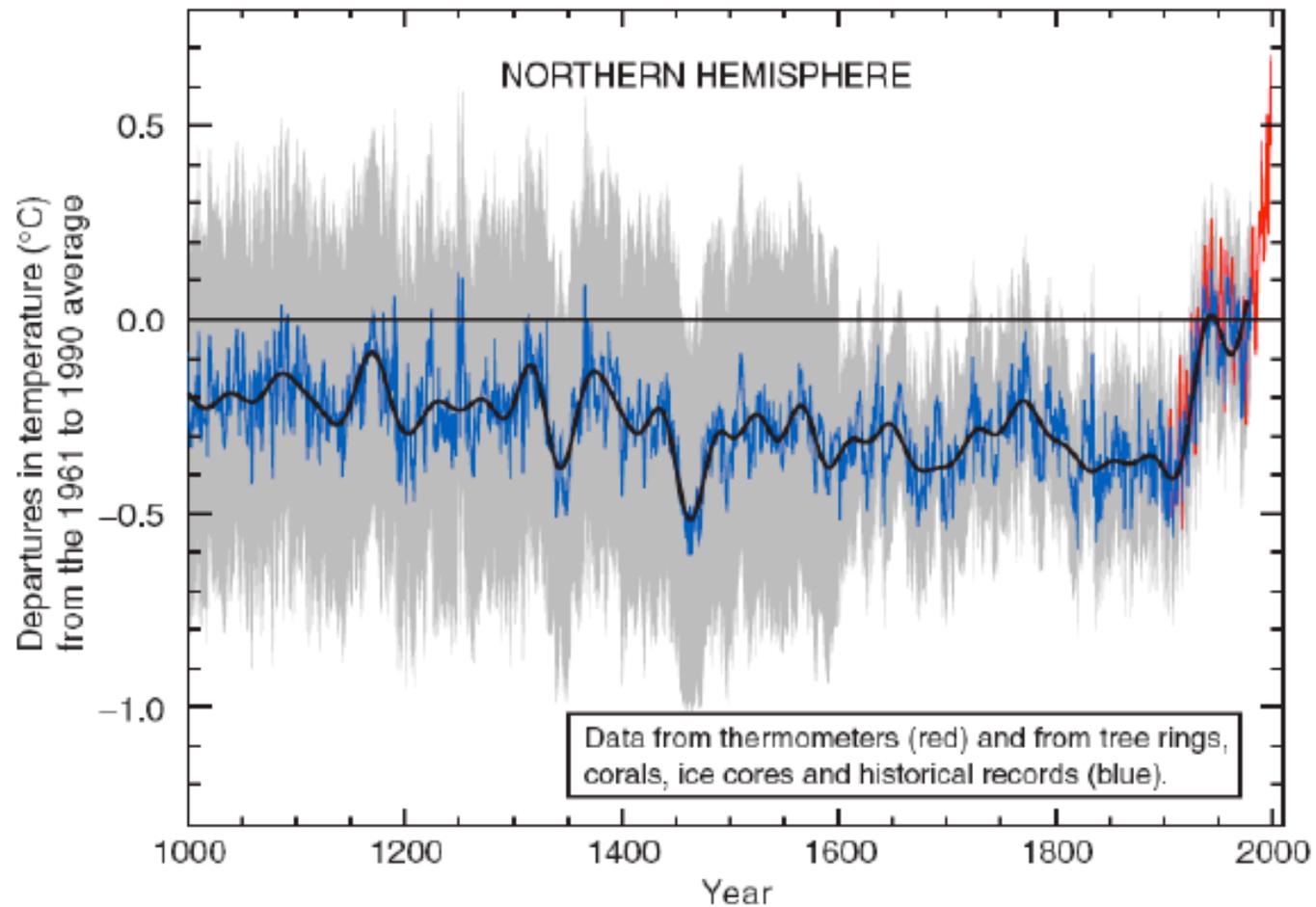


# Physical Sciences Case Study

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# Outline

- History and Reasons for the Study (Hockey Stick)
- Summary of the NRC Report 2006: *Surface Temperature Reconstructions for the Last 2000 Years*
  - Variety of Data Types & Cultures in the Study
- Issues Regarding Assuring Data Integrity
- Data Archiving Suggestions



**FIGURE O-4** Multiproxy reconstruction of Northern Hemisphere surface temperature variations over the past millennium (blue), along with 50-year average (black), a measure of the statistical uncertainty associated with the reconstruction (grey), and instrumental surface temperature data for the last 150 years (red), based on the work by Mann et al. (1999). This figure has sometimes been referred to as the “hockey stick.” SOURCE: IPCC (2001).

# **Rep. Barton's harassment of scientists, disdain for fellow lawmakers a disservice**

## Editorial

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The heart of science isn't quiet. Challenges to data, methodology and interpretation churn throughout the scientific process. Harassment of scientists, however, deserves no role in scientific inquiry. U.S. Rep. Joe Barton, R-Ennis, ignores this principle in his shameful hectoring of well-known climatologists.

