
year	ppm/yr
1980	1.67
1981	1.08
1982	0.99
1983	1.83
1984	1.32
1985	1.60
1986	1.02
1987	2.71
1988	2.24
1989	1.36
1990	1.27
1991	0.82
1992	0.64
1993	1.13
1994	1.62
1995	2.03
1996	1.10
1997	1.96
1998	2.91
1999	1.37
2000	1.24
2001	1.86
2002	2.36
2003	2.23
2004	1.65
2005	2.42



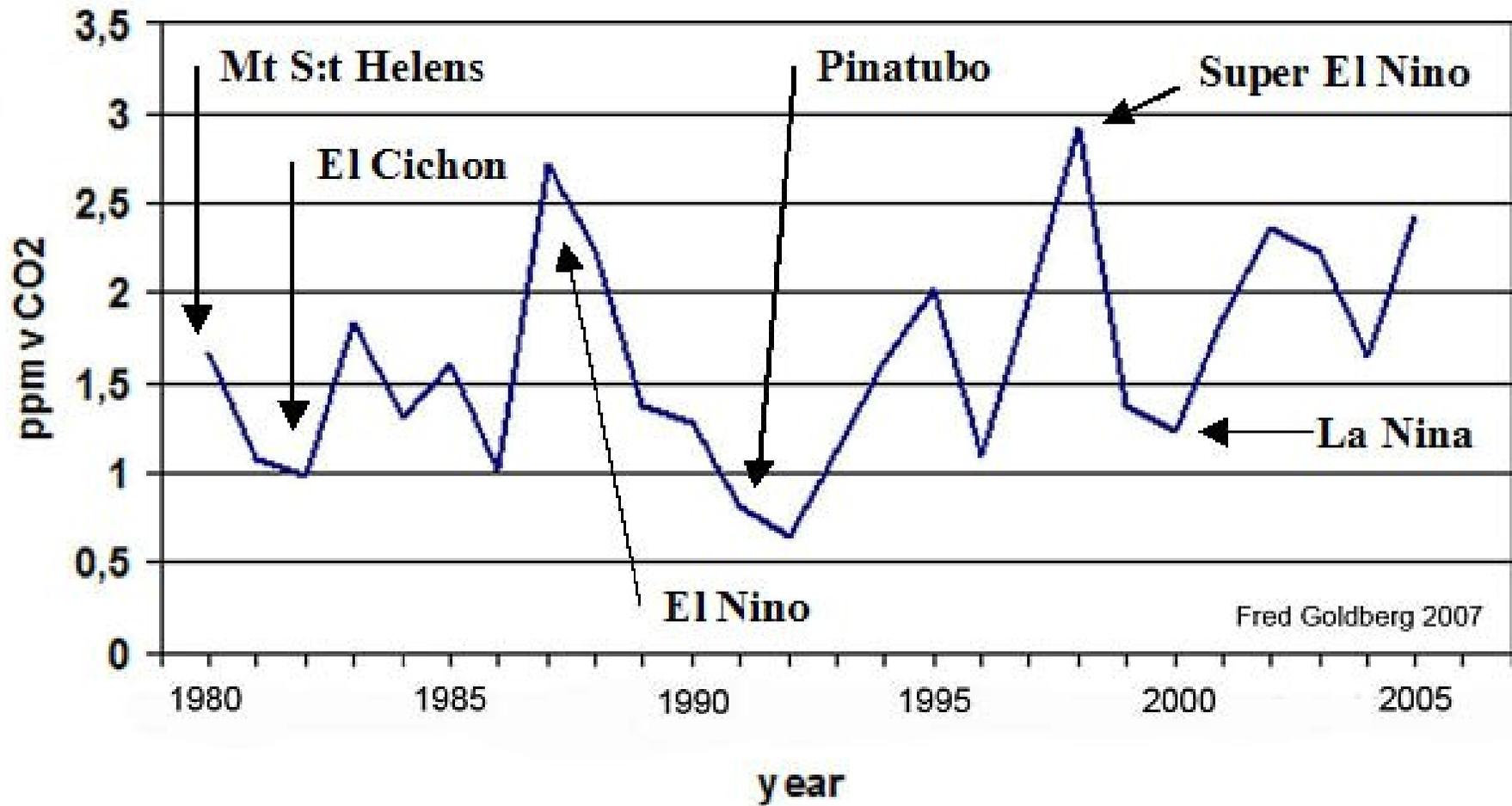
**Pinatubo**

**Super El Nino**

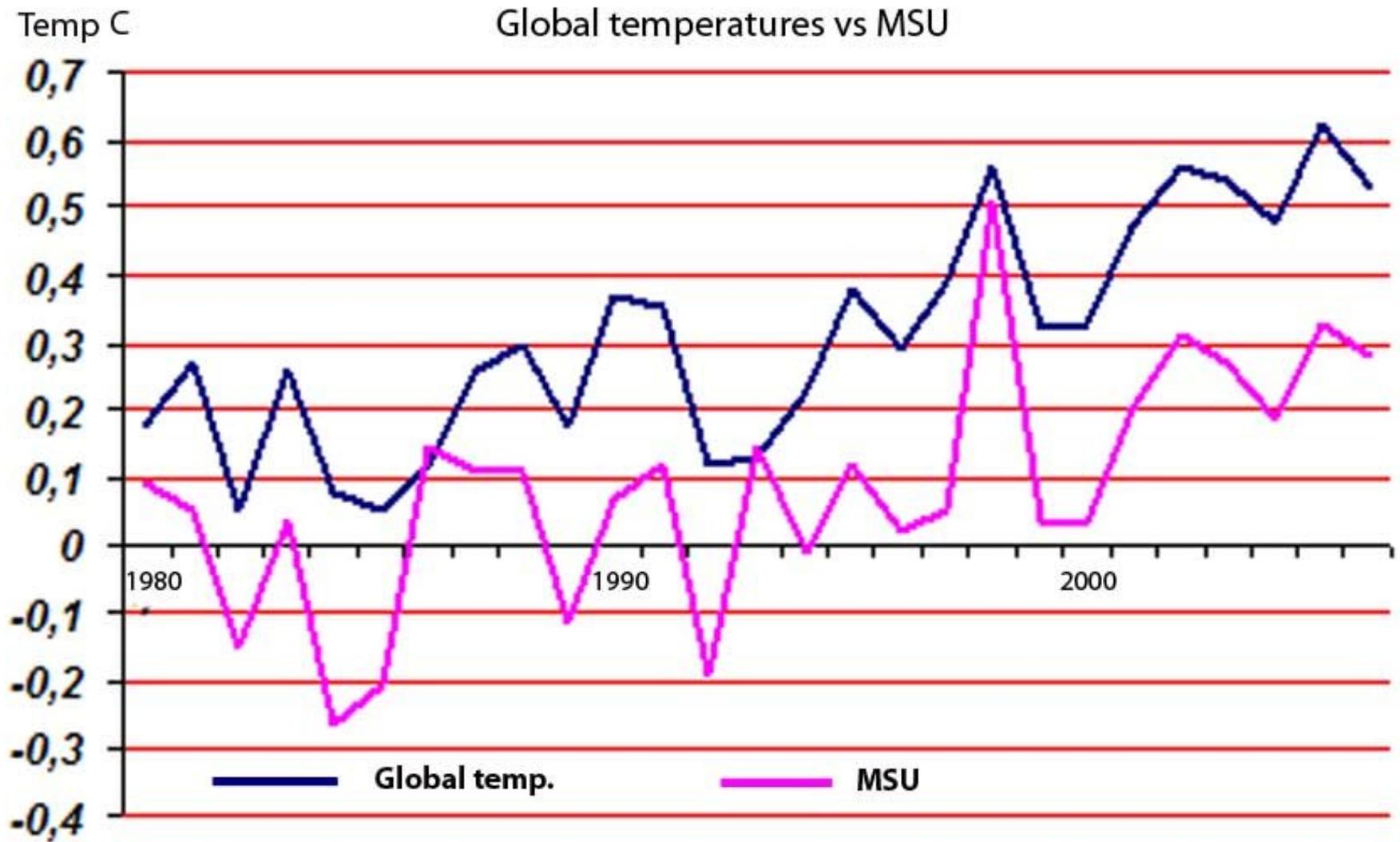
## Annual increase of CO2



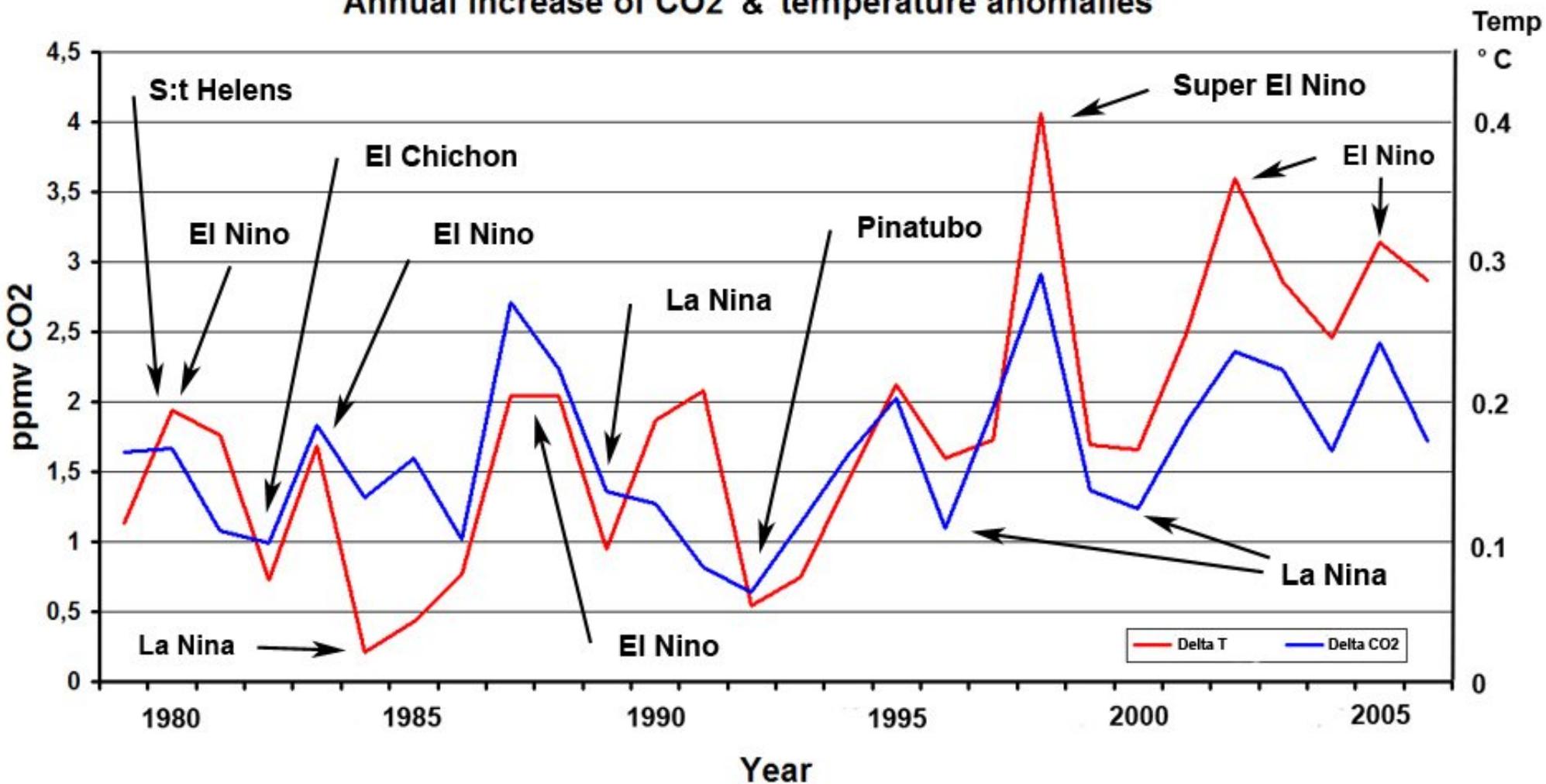
## Annual increase of CO2



## Temperatur anomalies from average temp. 1950-1980



Annual increase of CO2 & temperature anomalies



Fred Goldberg 2007

MSU temperature anomalies 1950-1980

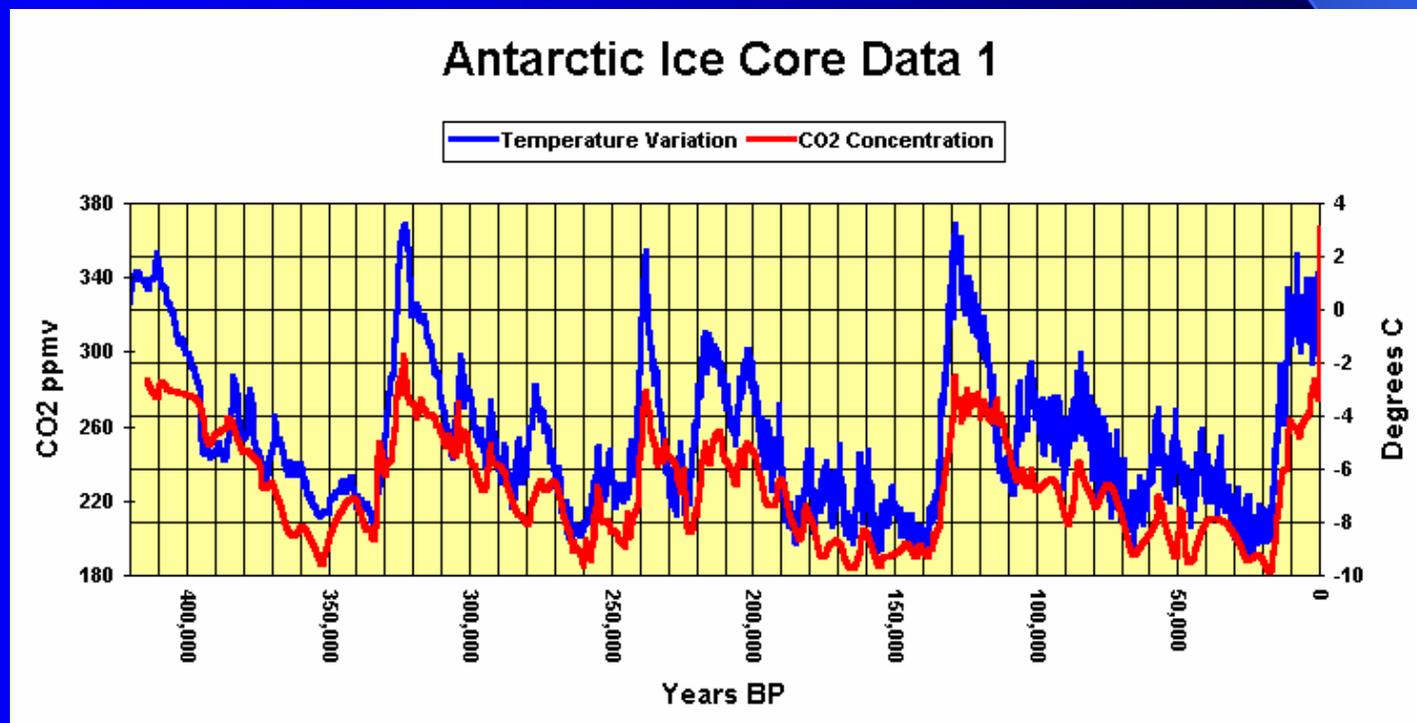
# **A multiregression statistical analysis show:**

**A highly significant correlation between  
temperature anomalies  
and  
annual CO<sub>2</sub> increases (P<0.0001)**

**No significant correlation between CO<sub>2</sub> increases  
and  
human caused annual CO<sub>2</sub> emissions (P>0.10).**

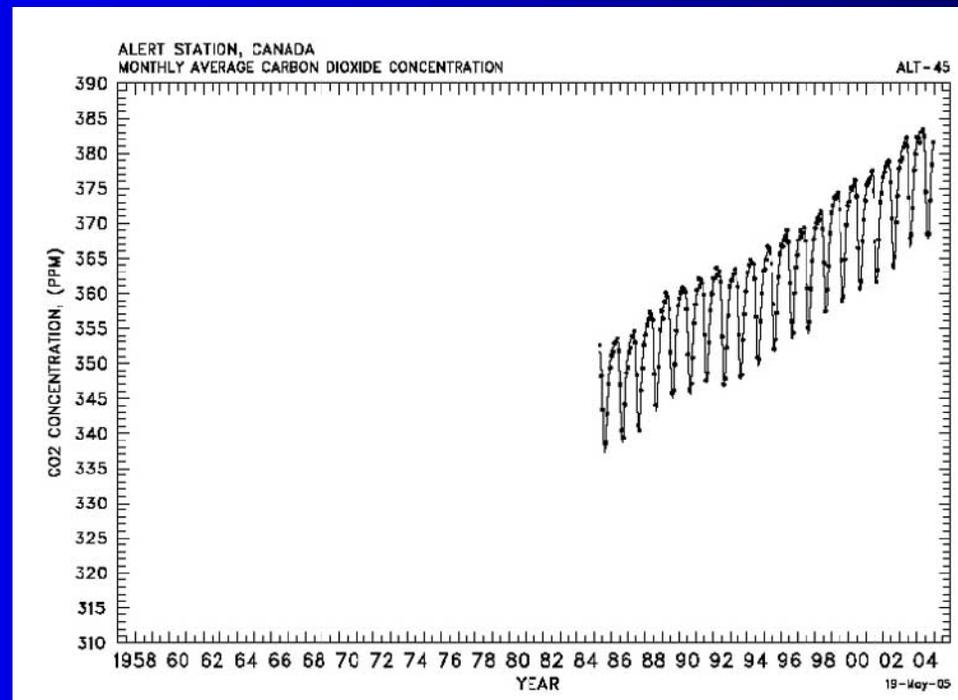
**There are primarily three factors controlling the CO<sub>2</sub> level in the atmosphere due to the atmosphere-ocean surface equilibrium process**

1. The ocean water surface temperature and its correlated surface area. During ice ages the ocean surfaces are also reduced and a larger ice area reduces the albedo factor. Changes over long time cycles due to ocean currents



