What is the truth about climate change?

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The course as planned!

1 Today
Is the climate actually changing and are we the cause?

2. Wednesday 30th January
What impacts are anticipated and roughly when?

3. Wednesday 13th February
What can WE do about it?

4. Wednesday 27th February
What about National/International level action?

Lecture 1

Is the climate actually changing and what evidence suggests we humans are the cause?

Bealings Village Hall

16 January 2008

Our beautiful, unique and fragile HOME.

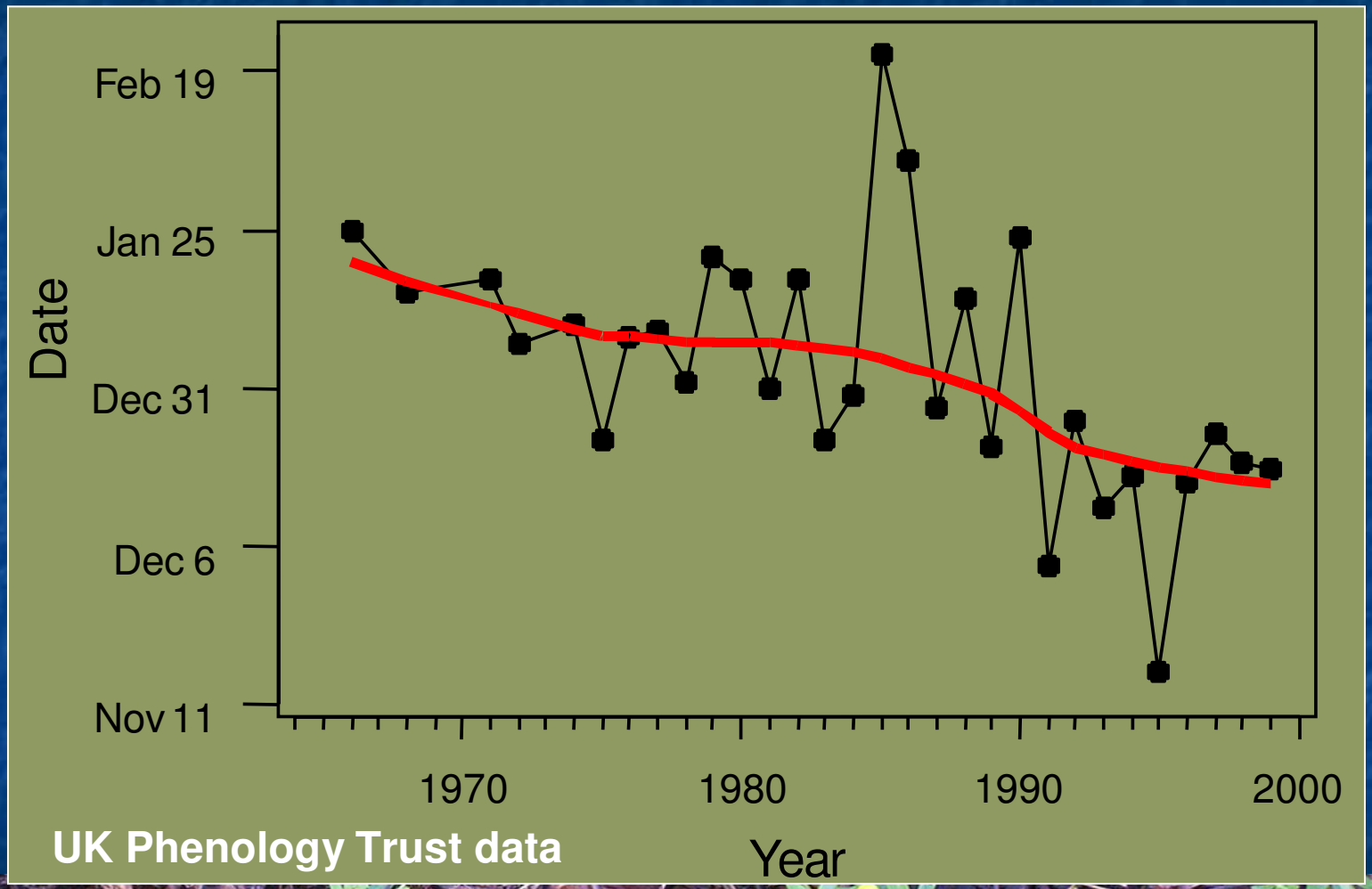
It is all we have!

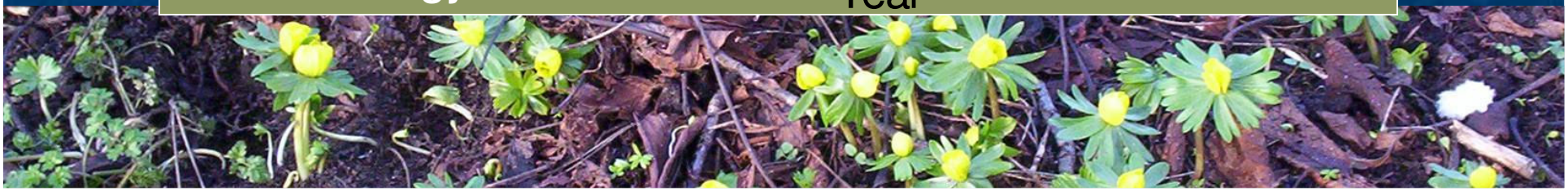
In what state will we leave it for our Grandchildren?

What on earth will 2050 bring?

Source :- John Rutherford - U3A-ES-EE&U

Aconite 1st flowering - Norwich



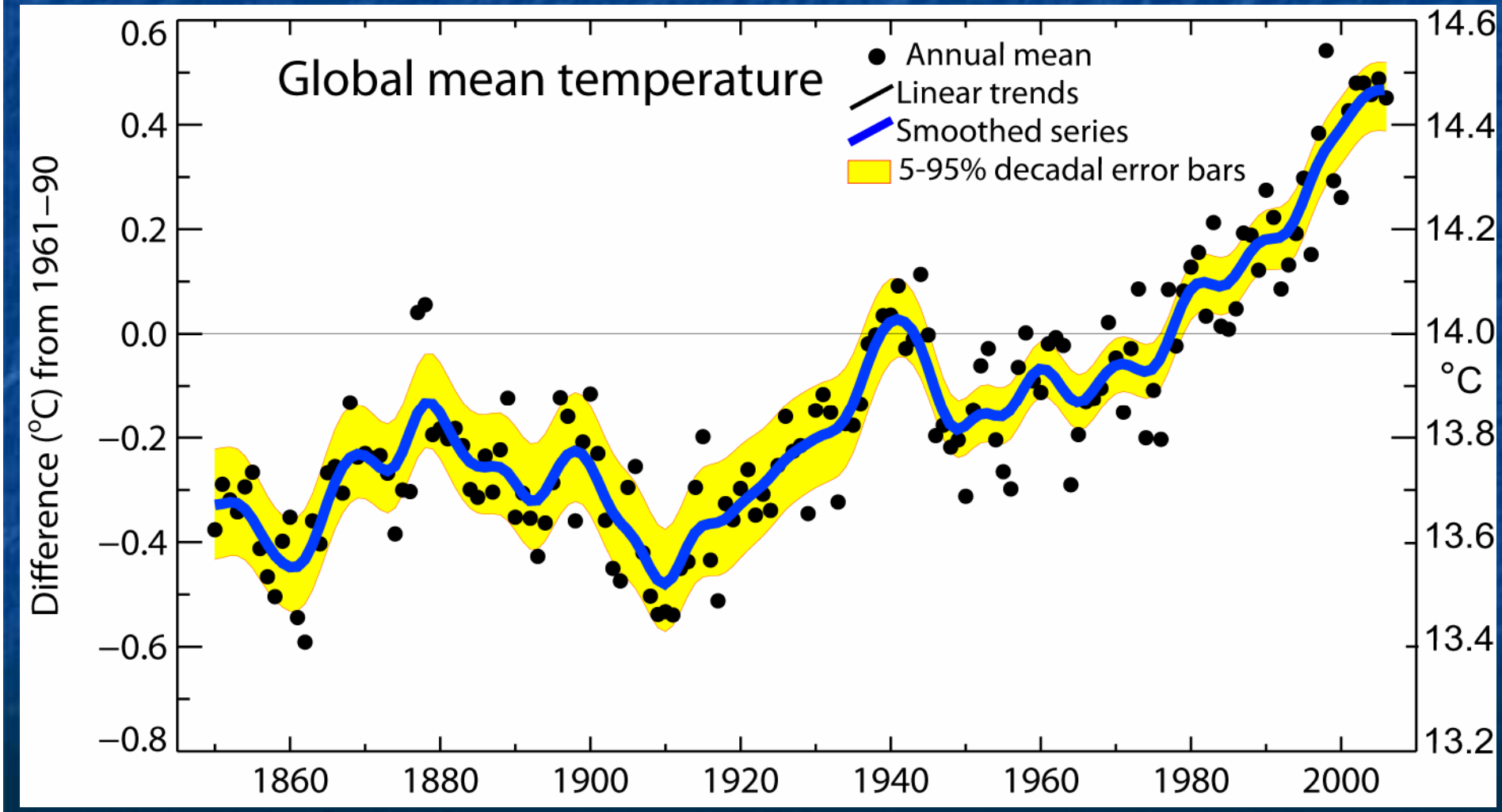


Hottest years on record, ranked by temperature!

But this is not evidence of future climate change?

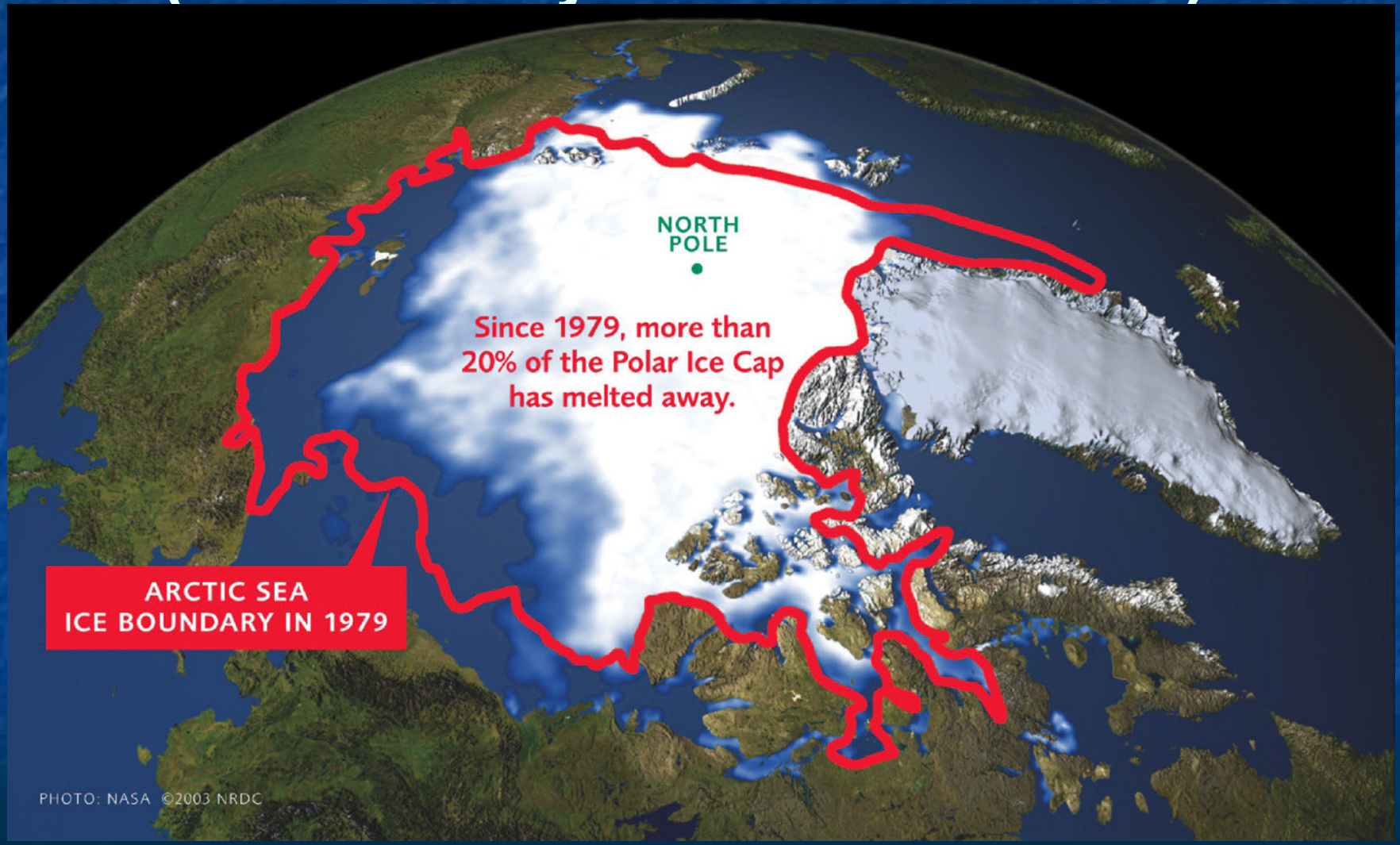
Rank	Year
1	2006
2	2005
3	1998
4	2002
5	2003
6	2004
7	2001
8	1997
9	1990
10	1995
11	1999
12	2000
13	1991
14	1987
15	1988
16	1994
17	1983
18	1996
19	1944
20	1989

Global mean temperatures are rising and rising faster with time



Source IPCC

The North Polar Ice Cap is disappearing (20% in 25 years - 1979-2004).



Source NASA

Warm summers etc are just a symptom of a more fundamental change and it is the latter that worries scientists.

