Messages from Ancient Ice

Danger Feedbacks !

Do Not Tamper

Very sensitive climate system

Messages from Ancient Ice

1. Today's atmospheric GHG concentrations have the planet committed to a global temperature increase that WILL be devastating to world agriculture. Projections of committed temperature increases (climate science, energy plans, national policy proposals) lead to a world of global food decline and of decline affecting all regions. Agriculture will not work in a 3 to 4°C world.

2. The level and rate of increase of atmospheric GHG concentrations today are unprecedented-way beyond their concentrations of the past 800,000 years. This equals a huge amount of additional heat energy in the atmosphere. The vast majority of this heat is going to warming the oceans and expended in the melting of planetary ice.

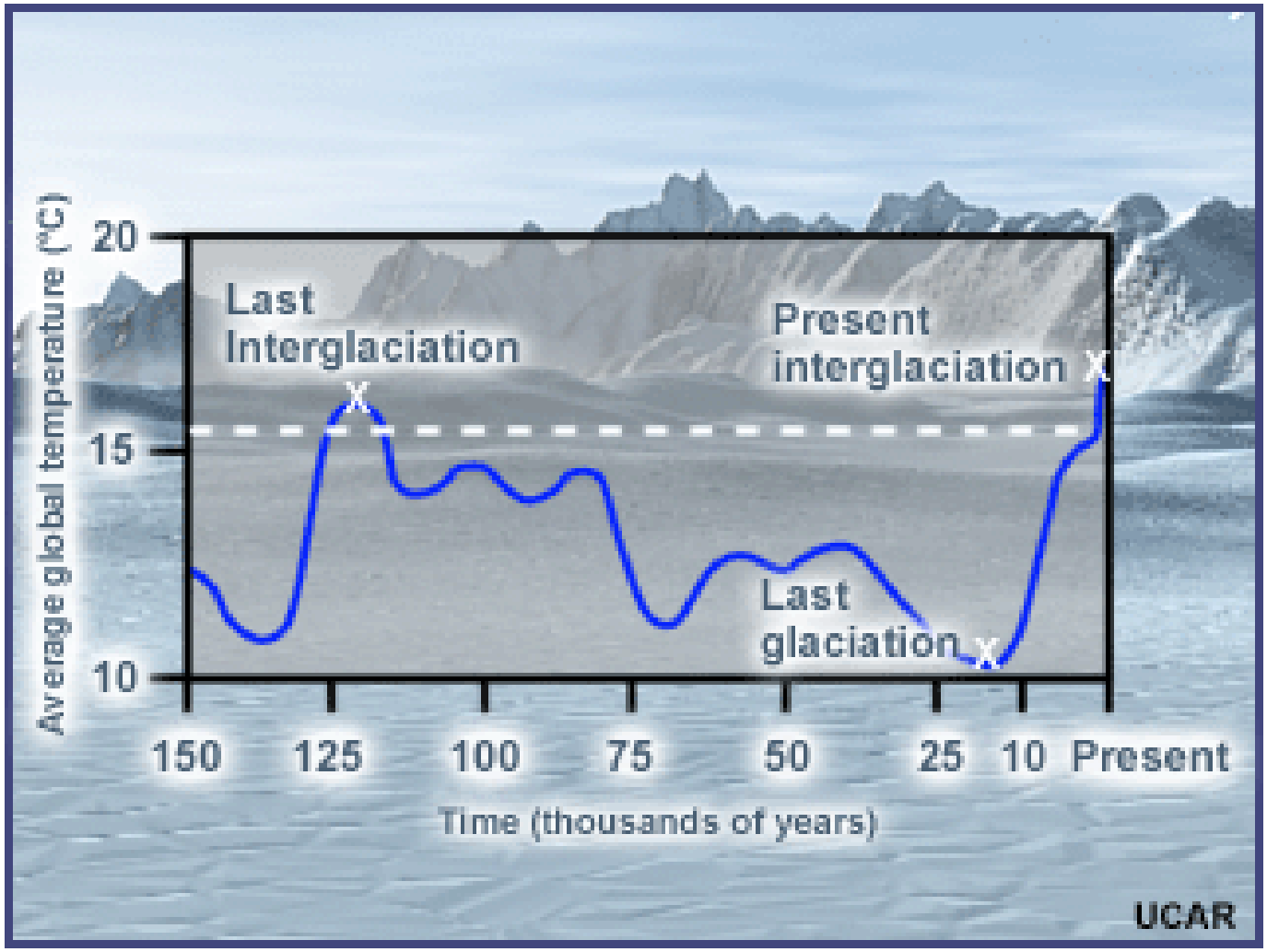
3. The planet's past warming episodes were driven by FEEDBACKS - Carbon methane and CO2 feedback and albedo loss/ice loss feedback.

4. The main feedback is methane carbon feedback.

5. Abrupt global warming is the natural norm.
The planet can warm by 10°C in 10 years.

Forcing the climate at this extent and rate in a warm period (not an ice age temperature low) has to result in an abrupt extreme heating.

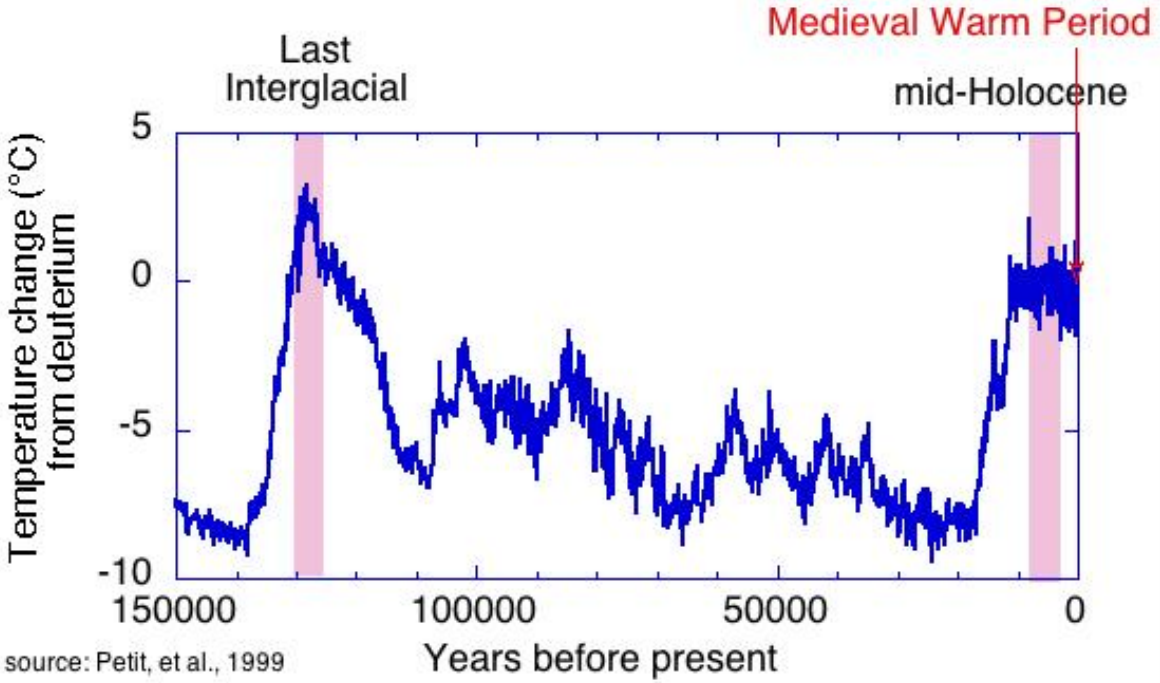
150,000 years



150,000 years

The Holocene is an unusually stable climate period.

