



Ce que la science dit VRAIMENT:
Le climat change. À cause de nous.



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Climate closure: Game over for climate skeptics

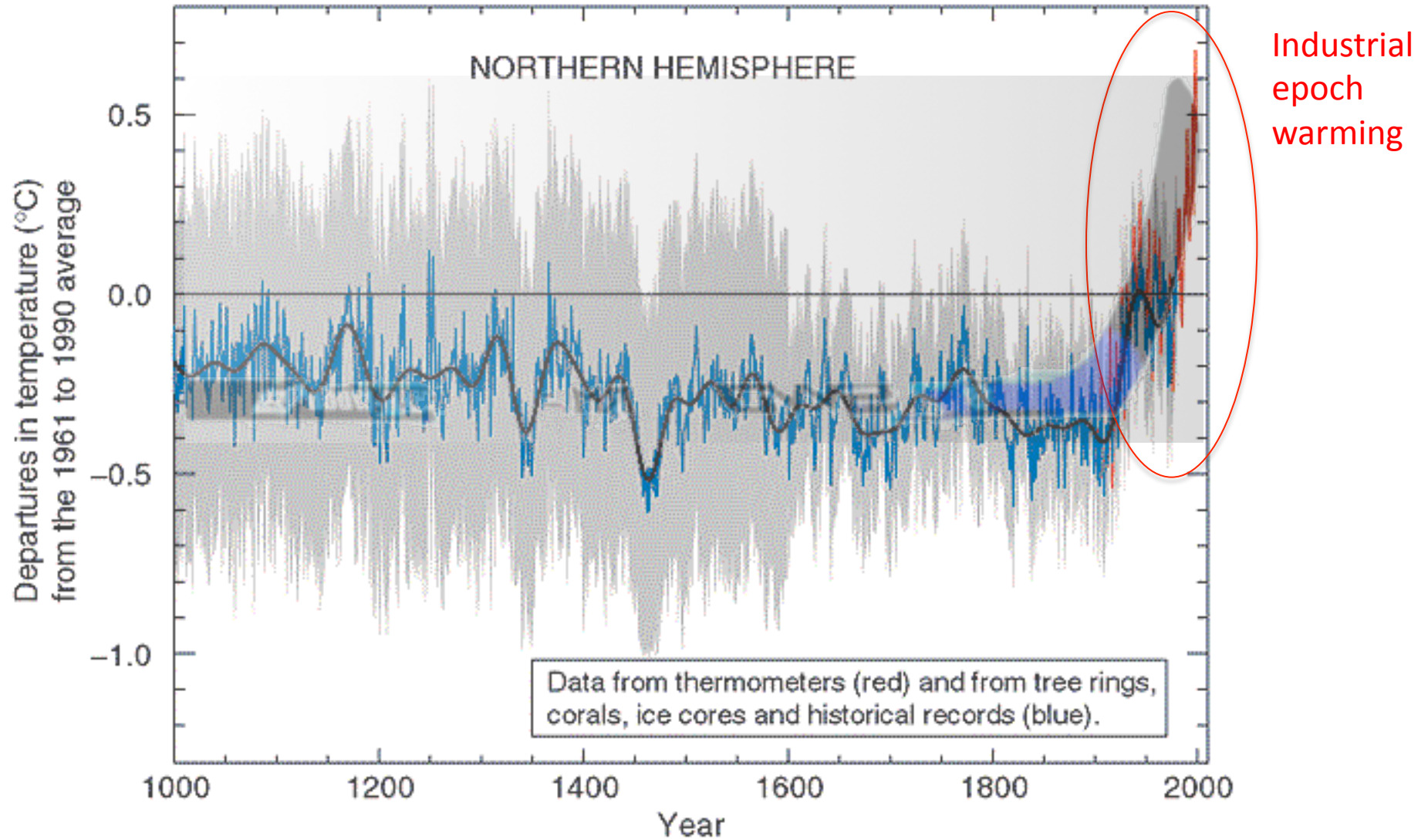
Réchauffement anthropique:
La fin de la récréation

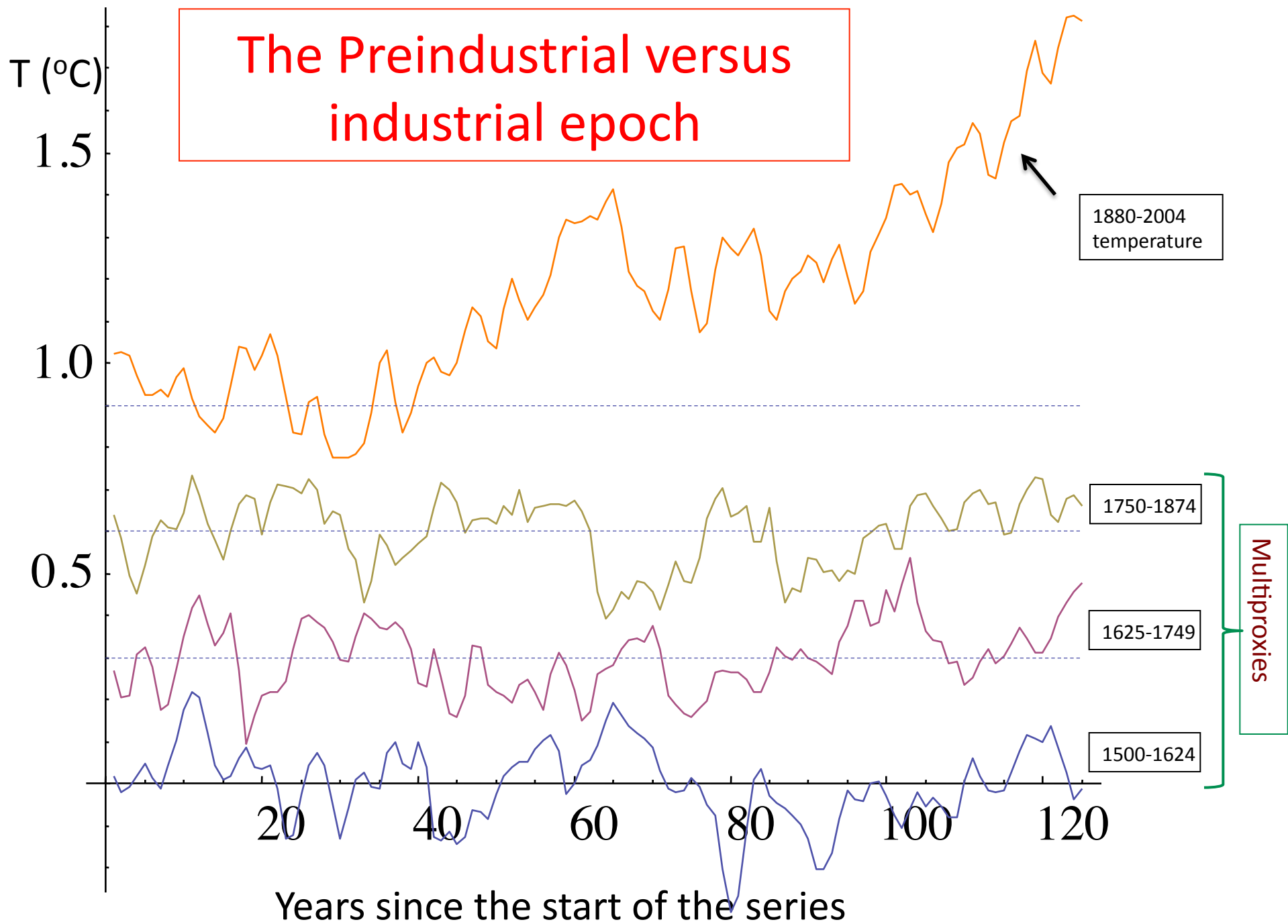
Lovejoy, McGill, 14 Dec. 2014

Evidence for warming

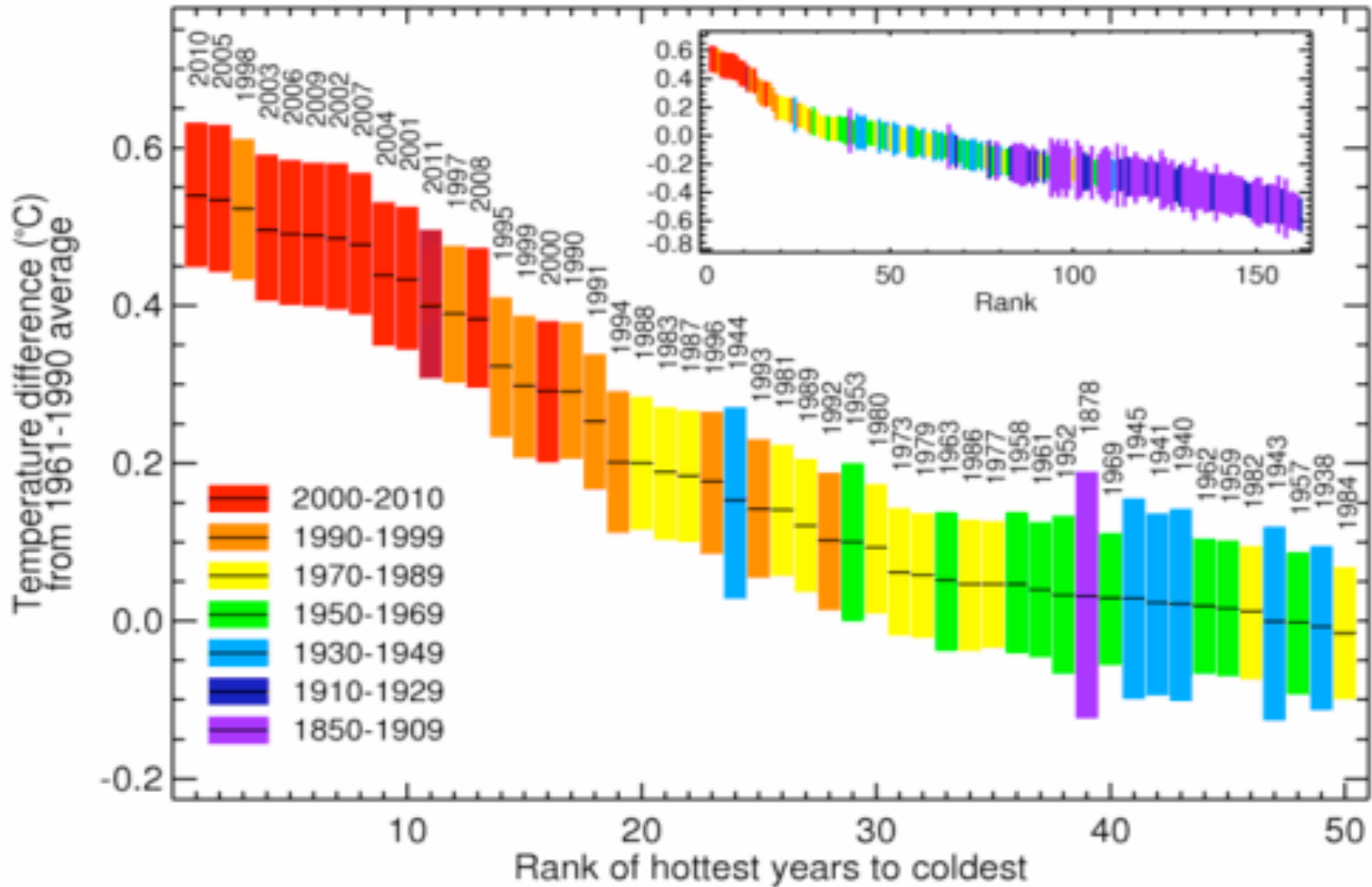
The “hockey stick”