Late last month, Barton requested mounds of documents from three scientists known for studying global warming. As chairman of the House Committee on Energy and Commerce, Barton demanded detailed documentation of almost every aspect of hundreds of studies the scientists had penned.

He made a similar request to the head of the National Science Foundation, writing, "The term 'records' is to be construed in the broadest sense ... whether printed or recorded electronically or magnetically or stored in any type of data bank, including, but not limited to ... summaries of personal conversations or interviews ... diaries ... checks and canceled checks ... bank statements."

Barton gave the scientists 18 days to comply with the request, which he has the power to convert into a subpoena.

One recipient was University of Virginia researcher Michael E. Mann, whose studies suggest the Earth's climate has grown warmer in large part due to humans' use of fossil fuels. Mann co-authored a 2001 report by the Intergovernmental Panel on Climate Change. Since then, numerous climate studies have supported Mann's original findings.

Partly because of its influence, Mann's early work still draws critiques from global-warming skeptics. Barton cited these critiques in his letter to Mann, adding "this dispute surrounding your studies bears directly on important questions about the federally funded work upon which climate studies rely."

The extraordinary scope of Barton's investigation has rightly appalled many scientists and lawmakers. The European Geosciences Union called the requests "burdensome and inappropriate." The director of the National Academy of Sciences vainly offered to appoint an independent panel to review the consensus on global warming claims.

A mark of the inappropriate nature of Barton's actions, a fellow Republican rebuked him in a public letter. U.S. Rep. Sherwood Boehlert, R-N.Y., chairman of the House Science Committee, warned Barton that his investigation was outside his committee's jurisdiction and showed "an insensitivity toward the workings of science [that] may reflect your Committee's inexperience in the areas you are investigating."

Calling Barton's precedent "truly chilling," Boehlert added, "My primary concern about your investigation is that its purpose seems to be to intimidate scientists rather than to learn from them."

Barton has responded to his critics with a bizarre tone unsuited to the subject's gravity. "We regret that our little request for data has given them a chill," his committee spokesman recently said.

Barton is right that global warming is a pressing and controversial issue — and tracking the use of federal funding is a worthwhile endeavor. In his indiscriminate mining for documents, however, Barton ignores the first steps of fact-finding: hearings, discussions with the scientists and reading the peer-reviewed and published papers in the field.

Given his indebtedness to the oil and power industries — from 1989-2004 he received more money from these industries than any other House member — Barton seems to be acting on motives other than a thirst for truth. This is a disservice to the nation. Harassing scientists is the wrong way to find answers to environmental questions that affect us all.

# Bloggers:

## RealClimate

From Wikipedia, the free encyclopedia

Jump to: [navigation](#), [search](#)

**RealClimate** is a commentary site ([blog](#)) on [climatology](#) by a group of climate scientists for the interested [public](#) and [journalists](#). It aims to provide a quick response to developing stories and provide the context sometimes missing in mainstream commentary. The discussion is intended to be restricted to [scientific](#) topics and to avoid [political](#) or [economic](#) implications of the science.

### Contents [\[hide\]](#)

- [1 Recognition](#)
- [2 Members](#)
- [3 External links](#)
- [4 References](#)

# Bloggers:

## Climate Audit

From Wikipedia, the free encyclopedia

Jump to: [navigation](#), [search](#)

**Climate Audit** is a [blog](#) run by [Stephen McIntyre](#) devoted to auditing the statistical methods and data used in [historical reconstructions](#) of past climate, especially [multiproxy](#) reconstructions such as the 1998 reconstruction by Mann, Bradley and Hughes ("MBH98"), which was prominently featured in the 2001 [IPCC Third Assessment Report](#).

McIntyre became interested in these issues after advocates of the [Kyoto Protocol](#) used the [Hockey Stick graph](#) from MBH98 in ways that he found similar to [Bre-X](#) and other [stock frauds](#), leading him to try to [audit](#) the MBH98 data and analysis. He launched the blog on October 26, 2004,<sup>[1]</sup> just before [Geophysical Research Letters](#) published a paper by McIntyre and [Ross McKittrick](#) critiquing MBH98. The blog is largely concerned with McIntyre's efforts to audit current climate publications. It supports comments.

The ClimateAudit blog was credited with spurring two hearings on the Hockey Stick Graph, open documentation and the reliability of peer review in government-funded science research by the U.S. House of Representatives Energy and Commerce Committee in 2006 at which Stephen McIntyre testified. Of the role of the Climate Audit blog in inspiring the hearings, the Prometheus blog of the Center for Science and Technology Policy Research of the University of Colorado at Boulder said, referring to ClimateAudit, "[McIntyre and McKittrick] also have provided a case study in the power of blogs in today's worlds of science and politics."<sup>[2]</sup>

Climate Audit has been highlighted by the press including [The Wall Street Journal](#)<sup>[1]</sup> and [United Press International](#)<sup>[2]</sup> .