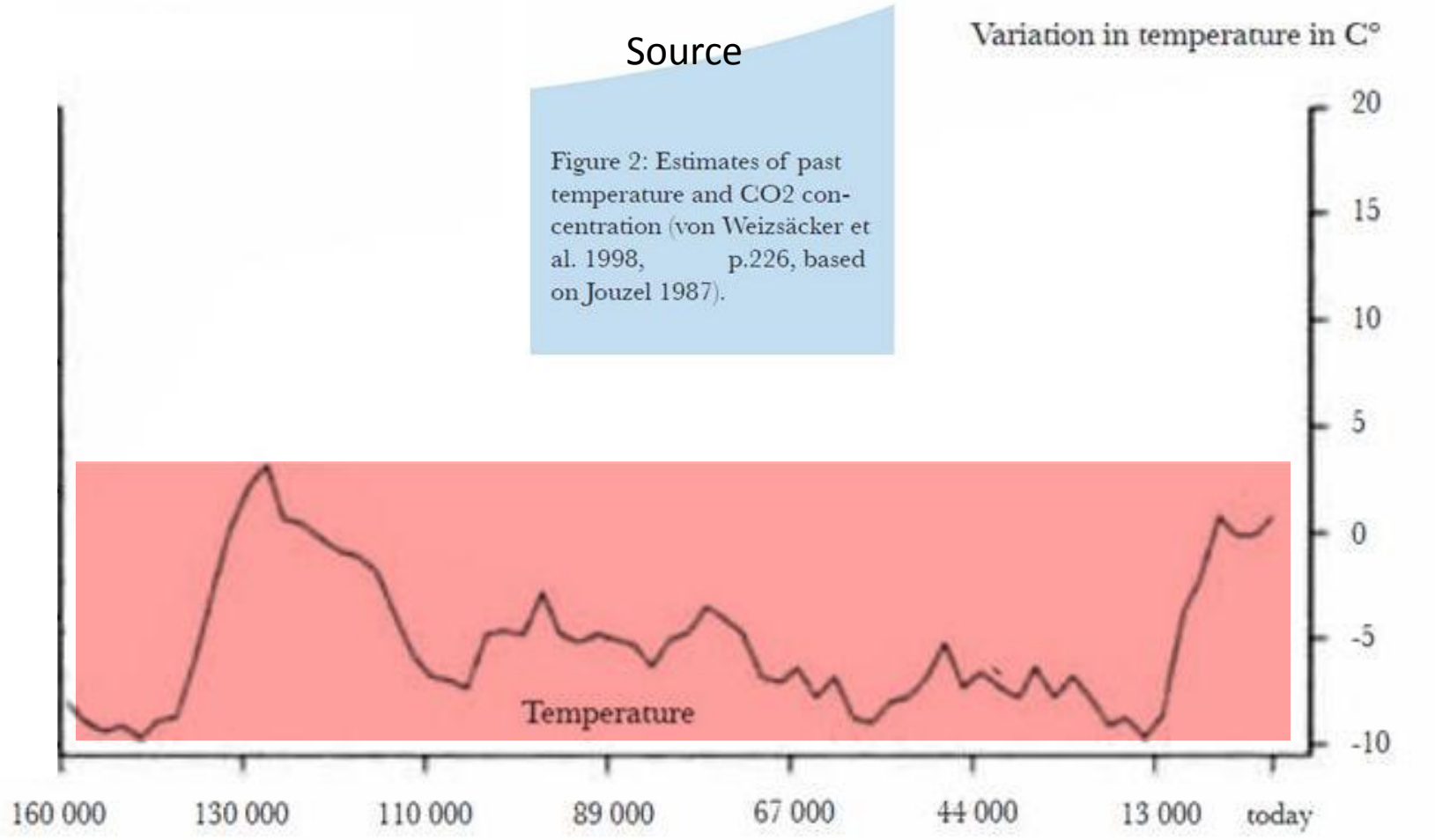
Vostok Antarctic ice
temperature change



NOAA

150,000 years

Global temperature change estimate from ice core data



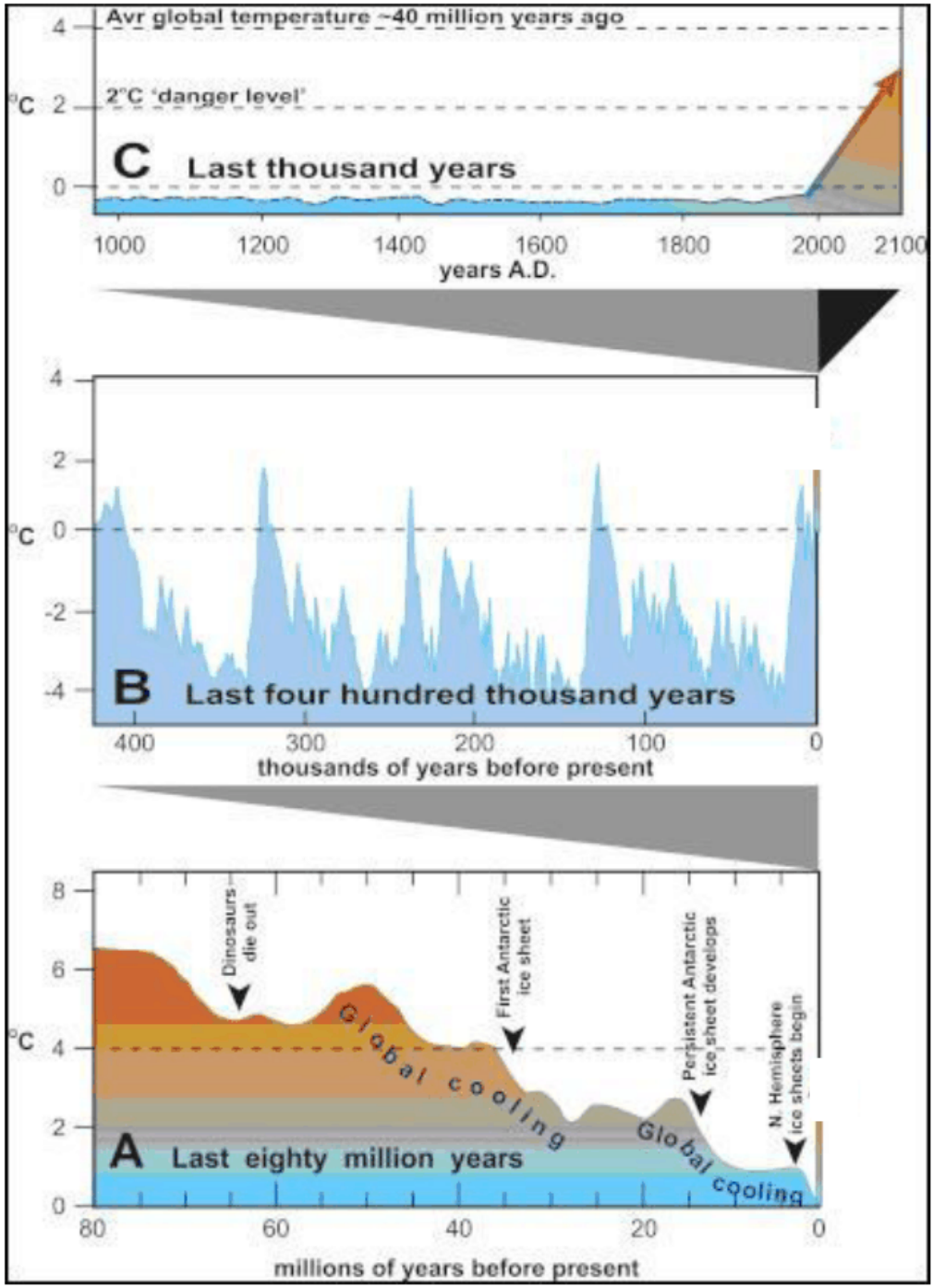
Change in average global temperature compared with today's average on three different time scales.

C. Temperature over the last 1000 year

B. Temperature over the last 400,000 years, based on oxygen isotope measurements from ice cores at Vostok Station, Antarctica. The measured range of temperature from glacial to interglacial in Antarctic ice cores is in fact 10°C, reflecting enhanced polar sensitivity to temperature change, but is scaled here to 5°C to correspond with the known temperature difference in average global temperature between glacial and interglacial climate.

A. Temperature over the last 80,000,0000 years.

Peter Barrett
Professor of Geology at Victoria University of Wellington and director of the Antarctic Research Centre.



Mid-Holocene 'Climatic Optimum'
28 November 2004 Real Climate

The best available evidence from recent peer-reviewed studies suggests that annual, global mean warmth was probably similar to pre-20th century warmth, but less than late 20th century warmth, at this time.

IPCC 2007

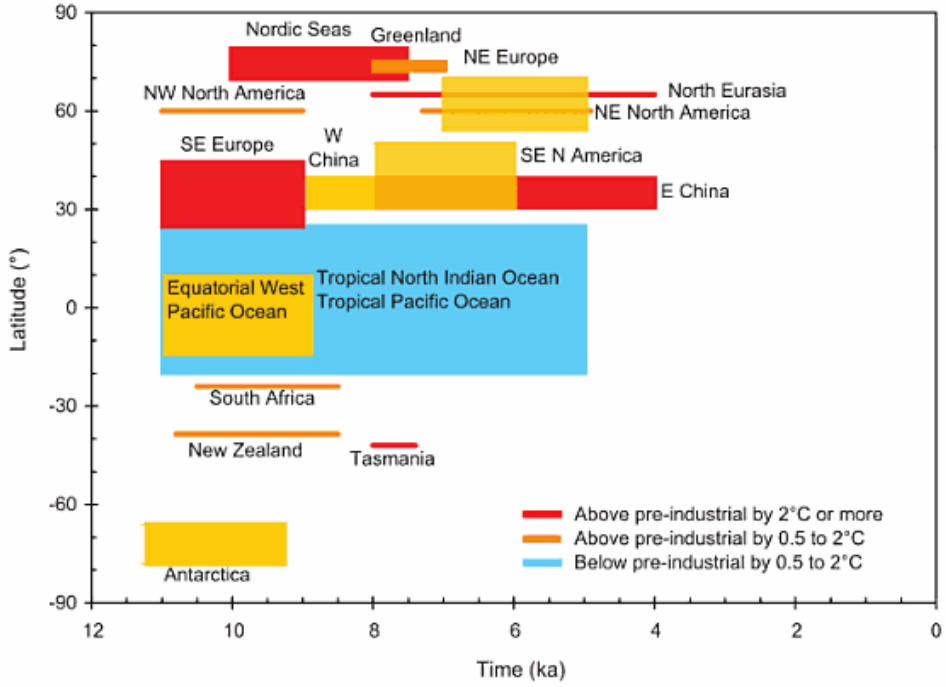
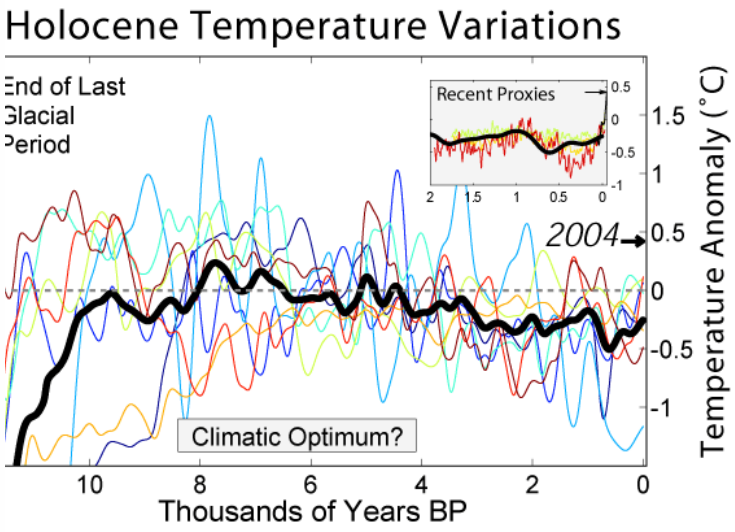
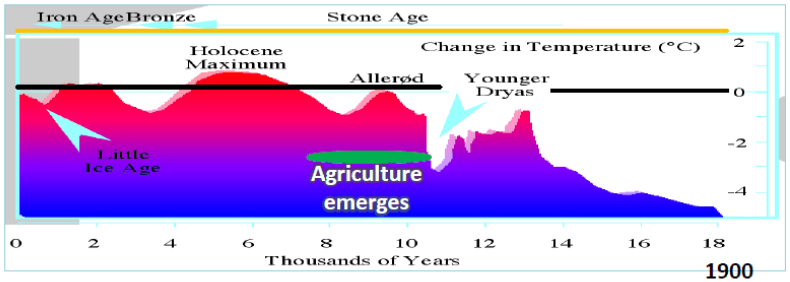


Figure 6.9. *Timing and intensity of maximum temperature deviation from pre-industrial levels, as a function of latitude (vertical axis) and time (horizontal axis, in thousands of years before present). Temperatures above pre-industrial levels by 0.5°C to 2°C appear in orange (above 2°C in red). Temperatures below pre-industrial levels by 0.5°C to 2°C appear in blue. References for data sets are: Barents Sea (Duplessy et al., 2001), Greenland (Johnsen et al., 2001), Europe (Davis et al., 2003), northwest and northeast America (MacDonald et al., 2000; Kaufman et al., 2004), China (He et al., 2004), tropical oceans (Rimbu et al., 2004; Stott et al., 2004; Lorentz et al., 2006), north Atlantic (Marchal et al., 2002; Kim et al., 2004), Tasmania (Xia et al., 2001), East Antarctica (Masson et al., 2000), southern Africa (Holmgren et al., 2003) and New Zealand (Williams et al., 2004).*