Mann, Bradley, Hughes 1998





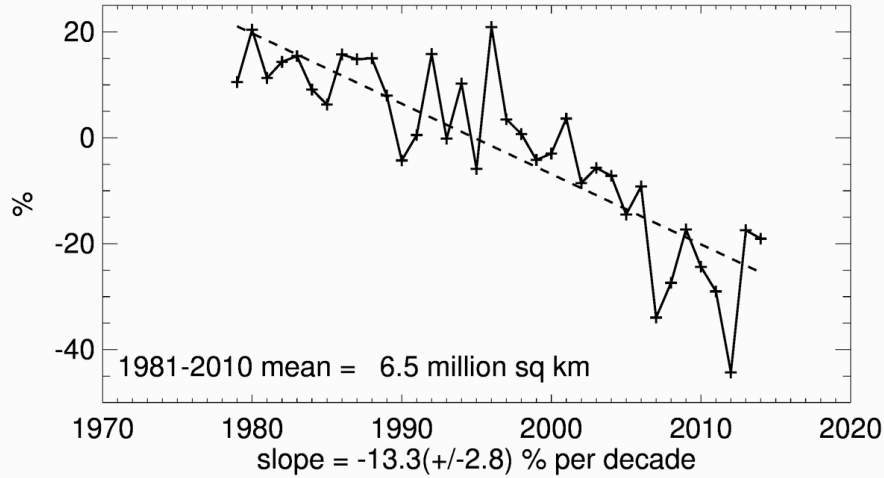
Ranking of temperatures from hottest to coldest



The Arctic

(melting of sea ice)

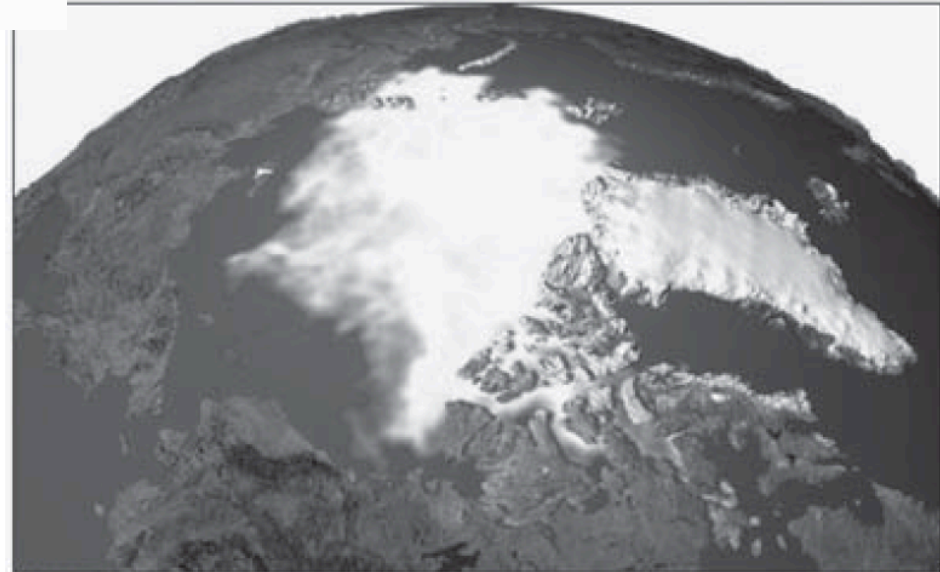
Northern Hemisphere Extent Anomalies Sep 2014



1979

SSM/I Composite Data

Over 2 million square km of sea ice lost over 35 years



2005

2003 SSM/I Composite Data

Doubting the warming

- 1. The models are unreliable they have not been tested, they aren't valid.

predictions of warming doesn't depend on the models

- 2. **Pre 2004:** "Heat Island effect": warm biases due to urbanization?

- The effect is very small

- 3. **1995- 2005:** Satellite temperatures versus surface measurements ...

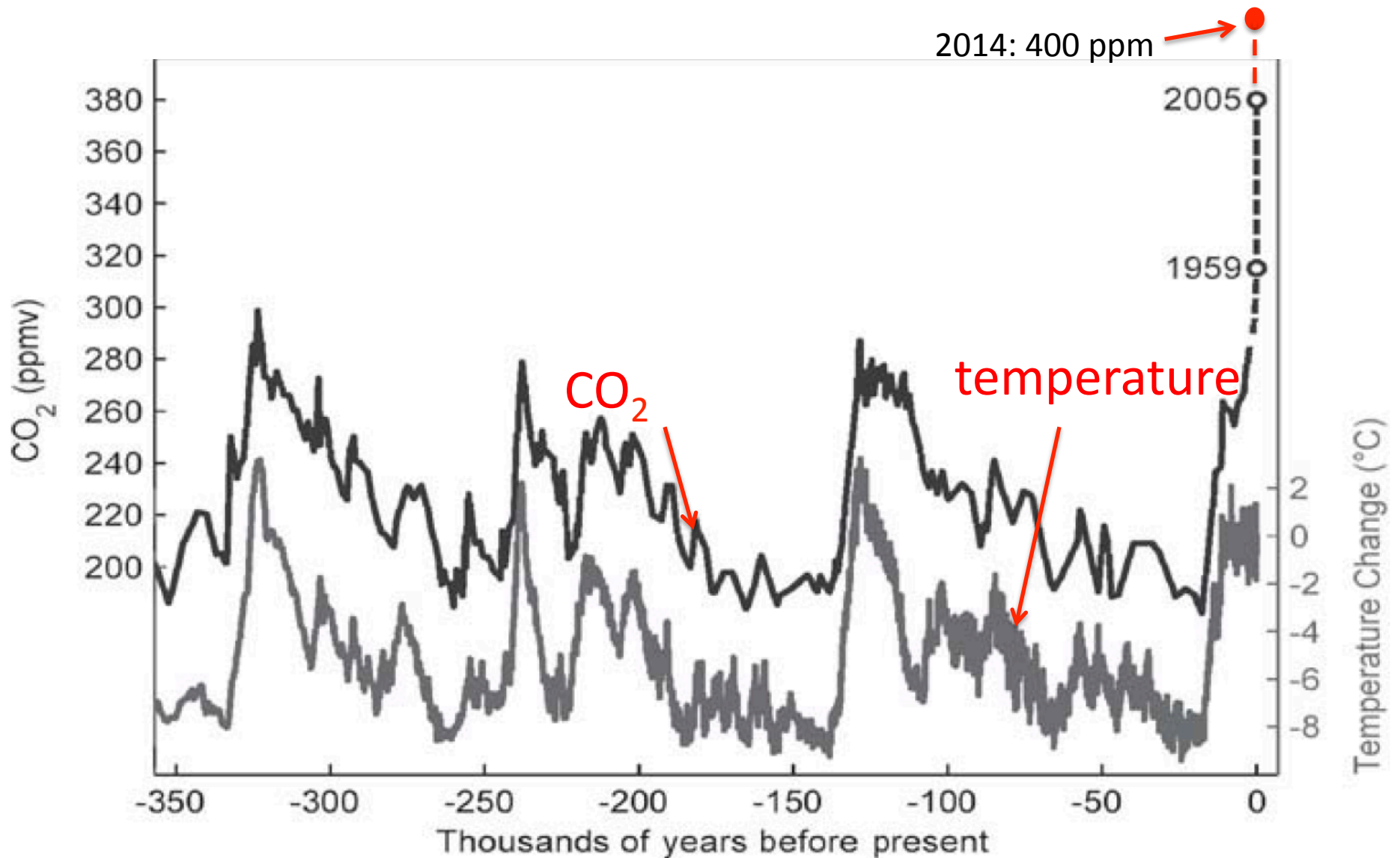
4 errors discovered (now there is agreement).

2006: "Because of the complexity of the problem, environmental skepticism was once tenable. No longer. It is time to flip from skepticism to activism."

-Michael Shermer, editor of the *Skeptical Inquirer*

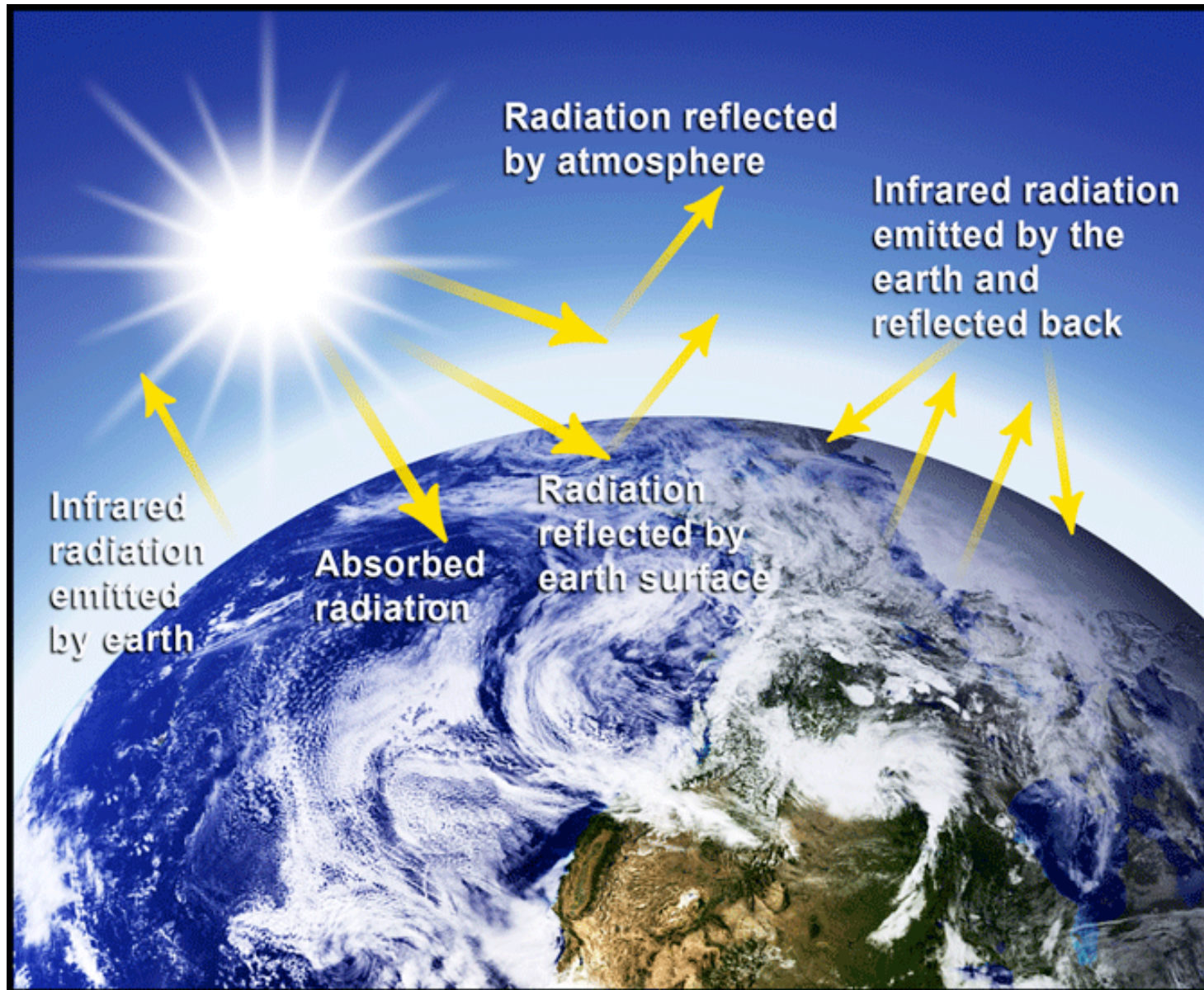
Anthropogenic Theory

CO₂: The last 350,000 yrs



Source: J. R. Petit and others, "Climate and Atmospheric History of the Past 420,000 Years from the Vostok Ice Core, Antarctica," *Nature* 399 (June 1999): 429–36.