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They are COMPATIBLE but not COMPELLING evidence!

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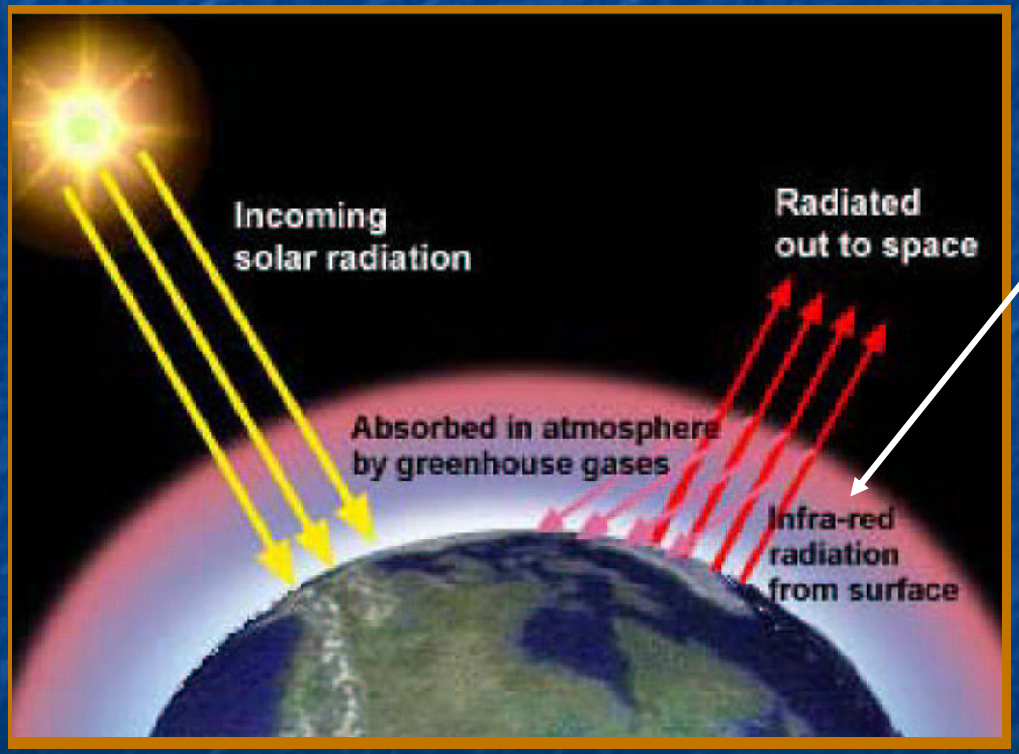
They are COMPATIBLE but not COMPELLING evidence!

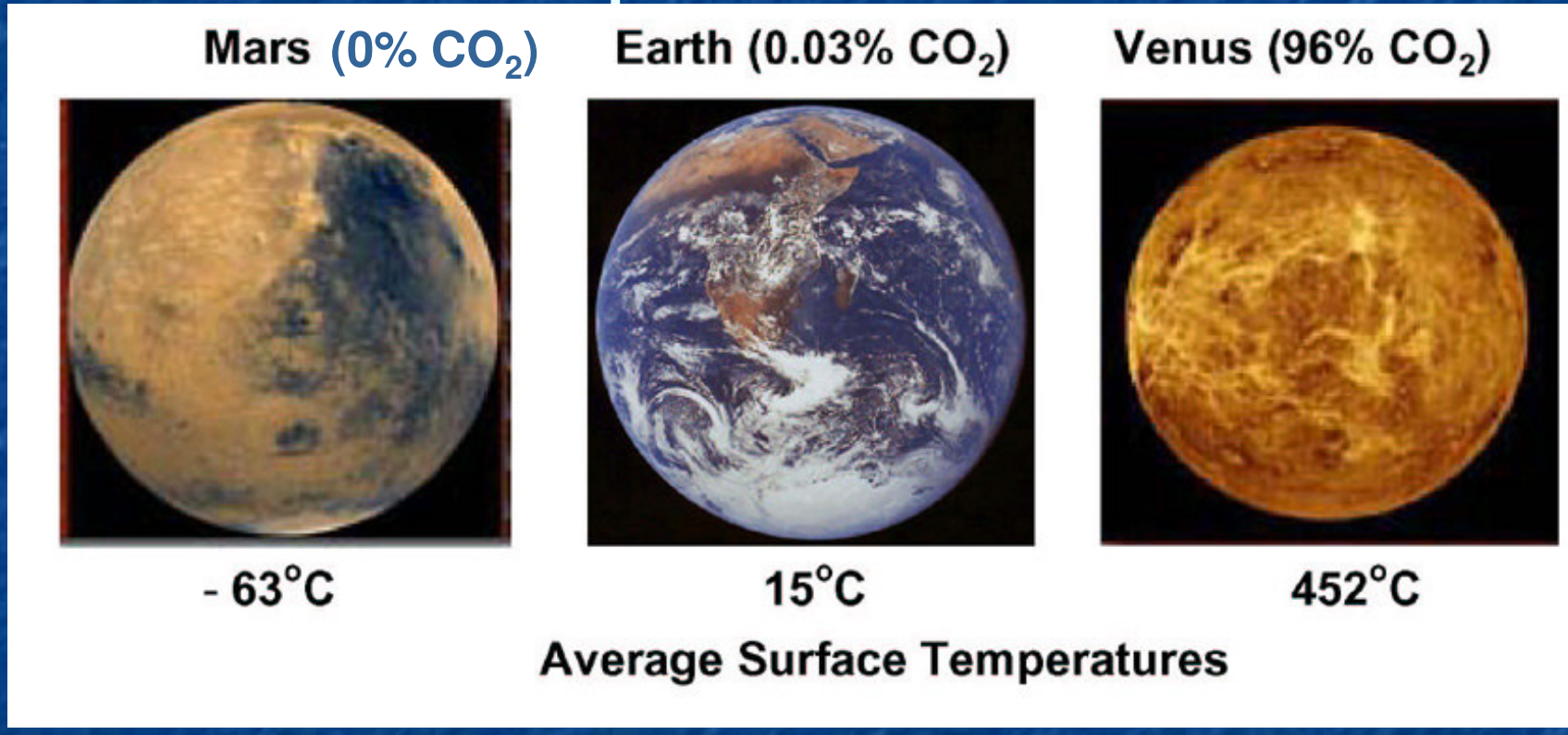
The key information comes from studying 800,000 years of climate change and elsewhere!

An aside -
What is the Greenhouse effect?



Greenhouse gases in the atmosphere act rather like a glass shell around the planet.

The Greenhouse effect in practice!



Without the Carbon Dioxide in our atmosphere, we would be at -19 °C, e.g. 34 °C cooler!

Source - C T Bowman, Stanford U., USA

Other evidence for the greenhouse effect.

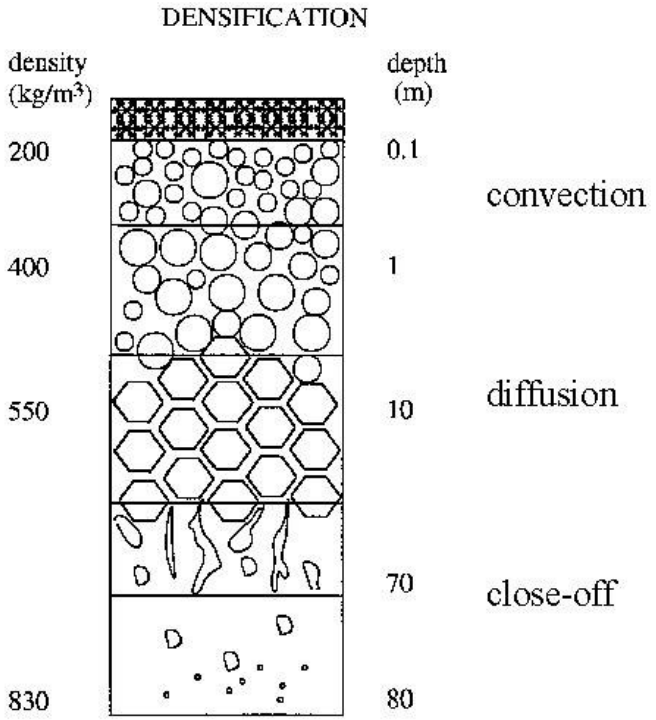
Ice core sampling in Antarctica

Source - British Antarctic Survey

The gas record in ice

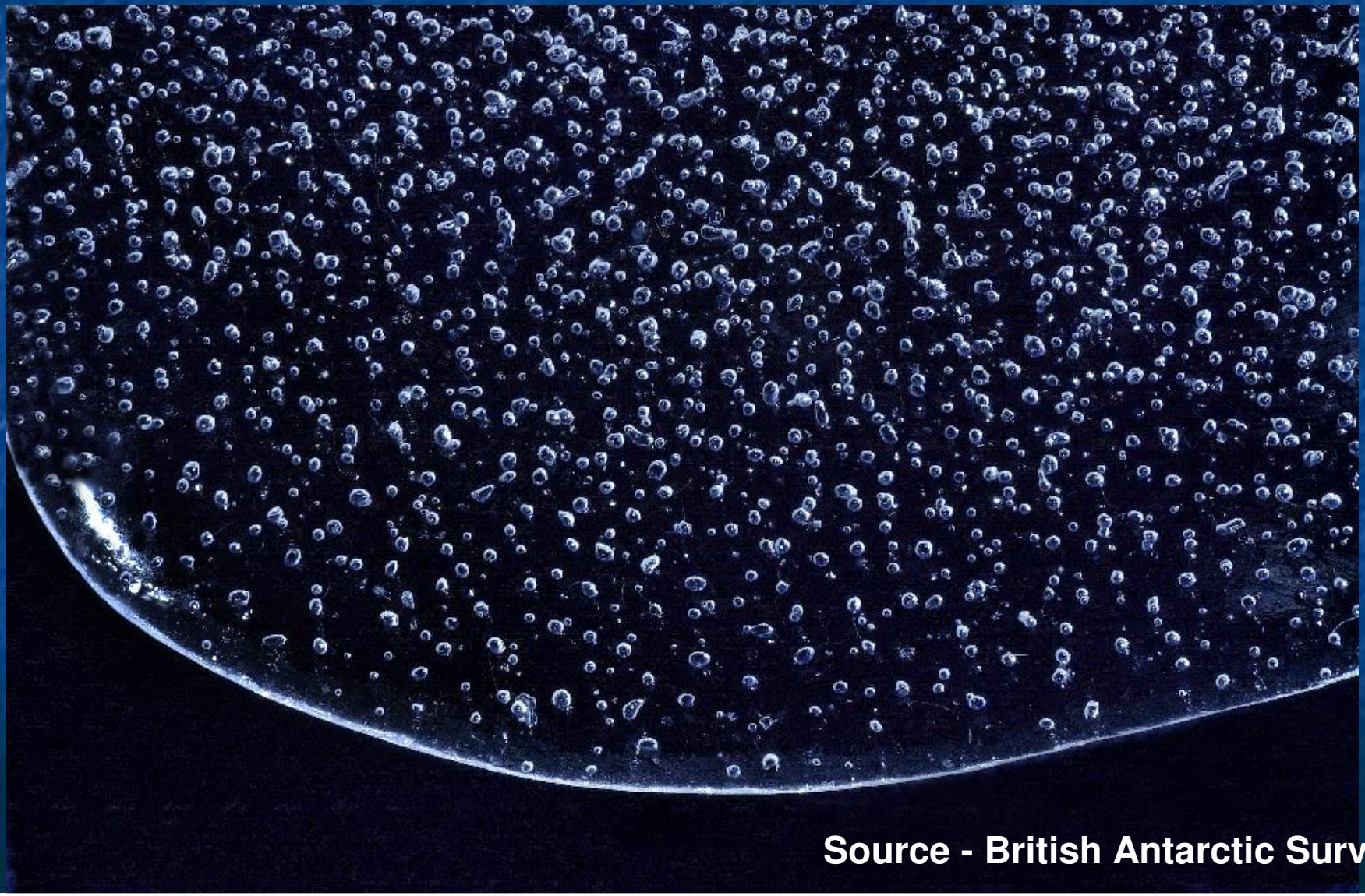
As the snow gets deeper, pressure turns loose snow into solid ice with trapped air bubbles.

The bubbles contain a sample of gases from the atmosphere at the time the snow fell, including CO_2 & CH_4.



Source - British Antarctic Survey

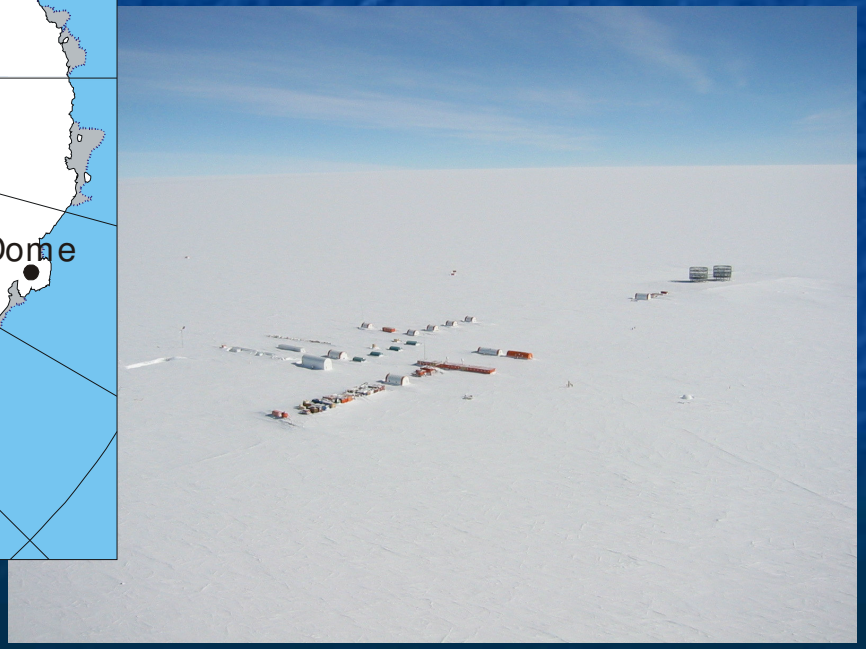
Gas bubbles in deep Antarctic ice!