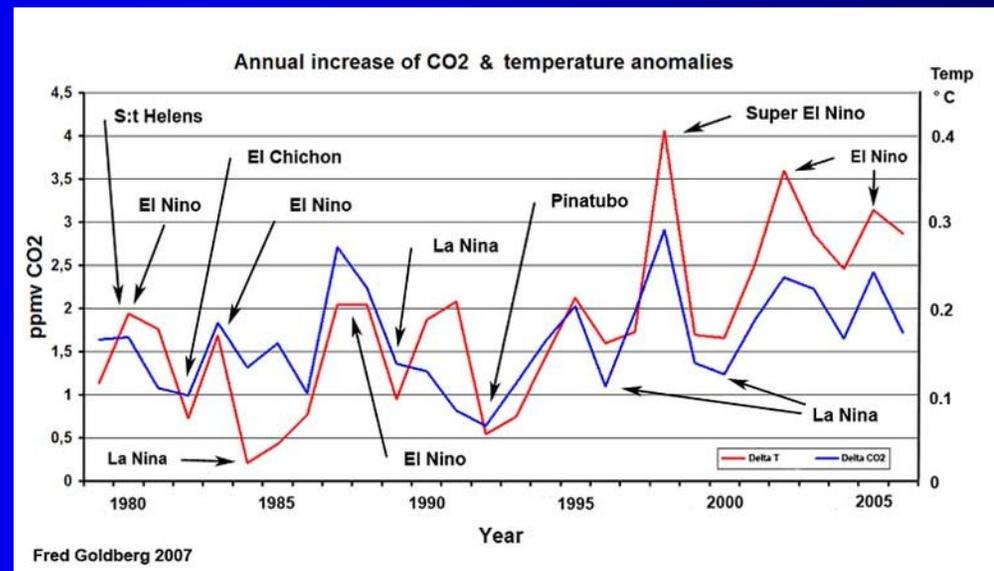
## There are basically three factors controlling the CO<sub>2</sub> level in the atmosphere

1. The ocean water surface temperature and its correlated surface area.
2. Annual seasonal changes of ocean water temperatures



## There are basically three factors controlling the CO2 level in the atmosphere

1. The ocean water surface temperature and its correlated surface area.
2. Annual seasonal changes of water temperatures
3. Natural events like volcanic eruptions and El Ninos affecting ocean surface water temperatures



## **What about the human CO<sub>2</sub>-emissions?**

**Today human emissions are 1% of the total CO<sub>2</sub> content in the atmosphere**

**Considering that the annual turnover of CO<sub>2</sub> with oceans and Biomass is 25% of all CO<sub>2</sub> in the atmosphere the annual human contribution is insignificant**

**The amount of CO<sub>2</sub> dissolved into the oceans are determined by the ocean surface temperature to reach equilibrium with atmosphere**

**In 1991-1992 as a result of the Pinatubo eruption the Earth cooled almost 1 C.**

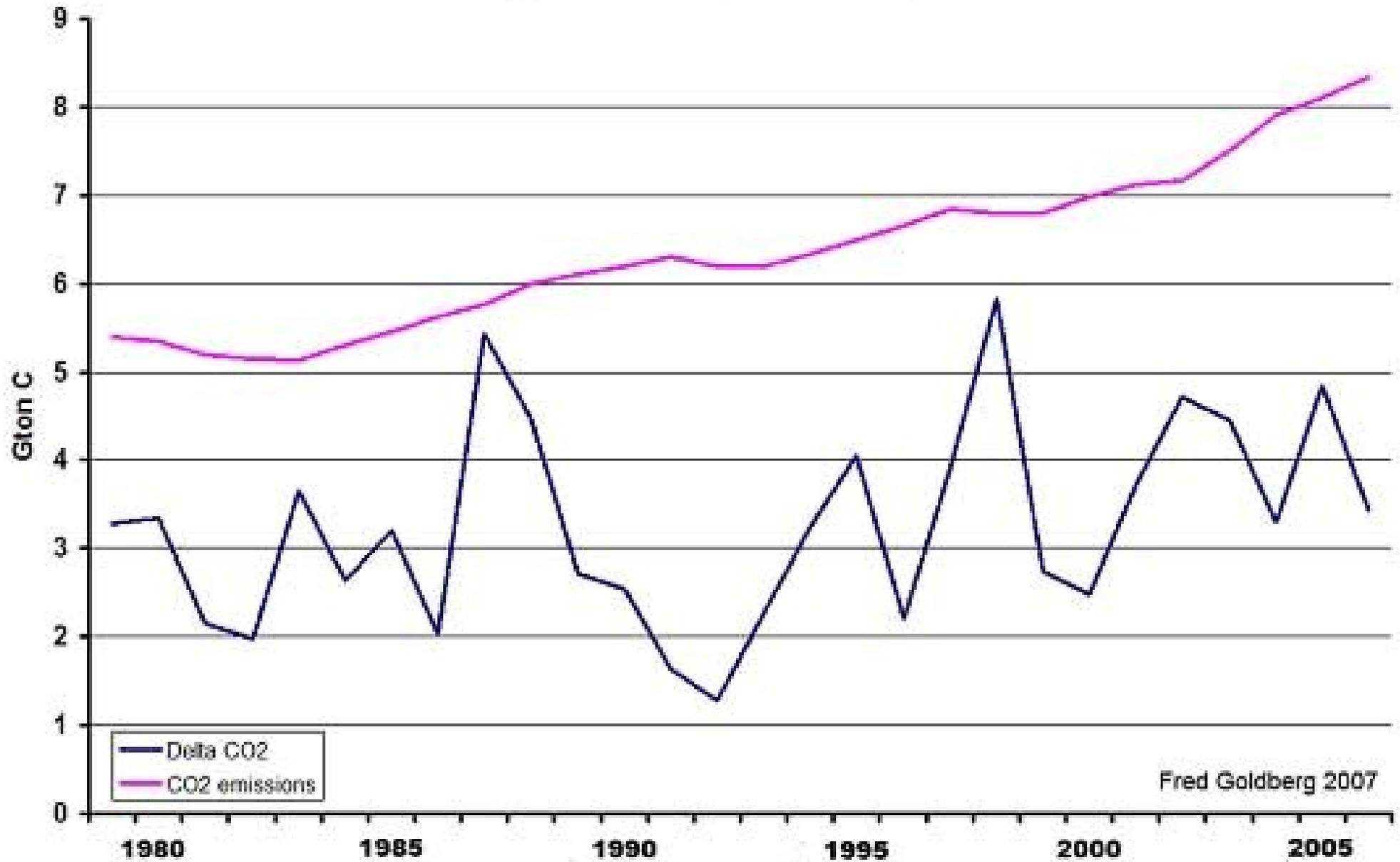
**The increase of CO<sub>2</sub> in the atmosphere was 1,47 ppm or 3 Gton C**