# Hockey stick controversy

From Wikipedia, the free encyclopedia

Jump to: [navigation](#), [search](#)

The so-called [Hockey stick graph](#) as shown in the 2001 IPCC report. This chart shows the data from Mann *et al.* 1999. The colored lines are the reconstructed temperatures, and the gray shaded region represents estimated error bars.

Reconstructions of [Northern Hemisphere](#) temperatures for the last 1,000 years according to various older articles (bluish lines), newer articles (reddish lines), and instrumental record (black line).

The **Hockey stick controversy** is a dispute over the reconstructed estimates of [Northern Hemisphere mean temperature changes over the past millennium](#),<sup>[1]</sup> especially the particular reconstruction of [Mann](#), Bradley and Hughes, <sup>[2]</sup> frequently referred to as the MBH98 reconstruction. The term "**hockey stick**" was coined by the head of [National Oceanic and Atmospheric Administration](#)'s (NOAA) [Geophysical Fluid Dynamics Laboratory](#), [Jerry Mahlman](#), to describe the pattern.

## Contents [\[hide\]](#)

- [1 Nature of the dispute](#)
- [2 Criticisms of the MBH reconstruction](#)
- [3 National Research Council Report](#)
- [4 Committee on Energy and Commerce Report \(Wegman report\)](#)
- [5 Updates](#)
- [6 References](#)
- [7 External links](#)

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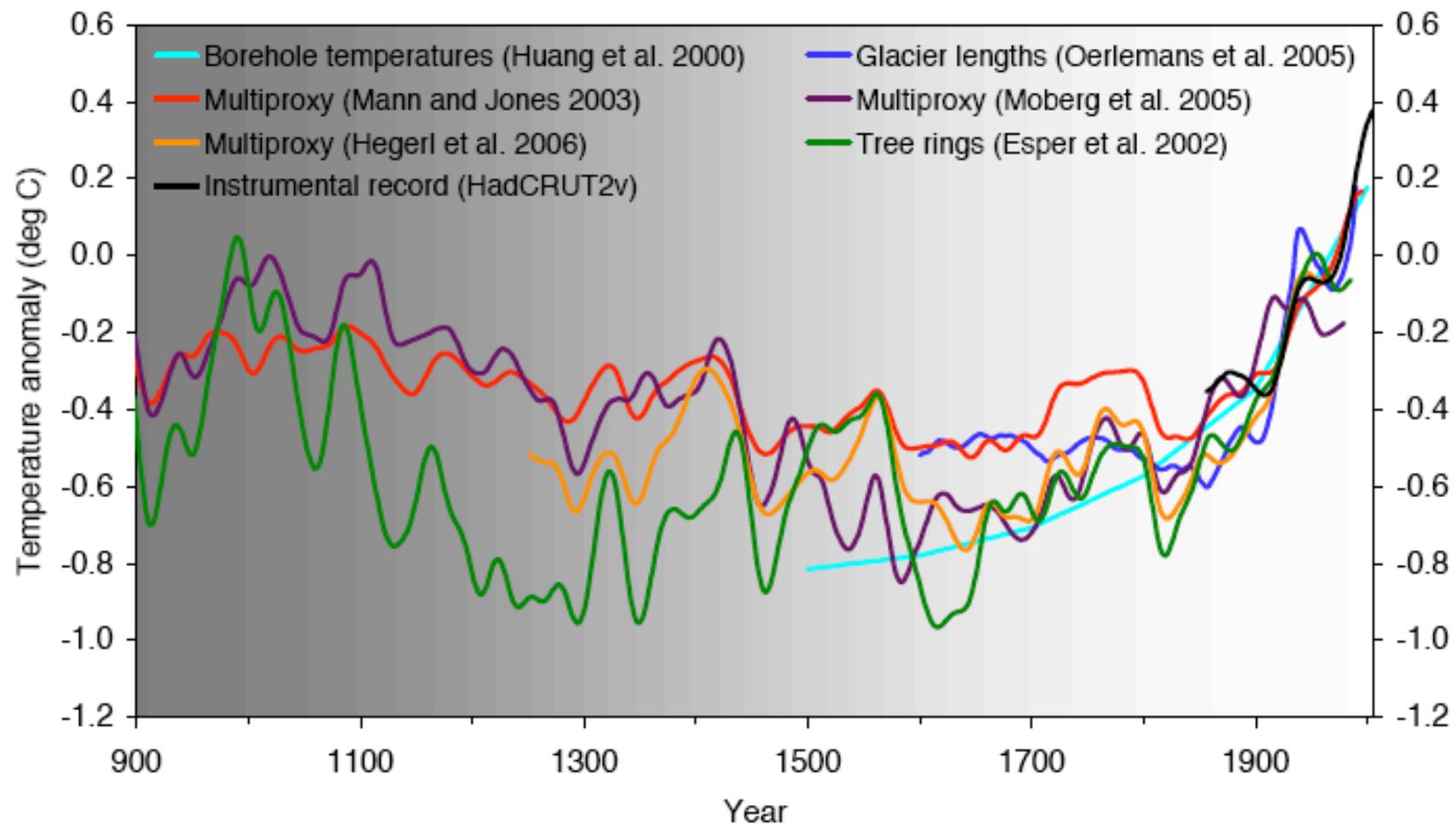
## Statement of Task