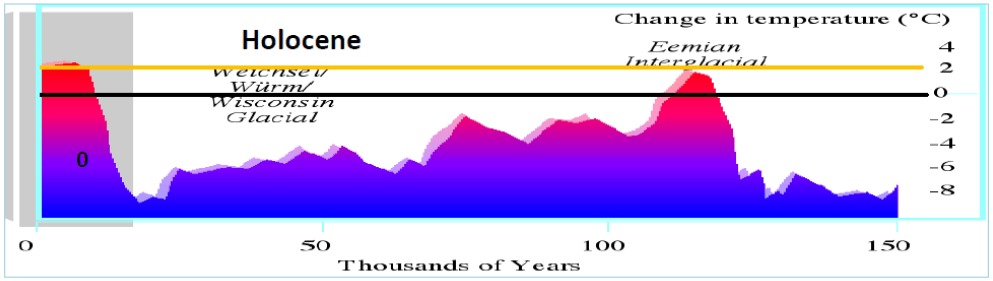


18,000 years

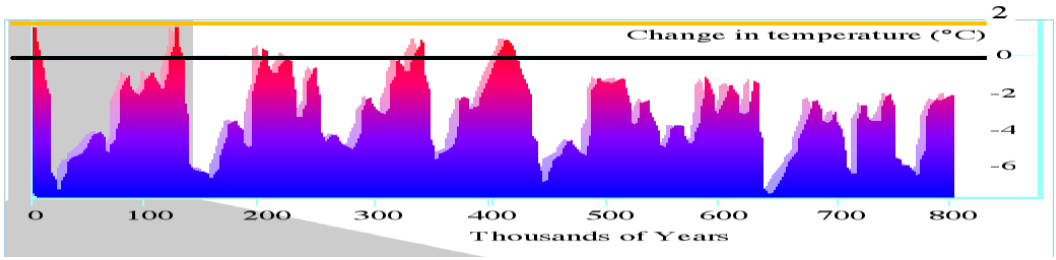
2°C

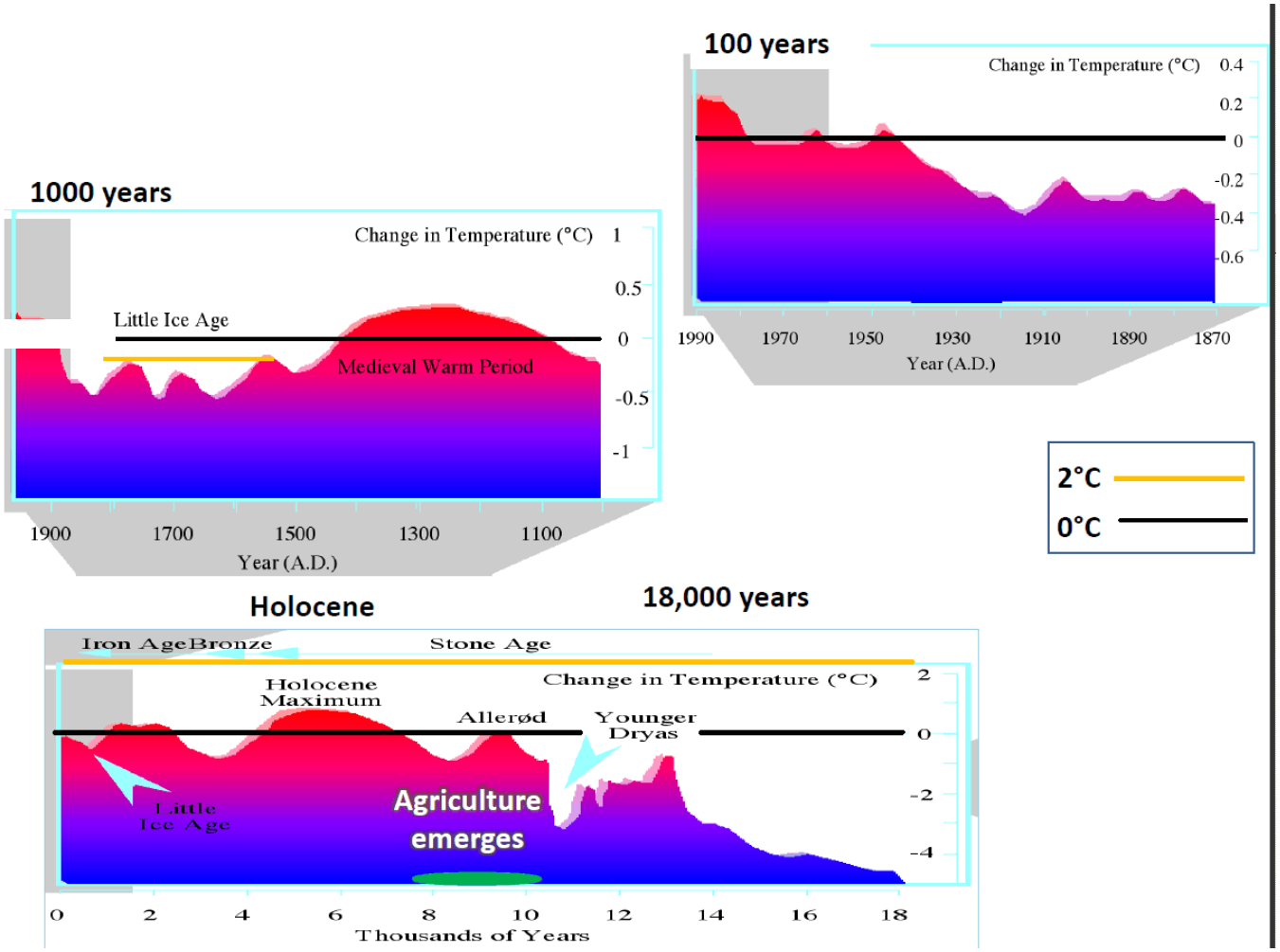
0°C

150,000 years

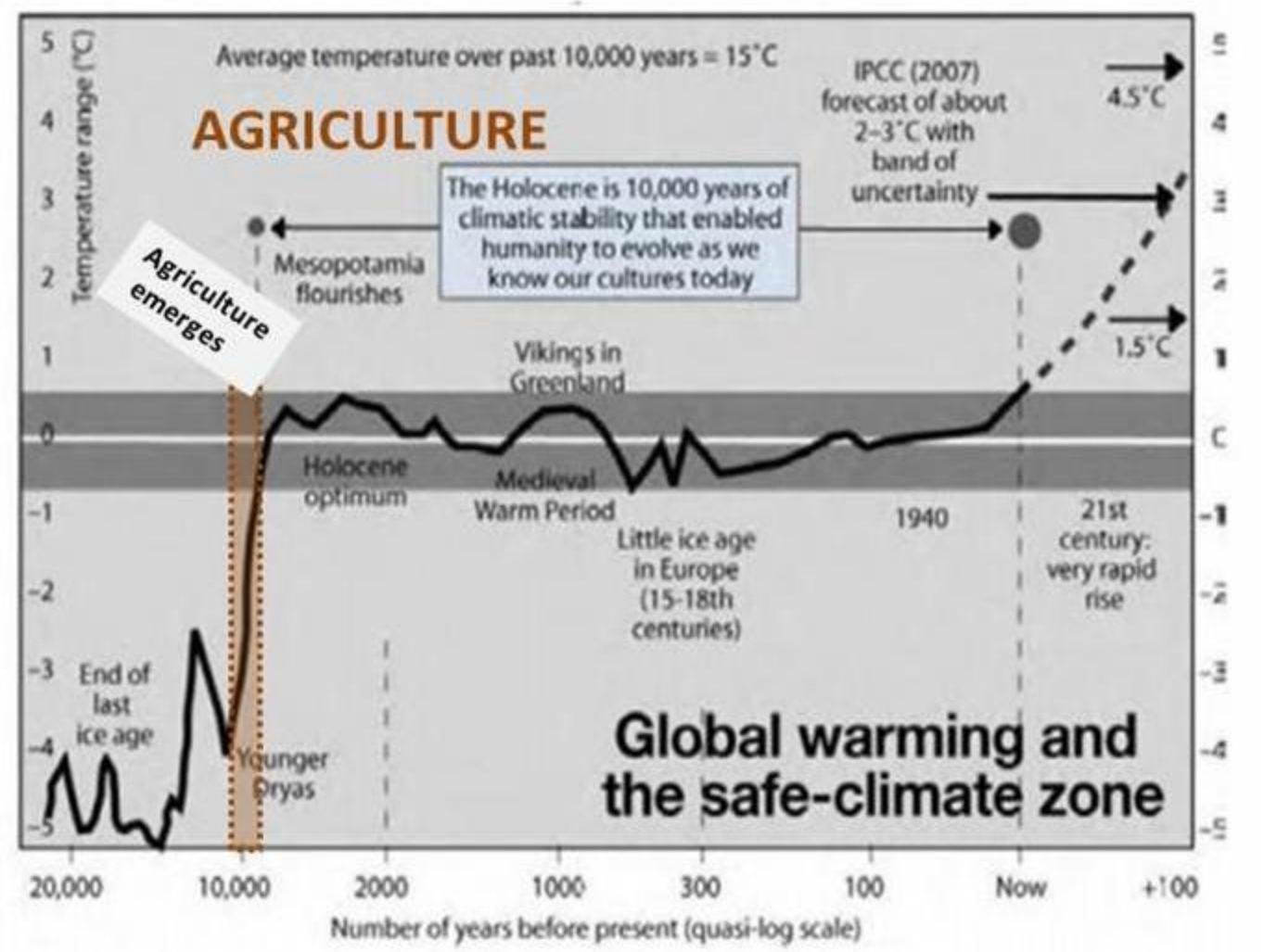


800,000 years




100 years
Change in Temperature (°C)
0.4
0.2
0
-0.2
-0.4
-0.6
1990
1970
1950
1930
1910
1890
1870
Year (A.D.)
1000 years
Change in Temperature (°C)
1
0.5
0
-0.5
-1
Little Ice Age
Medieval Warm Period
1900
1700
1500
1300
1100
Year (A.D.)
2°C
0°C
Holocene
18,000 years
Iron AgeBronze
Stone Age
Holocene Maximum
Change in Temperature (°C)
2
0
-2
-4
Allerød
Younger Dryas
Little Ice Age
Agriculture emerges
0
2
4
6
8
10
12
14
16
18
Thousands of Years

Global warming and the food security safe climate zone: -0.5°C to +0.5°C



Global warming and the safe-climate zone

- based on a slide by Robert Corell, Director of the Global Change Programs at the Heinz Center – from (Carbon Equity & Melbourne Climate Action Centre 2009, p2)

Agricultural Time line

Agriculture developed in a climate coming out of an ice age. It has been sustained by the unusual stable climate of the Holocene.

Global climate change is climate instability and weather extremes, which if ignored is bound to end the agricultural era.

800,000 year Ice Core

Positive climate feedbacks drives the post glacial temperature increase

The 800,000 year old ice core record shows a total temperature variation from ice age low to warm period high of about 10° C and it takes about 20,000 years .

A huge amount of warming would have been taken up by melting the planetary ice .
Today we are aiming for a 6° C temperature rise in 200 years and as starting in a warm period.

A very interesting discovery has been made from the ice cores.
Most of the temperature increase comes from climate feedbacks. The warming that takes the planet out of an ice age is a very small amount of warming from variation in the planet's orbit around the sun.

It is enough to cause the release of carbon as carbon dioxide and methane (from the planet) which causes the temperature increase and also to melt planetary ice sheets - also causing global temperature increase.

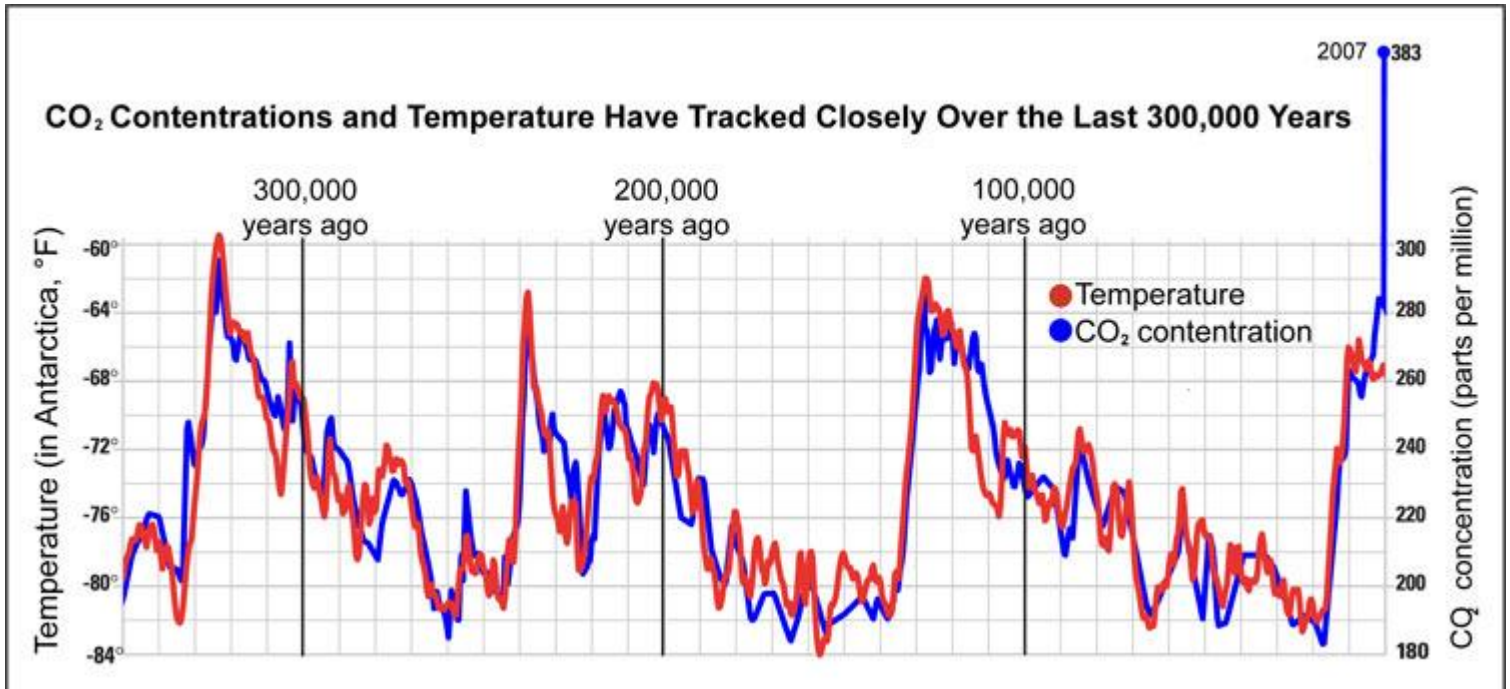
Our industrial emissions have already triggered these climate feedbacks - from a warm period ! (not from an ice age low) .