The theory of anthropogenic warming: the “Greenhouse effect”



Anthropogenic warming: Pre-GCM era

1896

Nobel prize winner Svante Arrhenius: CO₂ doubling: 5 – 6°C of warming, “climate sensitivity”



Svante Arrhenius
(1859 –1927)

1938

Callender estimated the warming as 2° C



Guy Stewart Callendar
1898 - 1964

1957

Keeling started his celebrated CO₂ measurements at Mauna Loa and at the south Pole

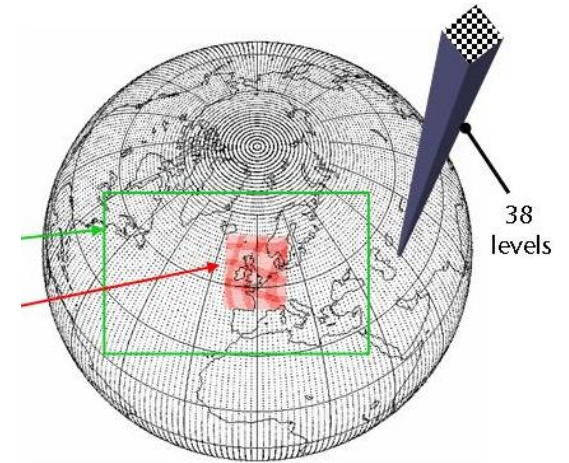


Charles David Keeling
1928 –2005

GCM era (post 1975)

GCM's: for CO₂
doubling:

US National Academy of Science	(1979):	1.5- 4.5°C
IPPC3	(2002):	1.5- 4.5°C
IPPC4	(2007):	2- 4.5°C
IPPC5	(2013):	1.5- 4.5°C



MilkyWay-2: World's fastest supercomputer



3,120,000 cores: 3×10^{16} Flops (Nov. 2014)

1998 climate models somewhat over-forecast the warming in the 2000's

IPCC 5 (2013) extremely

IPCC 4 (2007) “it is likely that human influence has been the dominant cause of the observed warming since the mid-20th century”

Natural variability Theory

Skeptics and Deniers post 2006

Accepting the warming:
**Alternative theory - Natural
variability** (including solar)

1. The warming is due to natural variability.

2. The “pause”: the earth has stopped warming
since 1998.

Implausible but not disproved until 2014...



Disproving Natural warming

Clim Dyn (2014) 42:2339–2351
DOI 10.1007/s00382-014-2128-2

Scaling fluctuation analysis and statistical hypothesis testing of anthropogenic warming

S. Lovejoy

Received: 9 January 2014 / Accepted: 26 March 2014 / Published online: 6 April 2014
© Springer-Verlag Berlin Heidelberg 2014

Abstract Although current global warming may have a large anthropogenic component, its quantification relies primarily on complex General Circulation Models (GCM's) assumptions and codes; it is desirable to complement this with empirically based methodologies. Previous attempts to use the recent climate record have concentrated on “fingerprinting” or otherwise comparing

1 Introduction

Well before the advent of General Circulation Models (GCM's), (Arrhenius 1896), proposed that greenhouse gases could cause global warming and he even made a surprisingly modern quantitative prediction. Today, GCM's are so much the dominant tool for investigating the

Friday, Dec. 12

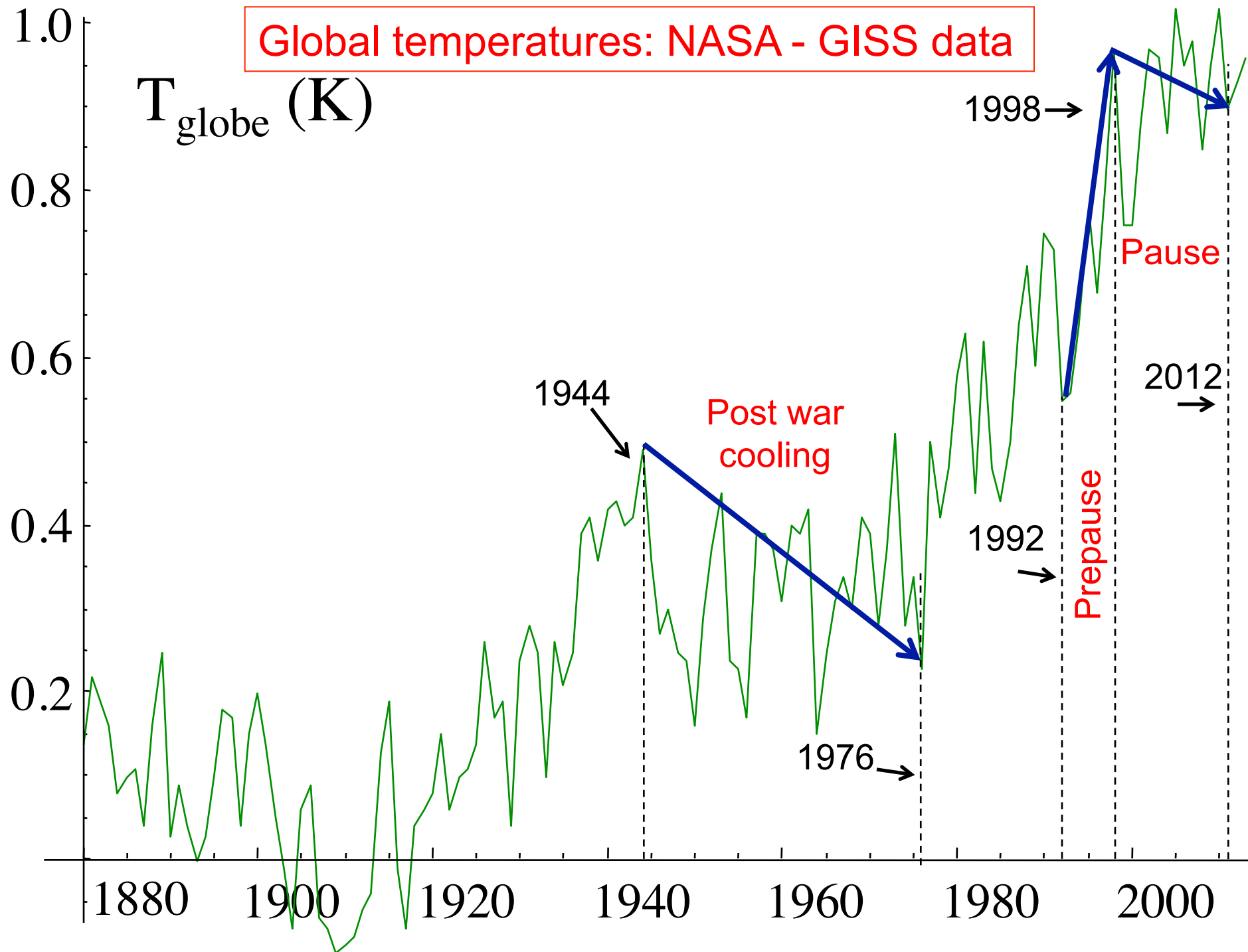
The screenshot shows the Altmetric interface for the article. At the top, a circular score of 181 is displayed. Below it, a text box states: "Is one of the highest ever scores in this journal (ranked #1 of 759)". The article is mentioned by 18 news outlets, 5 blogs, 31 tweeters, and 4 Facebook users. It is read by 29 Mendeley users and 0 CiteULike users. The article title is "Scaling fluctuation analysis and statistical hypothesis testing of anthropogenic warming". The page lists three news stories from outlets like Haaretz and TG Daily, all dated in April 2014. A red arrow points from the date "Friday, Dec. 12" to the article's publication date.