### Surface Temperature Reconstructions for the Last 2,000 Years

The committee will describe and assess the state of scientific efforts to reconstruct surface temperature records for the Earth over approximately the past 2,000 years. The committee will summarize current scientific information on the temperature record for the past two millennia, describe the main areas of uncertainty and how significant they are, describe the principal methodologies used and any problems with these approaches, and explain how central the debate over the paleoclimate temperature record is to the state of scientific knowledge on global climate change. As part of this effort, the committee will address tasks such as:

- Describe the proxy records that have been used to estimate surface temperatures for the pre-instrumental period (e.g., tree rings, sediment cores, isotopes in water and ice, biological indicators, indicators from coral formations, geological boreholes, historical accounts) and evaluate their limitations.
- Discuss how proxy data can be used to reconstruct surface temperature over different geographic regions and time periods.
- Assess the various methods employed to combine multiple proxy data to develop large-scale surface temperature reconstructions, the major assumptions associated with each approach, and the uncertainties associated with these methodologies.
- Comment on the overall accuracy and precision of such reconstructions, relevant data quality and access issues, and future research challenges.

**GERALD R. NORTH** (*Chair*), Texas A&M University, College Station  
**FRANCO BIONDI**, University of Nevada, Reno  
**PETER BLOOMFIELD**, North Carolina State University, Raleigh  
**JOHN R. CHRISTY**, University of Alabama, Huntsville  
**KURT M. CUFFEY**, University of California, Berkeley  
**ROBERT E. DICKINSON**, Georgia Institute of Technology, Atlanta  
**ELLEN R.M. DRUFFEL**, University of California, Irvine  
**DOUGLAS NYCHKA**, National Center for Atmospheric Research, Boulder, Colorado  
**BETTE OTTO-BLIESNER**, National Center for Atmospheric Research, Boulder, Colorado  
**NEIL ROBERTS**, University of Plymouth, United Kingdom  
**KARL K. TUREKIAN**, Yale University, New Haven, Connecticut  
**JOHN M. WALLACE**, University of Washington, Seattle



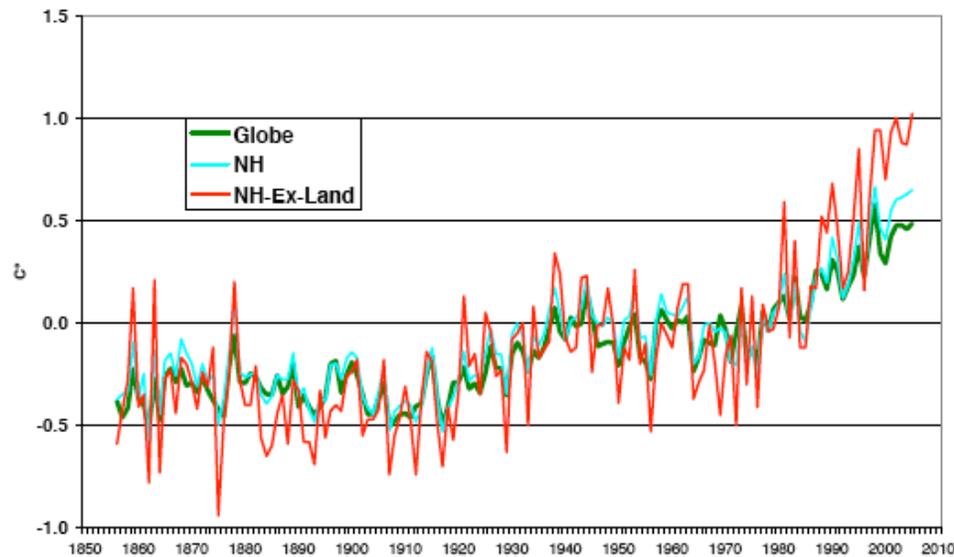
**FIGURE S-1** Smoothed reconstructions of large-scale (Northern Hemisphere mean or global mean) surface temperature variations from six different research teams are shown along with the instrumental record of global mean surface temperature. Each curve portrays a somewhat different history of temperature variations, and is subject to a somewhat different set of uncertainties that generally increase going backward in time (as indicated by the gray shading). This set of reconstructions conveys a qualitatively consistent picture of temperature changes over the last 1,100 years, and especially the last 400. See Figure O-5 for details about each curve.