**At the same time human emissions were 12,5 Gton C.**

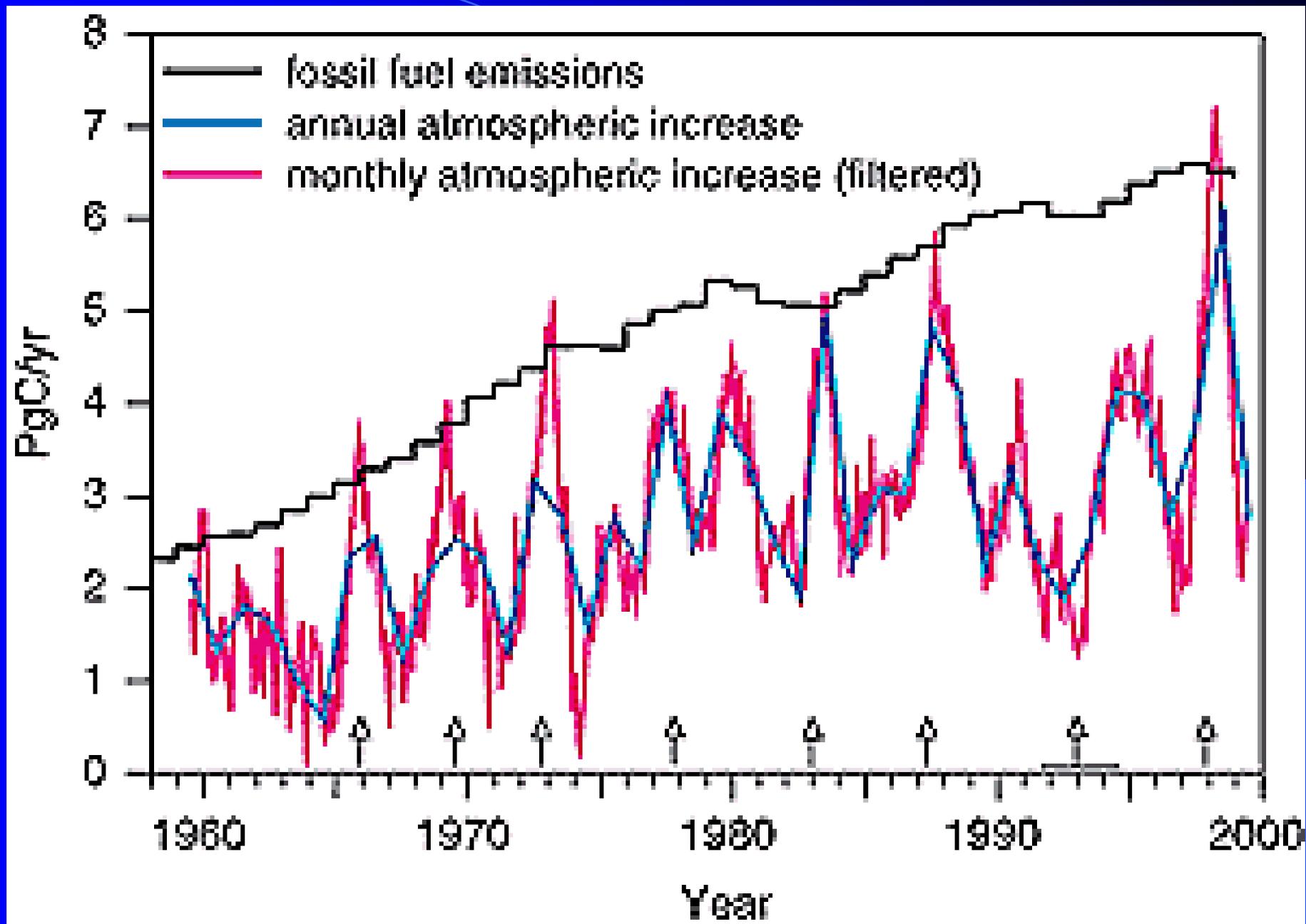
**Where did the remaining 9,5 Gton C go?**

**Most of it was dissolved into the oceans due to colder water**

## Annual CO<sub>2</sub> emissions & annual CO<sub>2</sub> increase



Fred Goldberg 2007



**Has there been a preindustrial  
CO<sub>2</sub>-level?**

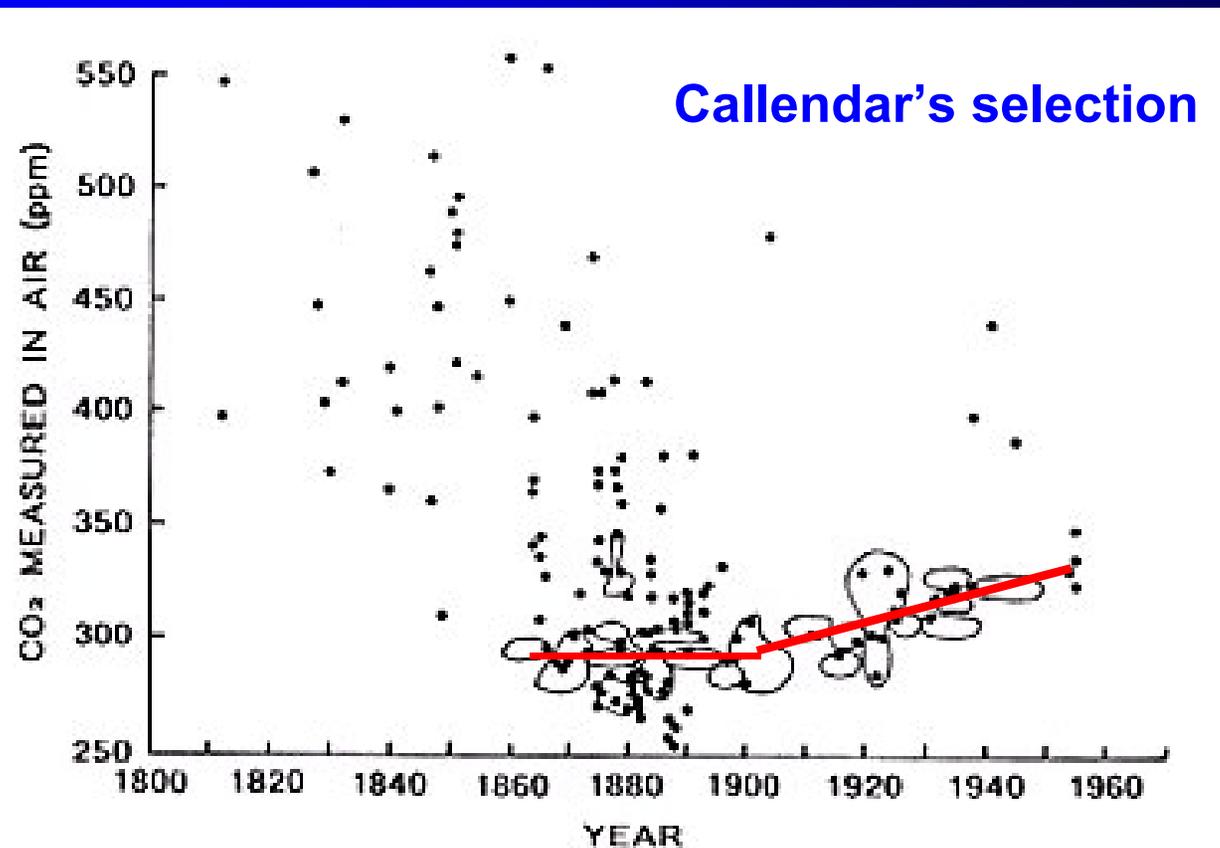


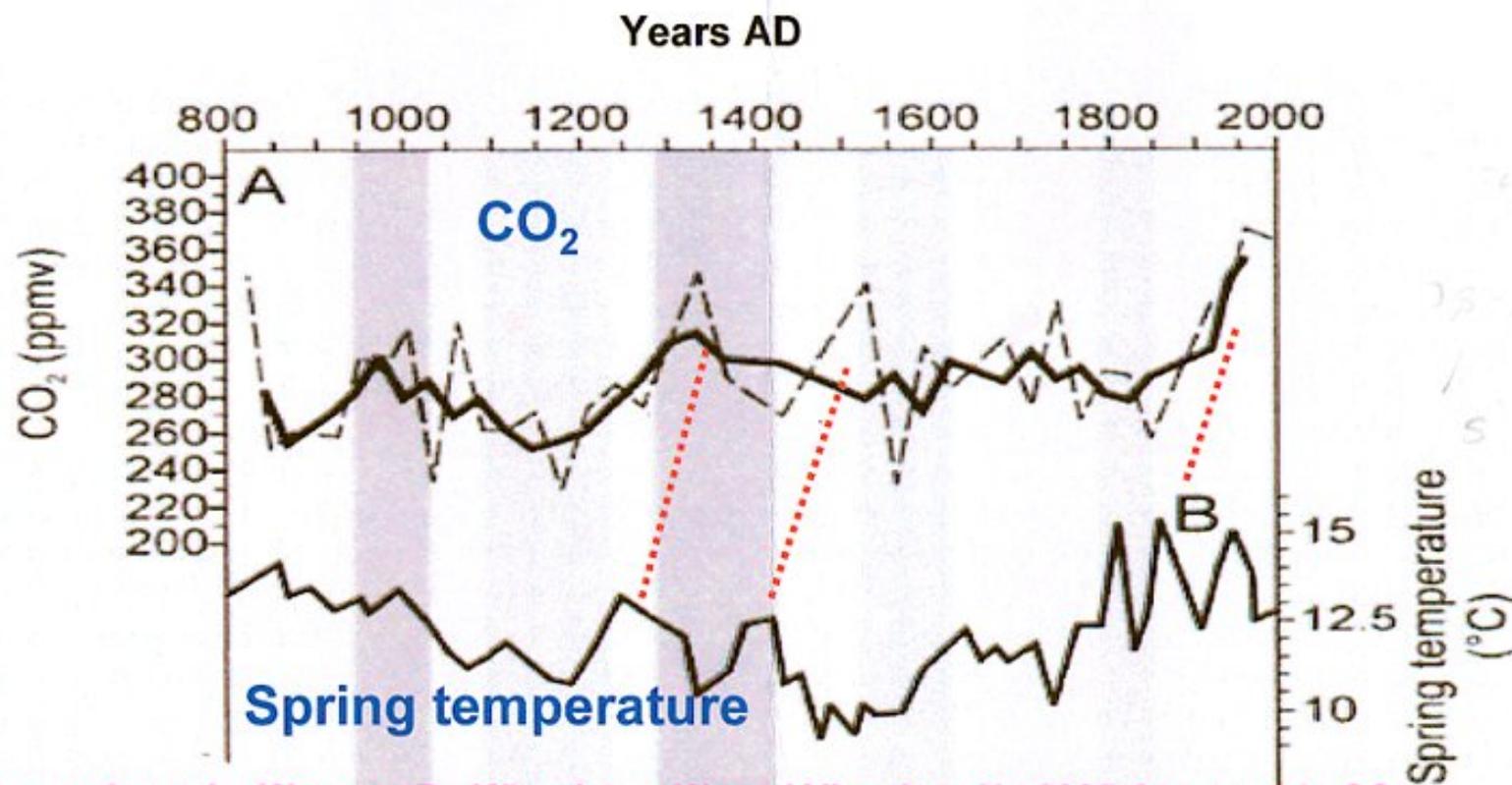
Figure 2. The mean values of atmospheric CO<sub>2</sub> measurements from Europe, North America, and Peru, between 1800 and 1955. The encircled values between 1860 and 1900 were arbitrary selected by Callendar [12] for estimation of 292 ppmv as the average 19<sup>th</sup> century CO<sub>2</sub> concentration.