Natural variability hypothesis was neglected by the scientific community

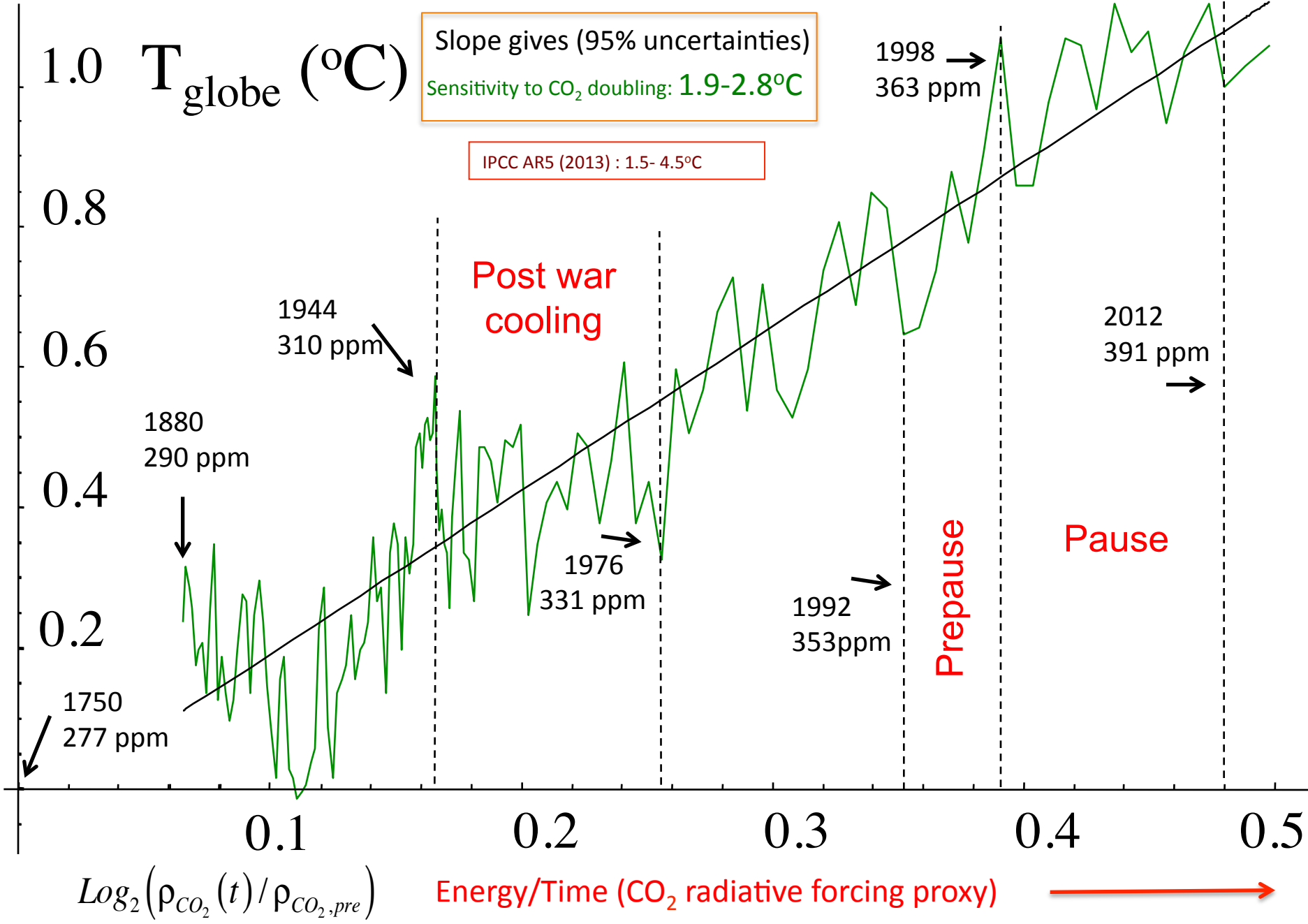


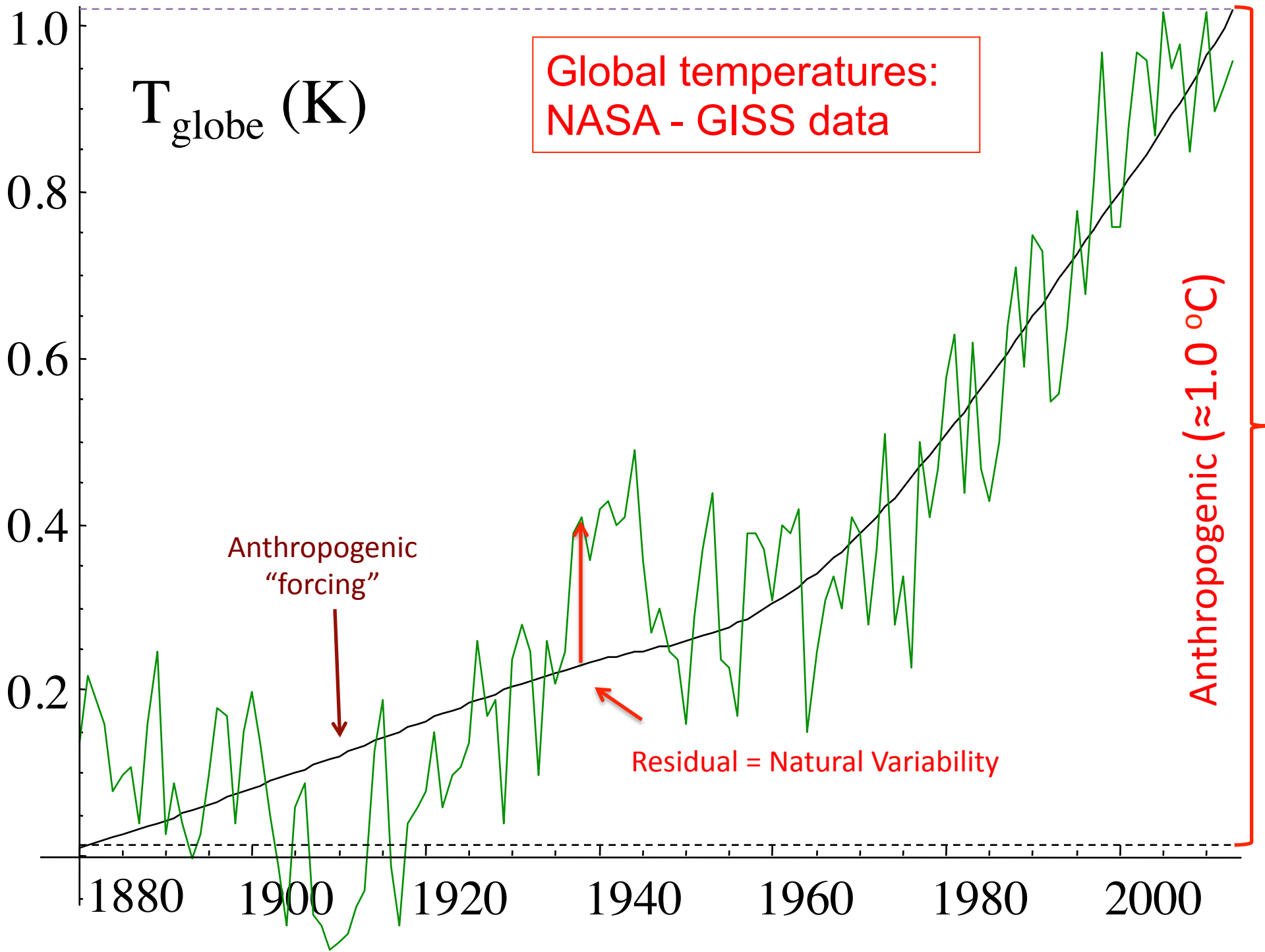
CO₂ forcing as surrogate for all anthropogenic effects

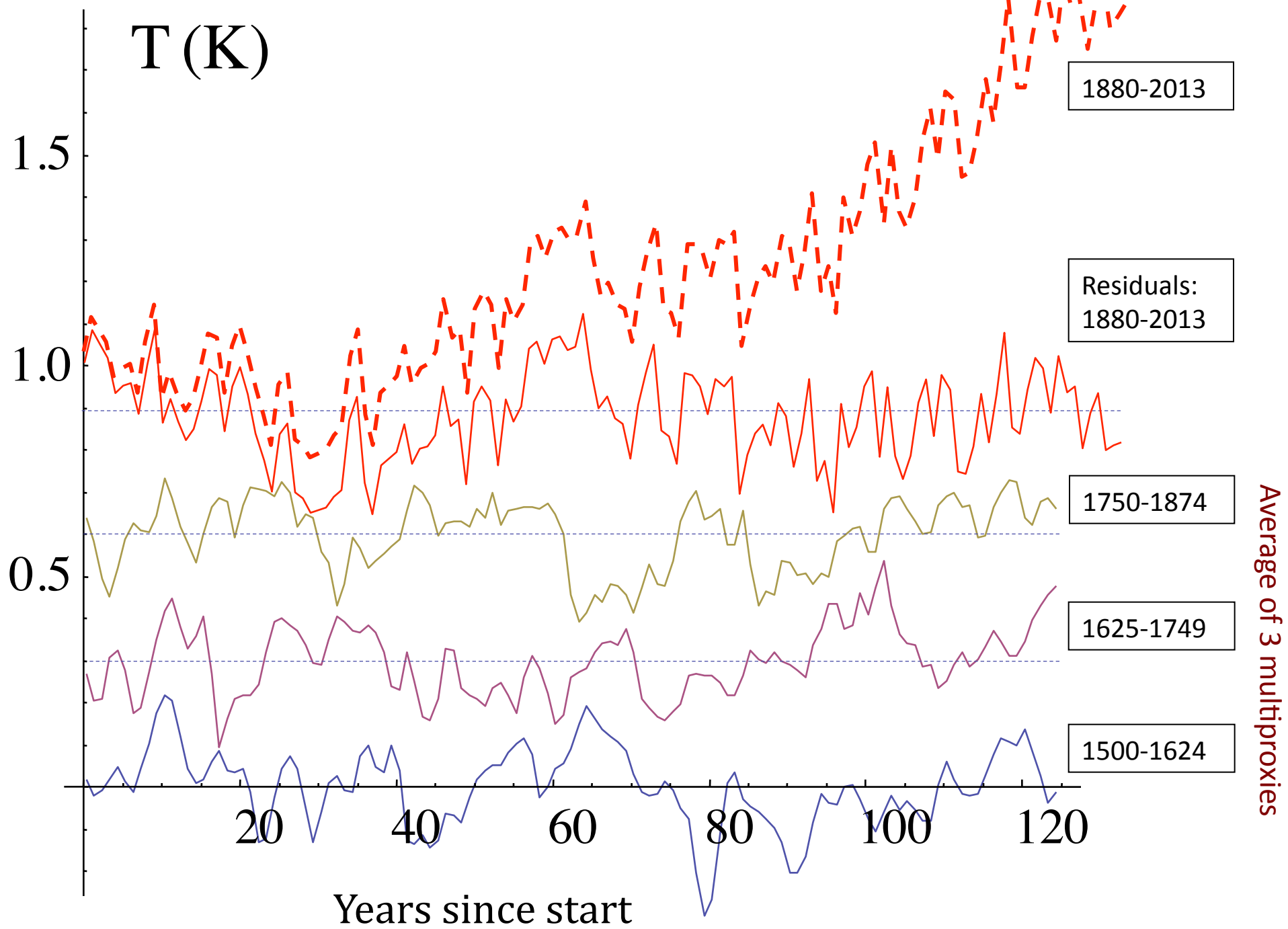
Roughly: you double the global economy, you double the emissions, land use and other changes, you double the effects