Source - British Antarctic Survey

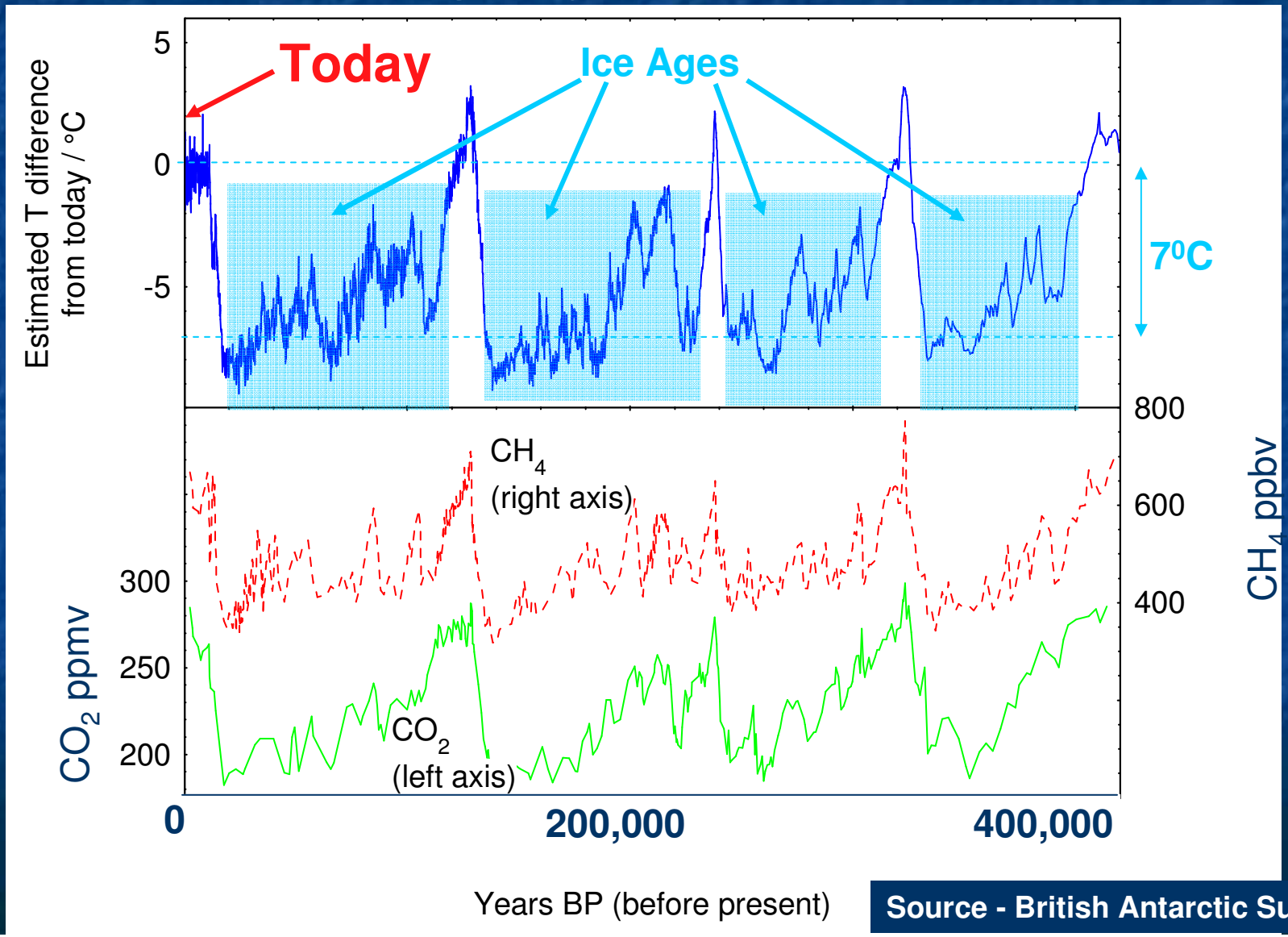
Sampling sites in Antarctica.

Vostok base



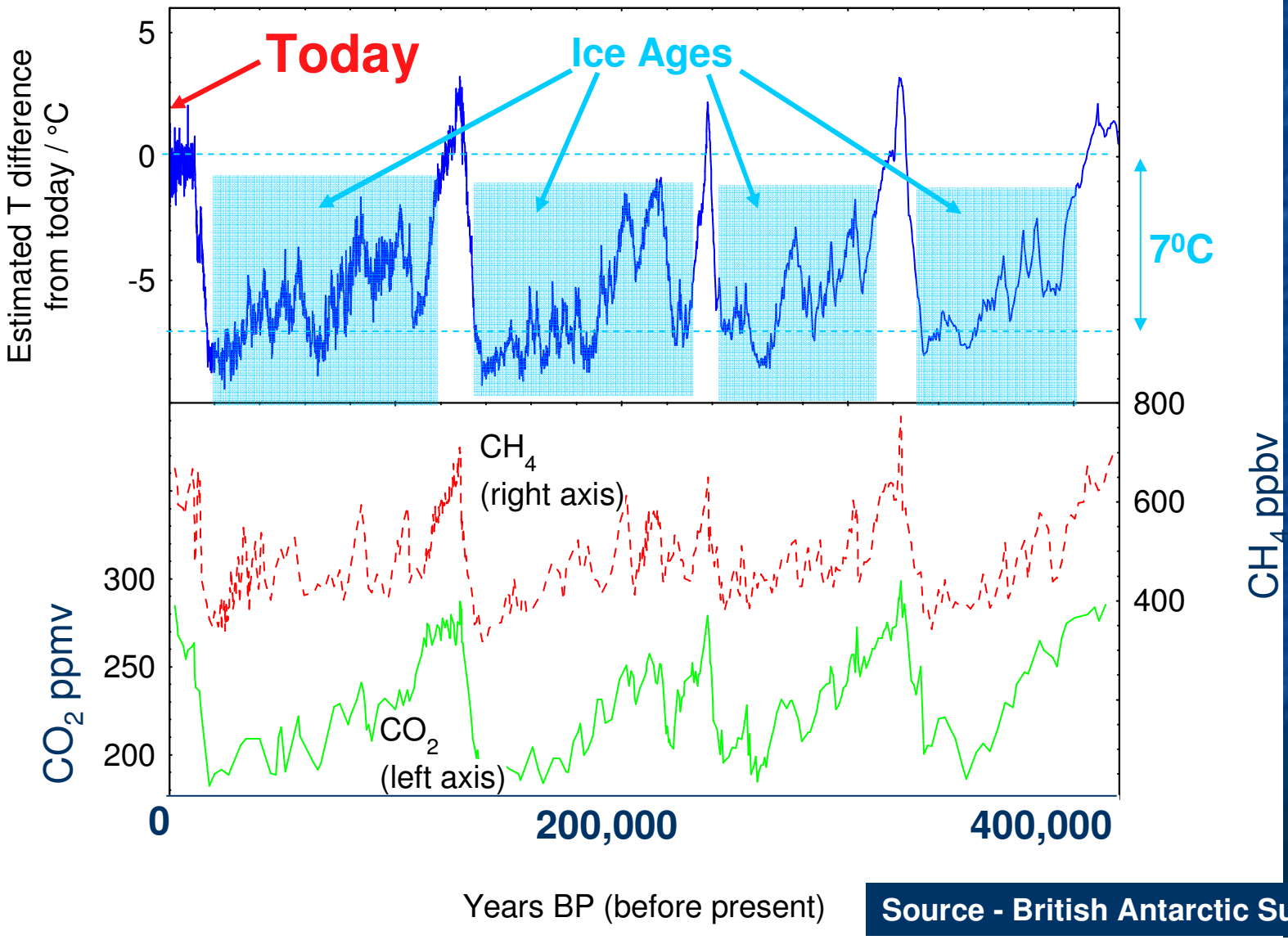
Source - British Antarctic Survey

Temperature & Greenhouse gas levels are tightly linked!



Source - British Antarctic Survey

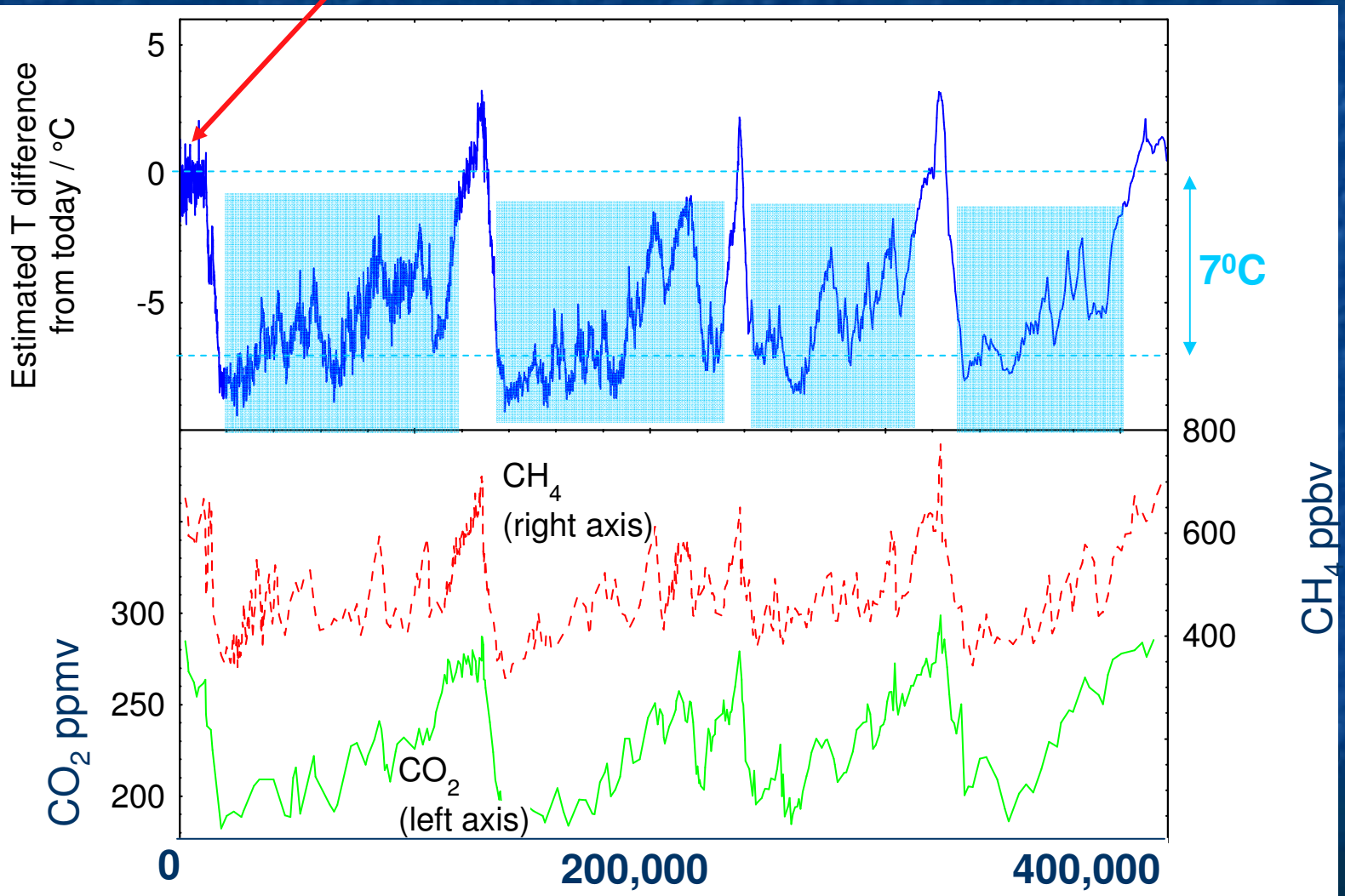
Instability as been the norm for the last 400,000 years (without man's help)!