**The mean values of atmospheric CO<sub>2</sub> measurements between 1800 and 1955.**

**Encircled values selected by Callendar made an average 19th century CO<sub>2</sub> concentration of 290 ppmv.**

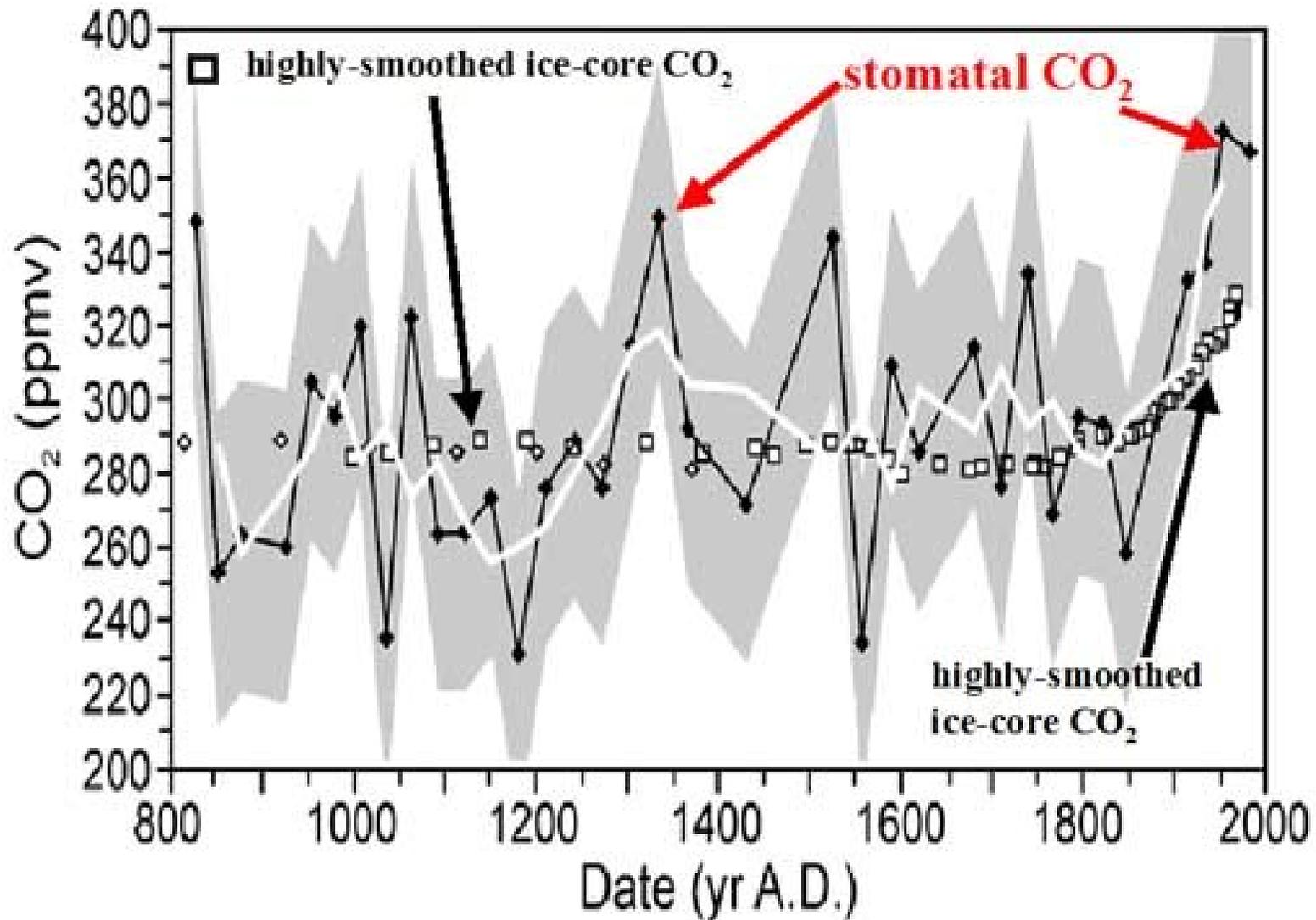
Redrawn after Fonselius et al.. 1956.

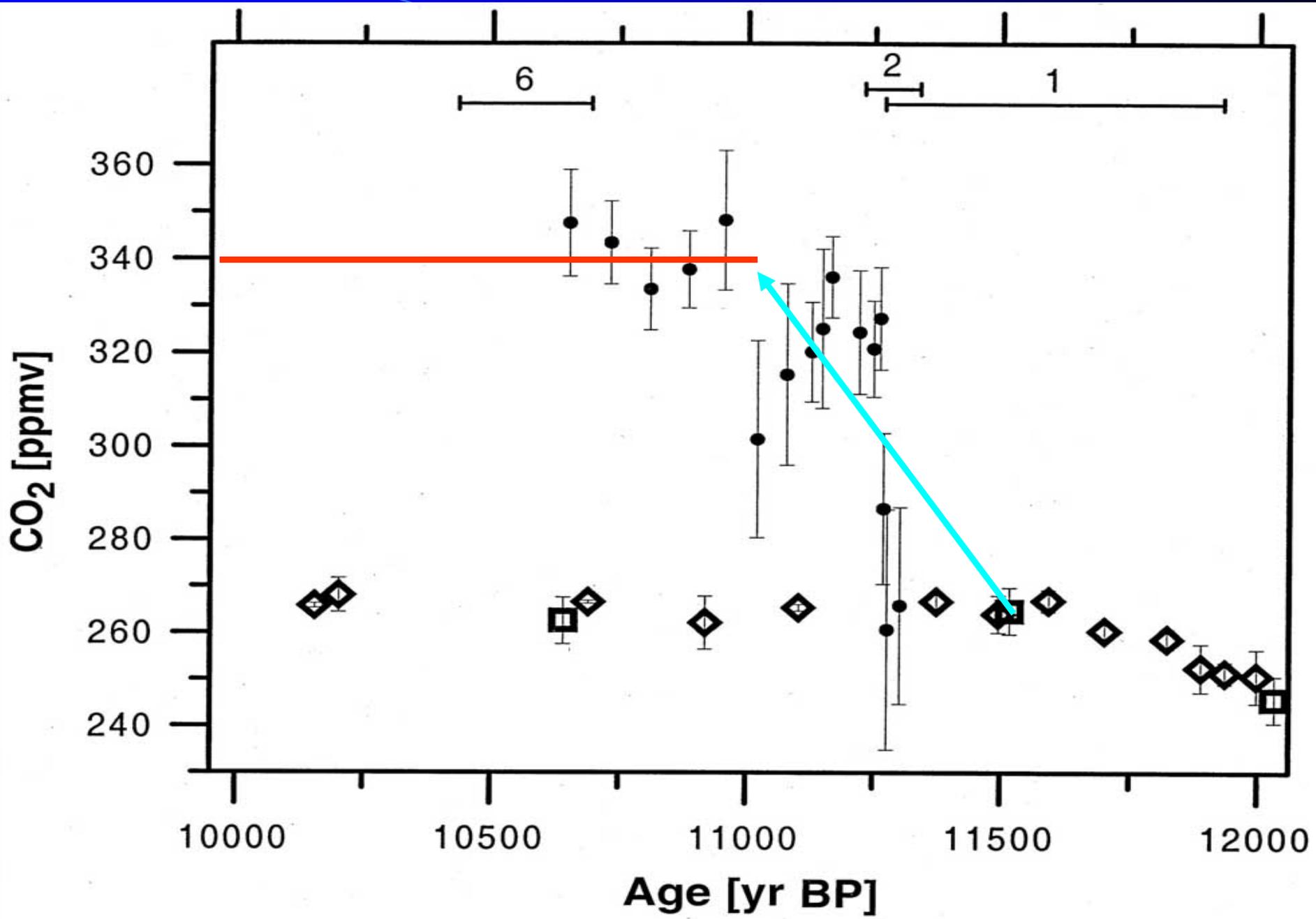
The change in temperature appears about 100 years before the change in atmospheric concentration of CO<sub>2</sub>



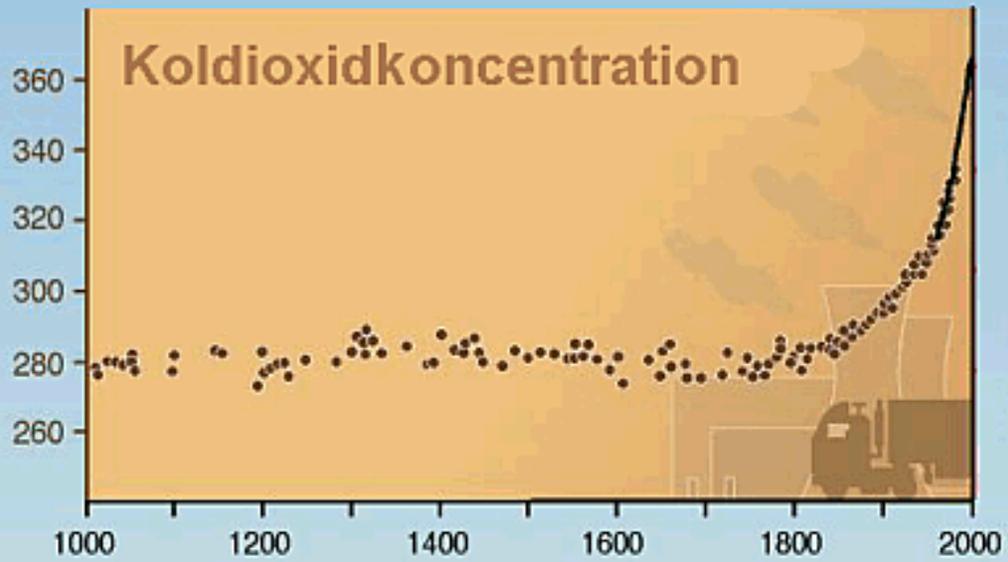
Kouwenberg, L., Wagner, R., Kürschner, W. and Visscher, H., 2005: Atmospheric CO<sub>2</sub> fluctuations during the last millenium reconstructed by stomatal frequency analysis of *Tsuga heterophylla* needles. *Geology* 33(1): 33-36.

Reconstructed CO<sub>2</sub> concentrations based on stomatal frequency counts from needles of the conifer, *Tsuga heterophylla*, for A.D. 800-2000: Who said global CO<sub>2</sub> cannot vary naturally with significantly large amplitude?