# Paleo-Science Cultures

- Historical Thermometer Data
- Tree Rings
- Borehole Data (adapted from other uses)
- Ice Data (isotope & borehole)
- Lake, Sea Bottom, Corals & Spelio Cores
- Glacier Lengths & Budgets
- Historical Documentary, etc.
- Climate Model Runs (controls and forced)
- Other ...

# ● Historical Thermometer Data

## Annual Temperature Anomalies



**FIGURE 2-1** Global, Northern Hemisphere, and Northern Hemisphere extratropical land area annual temperature anomalies from the HadCRUT2v surface temperature dataset. SOURCE: Jones et al. (2001).

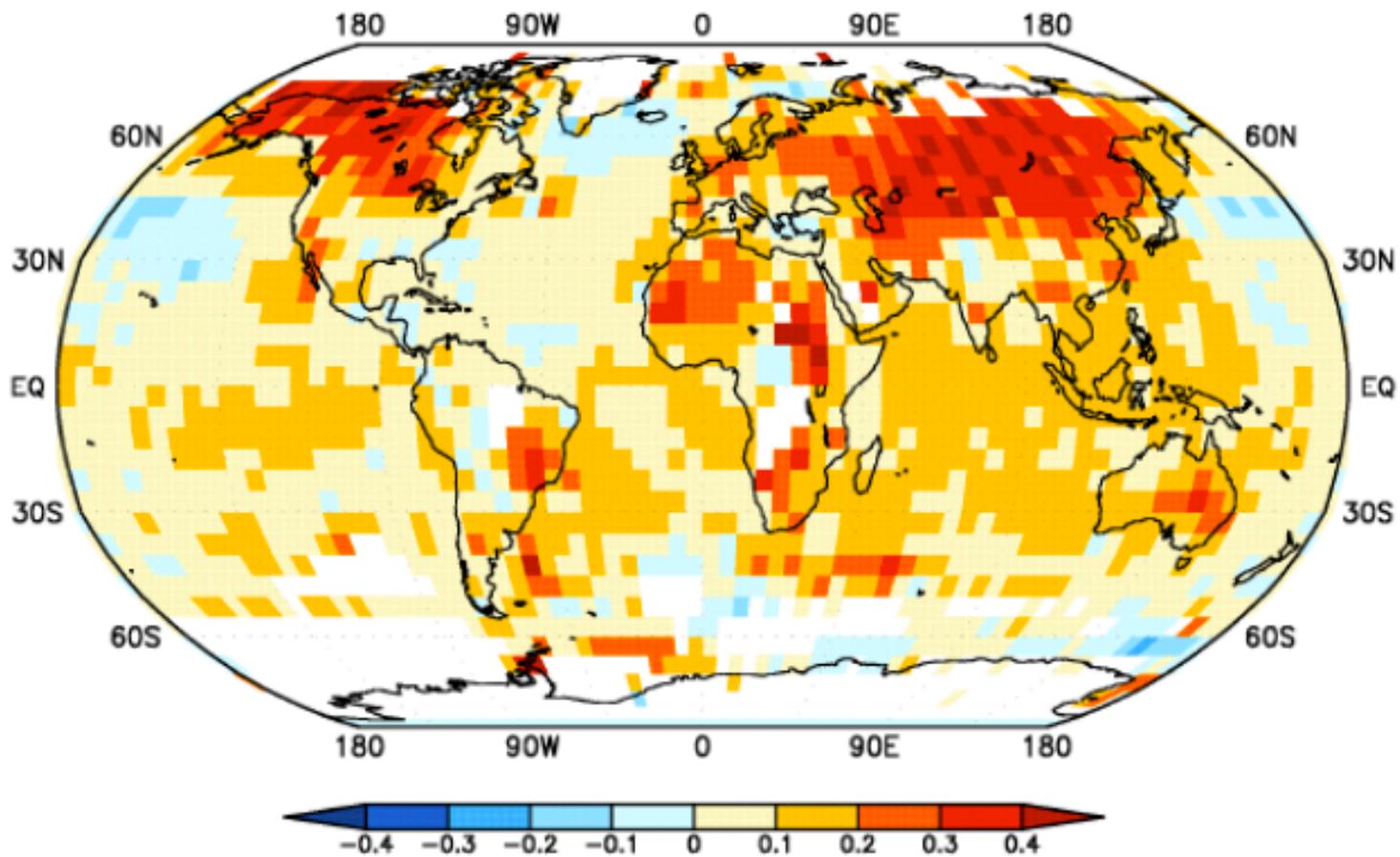
John,

You don't need to ask permission to get HadCRUT2v. It is sitting on our web site.