Source - British Antarctic Survey

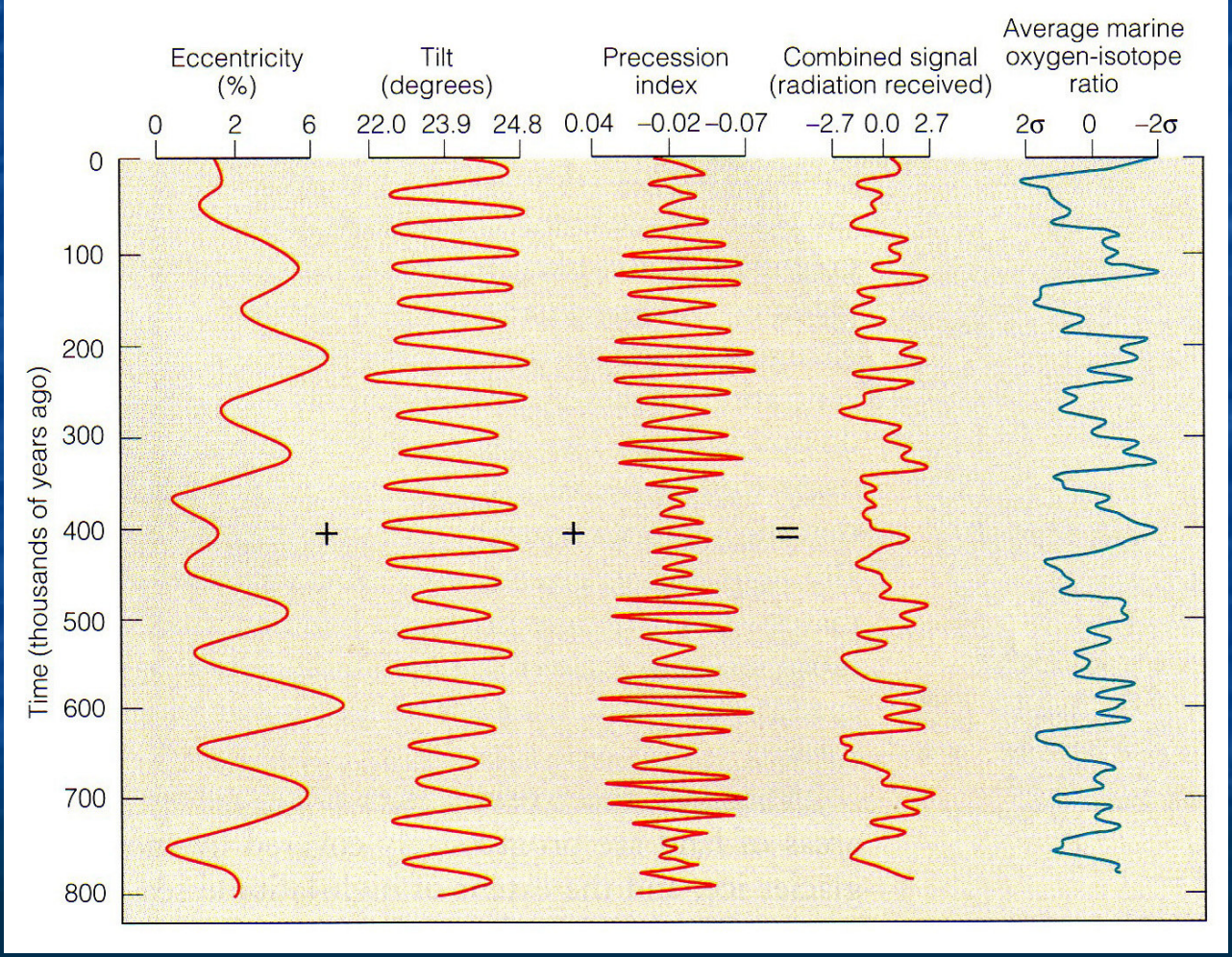
Last 10,000 years of exceptional stability

Haven't we been lucky!



Source - British Antarctic Survey

What is the cause of the 100k year climate cycle?



Answer - the way the earth wobbles as it circles the sun, ergo - nothing to do with man!

This changes the amount of heat arriving from the sun.

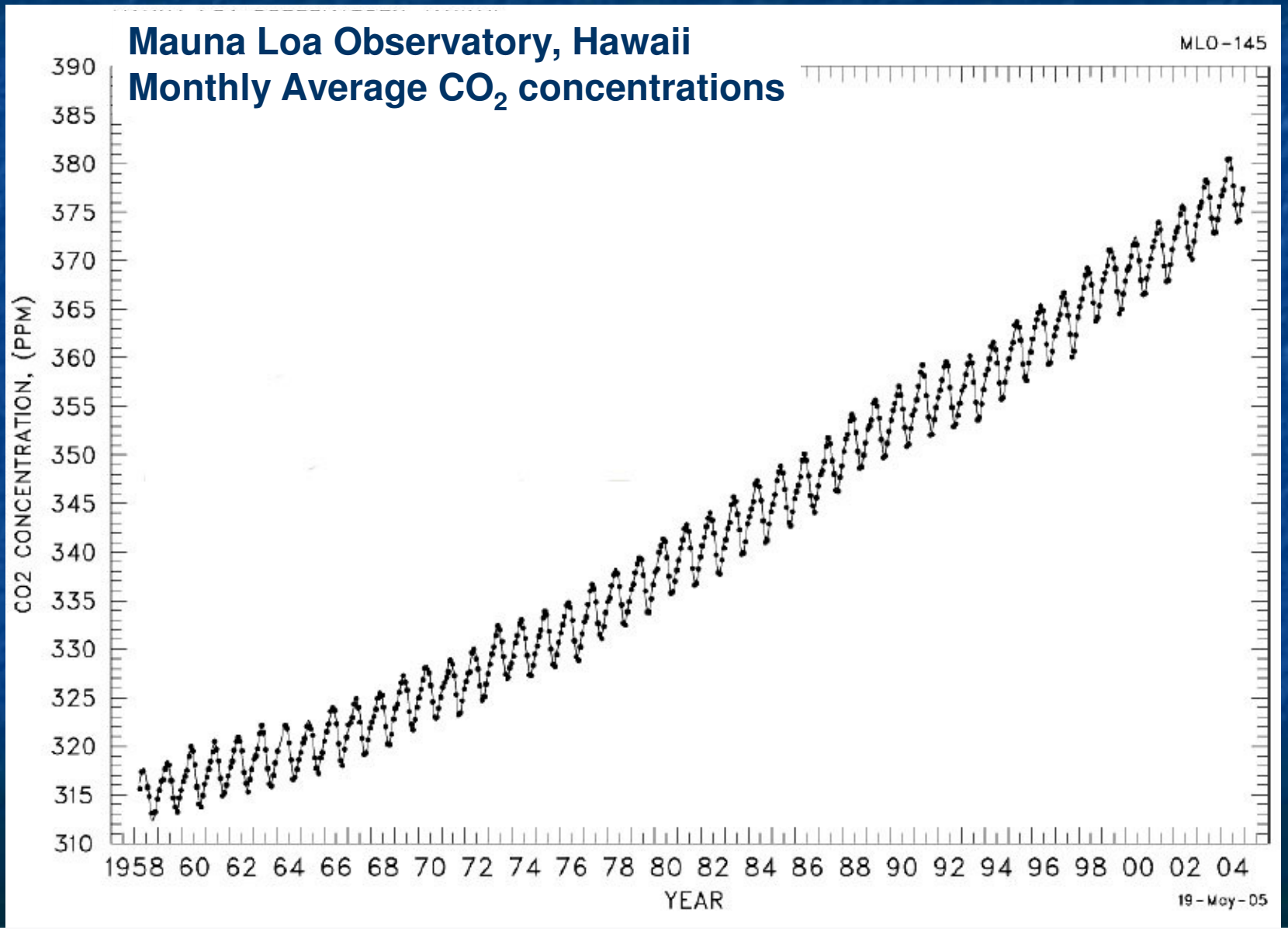
But changes in CO2 and CH4 hugely magnified the effect of this.

Source - The Dynamic Earth, Pub.Wiley

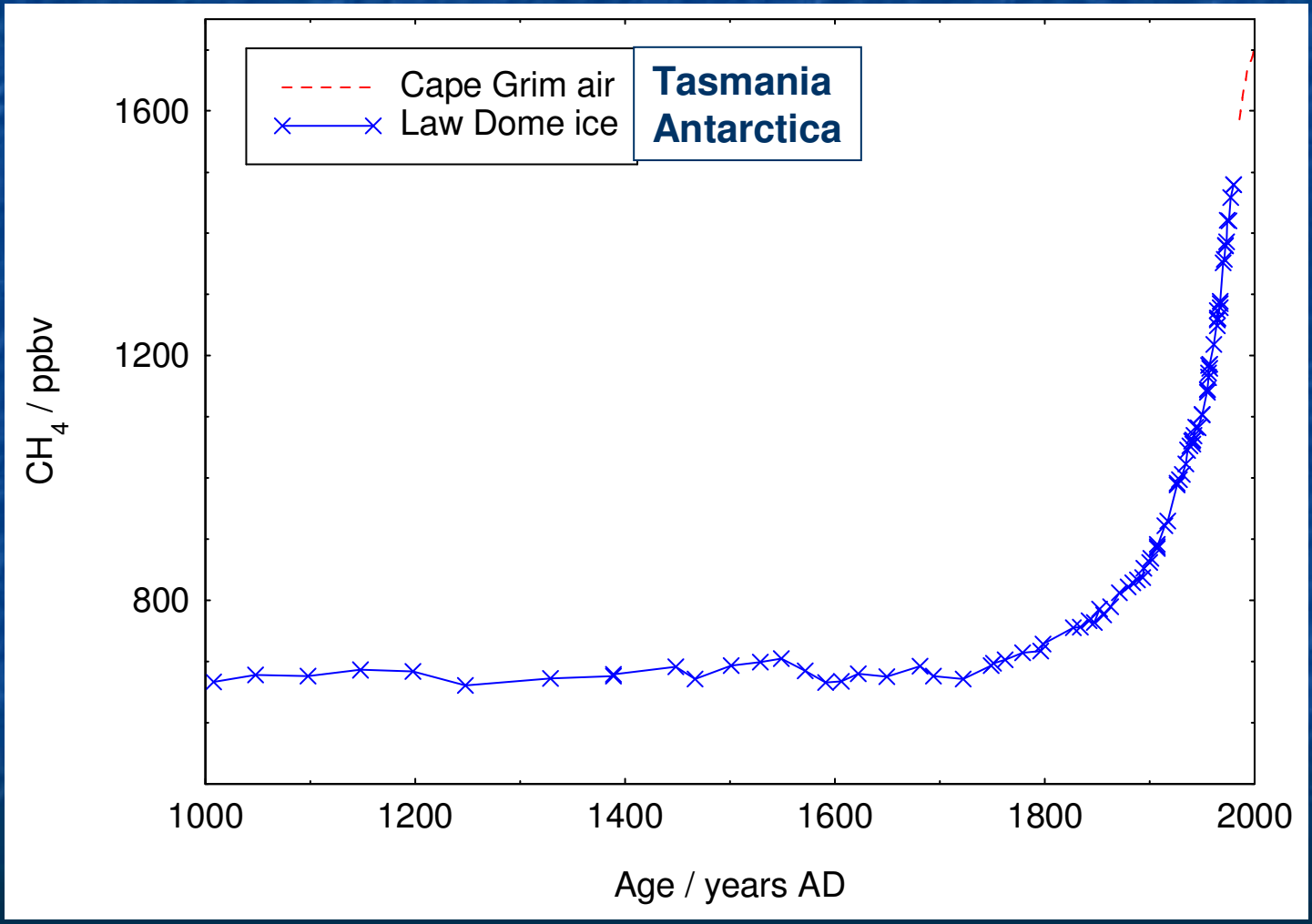
So history tells us that :-

- Green-house gas levels and temperature are intimately linked
- The Planet's climate has been very unstable in the past
- But the last 10,000 years has been an exception.
- SO WHAT IS HAPPENING NOW?

Detail of recent CO_2 measurements.