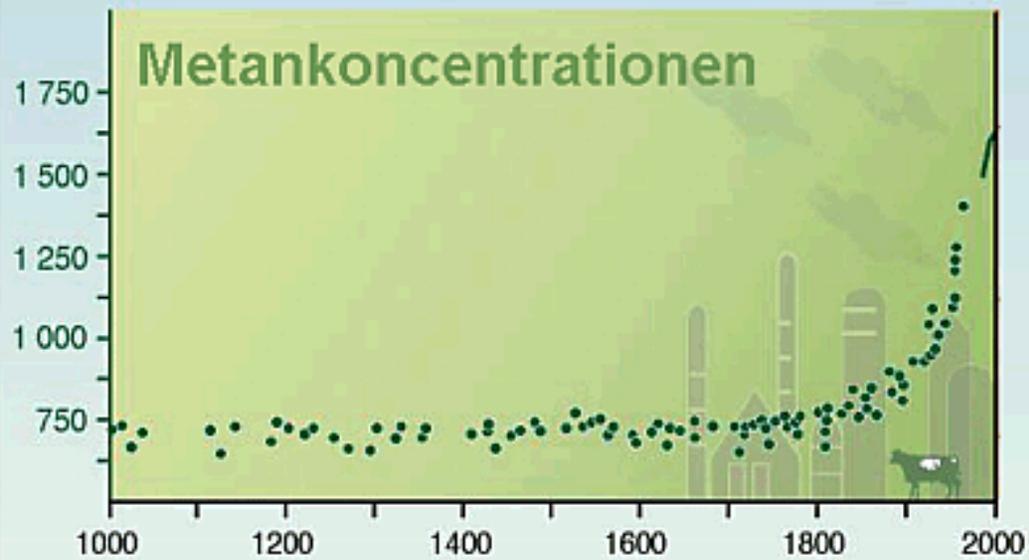




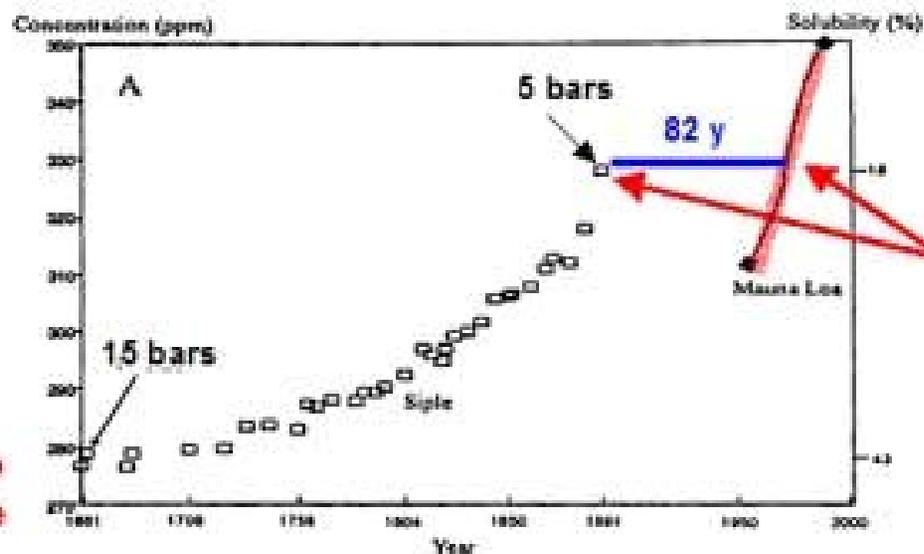
CO<sub>2</sub> (ppm)



CH<sub>4</sub> (ppb)

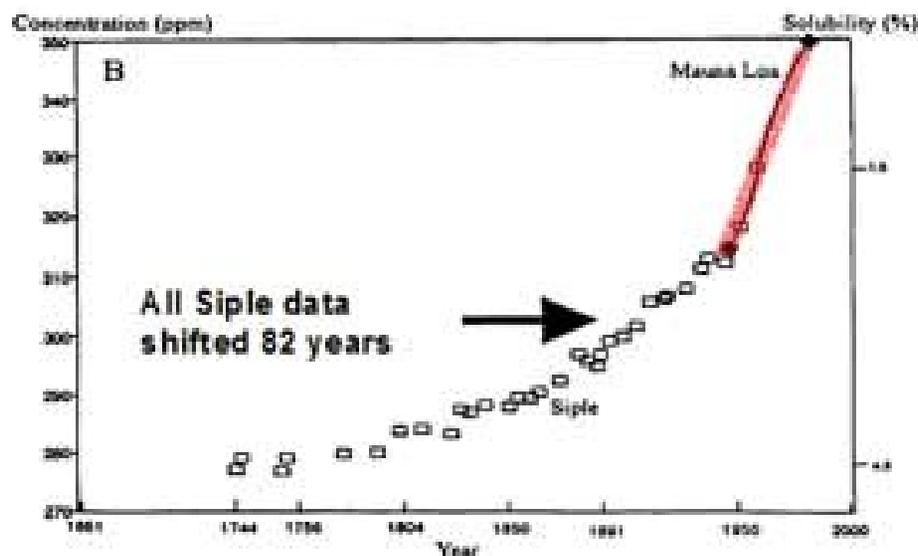


Decrease of CO<sub>2</sub> in ice was related to increasing pressure and formation of clathrates



328 ppmv  
in 1891 and 1973

FIRST CO<sub>2</sub> HOCKEY  
CURVE FROM  
SIPLE, ANTARCTIDA



(BERN GROUP: Neftel et al., 1985; Friedli et al. 1986).

The age of air bubbles in SIPLE ice deposited in 1891 was „corrected” by 82 years to 1973.

**PROBABLY ABOUT 30% OF CO<sub>2</sub>  
IS LOST FROM THE AIR BUBBLES:**

- (1) during firnification of snow**
- (2) in deep layers**
- (3) in decompressed ice cores**

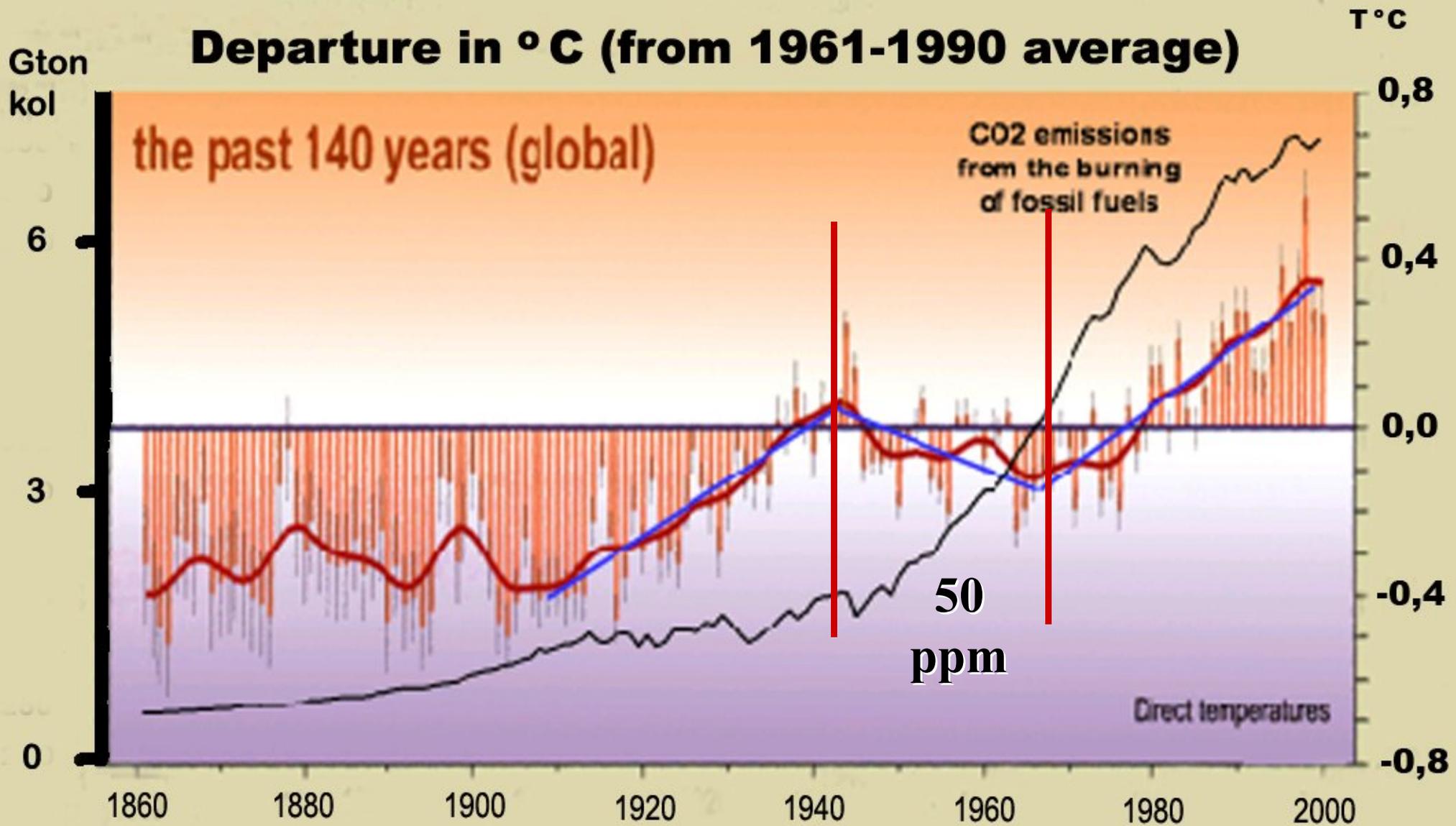
**Exact magnitude of CO<sub>2</sub> depletion remains  
to be determined experimentally**

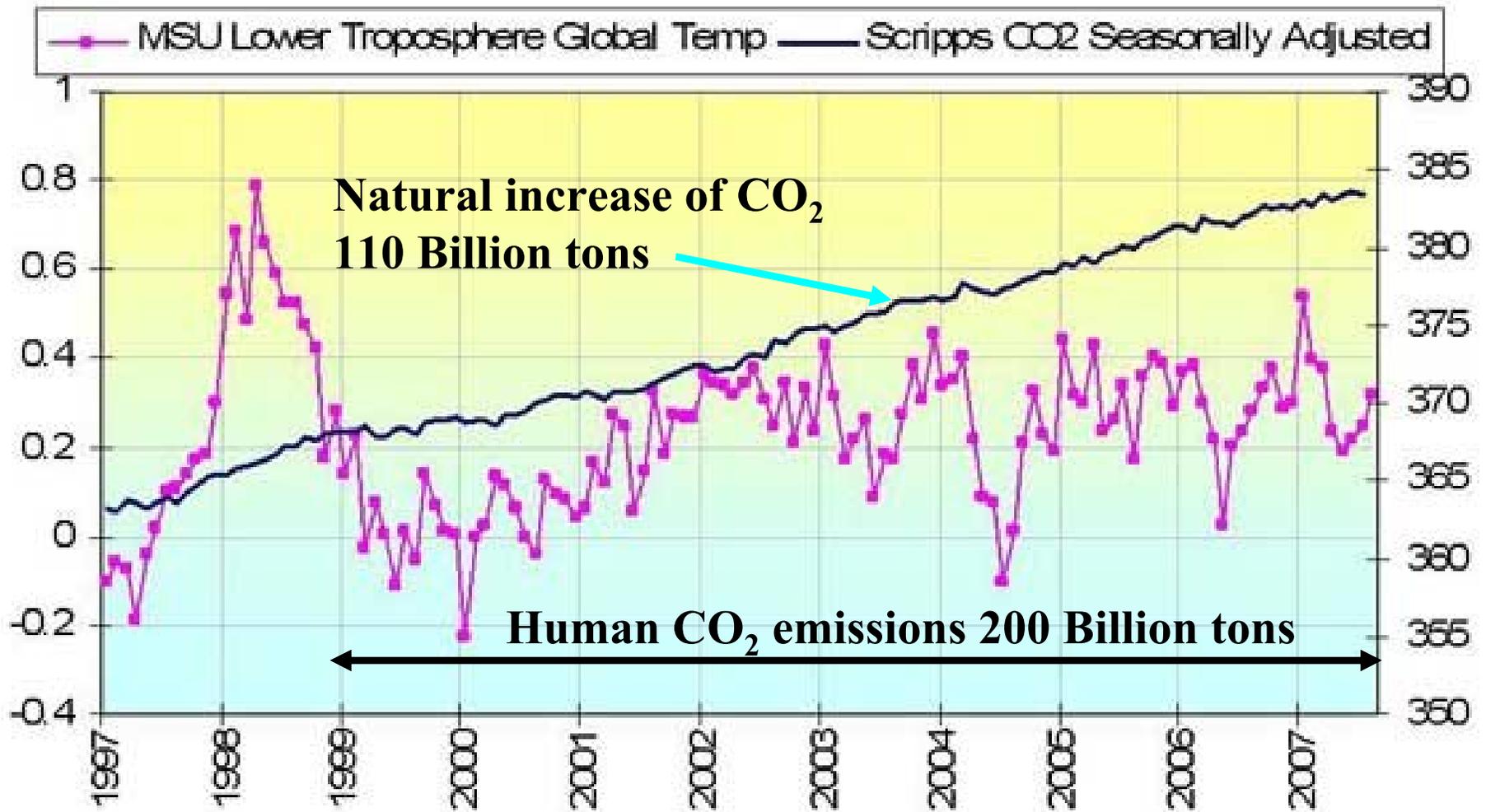
**To date, ice core studies are not able  
to provide a reliable reconstruction of CO<sub>2</sub>  
level in pre-industrial atmosphere.**