The IPCC does not include any of the feedbacks that drive the ice core temperature increases - carbon feedbacks and albedo loss feedback (ice melting.
While industrial emissions are changing the climate for 1000s of years, the IPCC projections are calculated to 2100.

Atmospheric CO2 increase lags (follows) temperature increase.

The Intergovernmental Panel on Climate Change (IPCC) states that there is greater than a 90 percent probability that CO_2 variations strongly amplified climate but did not trigger the end of glacial periods. For example, the IPCC states that Antarctic temperature started to rise several centuries before atmospheric CO_2 during past glacial terminations.

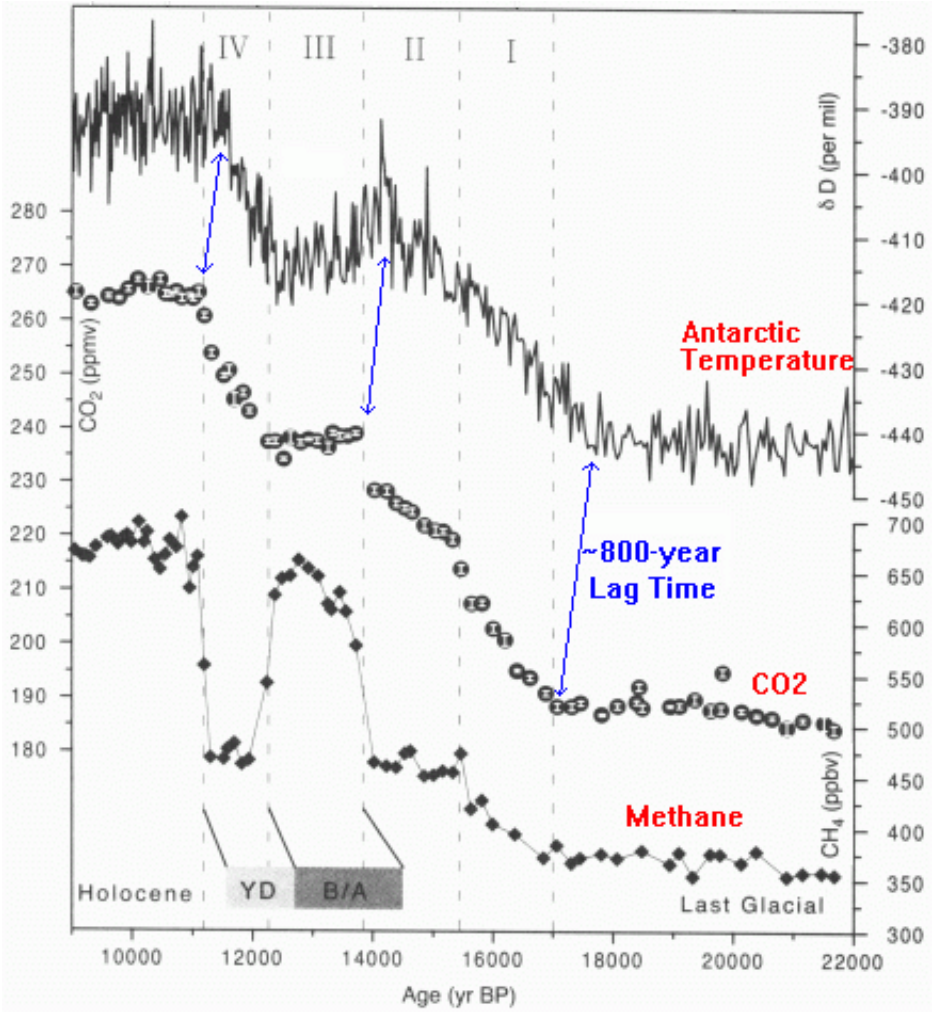
Measurements of atmospheric gases trapped in ice cores indicate that in the past 700,000 years, CO_2varied within a range of 180 to 300 parts per million (ppm) and concentrations of methane varied within 320 to 790 parts per billion (ppb) over this period



The sequence of events suggests that **the CO2 increase lagged Antarctic deglacial warming by 800 years.**

The most likely source of the CO2 increase is ocean out gassing.

Timing of Atmospheric CO2 and Antarctic temperature Changes across Termination III
Nicolas Caillon et al.



The start of the methane response typically lags the start of the temperature rise by less than 30–70 years

(Severinghaus et al. 1998; Fluckiger et al. 2004).

The increase in CH4 is completed in typically about a century.

Most analyses of the ice core data have tended to assume that changes in wetland emissions are responsible, with much of the discussion concentrating on apportioning those changes between the tropical and northern wetlands (e.g. Chappellaz et al. 1993a,b; Brook et al. 1996).

However, changes in the concentrations of sinks may also be important and the possible influence of other sources (marine hydrates, biomass burning and vegetation) must also be considered.

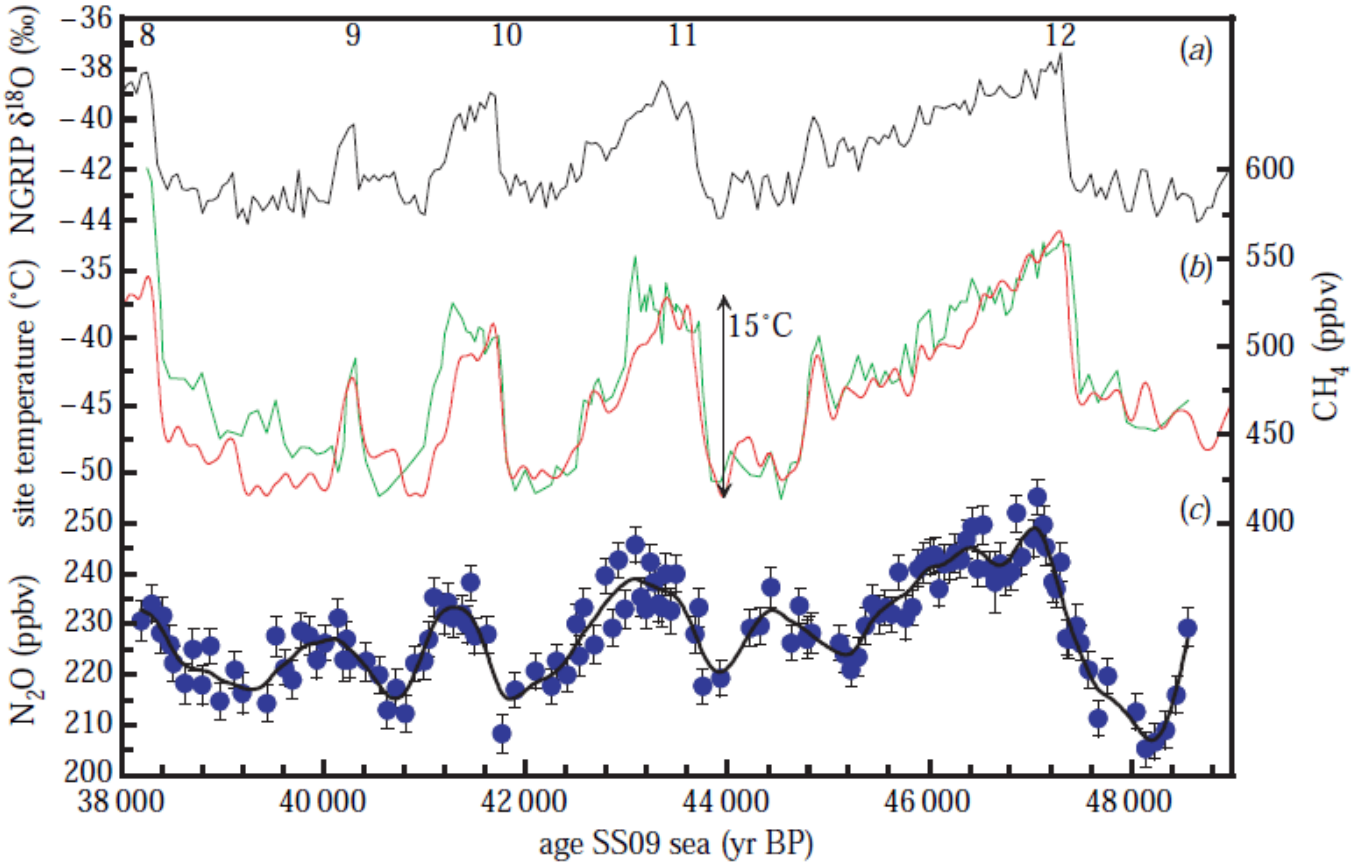
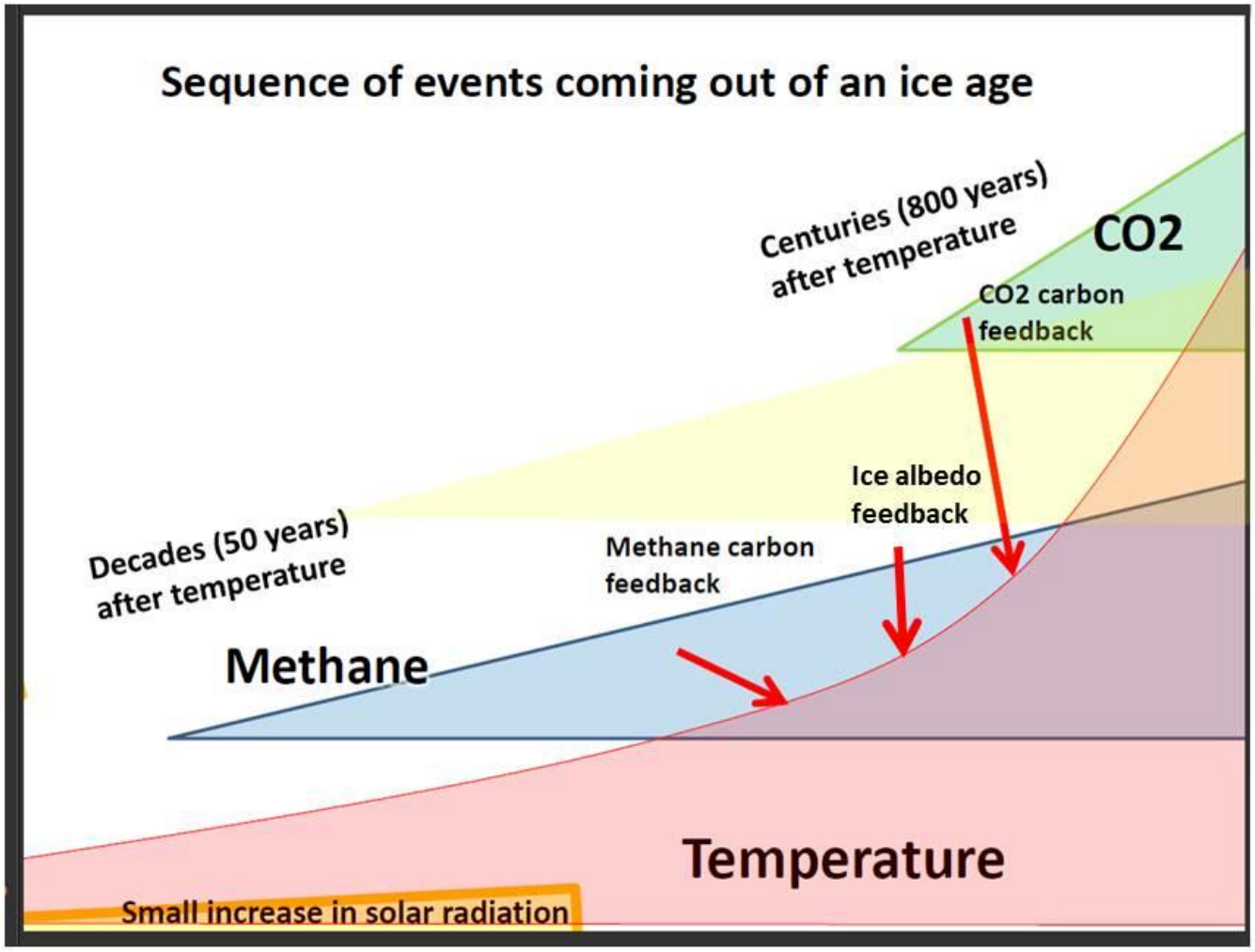


Figure 4. Oxygen isotope (North Greenland Ice Core Project Members 2004), temperature (red; Huber *et al.* 2006), CH_4 (green) and N_2O (Flückiger *et al.* 2004) data from NorthGRIP, Greenland over the period of 38–49 kyr BP on the SS09_sea time-scale (Johnsen *et al.* 2001). The period from D–O event 12 to 8 is shown (numbers at top of figure). The temperature curve was reconstructed using measurements of $\delta^{15}N_2$ and firn air modelling (Huber *et al.* 2006).