Global temperatures: NASA - GISS data

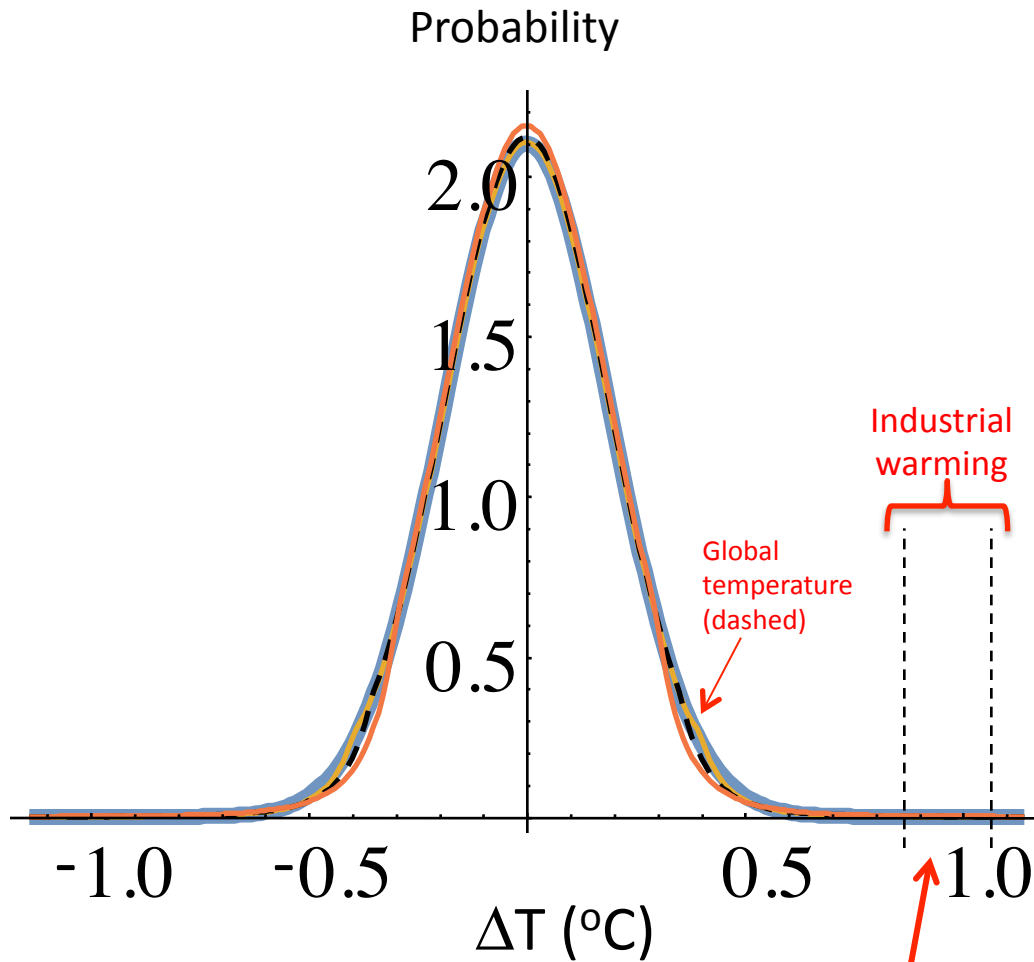






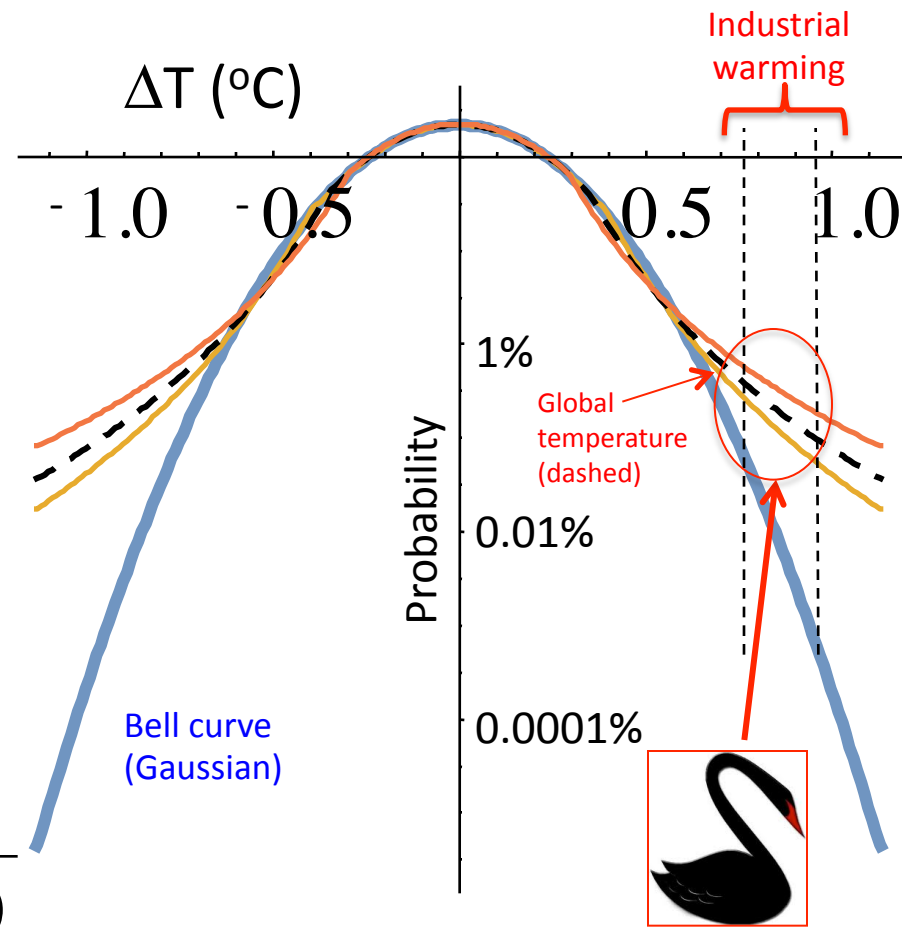
Probabilities of extremes: Bell Curve, Black Swans

Usual representation



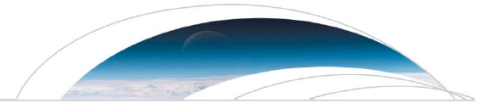
≈ 5 standard deviations: one in a million chance

Representation showing extremes



one in a thousand chance

The Pause



Geophysical Research Letters

RESEARCH LETTER

10.1002/2014GL060478

Key Points:

- The “pause” has a return period of 20–50 years (not unusual)
- Pre-pause (92–98) warming cancels the pause cooling
- The largest expected cooling event = 0.47 K; almost exactly the postwar cooling

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lovejoy@physics.mcgill.ca

Citation:

Lovejoy, S. (2014), Return periods of global climate fluctuations and the pause, *Geophys. Res. Lett.*, 41, doi:10.1002/2014GL060478.

Return periods of global climate fluctuations and the pause

S. Lovejoy¹

¹Physics, McGill, Montreal, Canada

Abstract An approach complementary to General Circulation Models (GCMs), using the anthropogenic CO₂ radiative forcing as a linear surrogate for all anthropogenic forcings [Lovejoy, 2014], was recently developed for quantifying human impacts. Using preindustrial multiproxy series and scaling arguments, the probabilities of natural fluctuations at time lags up to 125 years were determined. The hypothesis that the industrial epoch warming was a giant natural fluctuation was rejected with 99.9% confidence. In this paper, this method is extended to the determination of event return times. Over the period 1880–2013, the largest 32 year event is expected to be 0.47 K, effectively explaining the postwar cooling (amplitude 0.42–0.47 K). Similarly, the “pause” since 1998 (0.28–0.37 K) has a return period of 20–50 years (not so unusual). It is nearly cancelled by the pre-pause warming event (1992–1998, return period 30–40 years); the pause is no more than natural variability.

CLIMATE CHANGE

Global warming slowdown just a ‘pause’

NATURAL COOLING FLUCTUATION

It can't be used to prove that temperature changes not man-made, McGill prof says

KAREN SEIDMAN
GAZETTE UNIVERSITIES REPORTER

McGill University physics professor Shaun Lovejoy, already a global warming denier's worst enemy, has done it again with his latest statistical analysis showing that a recent slowdown in global warming is merely a “pause” — and not any kind of proof that man-made global warming has waned.

Lovejoy already regularly gets hate mail from global

Lord Christopher Monckton of Brenchley, who referred to Lovejoy's work as an emanation “of the forces of darkness.”

That was Lovejoy's study which proved conclusively, he says, that there is such a tiny probability that what we are experiencing is natural warming — probably less than 0.1 per cent — that it can be dismissed.

He has followed it up with a statistical analysis of average global temperatures be-



ALLEN MANN/THE GAZETTE

man-made.

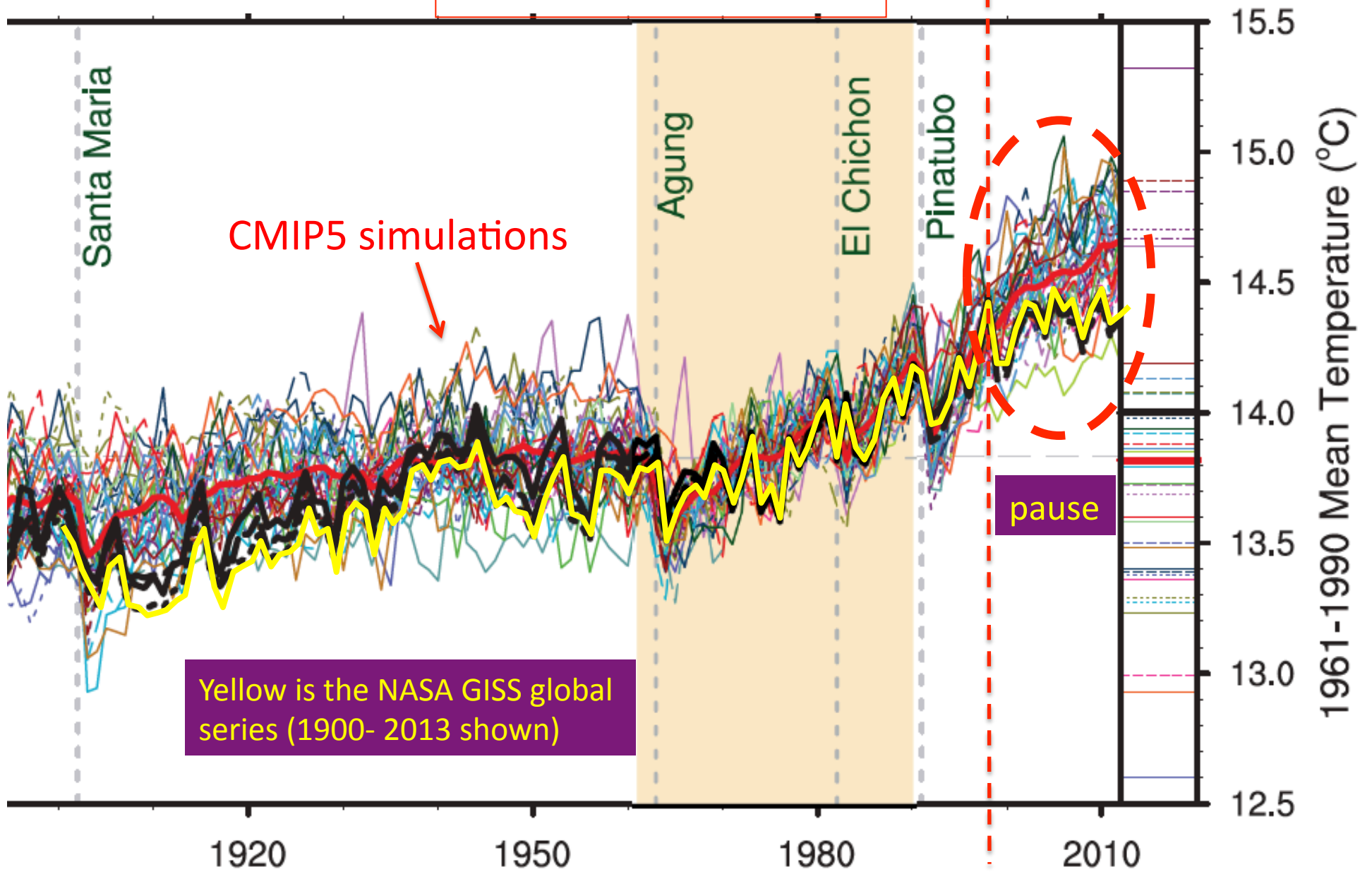
His most recent study addresses the argument raised by skeptics that, since greenhouse gases have continued to rise in the last 15 years while there has been a deceleration in rising temperatures, it must dispute the theory that global warming has been caused largely by man-made emissions.

But Lovejoy says his study concludes there has been a natural cooling fluctuation of about 0.28 to 0.37 C since 1998.

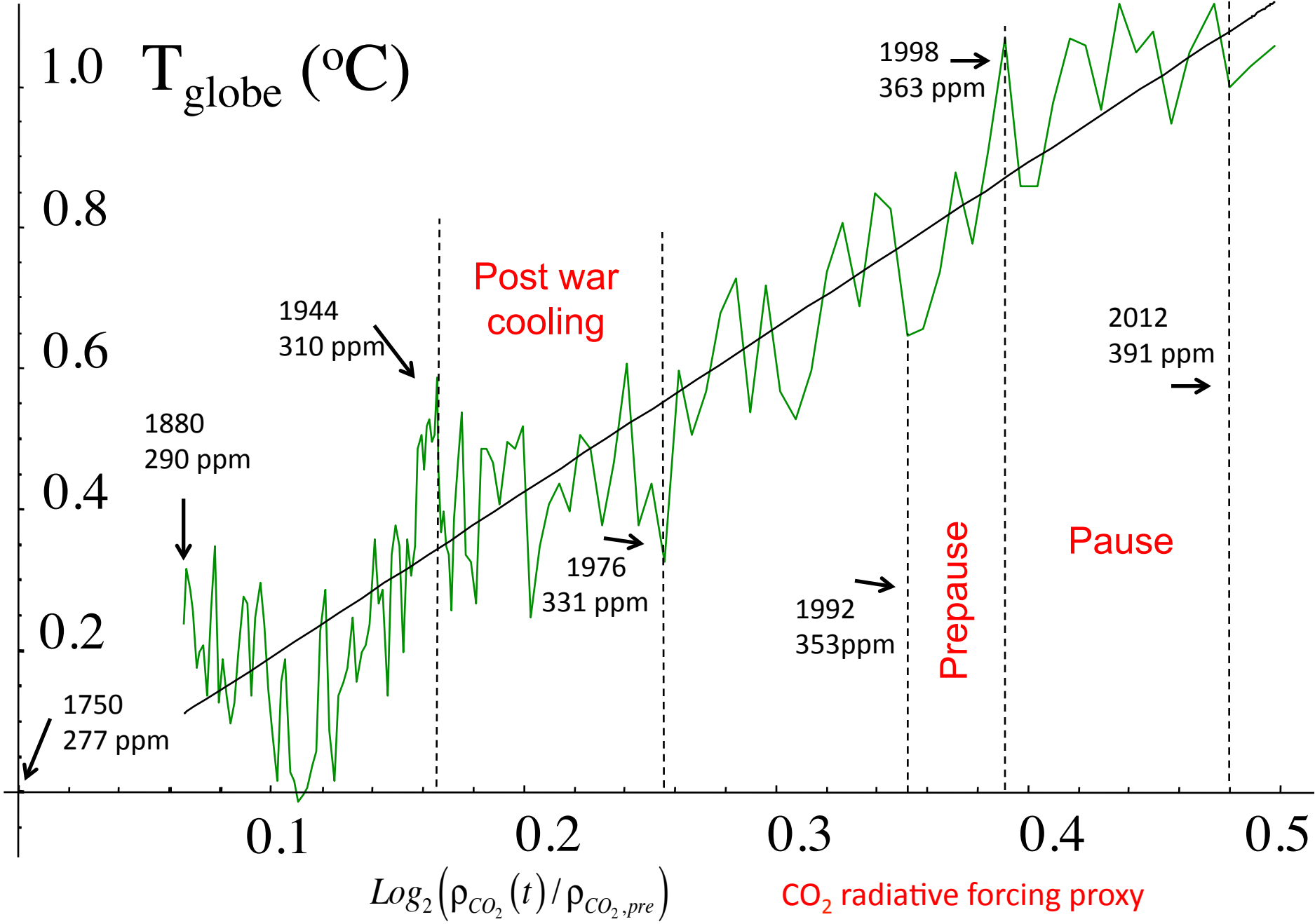
“Being based on climate records, this approach avoids any biases that might affect the sophisticated computer models that are commonly used for understanding global warming,” he said.