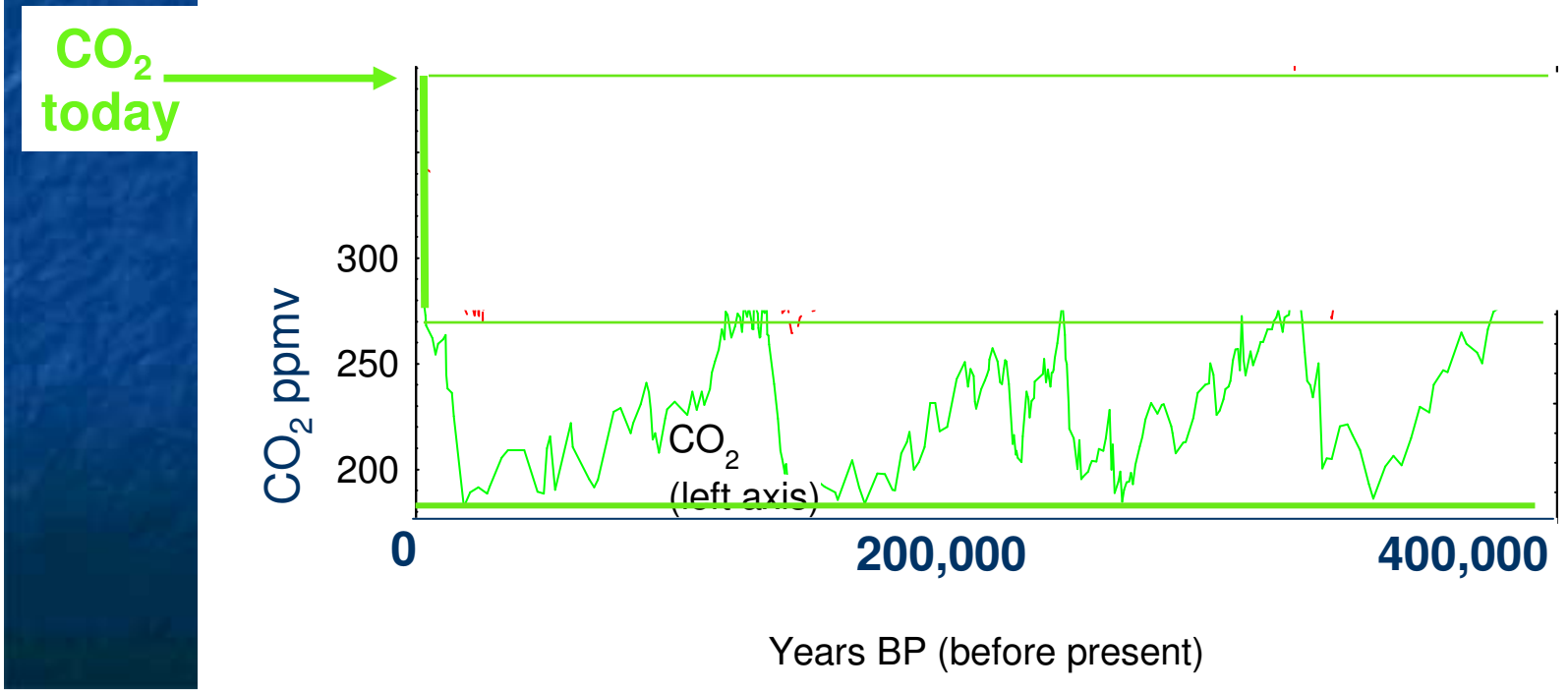
Recent changes in Methane levels



Source - British Antarctic Survey

Carbon Dioxide levels today -

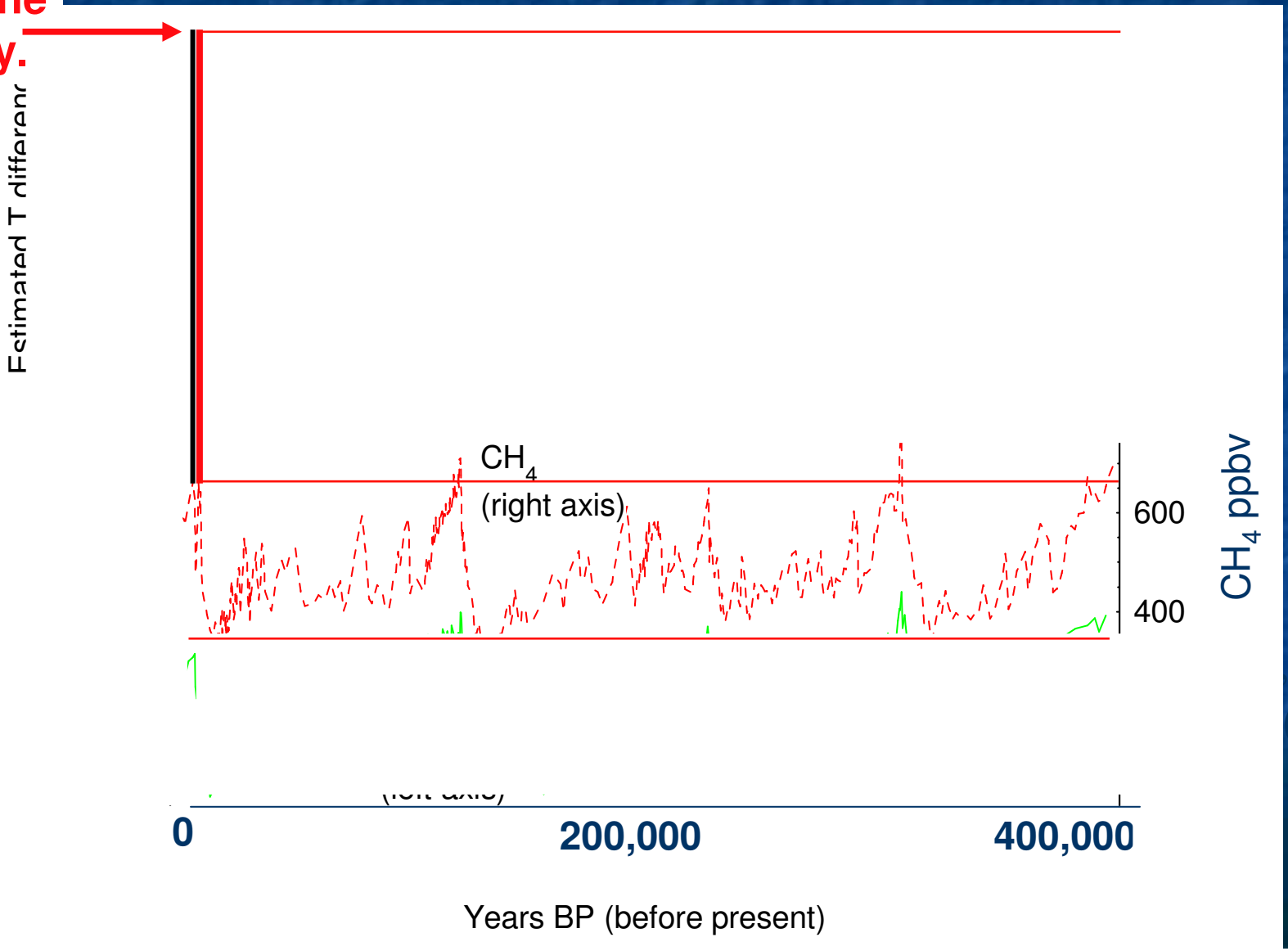
set against 400,000 years history!



Methane levels today -

set against 400,000 years history!

Methane Today.



Greenhouse gas changes have taken us into uncharted territory.

Gas	**Pre-industrial** **(& for 800,000 yrs BP)**	**Present-day**
CO_2	180-280 ppmv	~380 ppmv (36% increase over PI) (~680 ppmv by 2100 **)
CH_4	400-750 ppbv	~1750 ppbv (133% increase over PI)

** Assuming we continue "business as usual" & assuming no instabilities.

Given the clear link between greenhouse-gas & temperature

- The warming we are seeing is no mystery
- As are many other climate changes
- BUT they are just a precursor of what is yet to come.

Where do the greenhouse gases come from?

- There is overwhelming evidence that WE are causing the rise in greenhouse gases.
- We do so through -
  - Burning fossil fuels
  - Changing land use (forest destruction etc)
  - Livestock farming, landfills etc
- So what impact are they having now?
- And what impact will they probably have in the future (next lecture).

Some projections made in 2001 when the GG rises were seen.

- Arctic warms more rapidly than further south.
- Greater extremes of weather in N.Hemisphere
  - Storms
  - Droughts
  - Floods
- Rising sea levels
- So by 2007 ……

Changes in Precipitation, Increased Drought

- Significantly increased precipitation in eastern parts of North and South America, northern Europe and northern and central Asia.
- The frequency of heavy precipitation events has increased over most land areas - consistent with warming and increases of atmospheric water vapour
- Drying in the Sahel, the Mediterranean, southern Africa and parts of southern Asia.
- More intense and longer droughts observed since the 1970s, particularly in the tropics and subtropics.

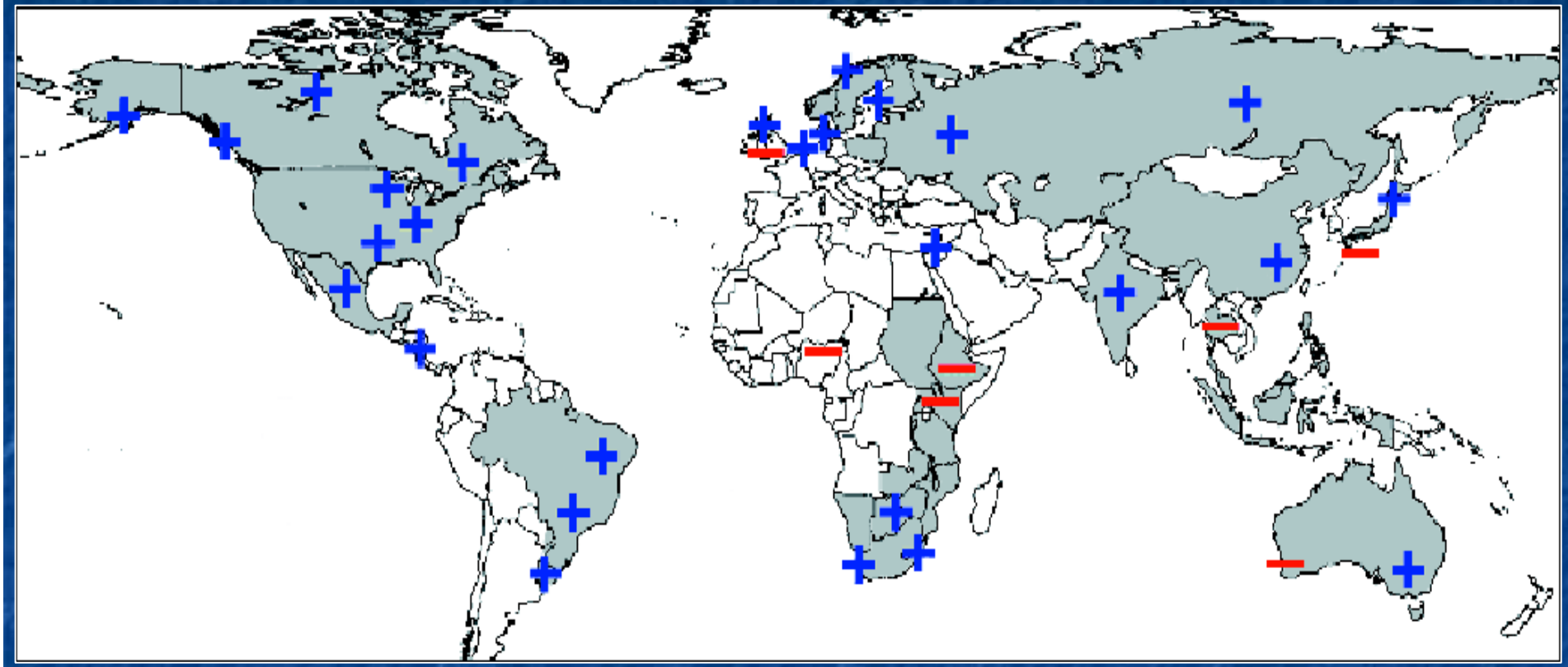
Source - Intergovernmental Panel on Climate Change

Other changes in Extreme Events

- Widespread changes in extreme temperatures observed
  - Cold days, cold nights and frost less frequent
  - Hot days, hot nights, and heat waves more frequent
- Observational evidence for an increase of intense tropical cyclone activity in the North Atlantic since about 1970
  - correlates with increases of tropical sea surface temperatures

Source - Intergovernmental Panel on Climate Change

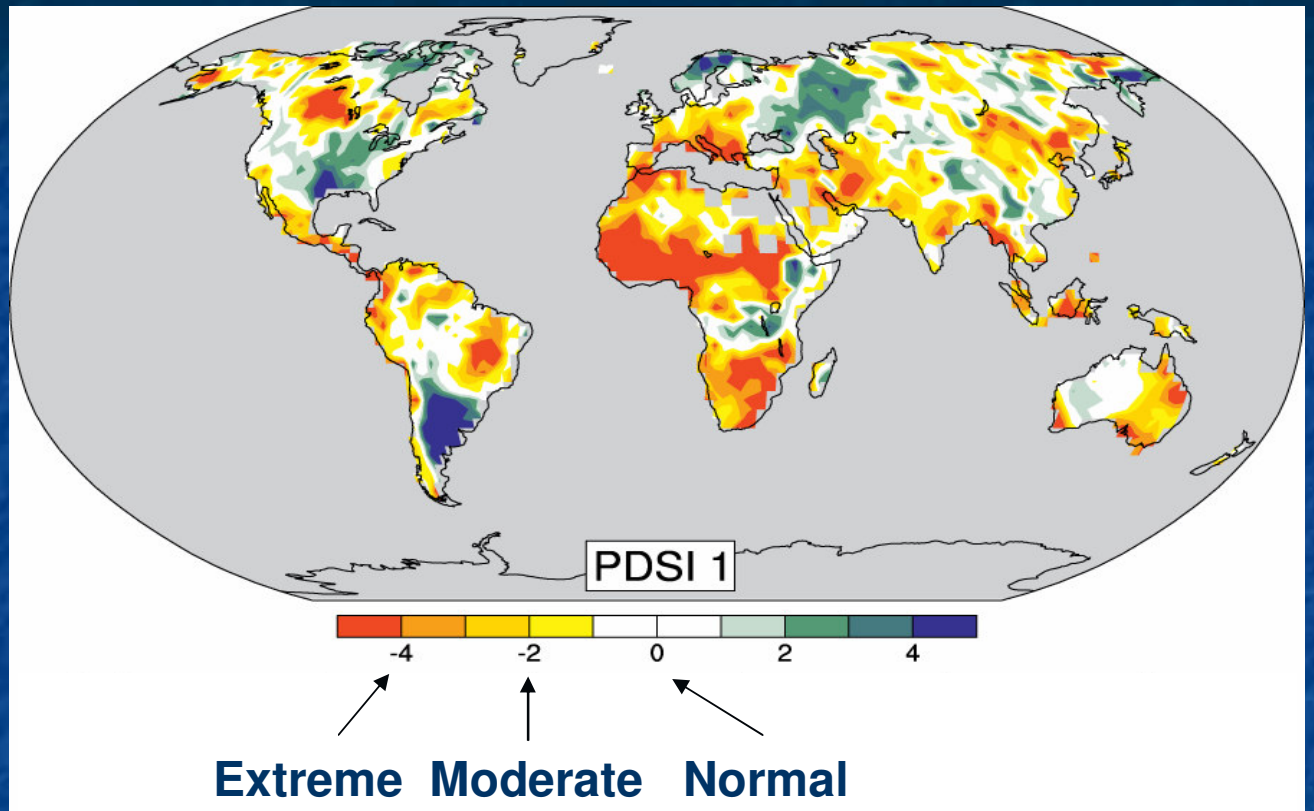
Proportion of heavy rainfalls: increasing in most land areas



Regions of disproportionate changes in heavy (95^{th}) and very heavy (99^{th}) precipitation

Source - Intergovernmental Panel on Climate Change

Drought also increasing in most places



Highlighting areas with the most marked increases in drought conditions over the last century.