<http://www.cru.uea.ac.uk/cru/data/temperature/> . . .

Cheers

Phil



**FIGURE 2-3** Observed surface temperature trends in degrees Centigrade per decade through 2005 beginning in 1870 (top) and beginning in 1950 (bottom) derived from HadCRUT2v data. SOURCE: Data from Jones et al. (2001); drawing by Todd Mitchell, University of Washington, Seattle.

## ● Tree Rings:

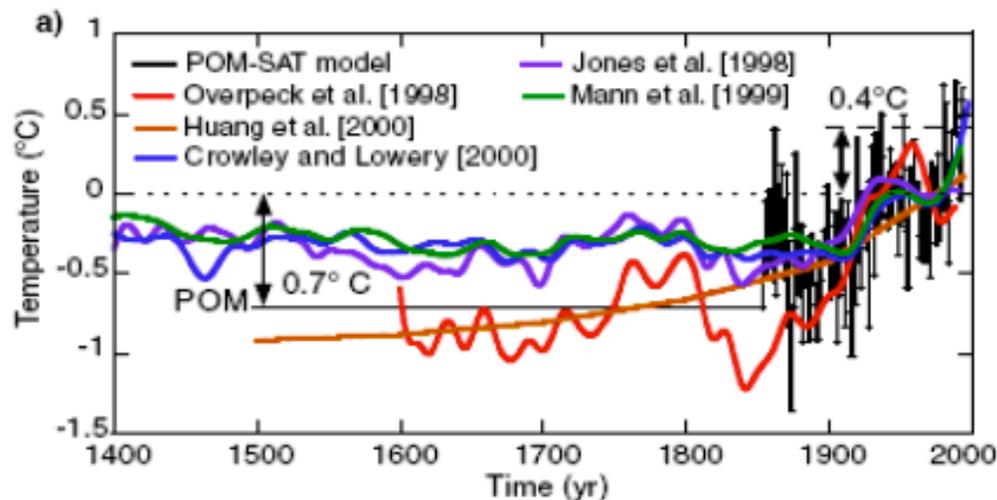
- Measurements of tree ring parameters from regions where temperature limits tree growth can be used to reconstruct surface temperature. These show that the 20th century warming is unusual since at least 1500.
- Tree rings have several features that make them well suited for climatic reconstruction, such as ease of replication, wide geographic availability, annual to seasonal resolution, and accurate, internally consistent dating.
- Tree ring records exist for the last two millennia, although spatial coverage decreases going back in time.
- Surface temperature reconstructions based on tree rings require attention to confounding factors; guidelines exist to identify and account for these factors.

Dendroclimatology is the application of tree ring science, or dendrochronology, to the study of climate (Fritts 1976). The online Bibliography of Dendrochronology (Dobbertin and Grissino-Mayer 2004) includes more than 10,000 references addressing questions in archaeology, climatology, ecology, forestry, hydrology, geology, geomorphology, and other areas. A considerable portion of tree ring data collected on all inhabited continents is freely available online (Grissino-Mayer and Fritts 1997).

## ● Borehole Data

The project “Global Database of Borehole Temperatures and Climate Reconstructions” has as its goal the assembly, analysis, and interpretation of borehole temperatures relevant to understanding the nature and causes of recent climate change. It was initiated by the International Heat Flow Commission of IASPEI, and implemented by the Geothermal Laboratory of the University of Michigan with support from the US NSF.

Contributors to this database include: A. Frasherri (Albania); J. Cull (Australia); V.M. Hamza (Brazil); V. Zui (Belarus); A.M. Jessop, J. Majorowicz, J-C Mareschal, K. Wang (Canada); M. Chen, S. Hu, S. Shen, L. Xiong, J.-A. Wang, J.-Y. Wang (China); V. Cermak, J. Safanda (Czech Republic); I. Kukkonen (Finland); S. Roy (India); C. Clauser (Germany); A. Brock of Ireland; M. Verdoya (Italy); S.S. Marchenko (Kazakhstan); S. Veliciu (Romania); S. Berkovchenko, R. Dorofeeva, D.Y. Demezhko, A.D. Duchkov, I. Golovanova, I. Klimovsky, A.A. Vasiliev (Russia); M.Q.W. Jones (South Africa); R. Kutas (Ukraine); K.E. Rollin (United Kingdom); D.S. Chapman, E.R. Decker, W.D. Gosnold, R.N. Harris, A.A. Nyblade, H.N. Pollack (United States).