Sequence of events coming out of an ice age
Centuries (800 years) after temperature
CO2
CO2 carbon feedback
Ice albedo feedback
Decades (50 years) after temperature
Methane carbon feedback
Methane
Temperature
Small increase in solar radiation

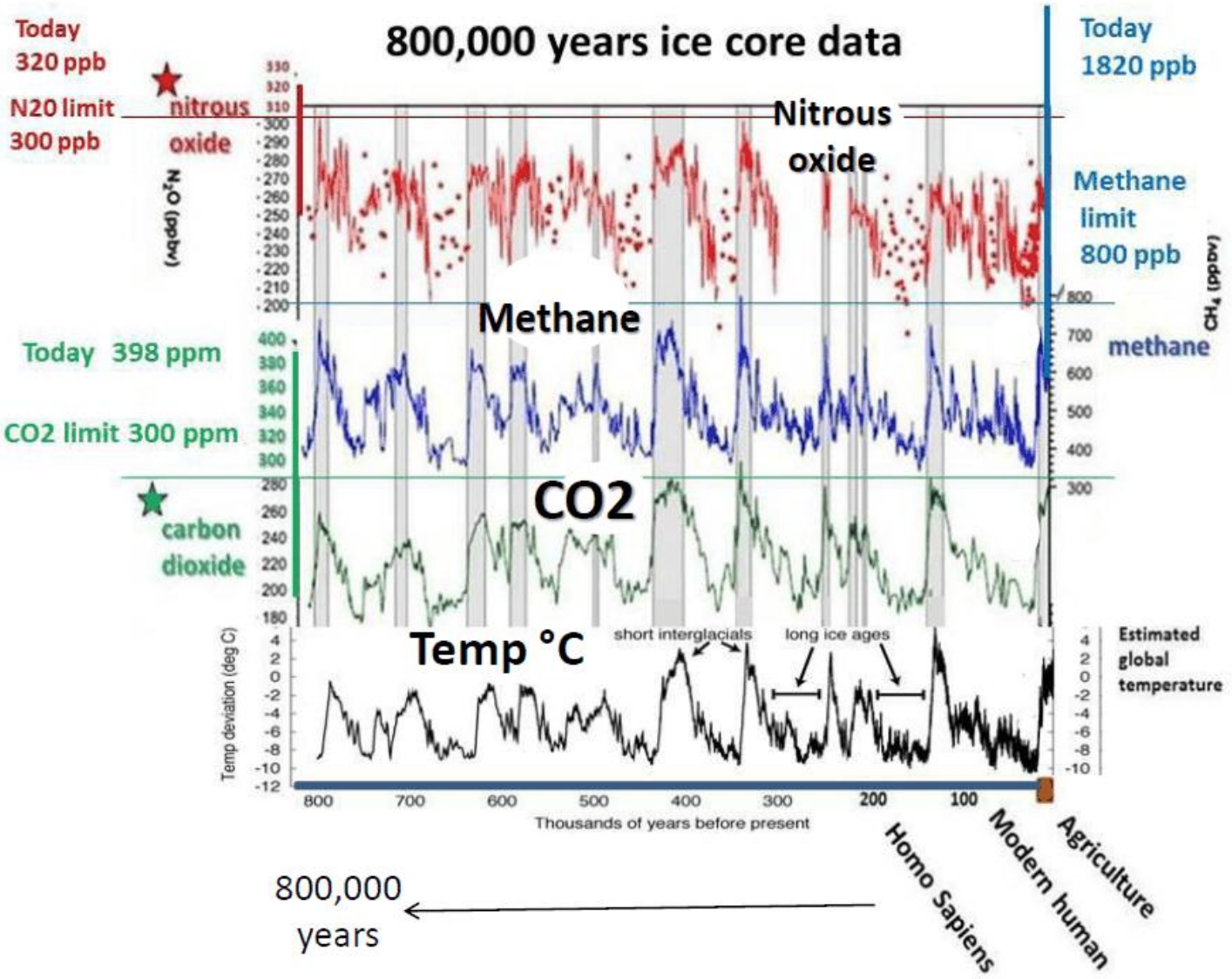
Methane carbon feedback emission is very sensitive to global warming and exerts a very powerful feedback temperature amplification.

It is primarily methane feedback (to a small triggering increase in solar radiation) that drives the ice age climate into an interglacial warm period.

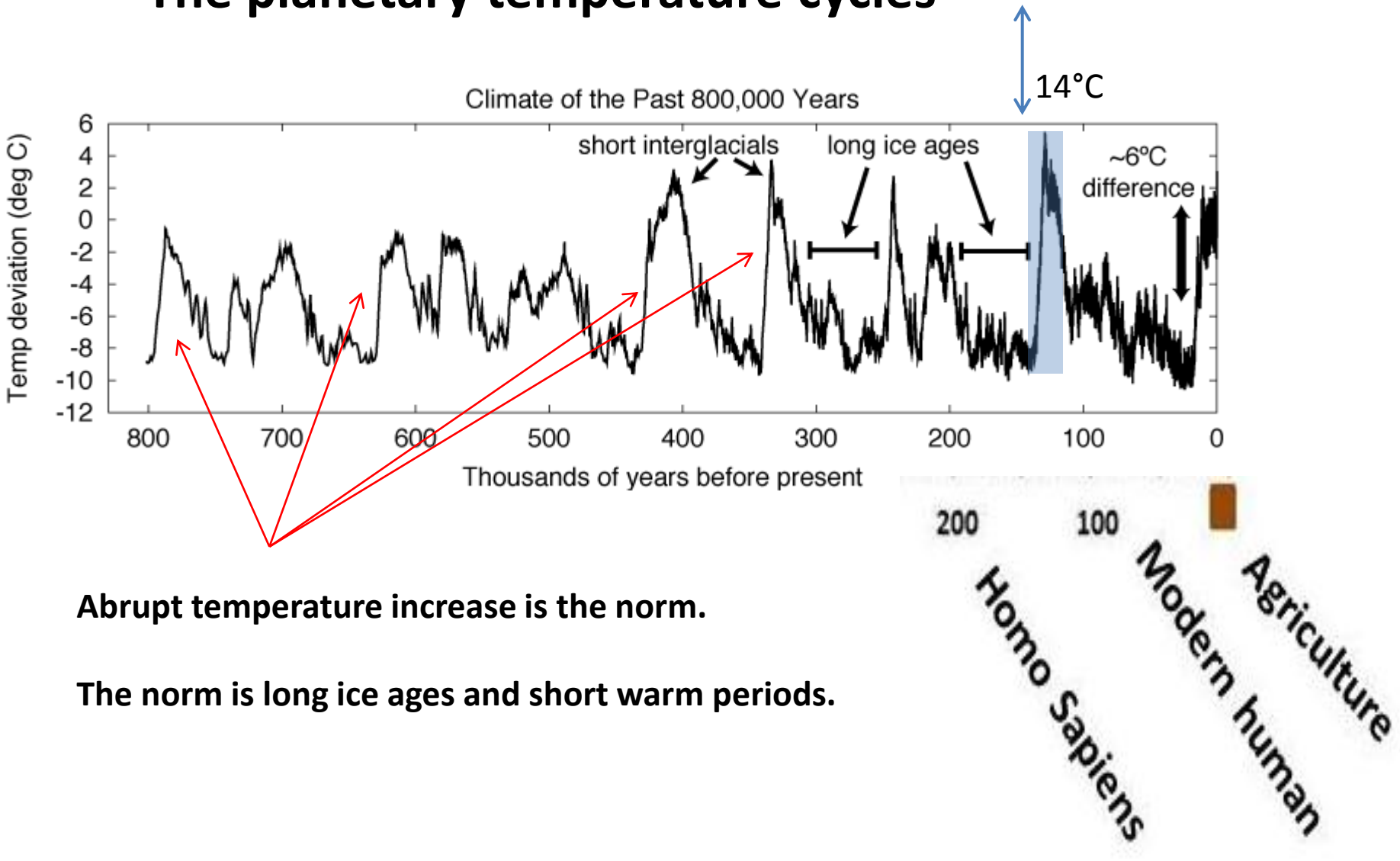
Methane is being practically ignored in global climate change assessment and in climate change policy consideration, the focus being carbon dioxide.

The rate of global temperature increase is ten times higher than the ice core record and the rate of increase of atmospheric GHG concentrations are many thousands (10,000) of times higher. This is bound to lead to catastrophic feedbacks very soon.