**Probable never will be.**

**Has human emissions caused  
global warming?**

# Bevis 5



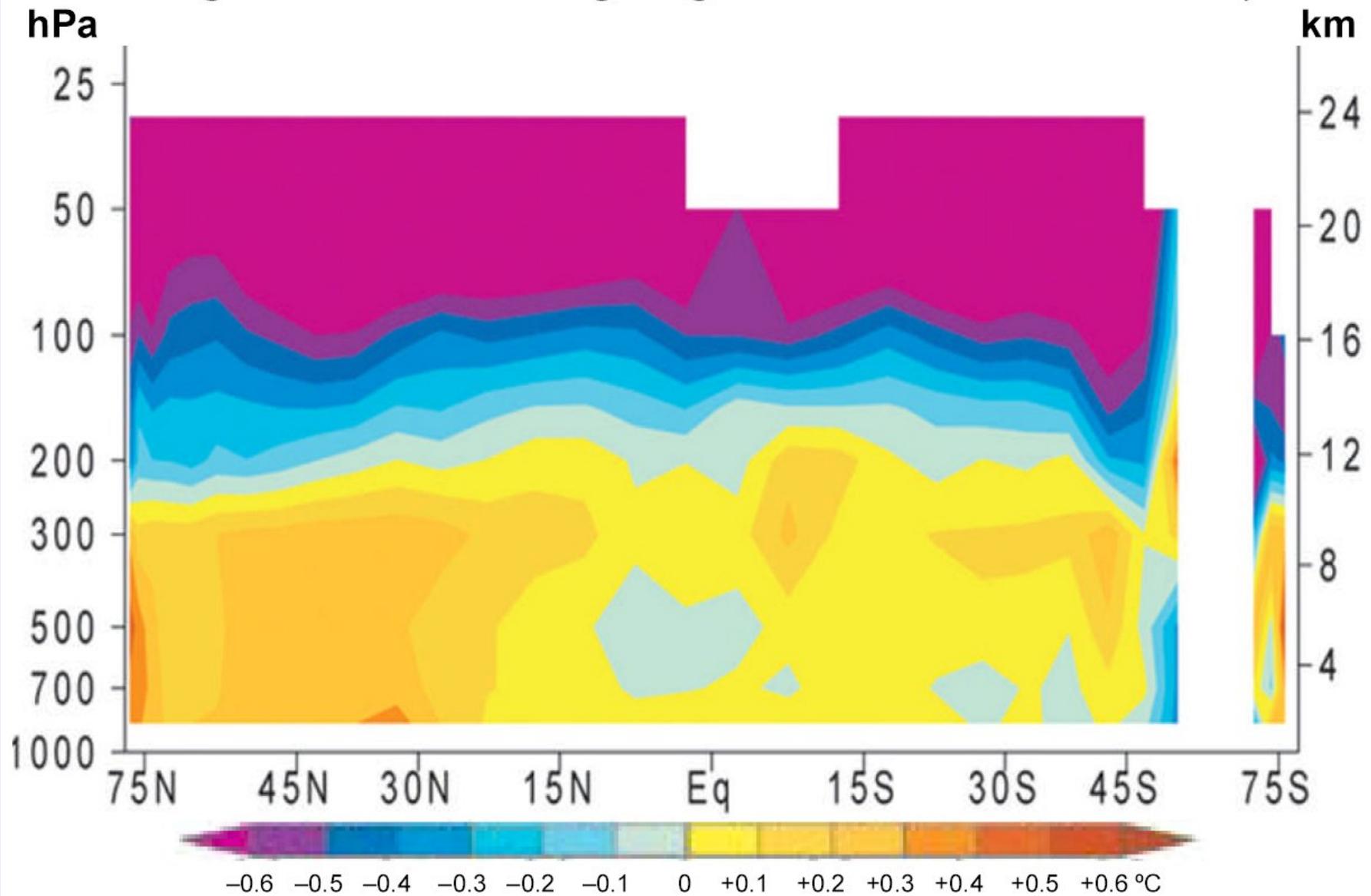


R-squared correlation strength of just 0.07

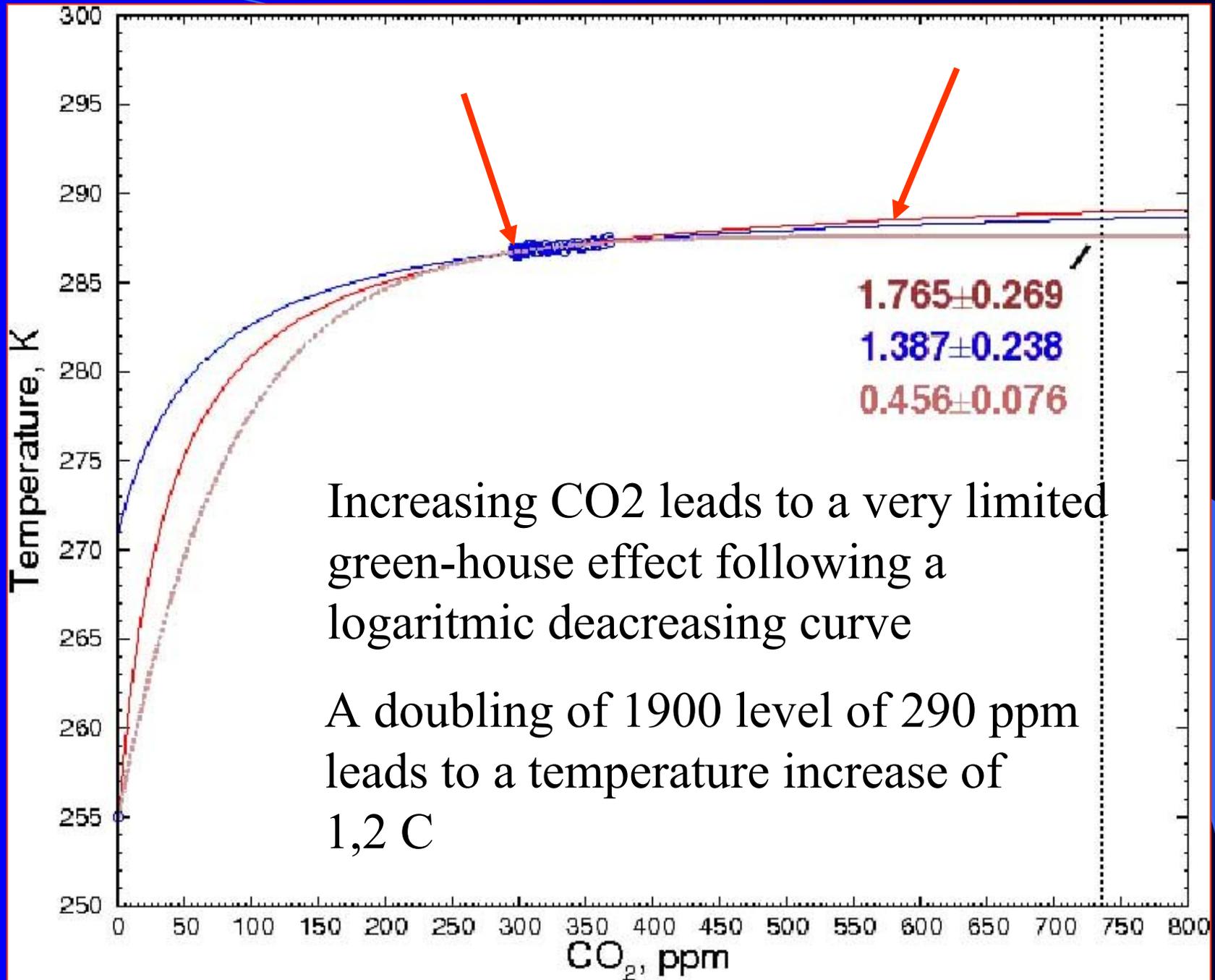
**IPCC models show that the total greenhouse effect of CO<sub>2</sub> and other gases in addition to particles and aerosols, will result in a heating of the atmosphere at 8.000-12.000 m altitude**



*No “greenhouse warming” signature is observed in reality*



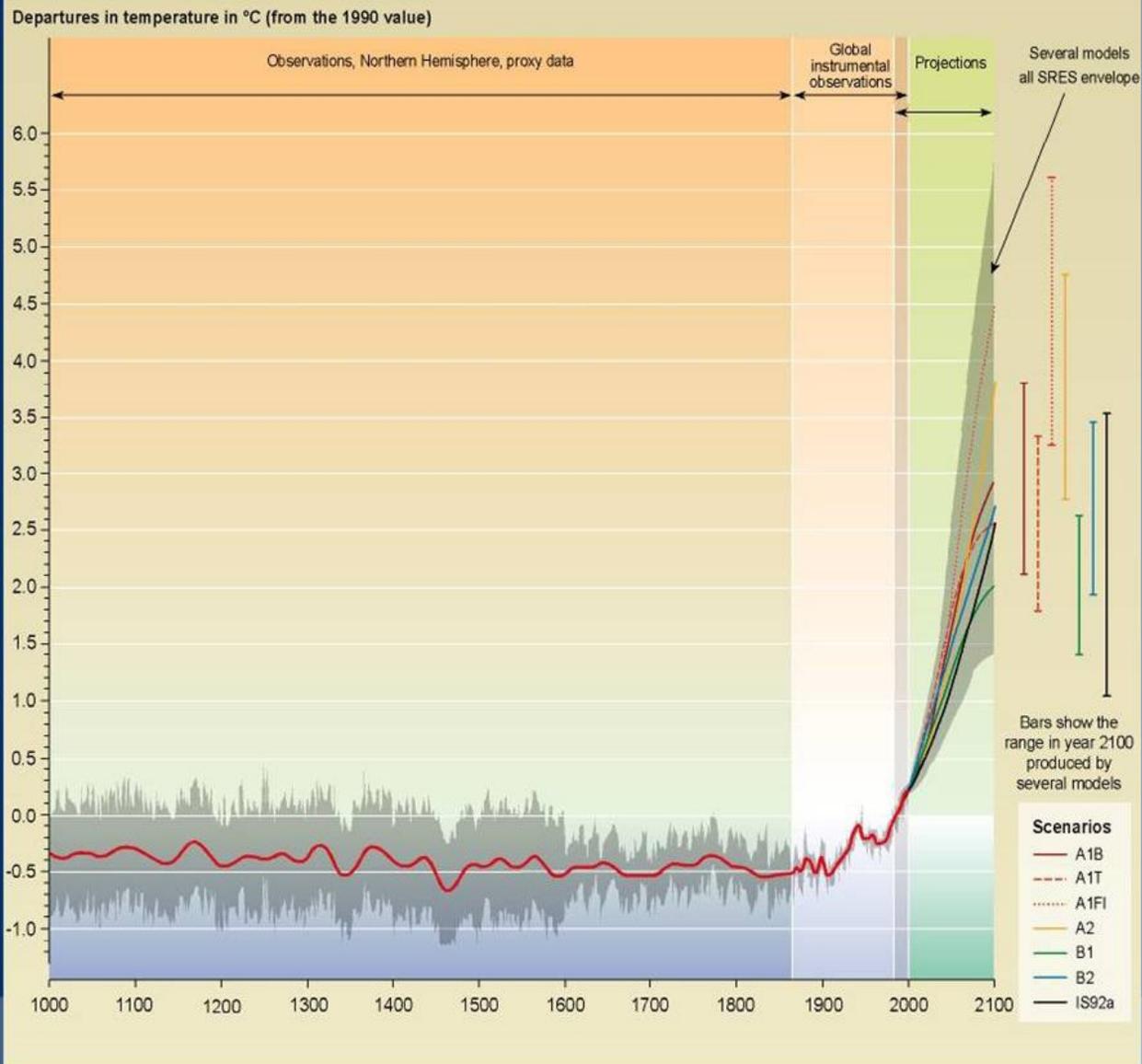
**MSU and balloon measurements show no warming**