And while his new finding

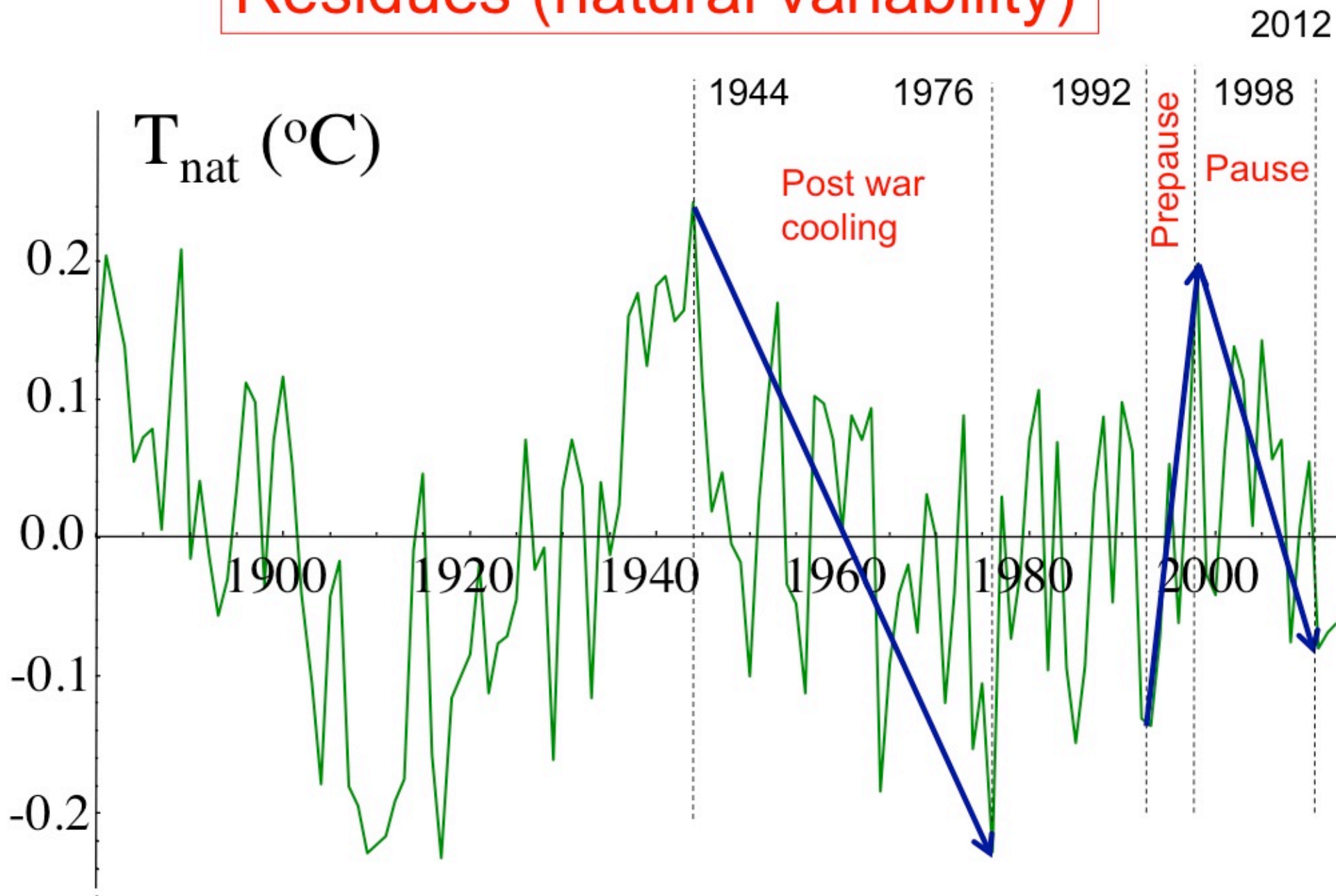
The Pause



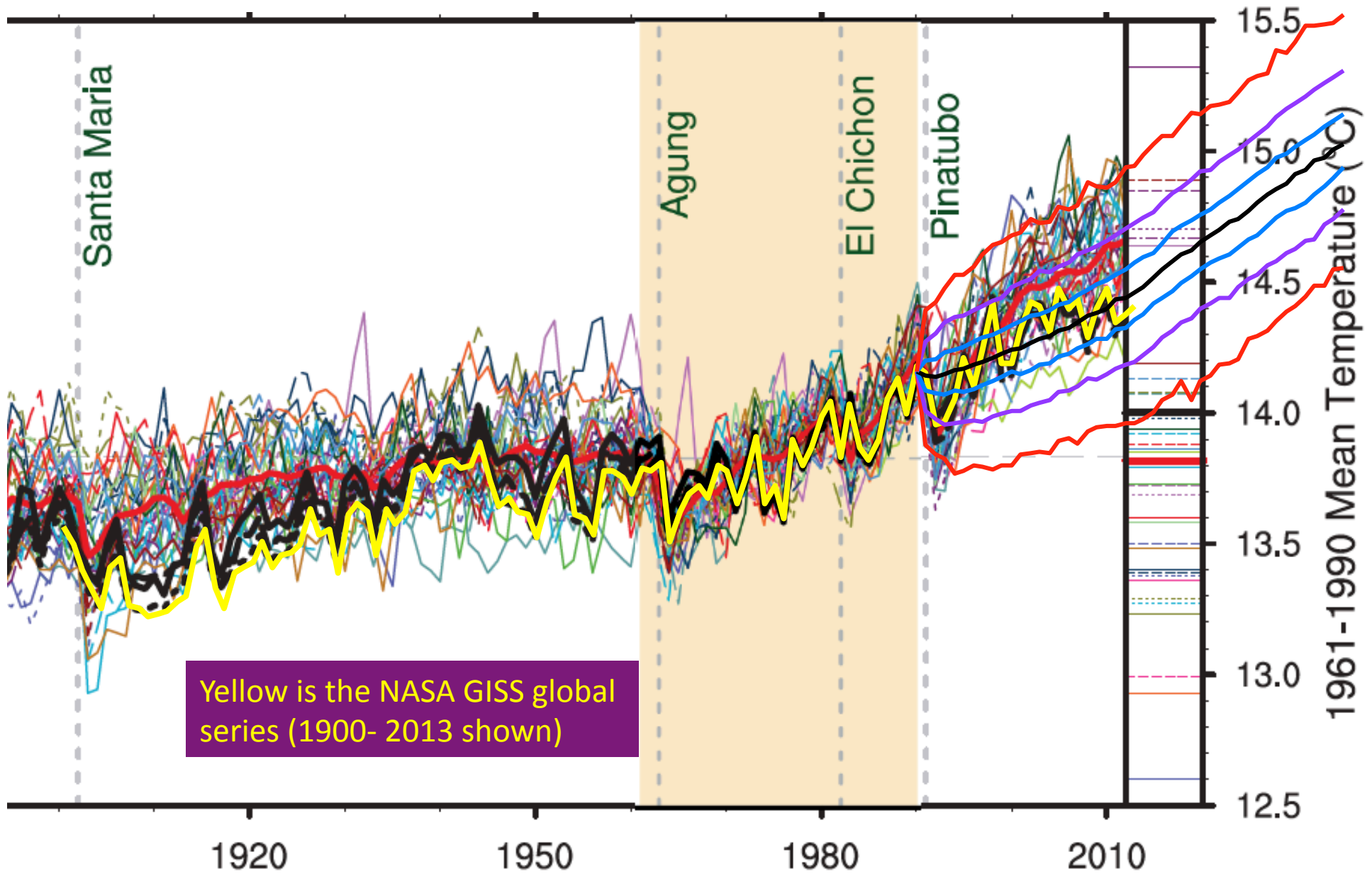
Global temperatures: NASA - GISS data



Residues (natural variability)



The pause with stochastic forecasts



The skeptics reaction (1)



CALGARY, April 17, 2014 /Canadian News Wire/

Friends of Science (Calgary based group)

...Friends of Science are also calling up the Chancellor of McGill University to retract the McGill press release and issue an apology for the use of Lovejoy's quote "This study will be a blow to any remaining climate-change deniers..."

Friends of Science Rescuing TransCanada's Energy East pipeline

On the TransCanada Hwy.,
near Anjou (since Nov. 19)

From the Facebook site of:
L'Association des communicateurs scientifiques du Québec
(Nov. 20, 2014)

Panneau qui aurait été vu sur la 40 à Anjou. Friends of Science est un organisme créé par la Canadian Society of Petroleum Geologists. Ou-wa-che. Via @Isabelle Burgun.

Vu aujourd'hui sur le long de la 40 à Anjou.

Et ça tombe la même journée que la révélation du Devoir que «TransCanada dispose d'un plan précis [et de sommes colossales] pour faire aboutir le projet Énergie Est».

Sur leur site, ils disent qu'ils ont un budget très limité... Ah? Et ils peuvent se payer une pub sur panneau lumineux?

Qui connaît ça, Friendsofscience.org?

« Our Goal:

To educate the public about climate science and through them bring pressure to bear on governments to engage in public debates on the scientific merits of the hypothesis of human induced global warming and the various policies that intend to address the issue.

Our Opinion:

It is our opinion that the Sun is the main direct and indirect driver of climate change. »

Après les créationnistes, voici les autruches patentées.



The skeptics reaction (2)

“A mephitic ectoplasmic emanation of the forces of darkness”

-Viscount Lord Christopher Monckton of Brenchley evaluating on this work



An ectoplasm

Common reactions.. and misconceptions:

-Use of historical information

Q: 800 years ago in medieval Europe *global* temperatures might have been warmer than today if so, doesn't this contradict the analysis?

A: Our conclusions are for **125 year periods** - there is nothing to prevent the same changes occurring much more slowly (i.e. over much longer periods).