GHG concentrations today and their limit for 80,000 years



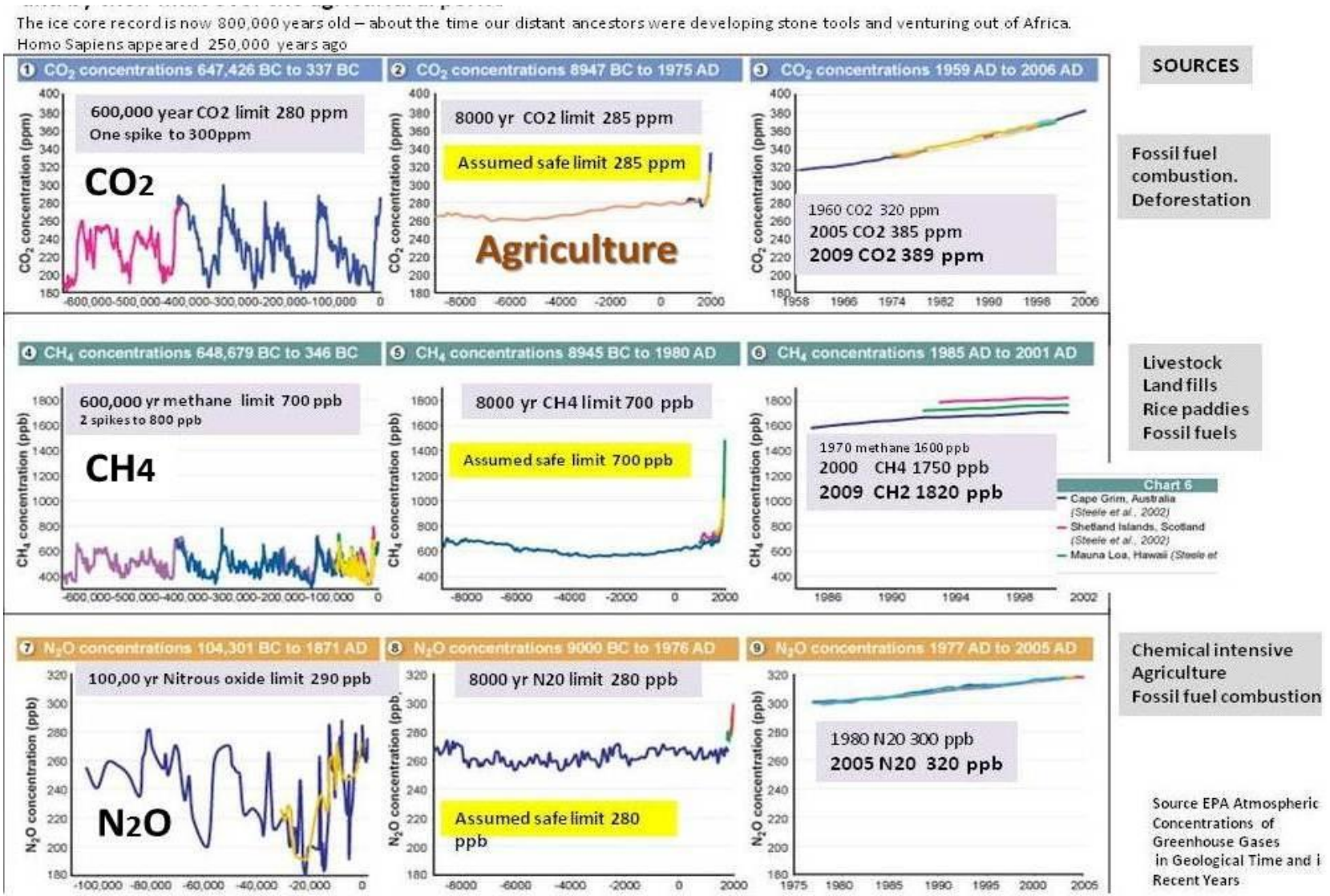
The planetary temperature cycles



Abrupt temperature increase is the norm.

The norm is long ice ages and short warm periods.

Assessing dangerous climate interference (GHG concentration) by climate safety for agriculture . Agriculture was invented with the climate coming out of a cold period 10,000 ago.



Abrupt global temperature increase–10°C in 10 years
1°C a year !

Another interesting discovery from the ice cores is just how one dropped abrupt global climate change can be .

Just11,500 years ago the planet warmed an astonishing 10C in 10 years – 1C every year!

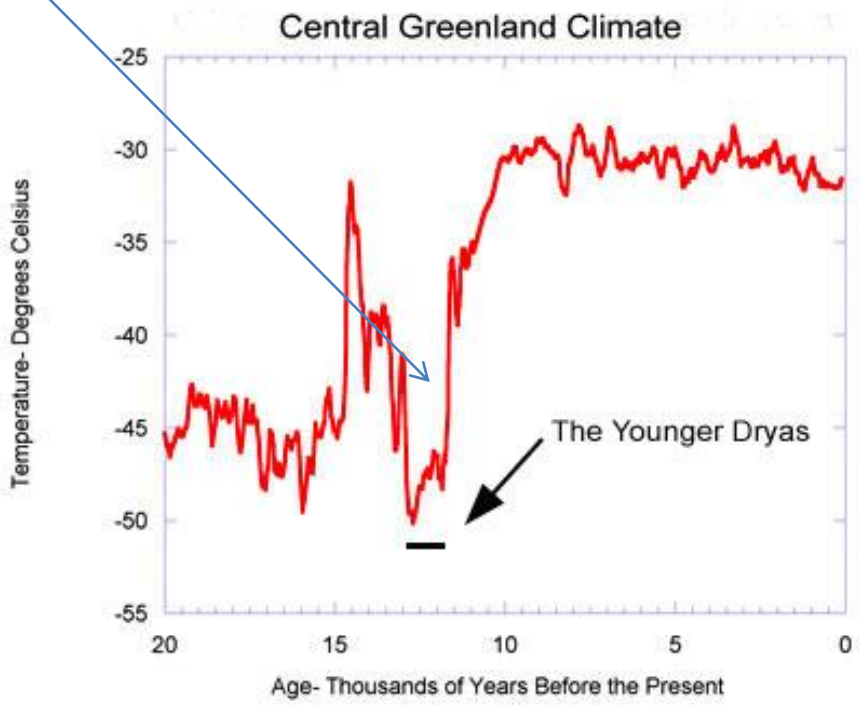
Around 15,000 years ago, the Earth started warming abruptly after about 100,000 years of an "ice age. The large ice sheets, which covered significant parts of North America and Europe, began melting as a result with the temperature stabilizing around 14,700 before present.

However, starting at about 12,800 BP, the Earth returned very quickly into near glacial conditions, and stayed there for about 1,200 years: this is known as the Younger Dryas (YD), since it is the most recent interval where a plant characteristic of cold climates, *Dryas Octopetala*, was found in Scandinavia.

The most spectacular aspect of the YD is that it ended extremely abruptly around 11,600 years ago. It is estimated from the annually-banded Greenland ice-core that the annual-mean temperature increased by as much as 10°C in 10 years. That's an 18°F warming in ten years.

During the past 110,000 years, there have been at least 20 such abrupt climate changes. . Only one period of stable climate has existed during the past 110,000 years--the 11,000 years of modern climate (the "Holocene" era). "Normal" climate for Earth is the climate of sudden extreme jumps--like a light switch flicking on and off.

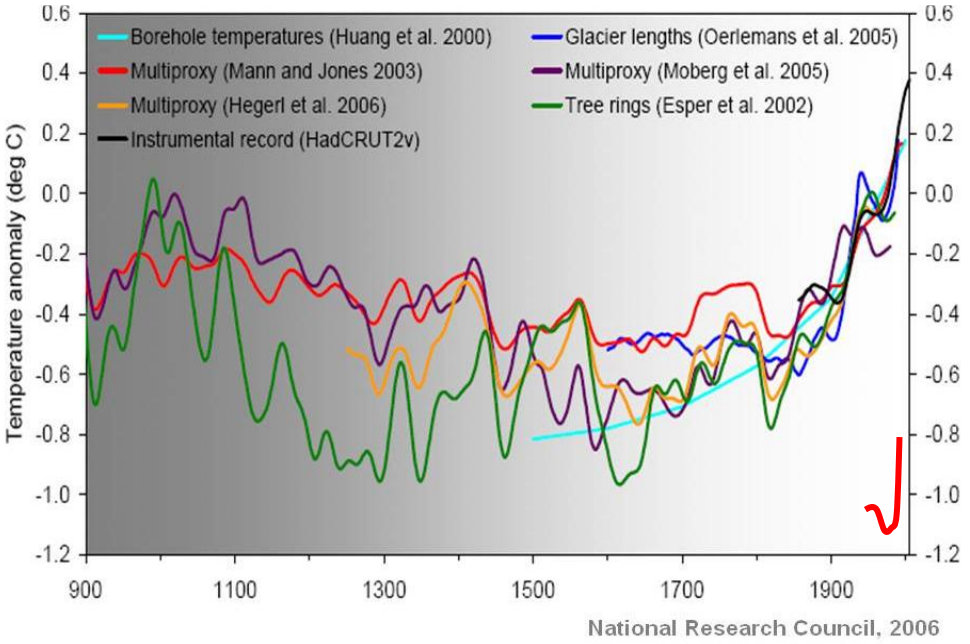
The historical records shows us that abrupt clima nt warm, stable climate is a rare anomaly.



Abrupt global temperature increase and climate change - 1°C a year

Climate computer models results do not fit with the ice core record (the real model), because they do not include the large climate feedbacks of ice melting albedo loss , and large carbon feedbacks.

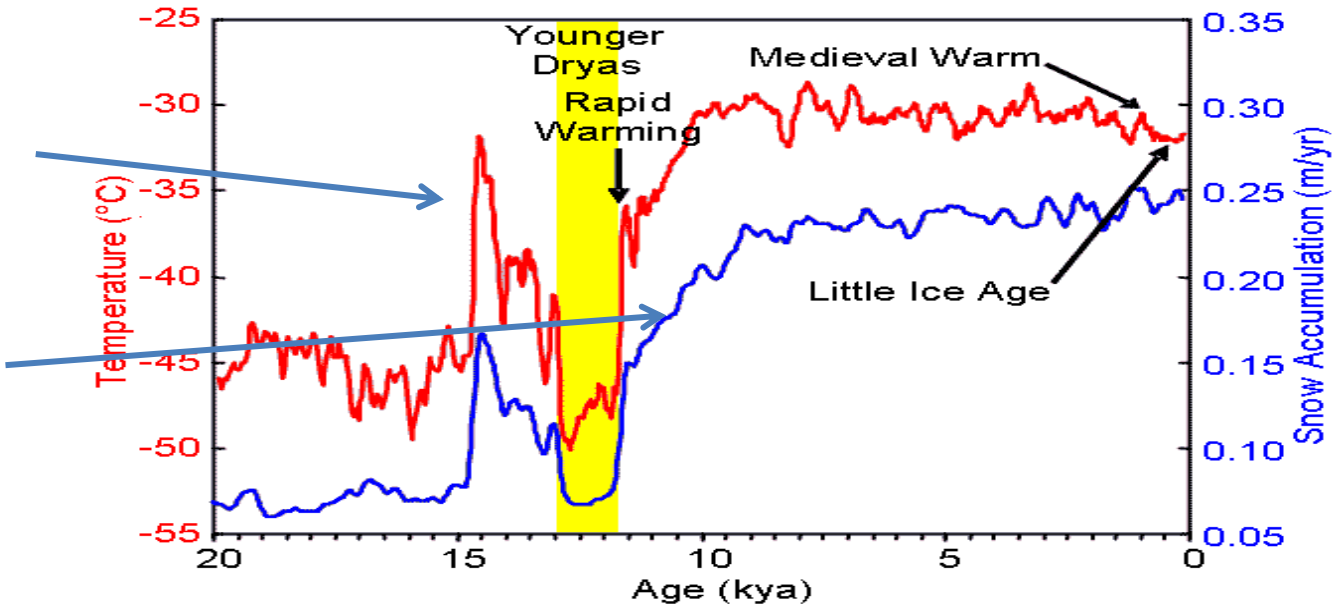
They tell us the planet will warm with GHG emissions but not how fast or how much.