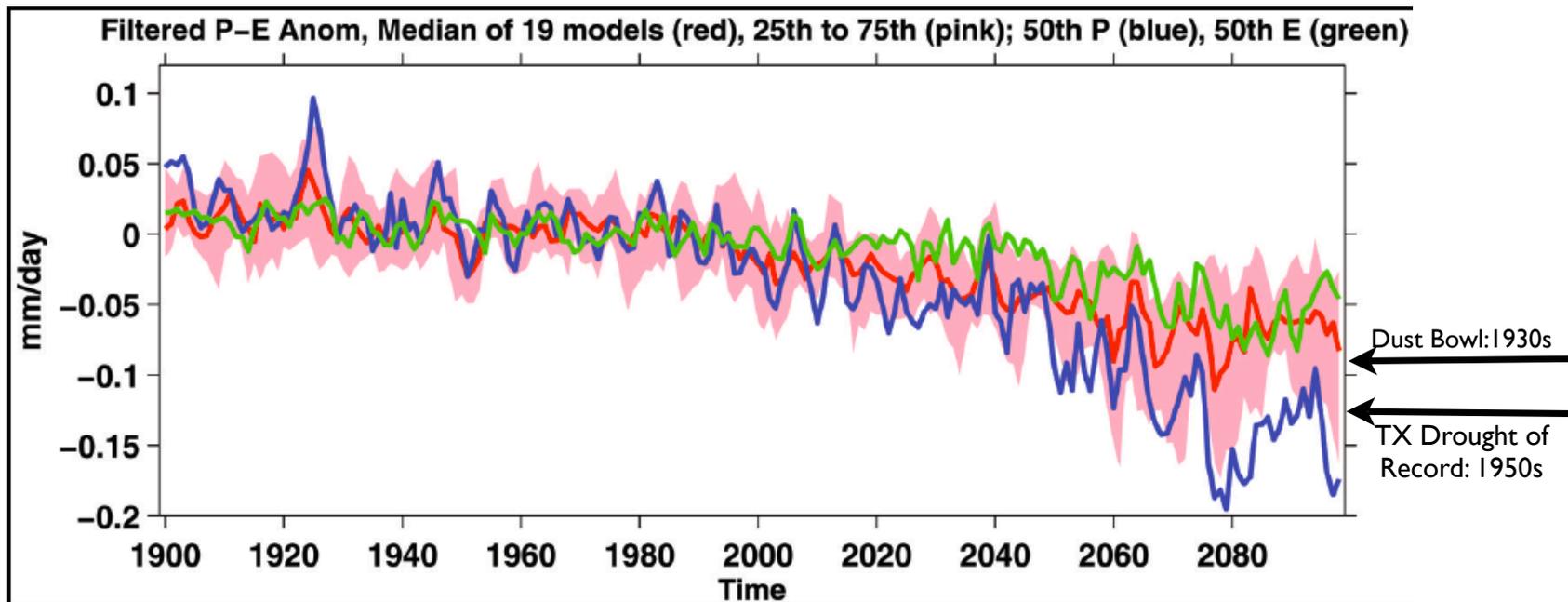


## ● Climate Model Runs (controls and forced)

- ~20 Countries have contributed detailed simulations of their climate models for the IPCC Assessment Report Four (AR4)
- These include simulations of the last century and the next under different emission scenarios.
- These simulation data are all available online at Lawrence Livermore National Lab