-Use of unrepresentative paleo or instrumental sources, (the “Friends”):

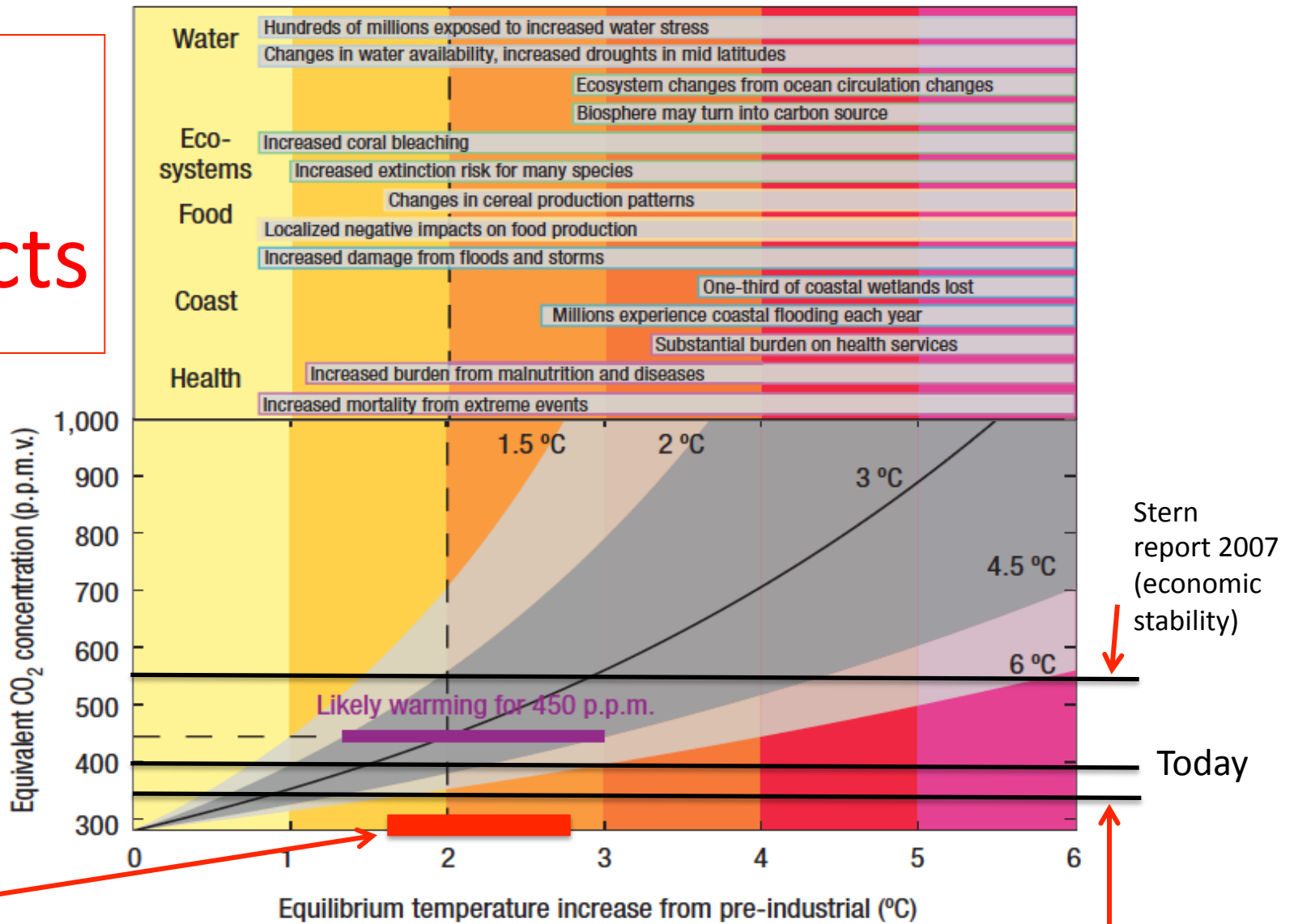
Q: The temperature change in central England from 1663-1762 was 0.90 °C, so such changes are not unusual.

A. England is only 0.04% of the earth's surface. The *global scale* temperature change was only 0.21±0.12 °C.

Impacts

The impacts

Knutti et al 2008



Our simple method:
doubling CO₂:
3.08±0.58 °C

For 450 ppm:
2.2±0.4 °C
(0.6±0.15 °C
more than in
2013)

“Levels of CO₂ in excess of only 350 ppm are not compatible with the planet on which civilization developed or to which life on earth is adapted”:
Hansen et al 2008

What is to be done?

The challenge: Decarbonize the economy

Can we break the link between economic growth
and CO₂ emissions?

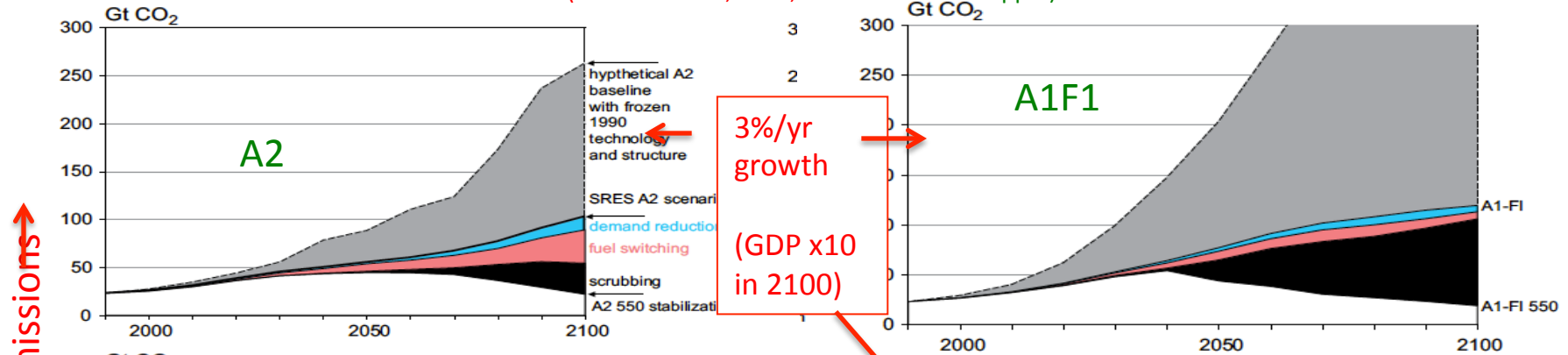
Today: 80% of the worlds energy comes from fossil fuels

Economists' magical thinking

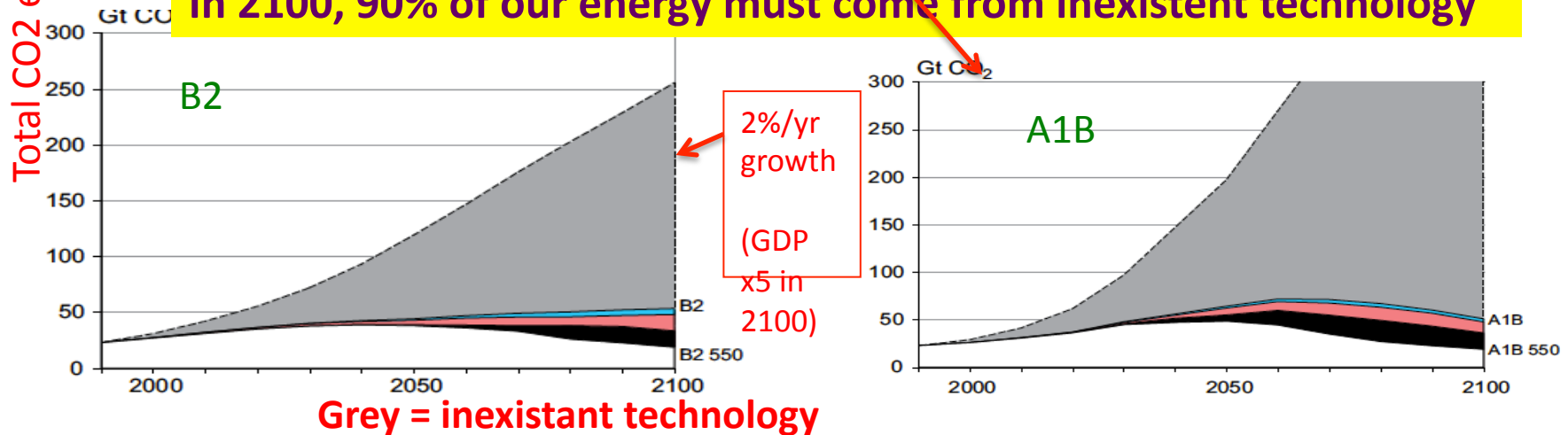
No physical limits: if the price is right then technology can be conjured up to solve any problem...

The role of existent and new technologies

(IPCC scenarios, 2007; Stabilisation at 550ppm)



In 2100, 90% of our energy must come from inexistant technology



NEW!

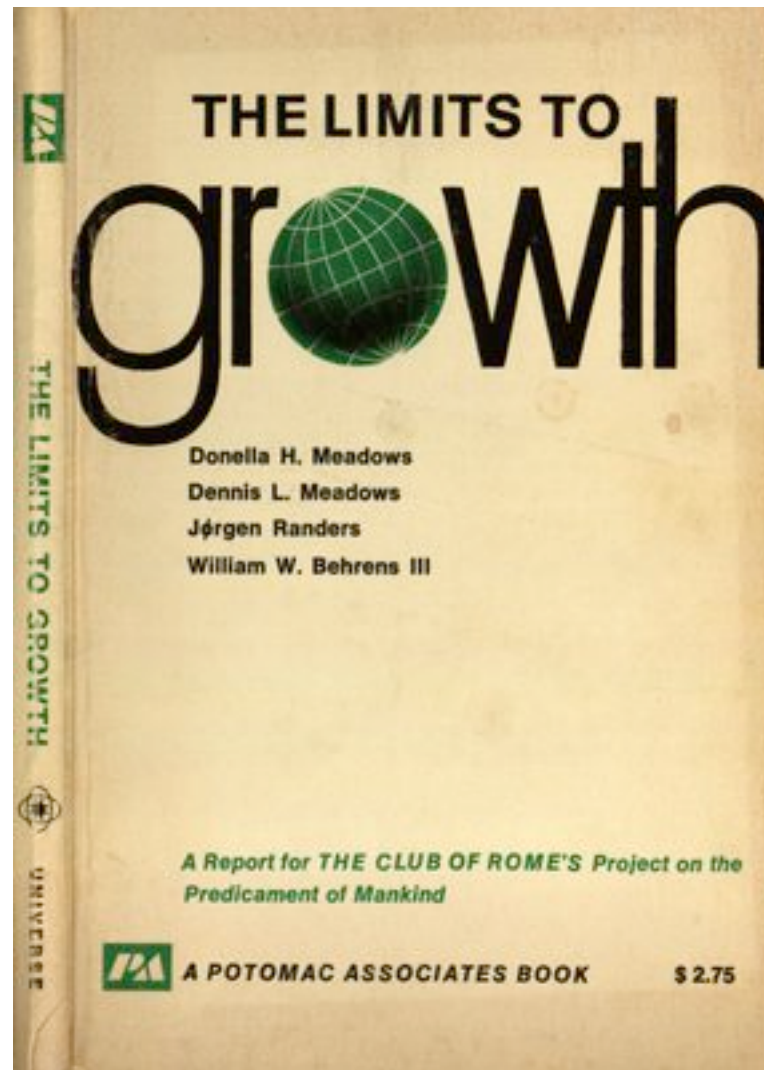
IPCC 2014 (working group 3 on mitigation and adaptation)

A major role for Carbon Capture and Storage technology that doesn't exist...

Is continued quantitative economic growth *possible*?