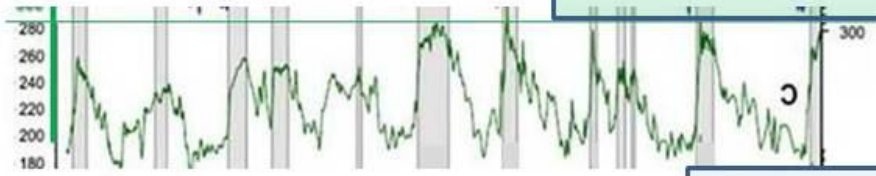
Today's comparative rate of GHG emissions driven warming

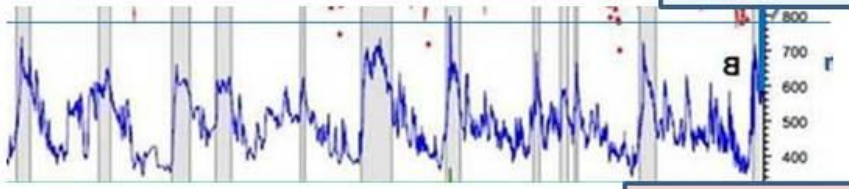
Abrupt
15°C
250 years

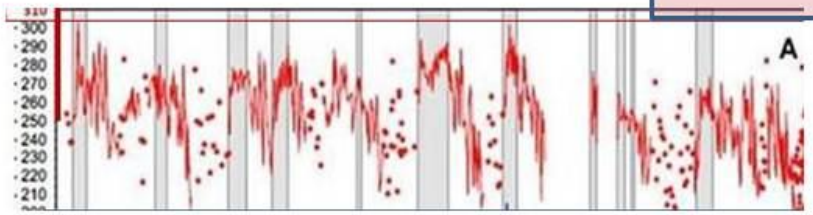
Super abrupt
10°C
10 years



	800,000 yr. range	Post industrial increase
Global temperature	14°C	= ?
Carbon dioxide	120 ppm	+ 98 ppm
Methane	420 ppb	+ 1020 ppb
Nitrous oxide	120 ppb	+ 20 ppb

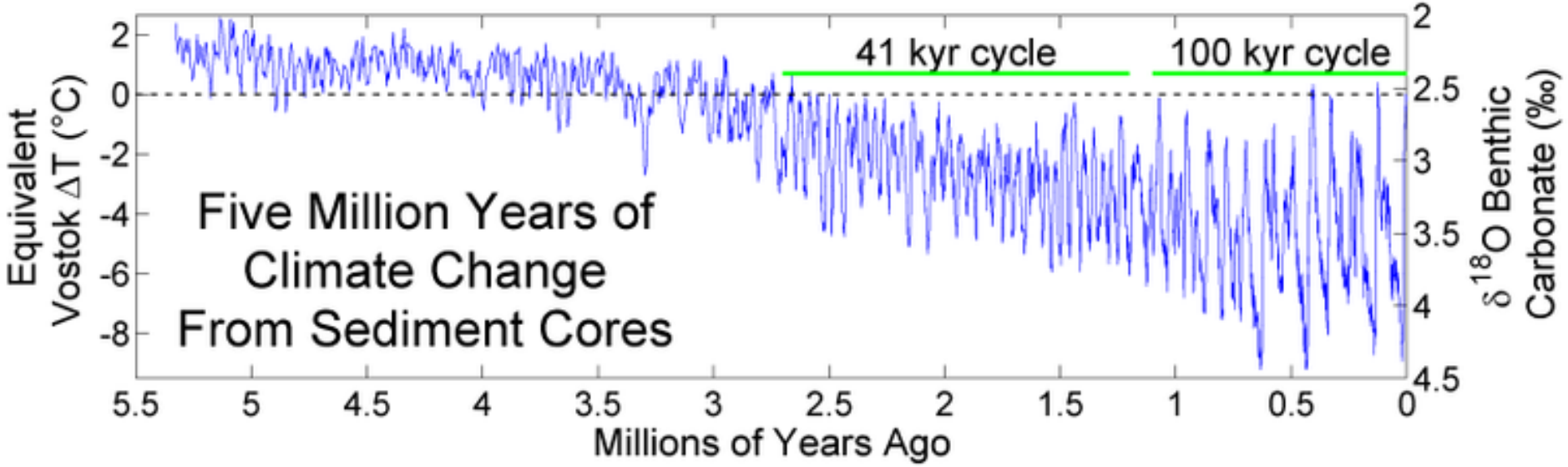






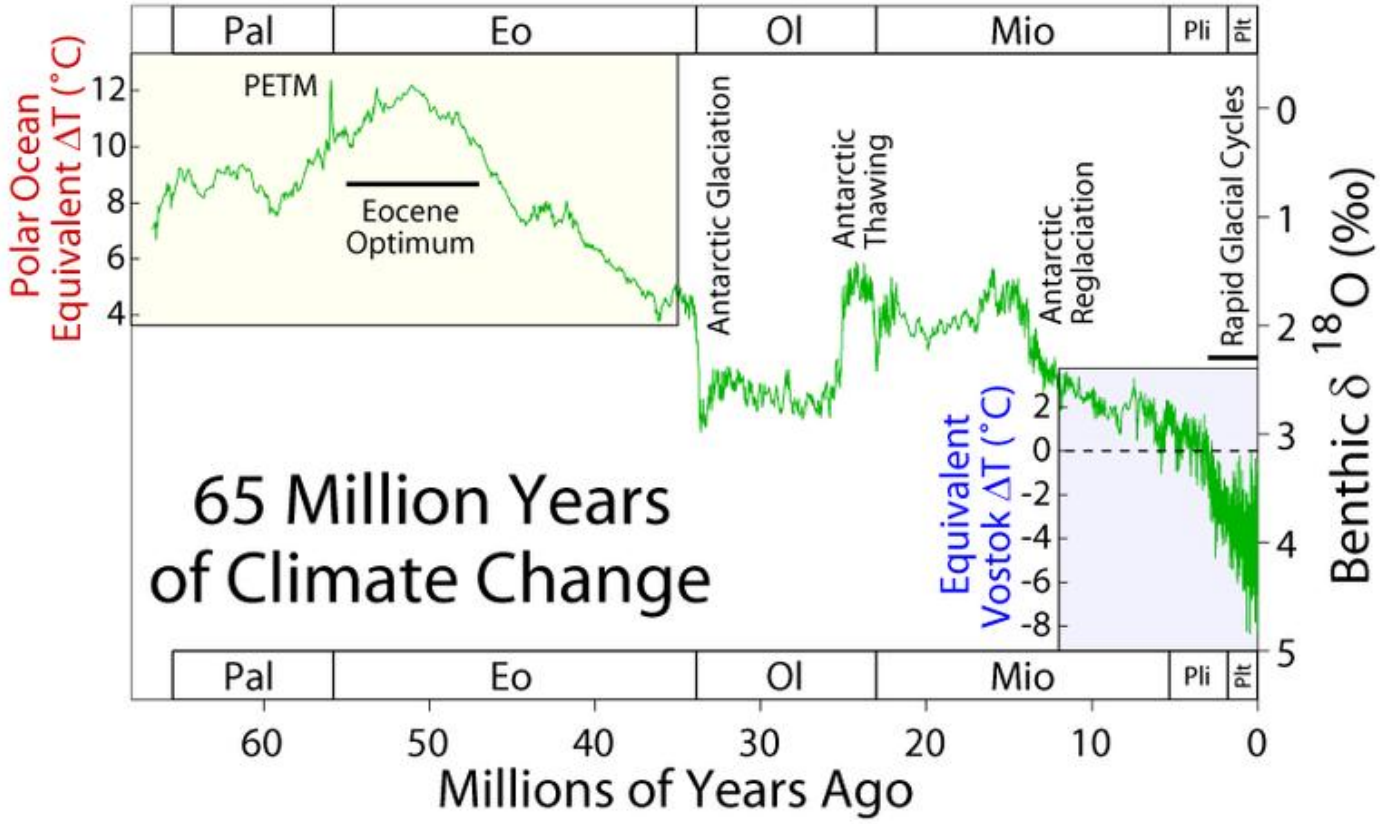
5 Million Years

The last 5 million years of climate history shows the planet settling in to our current 100k year cycles.