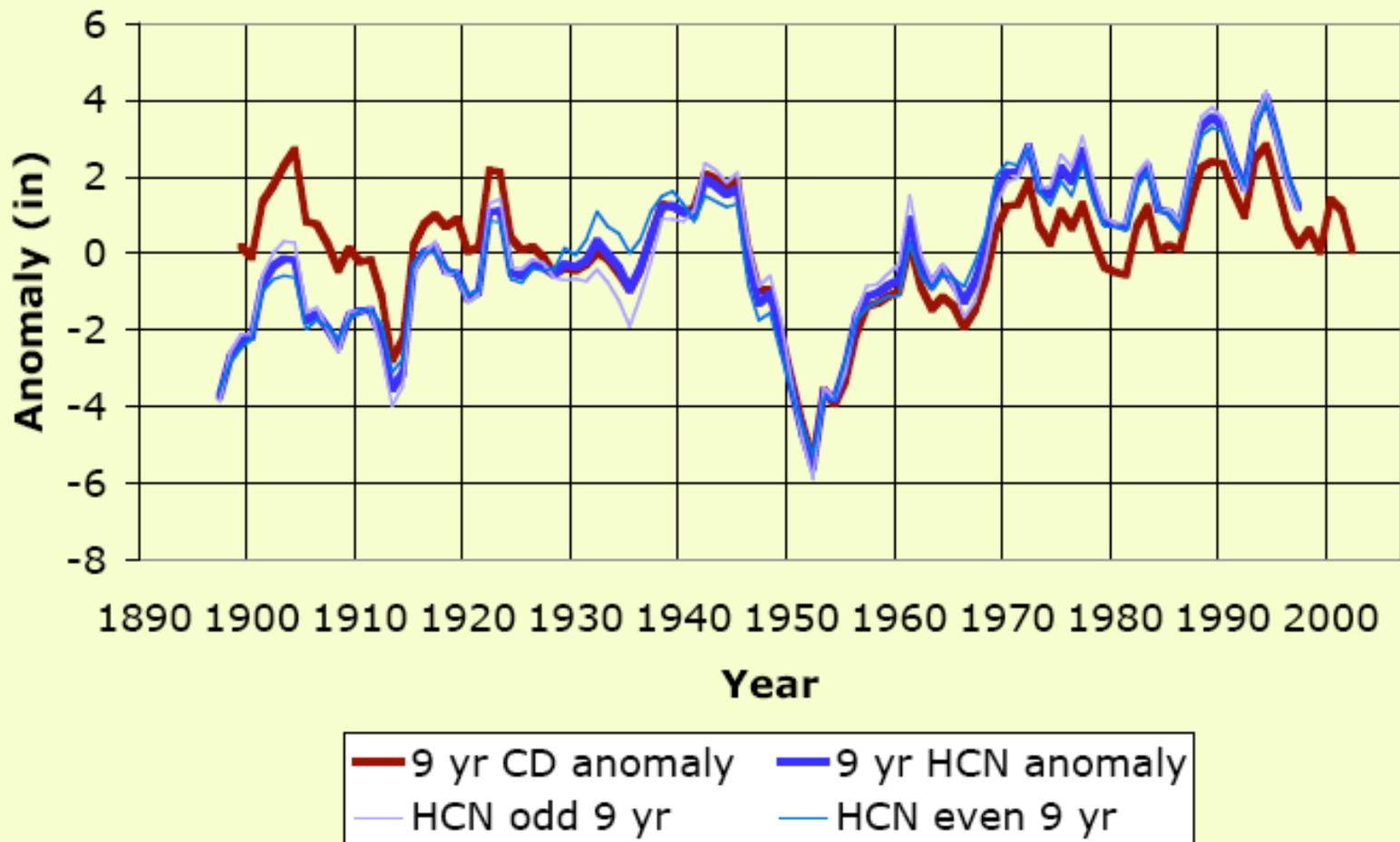
Subtropical drying accompanying rising CO<sub>2</sub> is also found in the models participating in the second Coupled Model Intercomparison Project (2). Here we examine future subtropical drying by analyzing the time history of precipitation in 19 climate models participating in the Fourth Assessment Report (AR4) of the IPCC (3). The future climate projections followed the A1B emissions scenario (4) in which CO<sub>2</sub> emissions increase until about 2050 and decrease modestly thereafter leading to a CO<sub>2</sub> concentration of 720 ppm in 2100. We also analyzed the simulations by these

From a paper in *Science Express* to appear in *Science* in the next week or two



Note: The Droughts of the 30s and 50s were related to Sea Surface Temperature Anomalies (mainly La Ninas). The simulations above are for the background climate -- La Ninas are to be superimposed.

### Texas 9 Year Running Mean Precip



John Nielsen-Gammon, Texas A&M University Legislative Briefing March 26, 2007

HCN=Historical Climate Network (NOAA); CD=Climate Divisions

e-mail: 9/2006

Dear Dr North,

As you know, I requested Dr Cicerone, in his capacity as President of the National Academy of Sciences (NAS), to request unarchived data and methods relied upon by the recent National Research Council (NRC) panel on Surface Temperature Reconstructions. Dr Cicerone has declined to do so, stating that the NRC lacked authority to “command” the recalcitrant authors to do so. In my original letter, I expressed my understanding of this and simply requested that he request the authors to do so, fully understanding that he could not apply any sanctions in the event that the authors refused a reasonable request from the NAS President.

Since Dr Cicerone has declined to act, I am writing to request that you do so in your capacity as Chairman of the NRC Panel. Obviously it would have been more appropriate had the matter been raised when Drs Mann, Hegerl and D'Arrigo appeared before the panel.

However, since this was not done at the time, I request that you do so now. In an Appendix to this letter, I have set out missing and pertinent data for six authors. As I had said in my previous letter to Dr Cicerone, I understand that you do not have the authority to require compliance. However, I believe that a request coming from you would have considerable weight and, hopefully the authors in question will cooperate voluntarily with such a request from you without further ado. If they don't, then nothing is lost by your making the request.

Yours truly,  
Stephen McIntyre

# Other...

- Ice Data (isotope & borehole)
- Lake, Sea Bottom, Corals & Spelio Cores
- Glacier Lengths & Budgets
- Historical Documentary, etc.
- Even More ...

# Issues Regarding Data

- Need for QC'd Archives in some subfields
- In US, Lead Agencies should have responsibility for individual data types (NSF, NOAA, DOE, USGS, EPA, NASA, CRELL, IODP, etc.)
- Individuals have responsibilities, but one size does not fit all as cultures mature.
- Software for processing:
  - How Much? How Promptly? How long to keep?
- Journal, Agency Responsibilities