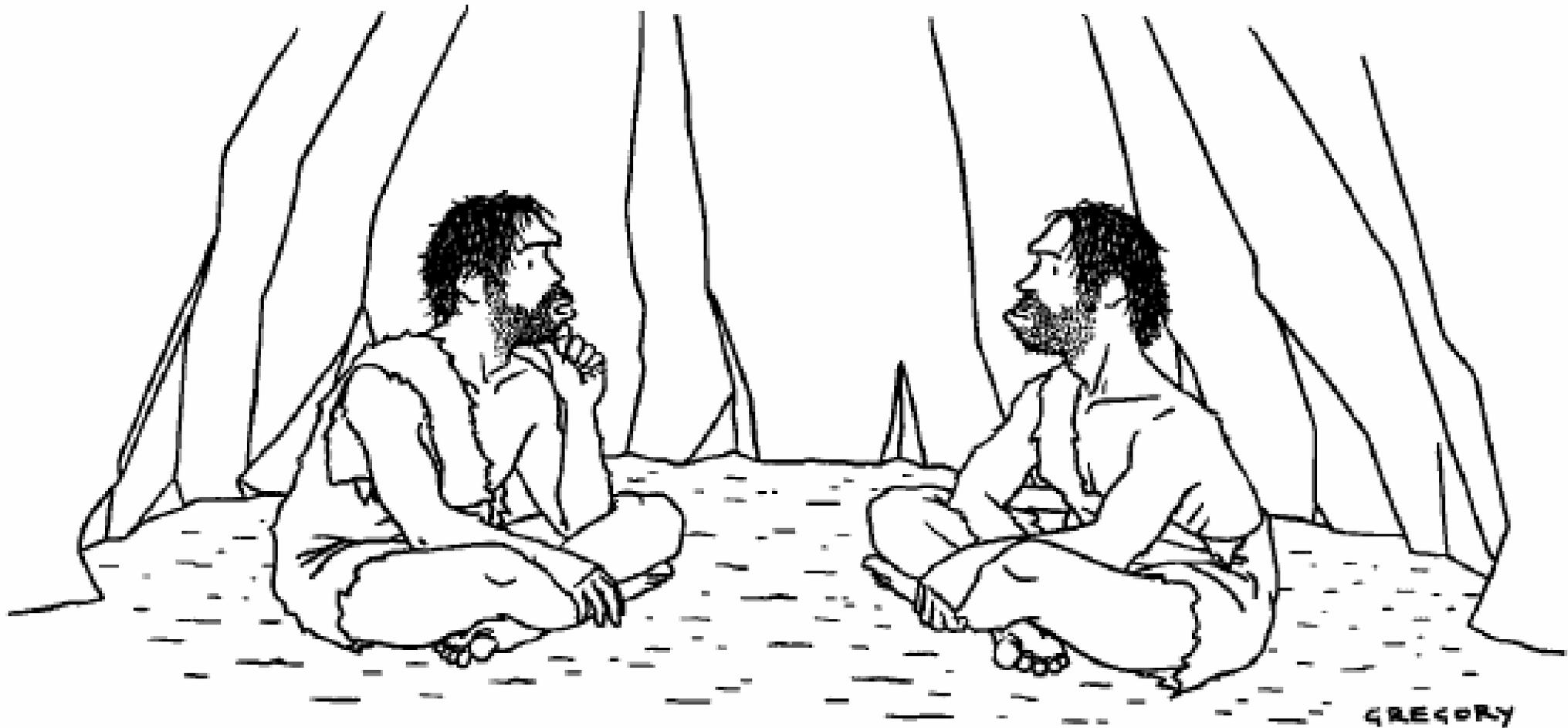
Increasing CO<sub>2</sub> leads to a very limited green-house effect following a logarithmic decreasing curve

A doubling of 1900 level of 290 ppm leads to a temperature increase of 1,2 C

# Variations of the Earth's surface temperature: year 1000 to year 2100



SYR - FIGURE 9-1b



*“Something’s just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty.”*

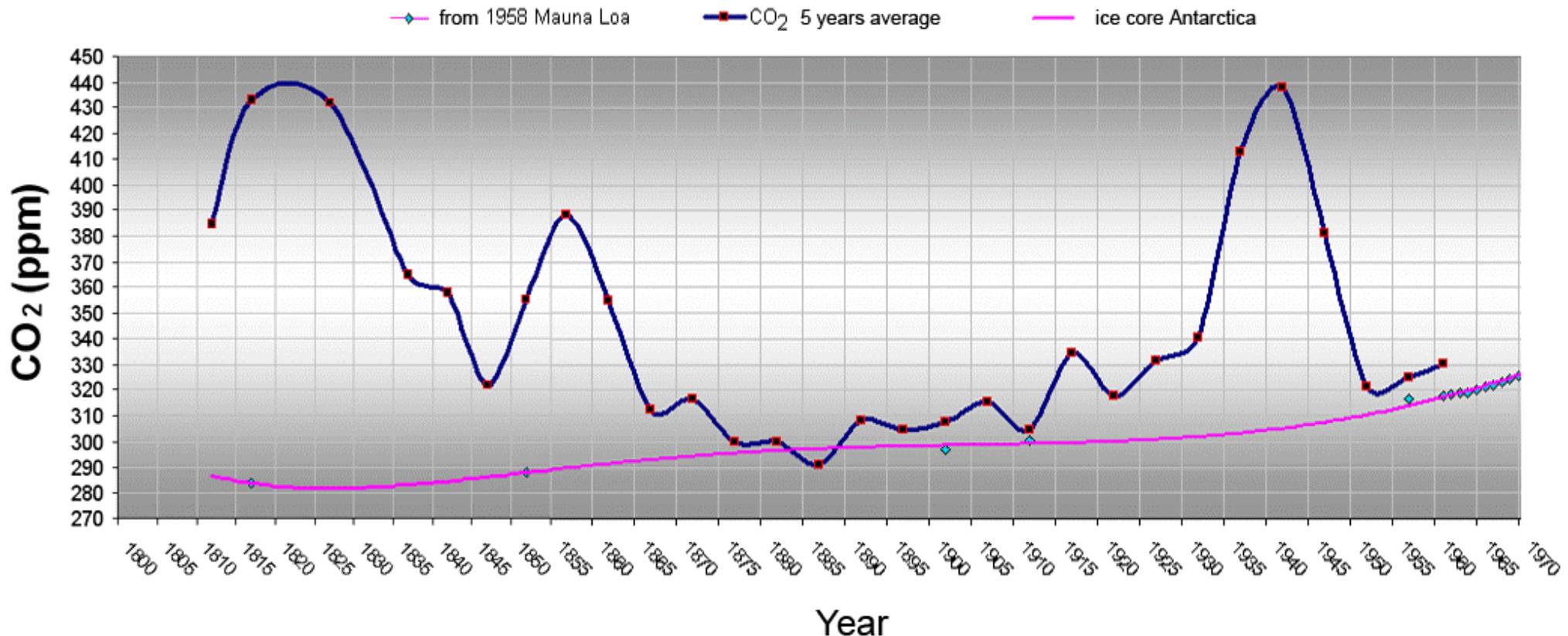
**Thank you for your  
attention**

## Ernest-Georg Beck, Freiburg, August 2006:

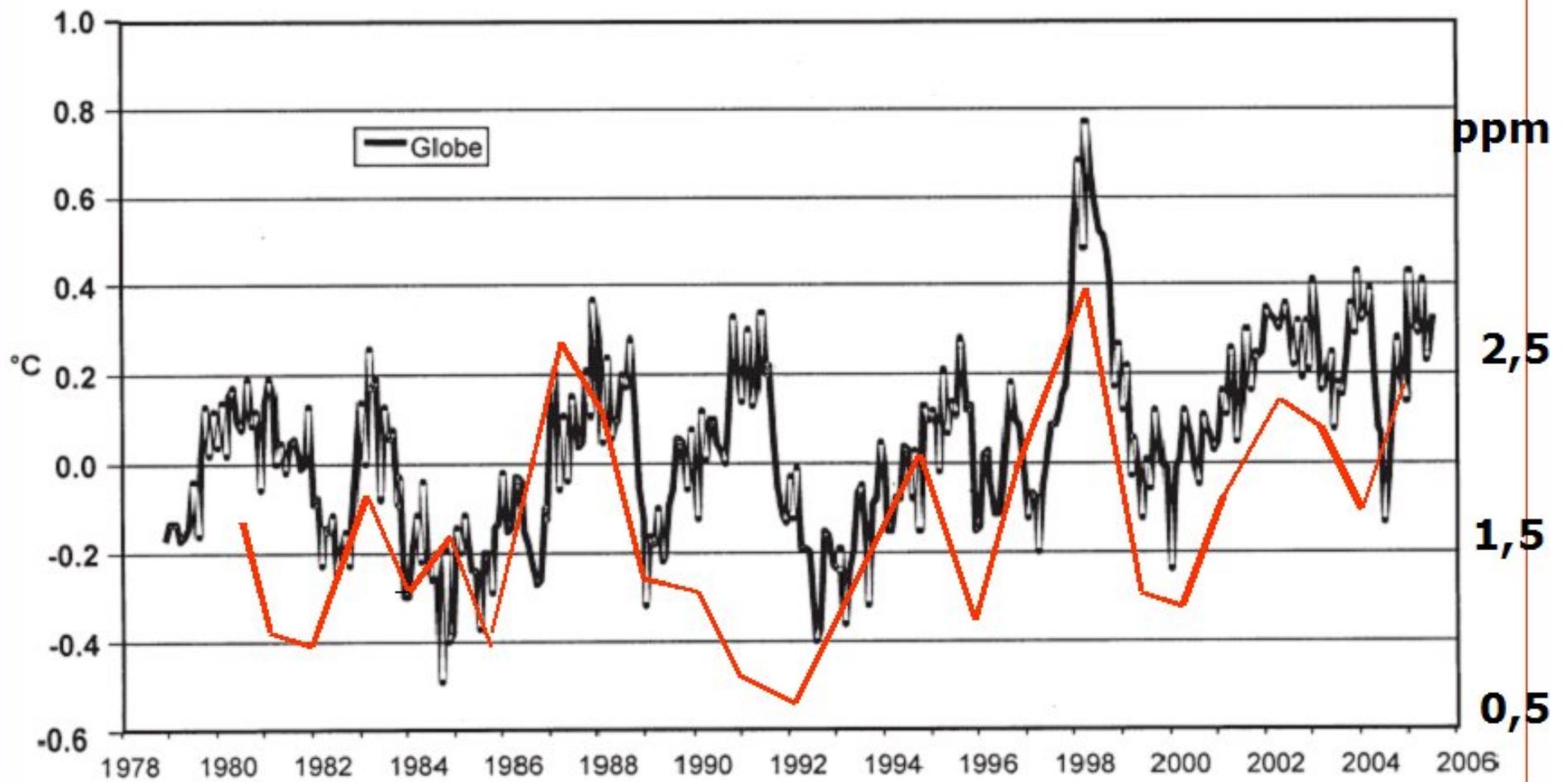
„180 Years Accurate CO<sub>2</sub> – Gas Analysis of Air by Chemical Methods” (106 pages; 175 references).

Most of >90 000 atmospheric CO<sub>2</sub> measurements (accuracy between 1 and 3%) were ignored by Callendar, Keeling and IPCC.