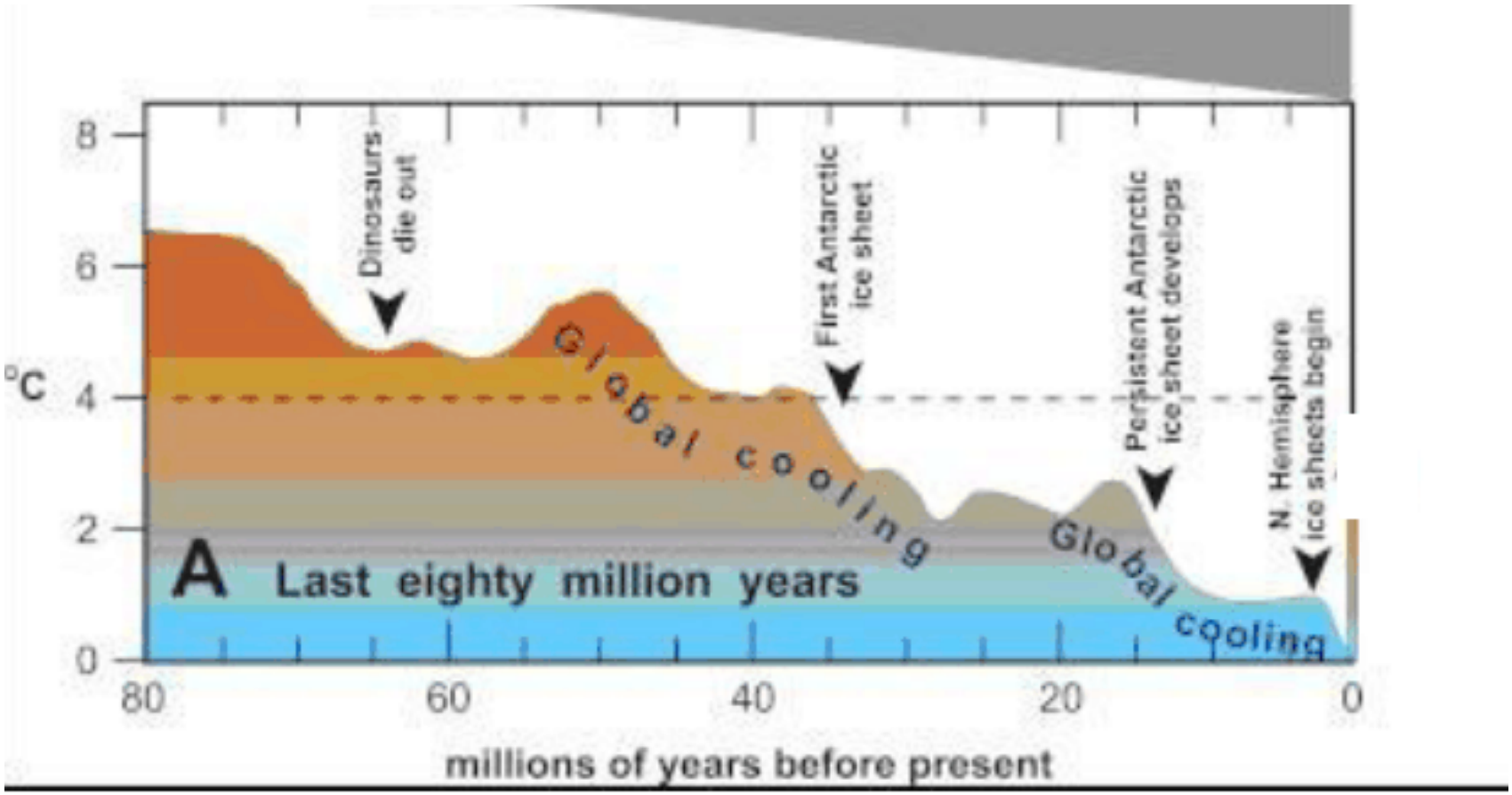


65 Million Years

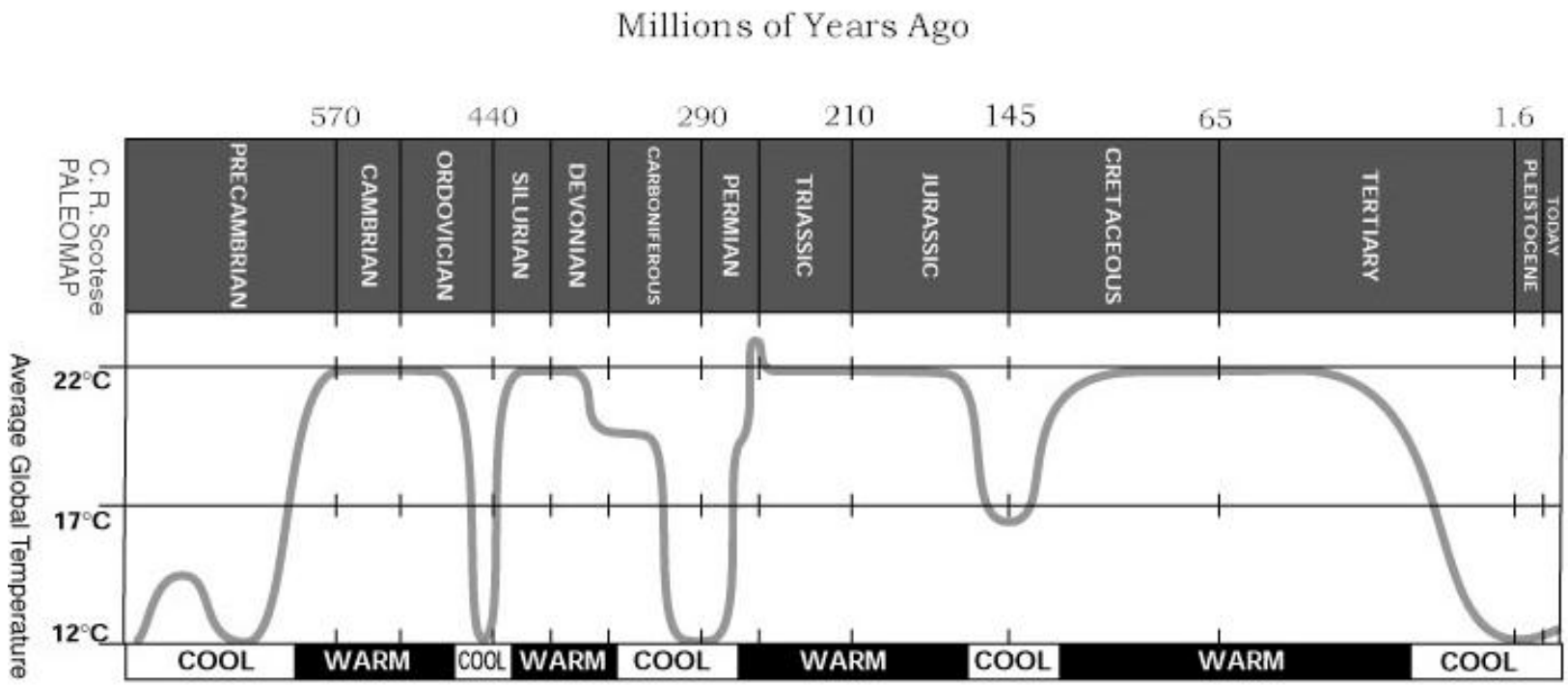
The image below shows the climate was much warmer prior to 7 million years ago. Here we can see the Eocine optimum and the PETM event, which may have involved a massive methane hydrate release.



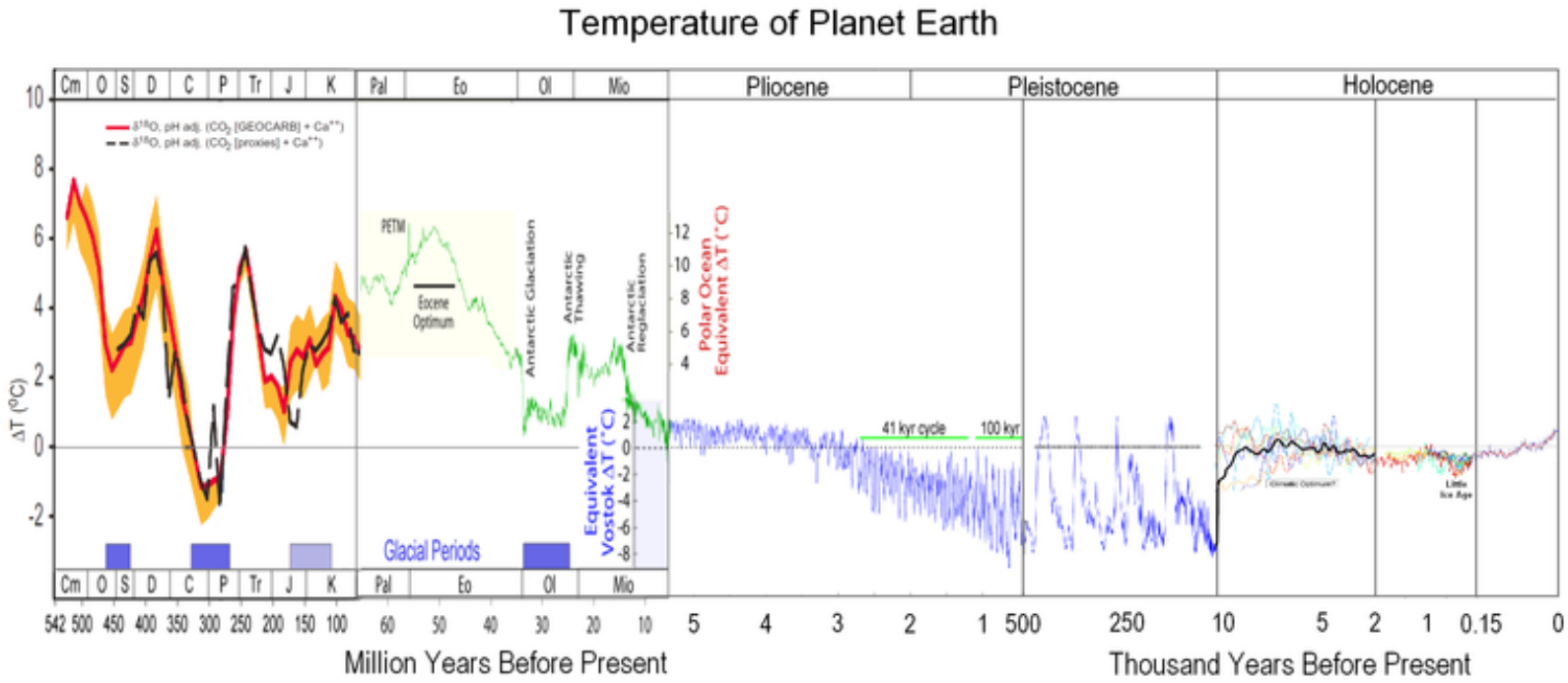
80 million years



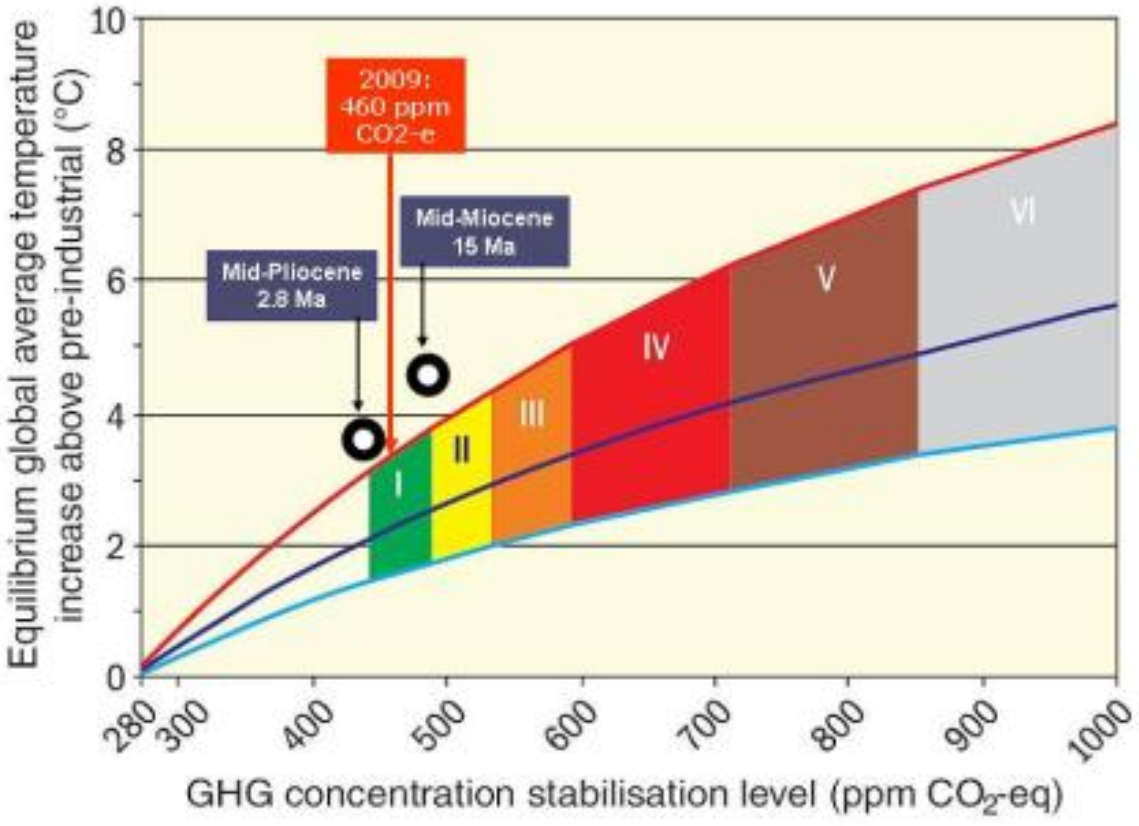
500 million years



542 Million Years



The relations between atmospheric CO2-equivalent (including the radiative forcing of methane) and mean global temperature, according to Charney's climate sensitivity parameter (Hansen et al., 2007, 2008) (IPCC-2007). Circles mark new paleoclimate estimates of atmospheric conditions in the mid-Pliocene (2.8 million years ago) and the mid-Miocene (15 million years ago), with implications to current climate trajectories.



The world is presently in the most dire emergency situation.

The real whole Earth model tells us atmospheric global warming GHG concentrations have been allowed to increase to catastrophic levels .

The 12°C global temperature excursion of the ice core record is driven by positive climate feedbacks , all of which are now triggered by industrial global warming.

None of these feedbacks are included in the calculation for climate sensitivity nor in the climate change impacts assessments of the scientists.

GHG concentrations today are at least double their over all concentrations that have led to planetary heating episodes of over 10°C during the last 800,000 years – from an ice age low.

Today the climate system feedbacks are being triggered faster than never before from a warming high !!

This 10°C (or more) from feedbacks could happen abruptly at the rate of 1°C a year any time now.

The ice cores tell us we are now risking a runaway greenhouse effect.

Climate sensitivity is double today's assumption. We are beaded for a 16°C warming
Earth's hot past could be prologue to future climate
www2.ucar.edu/.../earth-s-hot-past-could-be-prologue-future-climate
January 13, 2011

BOULDER—The magnitude of climate change during Earth's deep past suggests that future temperatures may eventually rise far more than projected if society continues its pace of emitting greenhouse gases, a new analysis concludes. The study, by National Center for Atmospheric Research (NCAR) scientist Jeffrey Kiehl, will appear as a "Perspectives" piece in this week's issue of the journal Science.

Building on recent research, the study examines the relationship between global temperatures and high levels of carbon dioxide in the atmosphere tens of millions of years ago. It warns that, if carbon dioxide emissions continue at their current rate through the end of this century, atmospheric concentrations of the greenhouse gas will reach levels that last existed about 30 million to 100 million years ago, when global temperatures averaged about 29 degrees Fahrenheit (16 degrees Celsius) above pre-industrial levels.

Kiehl said that global temperatures may gradually rise over the next several centuries or millennia in response to the carbon dioxide. Elevated levels of the greenhouse gas may remain in the atmosphere for tens of thousands of years, according to recent computer model studies of geochemical processes that the study cites.

The study also indicates that the planet's climate system, over long periods of times, may be at least twice as sensitive to carbon dioxide than currently projected by computer models, which have generally focused on shorter-term warming trends. This is largely because even sophisticated computer models have not yet been able to incorporate critical processes, such as the loss of ice sheets, that take place over centuries or millennia and amplify the initial warming effects of carbon dioxide.

"If we don't start seriously working toward a reduction of carbon emissions, we are putting our planet on a trajectory that the human species has never experienced," says Kiehl, a climate scientist who specializes in studying global climate in Earth's geologic past. "We will have committed human civilization to living in a different world for multiple generations."

The Perspectives article pulls together several recent studies that look at various aspects of the climate system, while adding a mathematical approach by Kiehl to estimate average global temperatures in the distant past. Its analysis of the climate system's response to elevated levels of carbon dioxide is supported by previous studies that Kiehl cites. The work was funded by the National Science Foundation, NCAR's sponsor.

Learning from