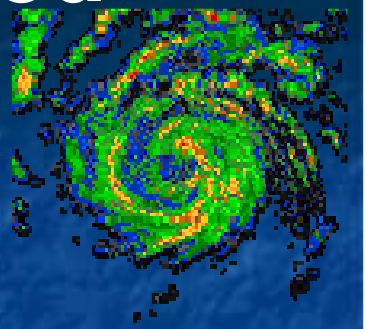
Source - Intergovernmental Panel on Climate Change

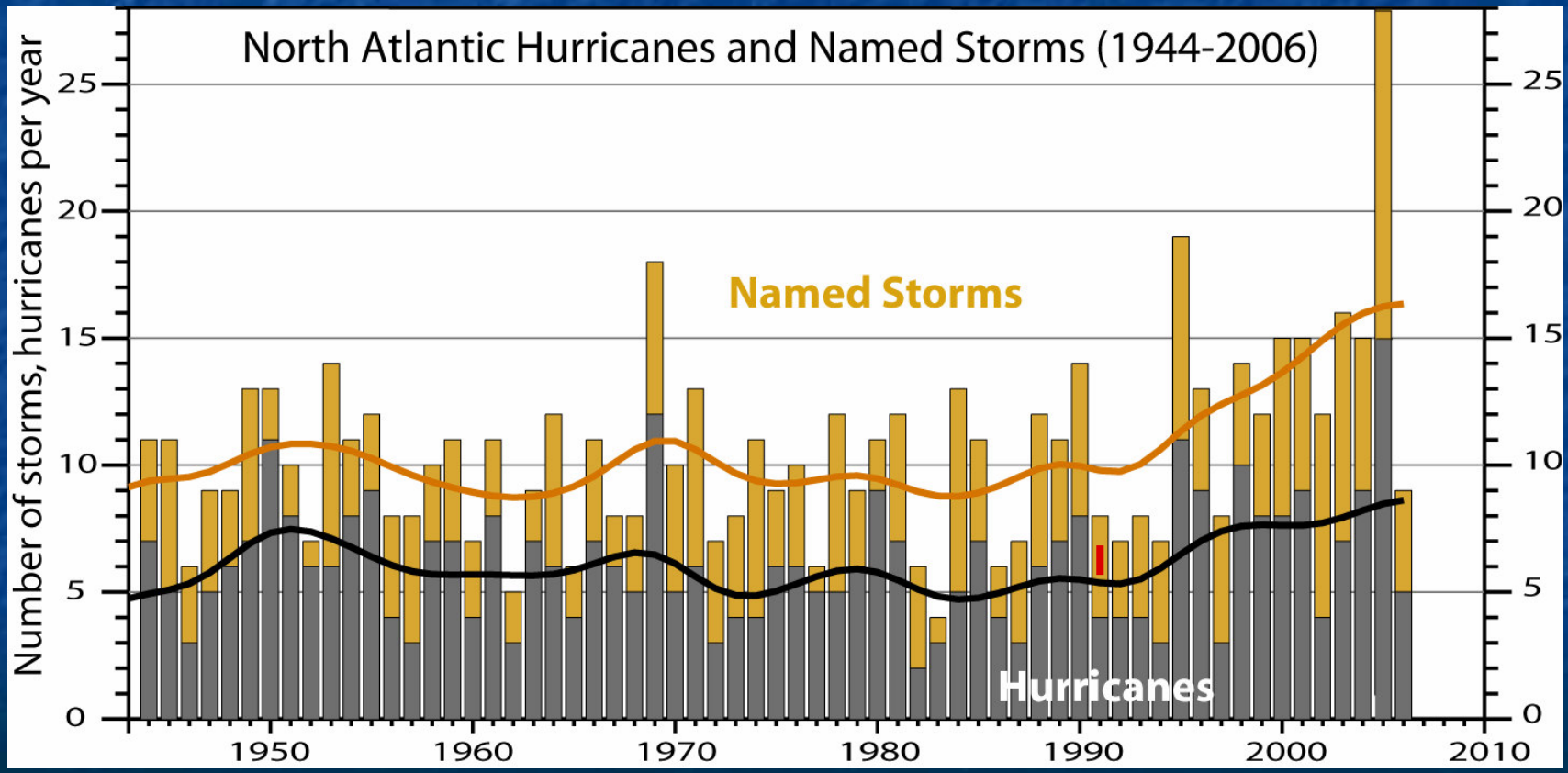
Circulation changes

Climate change is also affecting storm tracks, winds and temperature patterns

Source - Intergovernmental Panel on Climate Change

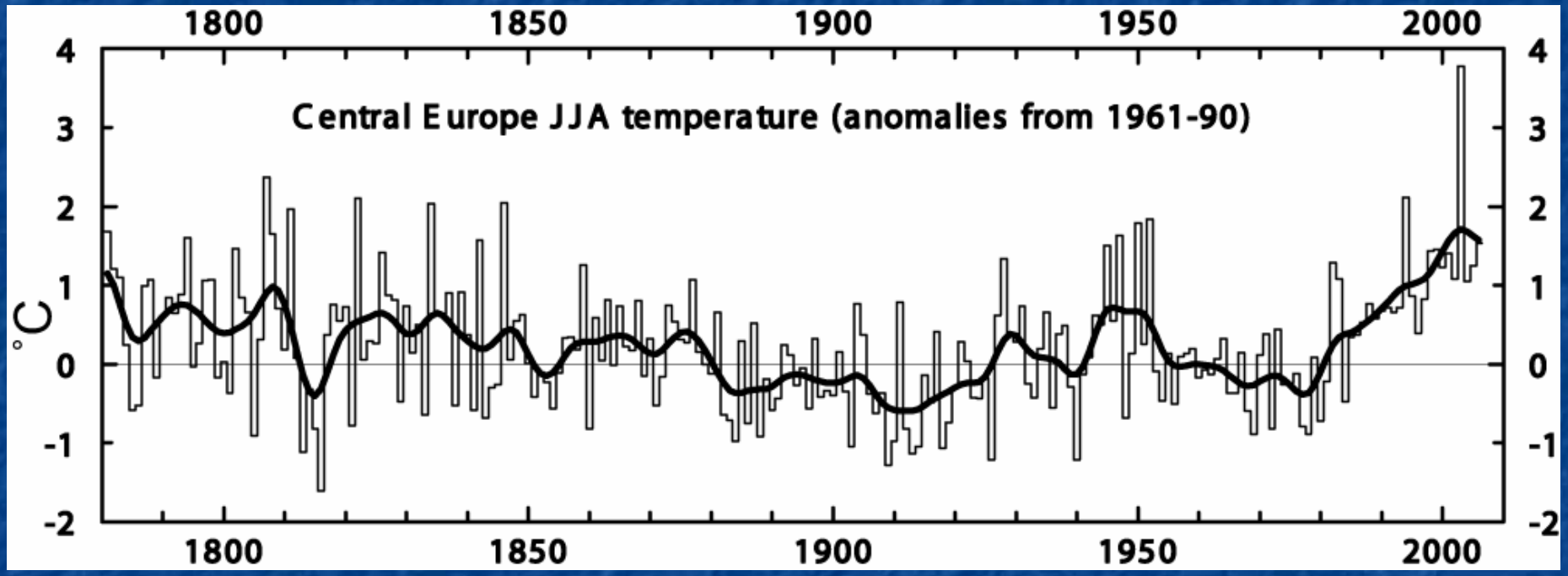
North Atlantic hurricanes increased with Sea Surface Temperatures





Source - Intergovernmental Panel on Climate Change

Heat waves are increasing in Europe

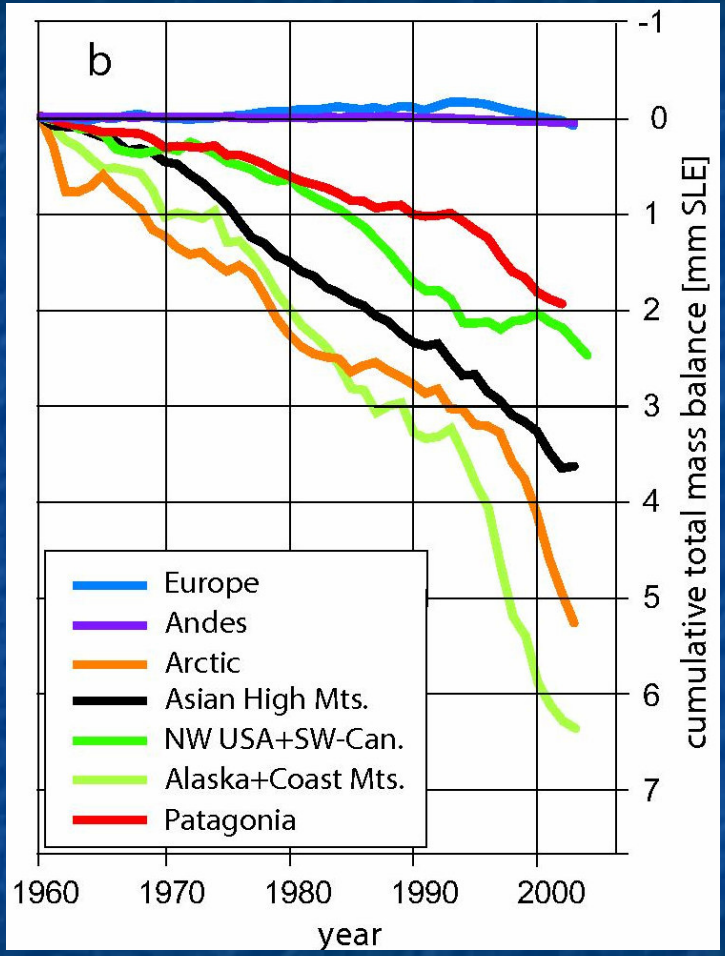


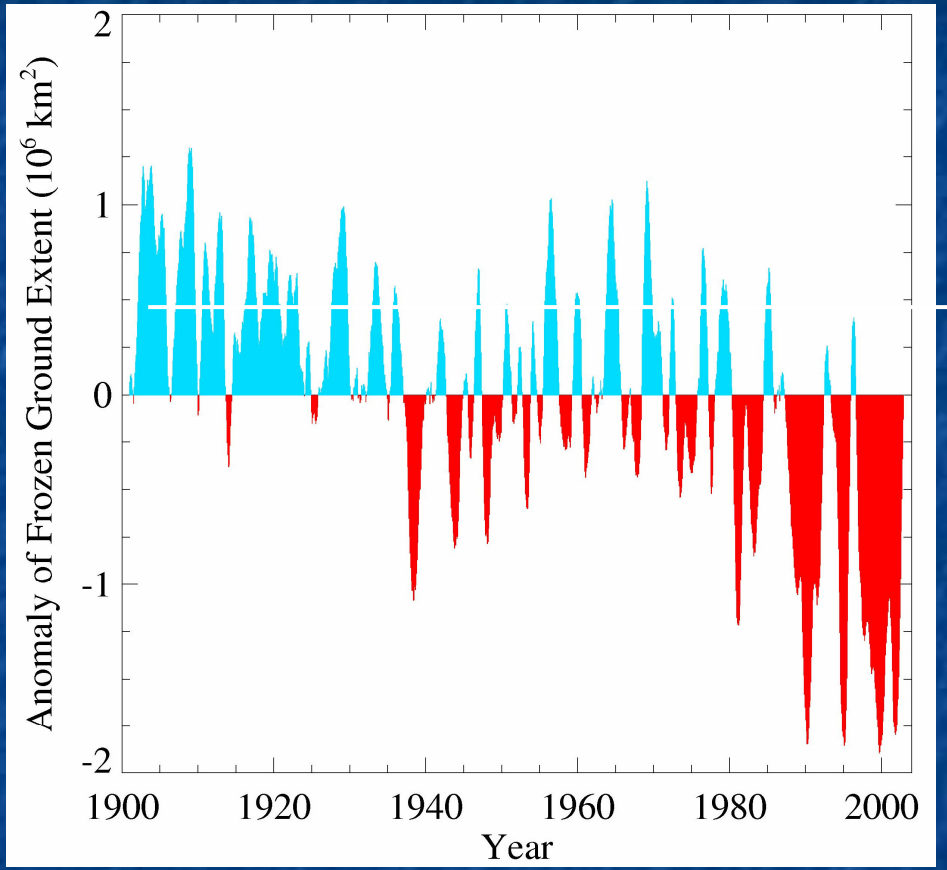
Extreme Heat Wave
Summer 2003 - Europe

JJA=June/July/August

Source - Intergovernmental Panel on Climate Change

Glaciers and frozen ground decreasing





mmSLE = mm Sea Level Equivalent

Source - Intergovernmental Panel on Climate Change

These are changes that have already occurred.