Limits to Growth: Overshoot and collapse

According to the 1972 “Business as Usual” projection, the last 40 years have tracked well and collapse will start around 2015 (G. Turner, 2014)

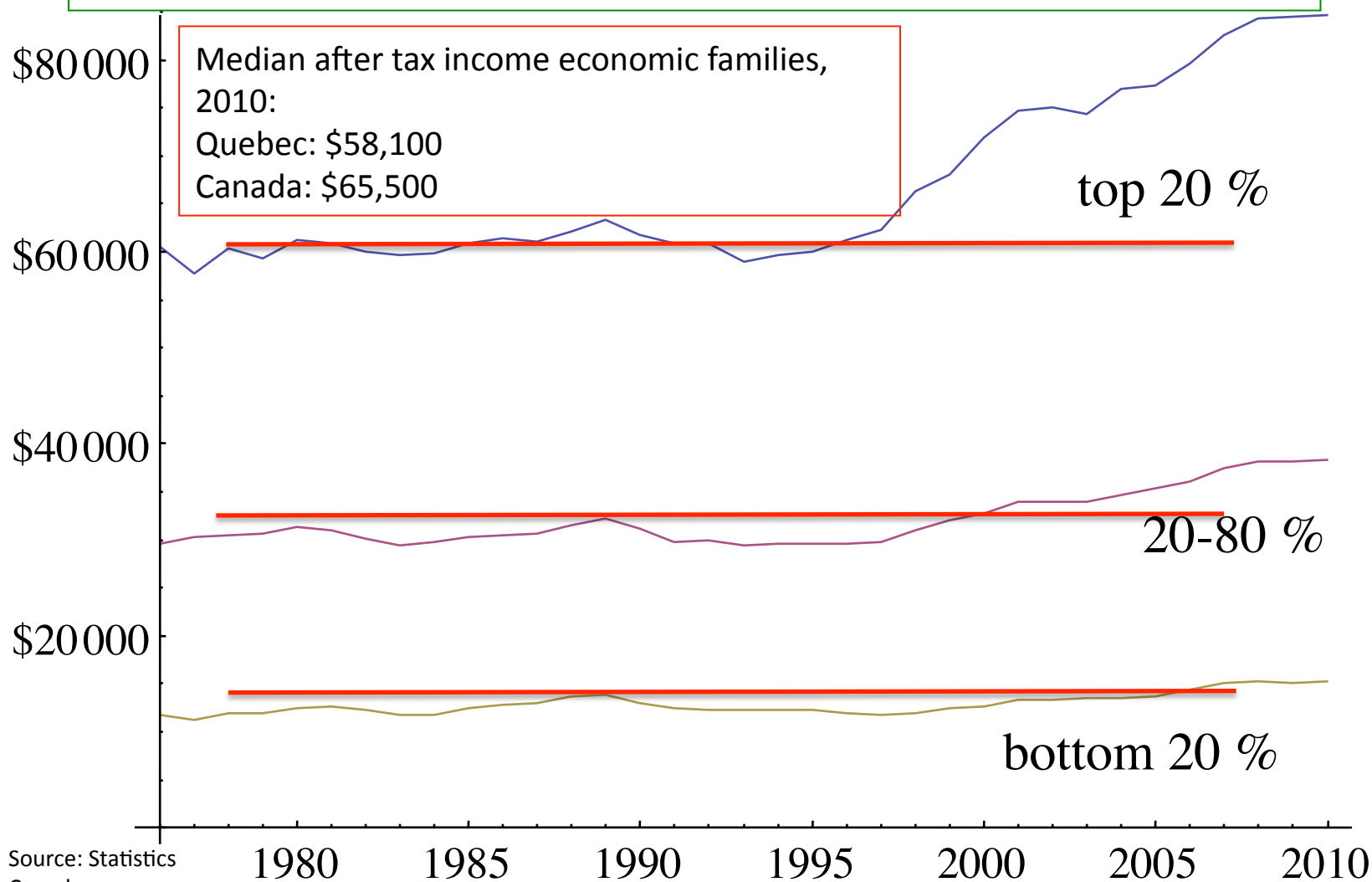


Note: The **nonlinear** model is completely based on physical (not financial inputs and outputs).

1972

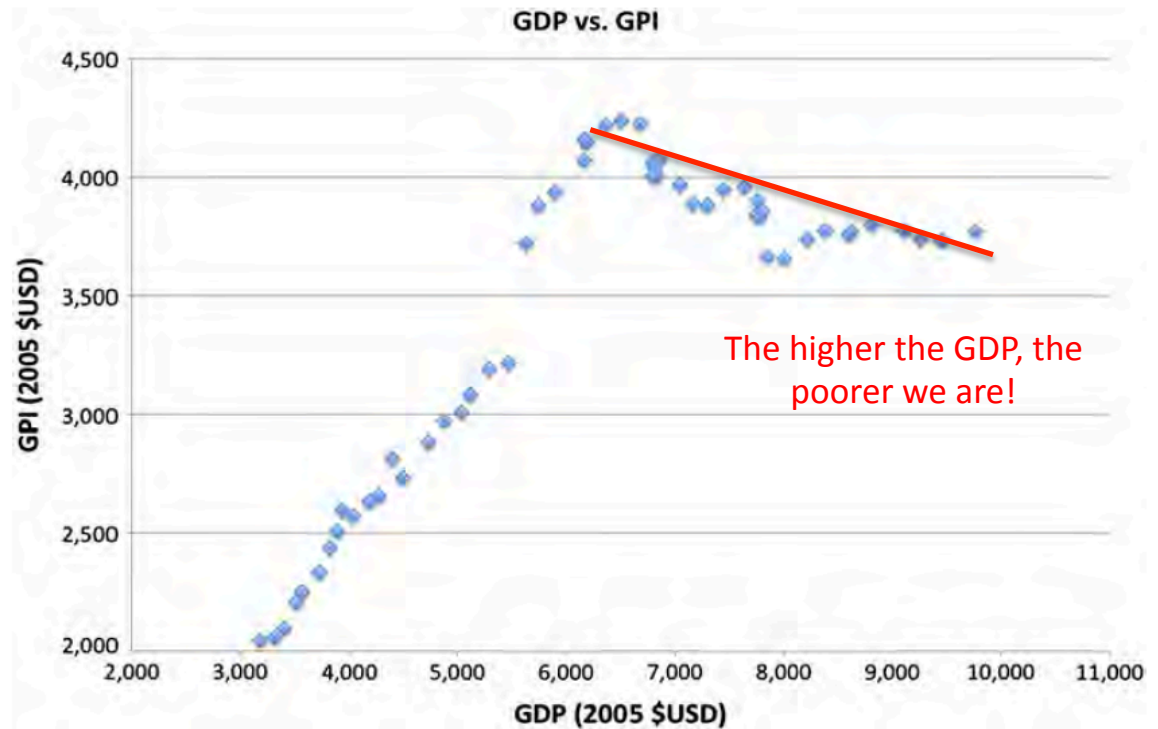
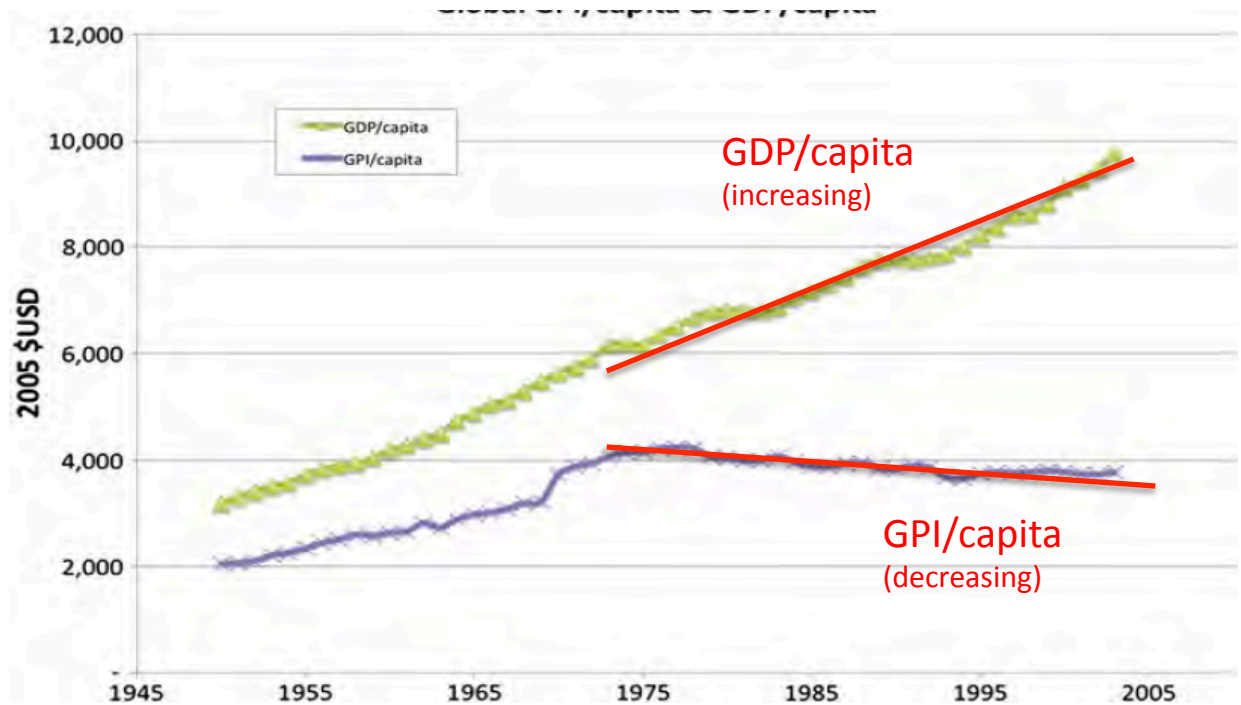
Is continued quantitative growth *desirable*?

After - tax income, by family unit, Canada, 1976 – 2010
(2010 constant dollars, economic families)



GDP versus GPI

GDP=Gross Domestic Product
GPI=Genuine Progress Indicator



What is to be done?

- Global Warming is a global problem requiring global scale cooperation.
- Saving the climate is incompatible with the current triumph of the unfettered market.

What is to be done?

**NAOMI
KLEIN**
THIS CHANGES
EVERYTHING
CAPITALISM vs
THE CLIMATE



**Divest
McGill**

SIGN THE PETITION AT DIVESTMCGILL.COM



@DivestMcGill



"Divest McGill"



divestmcgill@gmail.com

WHAT'S A "DIVEST MCGILL" ?

Divest McGill is a campaign calling on McGill University to clear its endowment of investments in the fossil fuel industry and to reinvest in sustainable alternatives. We're part of a movement of 500+ fossil fuel divestment campaigns worldwide getting their institutions to address the urgency of climate change and work towards climate justice.

FOSSIL FUELS ARE RISKY BUSINESS

- Fossil fuel companies are valued under the assumption that all of their reserves will be burnt and that they will continue to receive subsidies. But as society catches up to climate realities, this overvaluation means there's a \$6 trillion USD "carbon bubble" that's poised to burst.
- There are profitable alternatives: fossil-free portfolios have performed better in the last ten years than those including fossil fuel companies.¹

WHERE ARE WE AT?

- Divest McGill has the support of all 3 student societies, 1500+ signatures on our petition from students, staff, faculty & alumni, and endorsements from a wide variety of campus and community organizations.
- We are currently challenging a May 2013 decision by McGill's Committee to Advise on Matters of Social Responsibility (CAMSAR) in response to our petition not to divest from fossil fuel companies.
- Our day-to-day is filled with creative actions, speaking events, research briefs & editorials, meetings with students, alumni, professors & community

**COULE
PAS
CHEZ
NOUS**



“L'AVENIR N'EST PAS
DANS LES PIPELINES!”

COULE PAS CHEZ NOUS!
EST UNE CAMPAGNE DE SENSIBILISATION
CITOYENNE QUI DIFFUSE DE L'INFORMATION
AFIN DE MIEUX COMPRENDRE L'ENJEU
PÉTROLIER ET POURQUOI NOUS DEVONS DIRE
NON AU TRANSPORT DE PÉTROLE SUR NOTRE
TERRITOIRE

AGISSONS ENSEMBLE MAINTENANT!!



**DÉFILEZ JUSQU'EN BAS POUR NE
RIEN MANQUER!**



Ce que la science dit VRAIMENT:
Le climat change. À cause de nous.



Association des
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du Québec

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Conclusions

1. It is much easier to disprove a theory (natural warming) than to prove one (anthropogenic warming).
2. The total anthropogenic warming since 1880 is about 1°C, for CO₂ doubling, 3.08±0.58°C.
3. The probability of the warming being natural is less than 0.1%.
4. The pause is a natural cooling event superposed on anthropogenic warming.
5. Decarbonizing is unlikely with continued global economic growth (“magical thinking”).
6. For many of us, continued economic growth is undesirable (lower GPI).