### CO<sub>2</sub> -1812 - 2004 Northern Hemisphere , Chemical Measurement

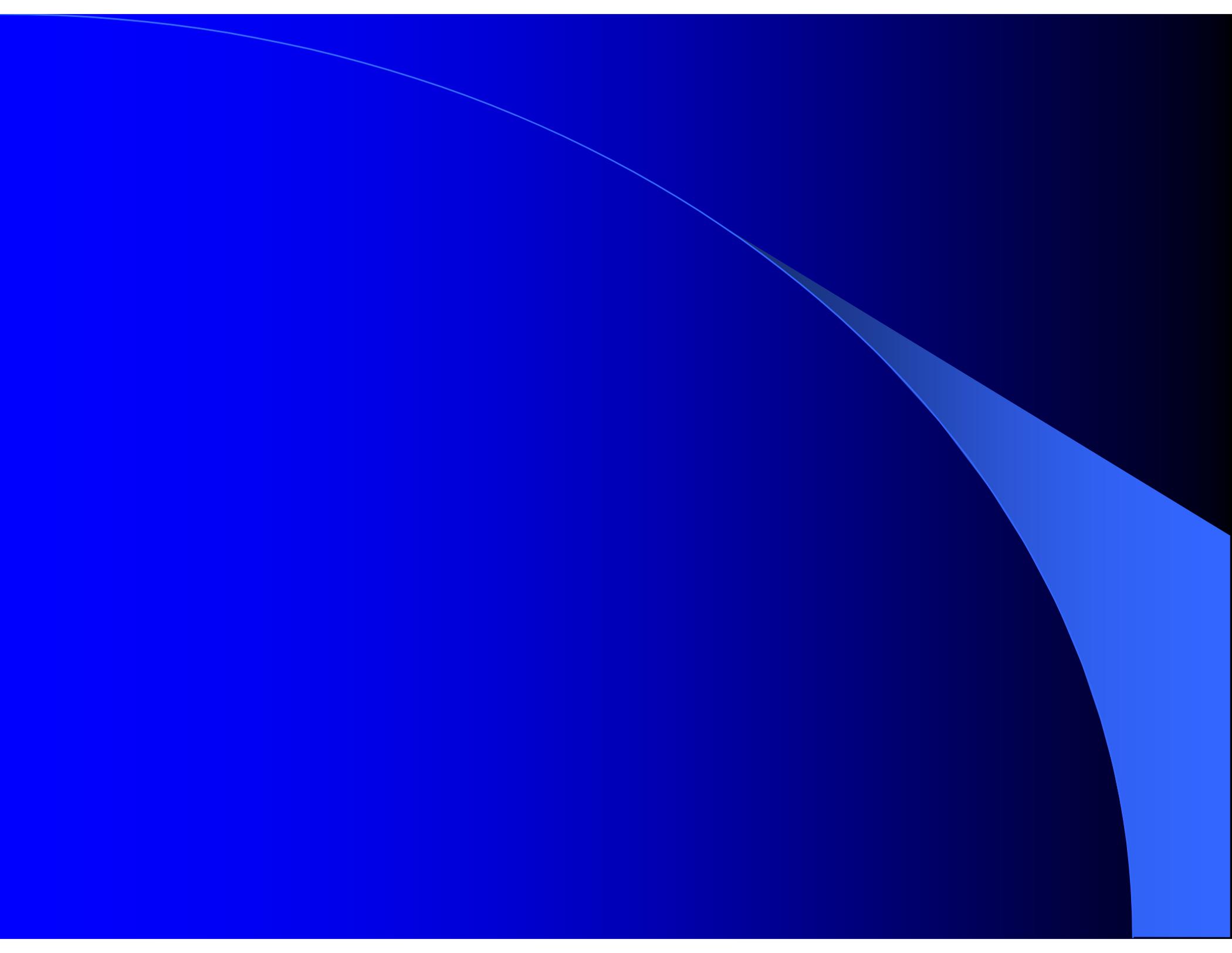


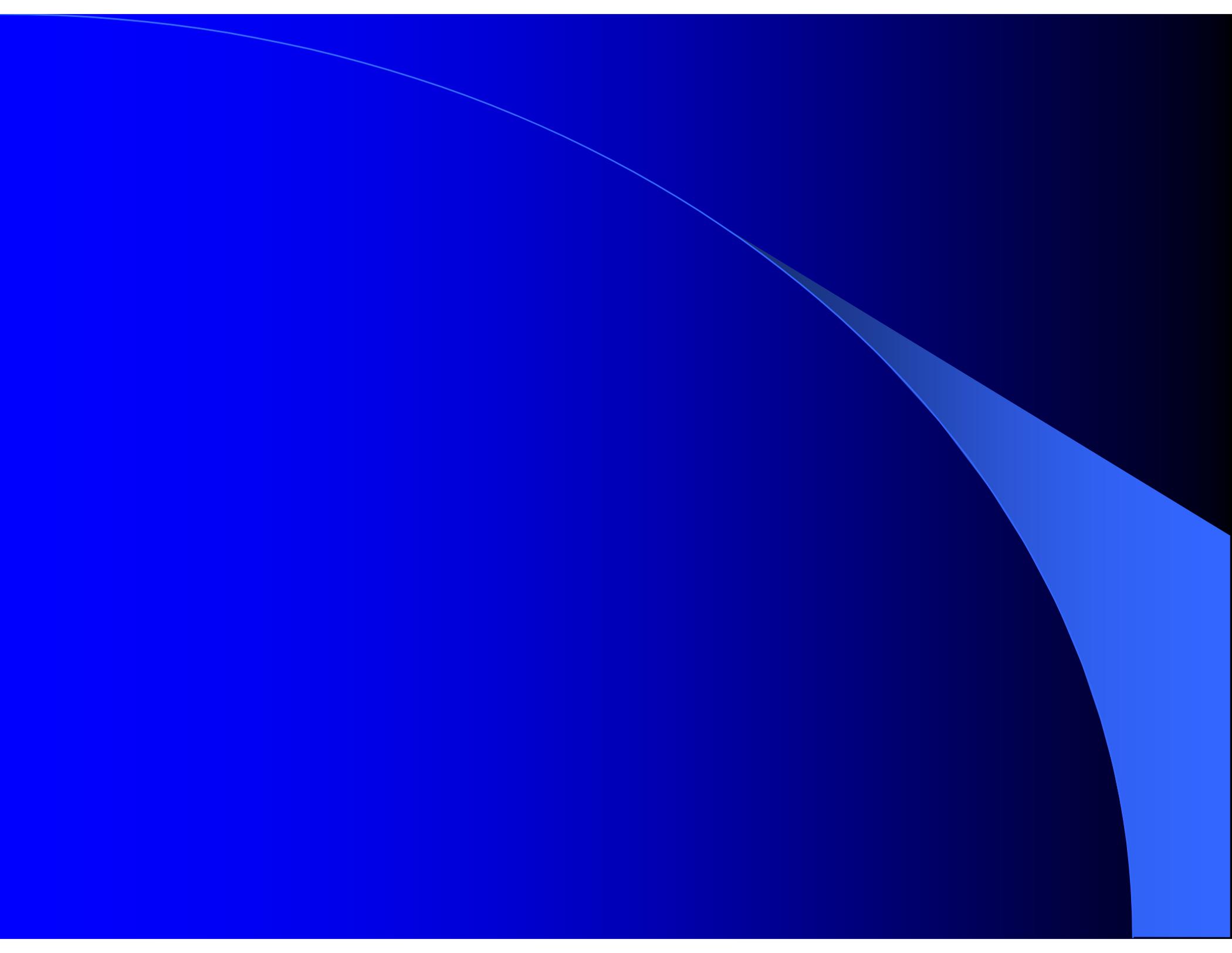
Average (5 years) local atmospheric CO<sub>2</sub> concentrations between 1812 and 1961, based on 320 technical papers. Red line represents SIPLE ice core CO<sub>2</sub> measurements combined with Mauna Loa data. Three big CO<sub>2</sub> maximums between 390 and 440 ppmv were observed at many stations between 1820 and 1942.



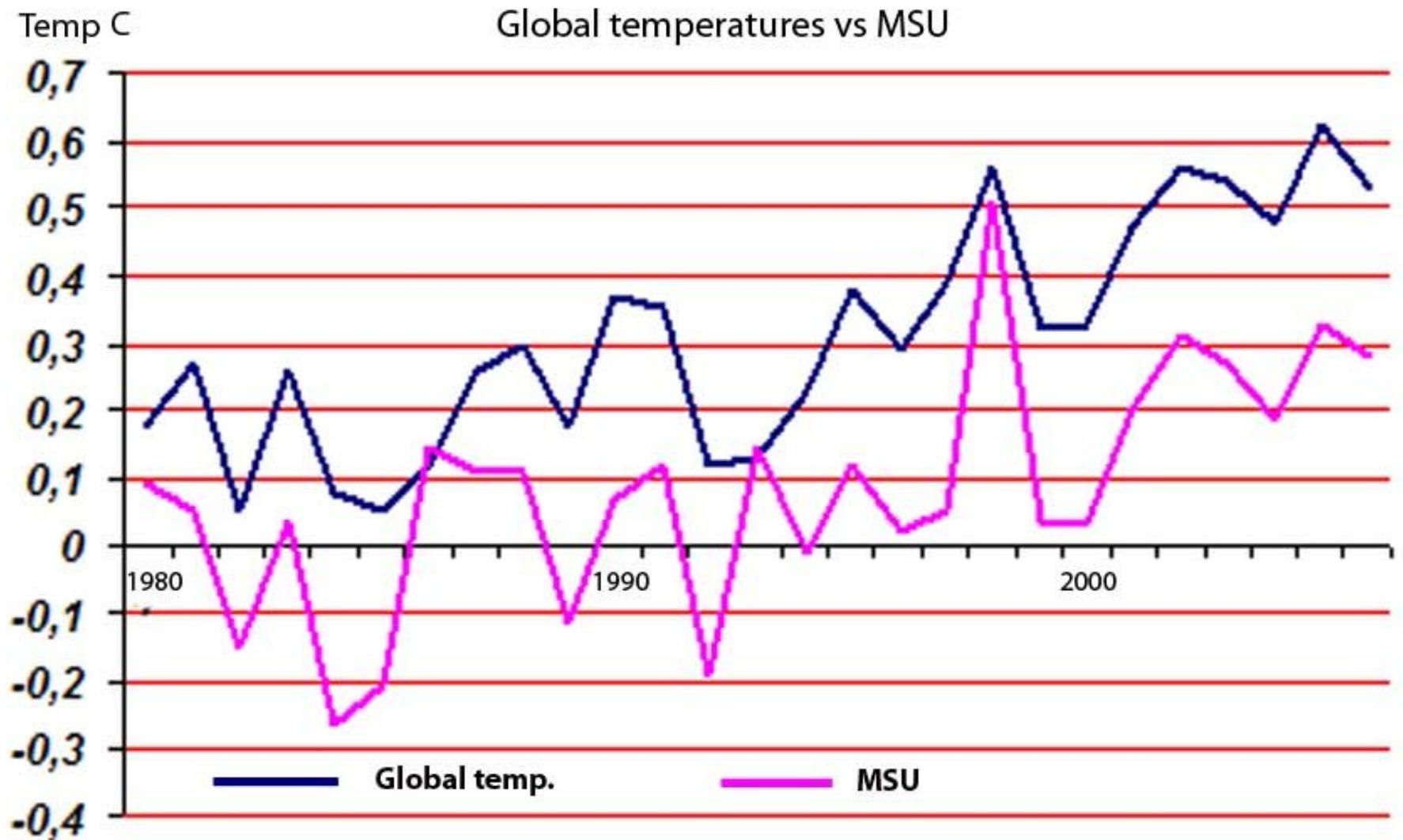
**Figure 1.1. Satellite Temperature Record 1979–2004, trending up at a modest 0.125 degrees Celsius per decade. A strong El Niño occurred in 1998.**

Compiled by John Christy, University of Alabama–Huntsville.





## Temperatur anomalies from average temp. 1950-1980



Fred Goldberg 2008

Global temperatures exaggerated approx. 100%