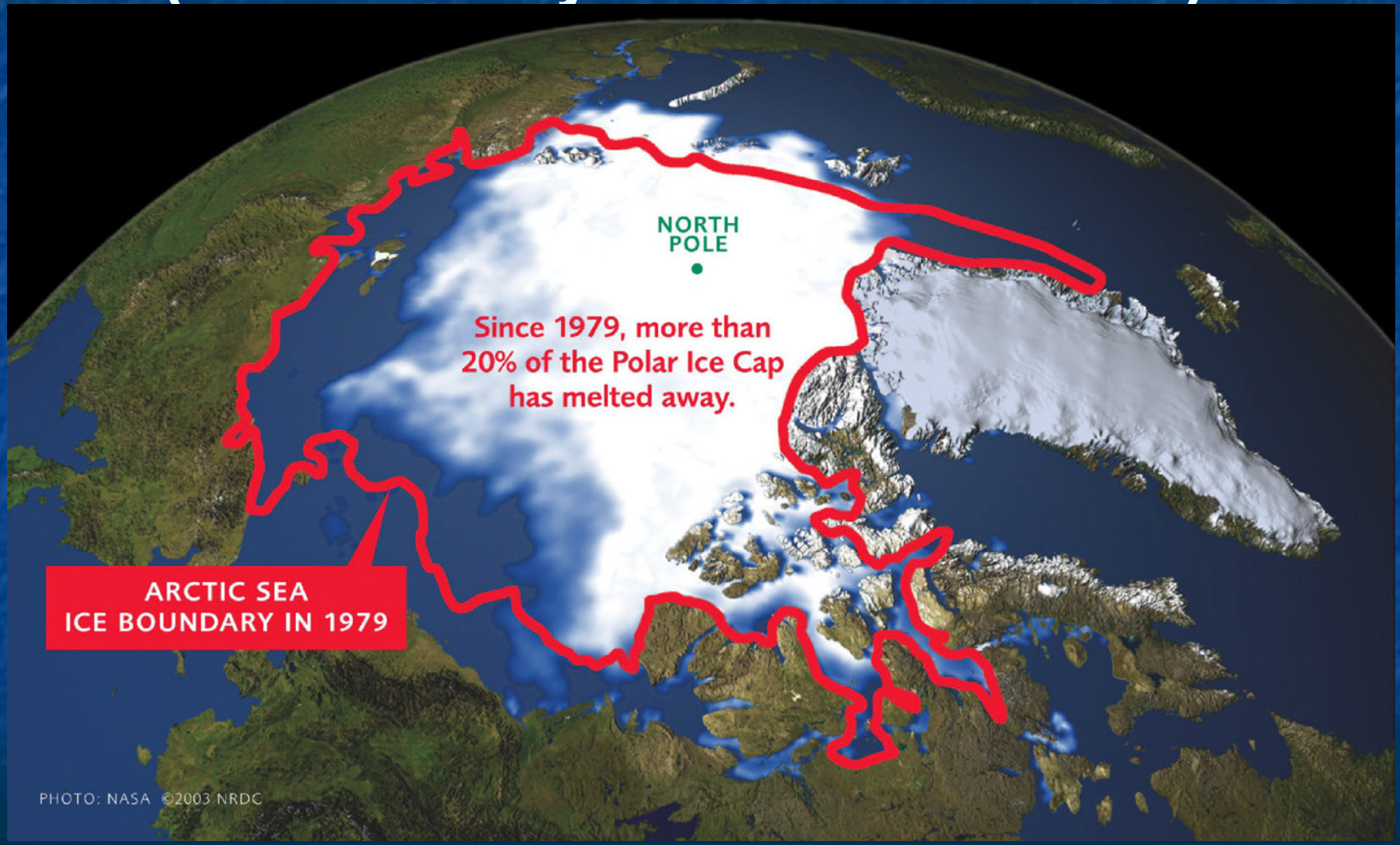
They were fairly accurately predicted 5-10 years ago.

And none of them are particularly good news for humanity.

But they are a precursor of what is to come.

Now for something very new and worrying!

The North Polar Ice Cap is disappearing (20% in 25 years - 1979-2004).



Source NASA

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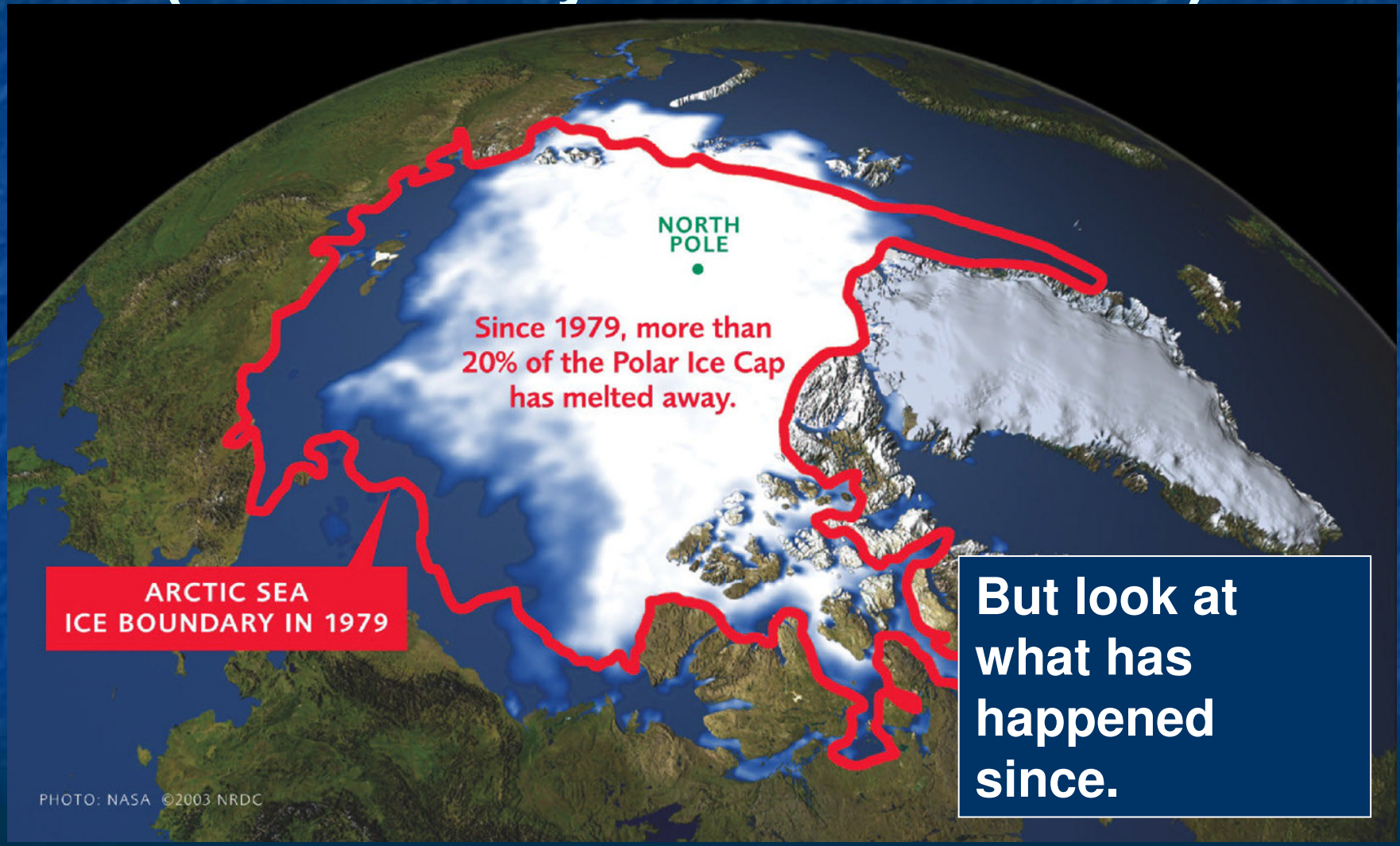
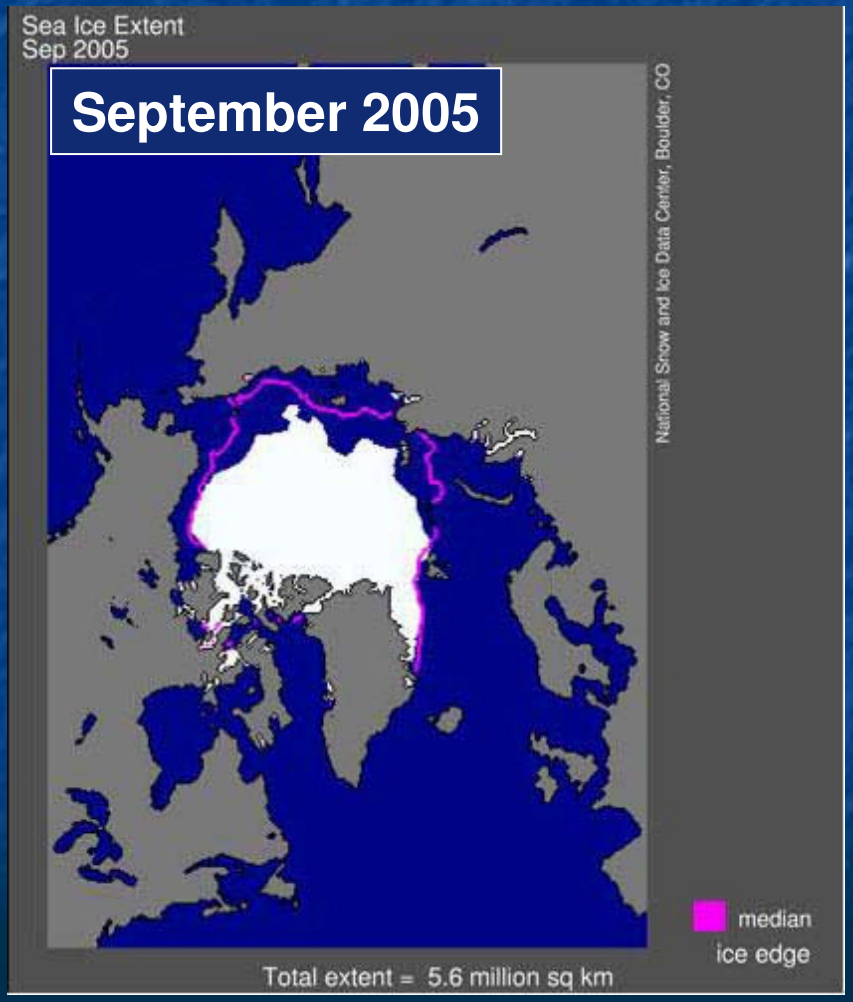


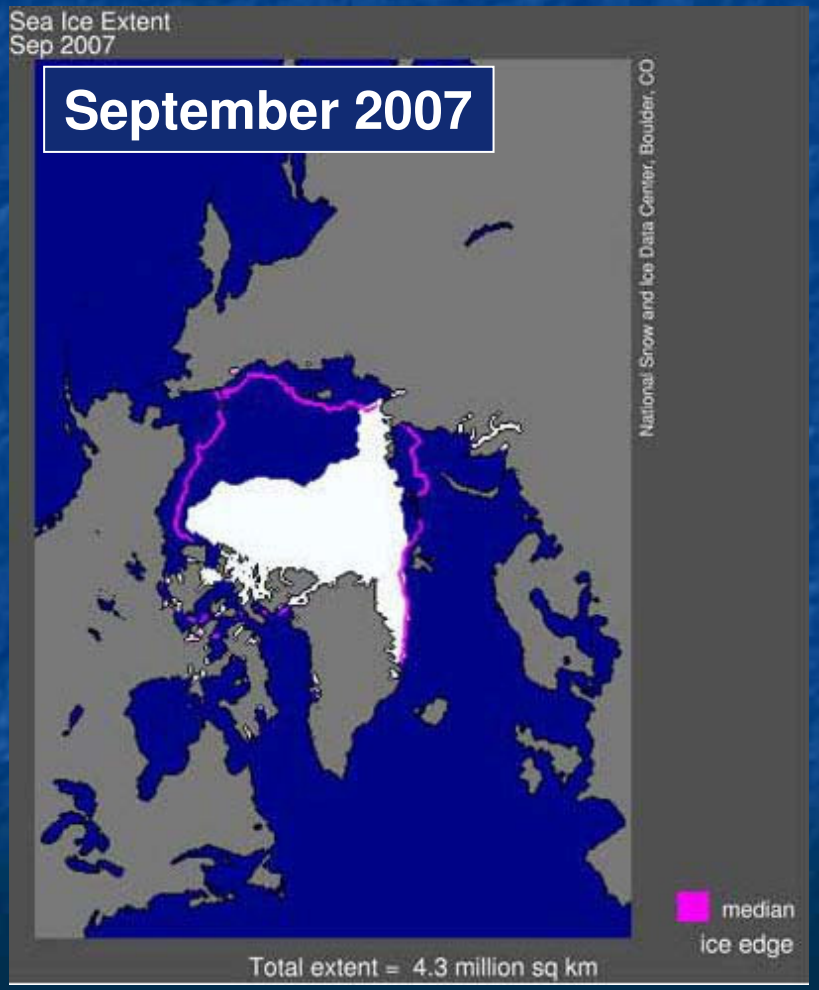
But look at what has happened since.

Source NASA

The North Polar Sea-Ice

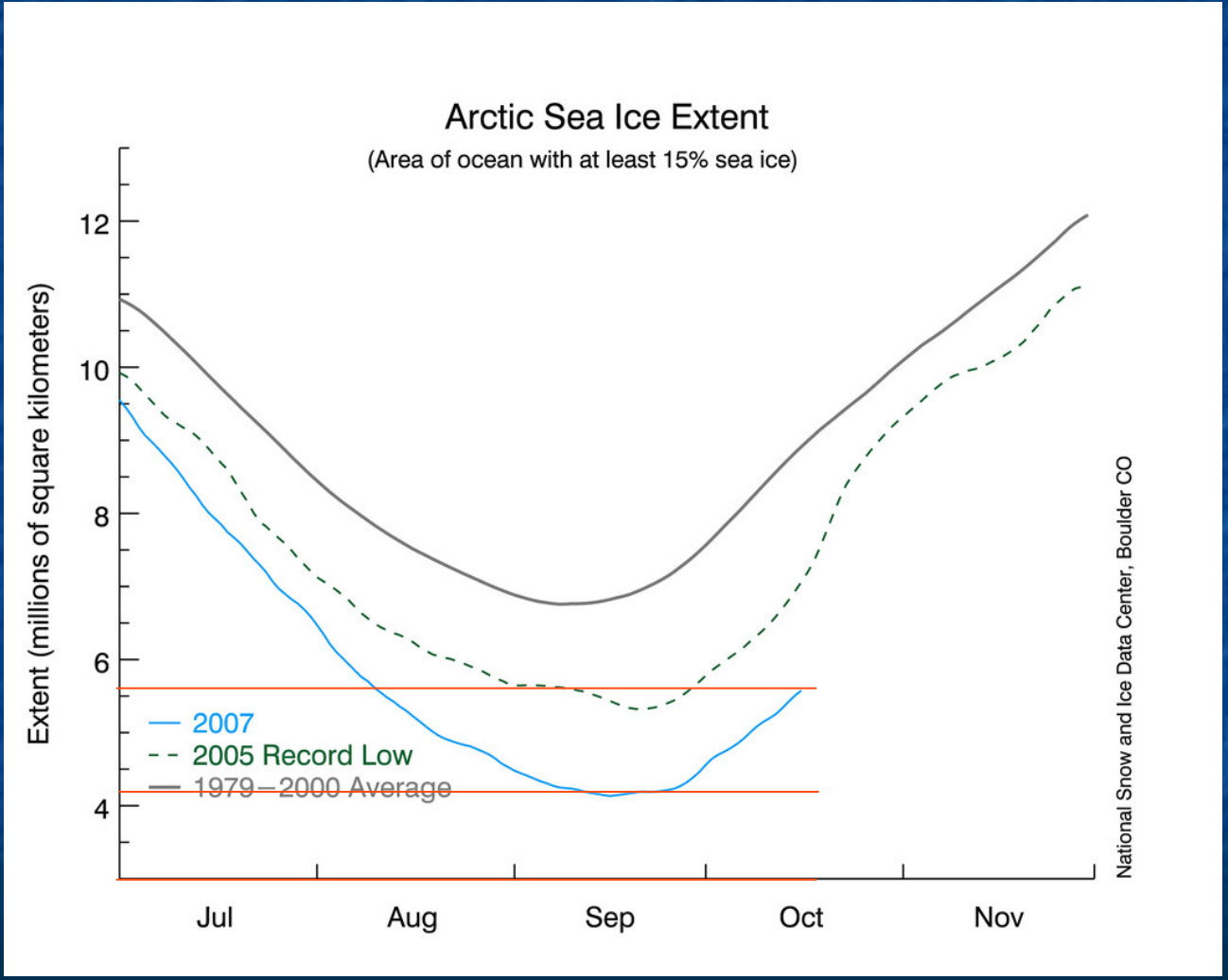
25% reduction over last TWO years!





Source - National Snow & Ice Data Centre - USA

The same data graphically.

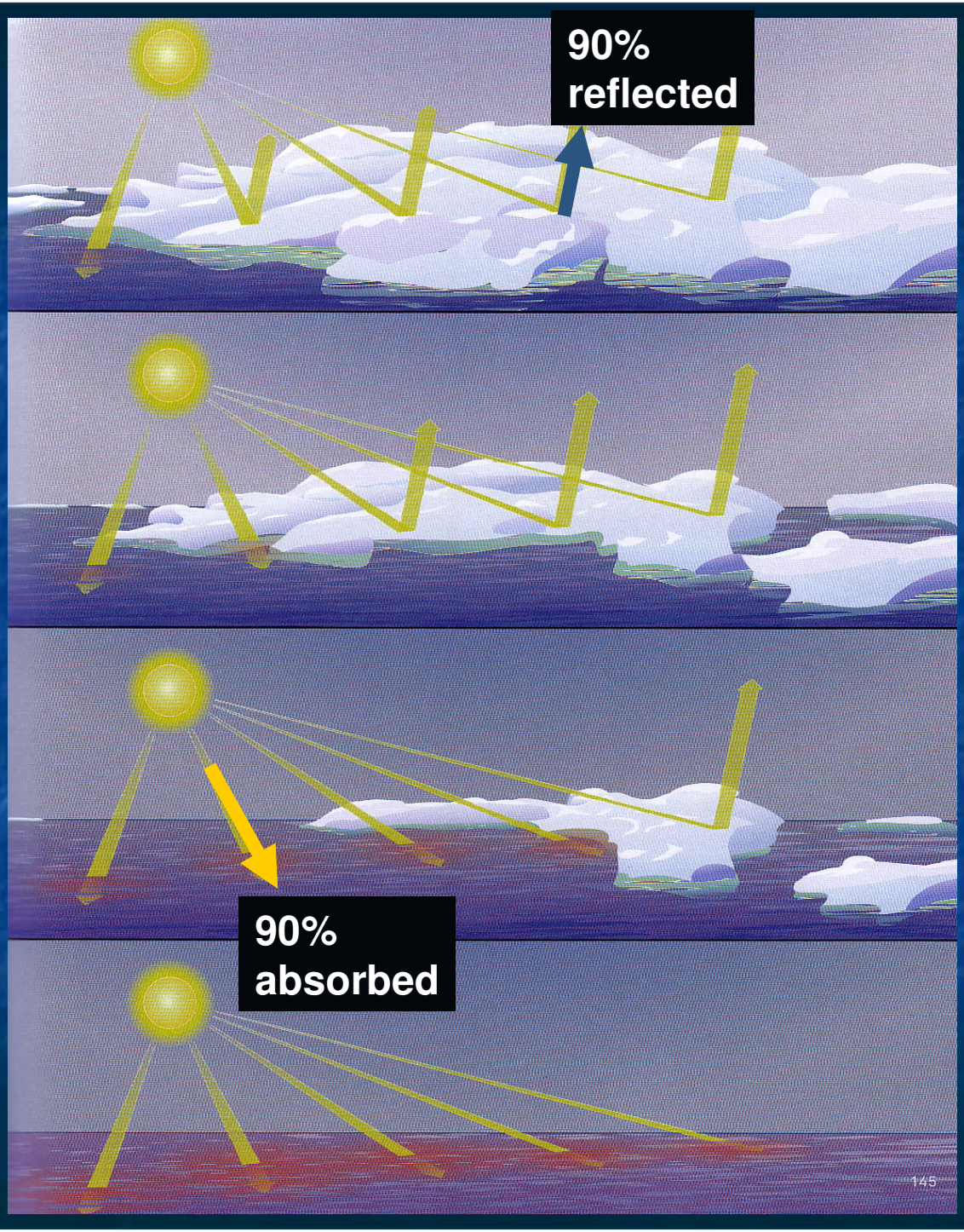


Source - National Snow & Ice Data Centre - USA

Ice-sheet instability.

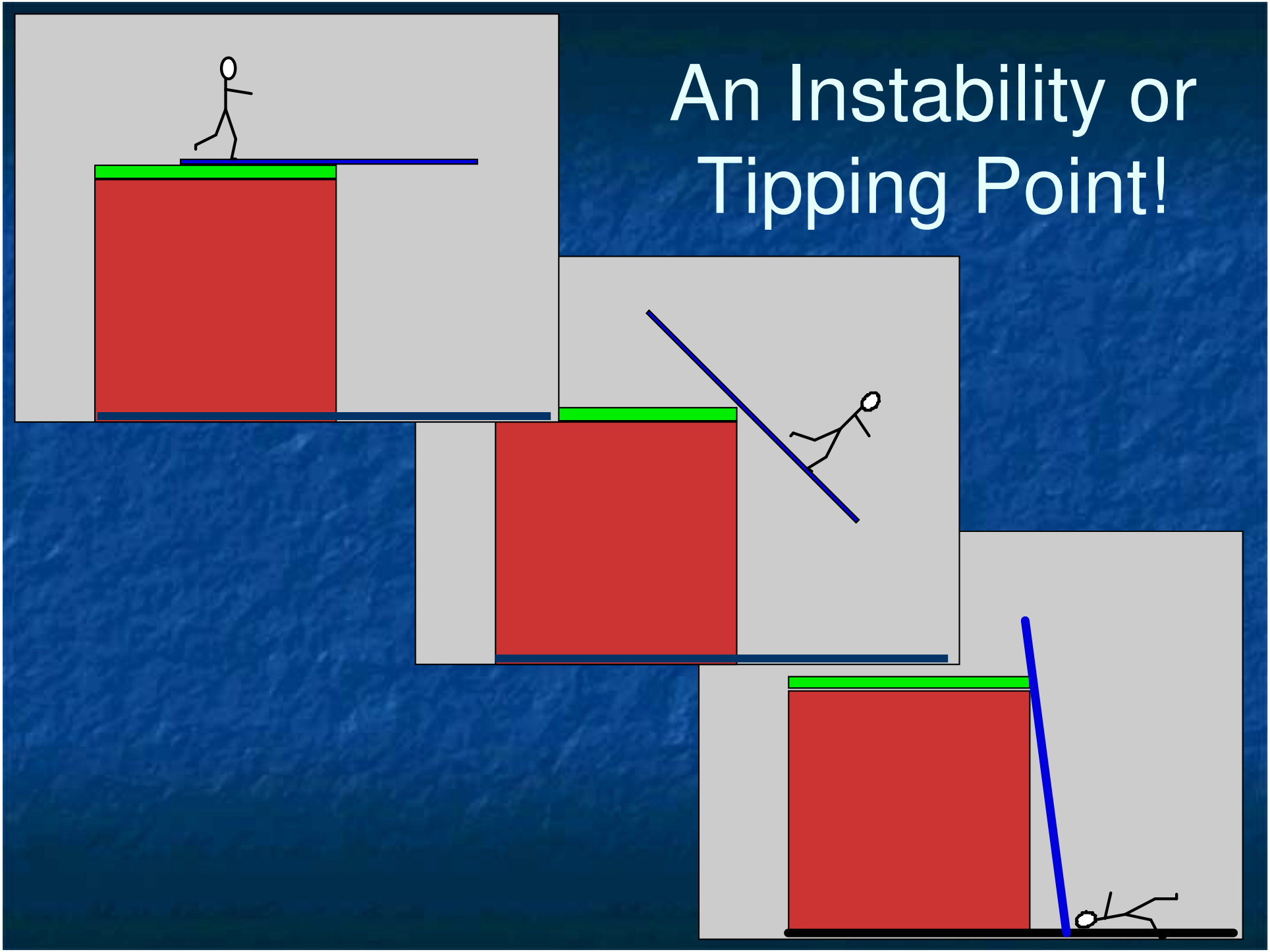
Loss of snow or ice cover greatly increases rate of warming, so the remaining ice melts faster.

This is happening in the Arctic today.



Source :- “An Inconvenient Truth” by Al Gore

An Instability or Tipping Point!



Has a tipping point been passed on the N.Polar ice sheet?

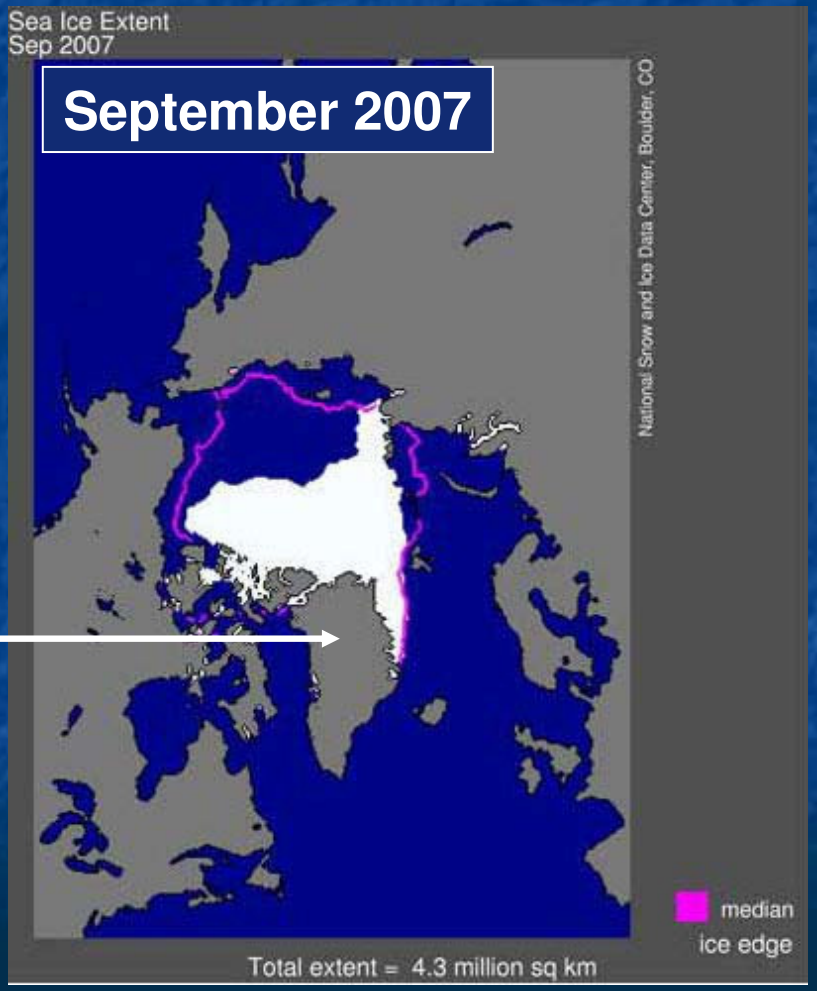
If YES, melting will likely proceed out of control until no ice is left.

Why worry?

- The Greenland Ice Cap joins on to the N.Polar Ice Sheet
- If it melts, sea level rises by 7m or 23 feet
- My home sits on the 5m contour!!!
- And there other nasties that could be triggered making matters even worse.

Is the Greenland Ice Cap next to go?

Greenland is currently losing 200 cubic kilometres of ice per annum!



A riposte to “The Great Global Warming Swindle” *

* A recent Channel-4 fictional “documentary”!

You can download this from www.royalsoc.ac.uk
Search for Climate Change Controversies

Acknowledgements

- Figures are acknowledged as they occur.
- Linking text and overall presentation by J E Midwinter.

Finis - Part 1