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# Examining the 'Hockey Stick' Controversy

Testimony to the  
Energy and Commerce Committee  
Subcommittee on Oversight and Investigations  
July 27, 2006

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# Global Climate Change Basics

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- Human activities are increasing atmospheric greenhouse gases (GHG) (**unequivocal**)
- The earth is warming (**unequivocal**)...
- ...at an unprecedented rate (**confident**)
- Warming over past 5 decades caused primarily by man-made GHG (**confident**)
- Effects of warming are being observed now:  
**Sea-level rise, glacier melting, more frequent and intense heat waves, more intense storms**  
(**confident**)
- Warming will continue for a long time, even after GHG stabilize (**confident**)

# Main Points

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- The so-called “hockey-stick controversy” is actually not a controversy, scientifically.
- Criticisms of the “hockey stick” in no way undermine the science of climate change. It is not central to our understanding of climate change.
- The results of the hockey stick represent the gradual development of scientific understanding of past climate, not a step-change.
- Climate change assessments are working well under the supervision of climatologists.

# Hockey Stick Basics

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NAS report

## Surface Temperature Reconstructions for the Last 2,000 Years June 2006

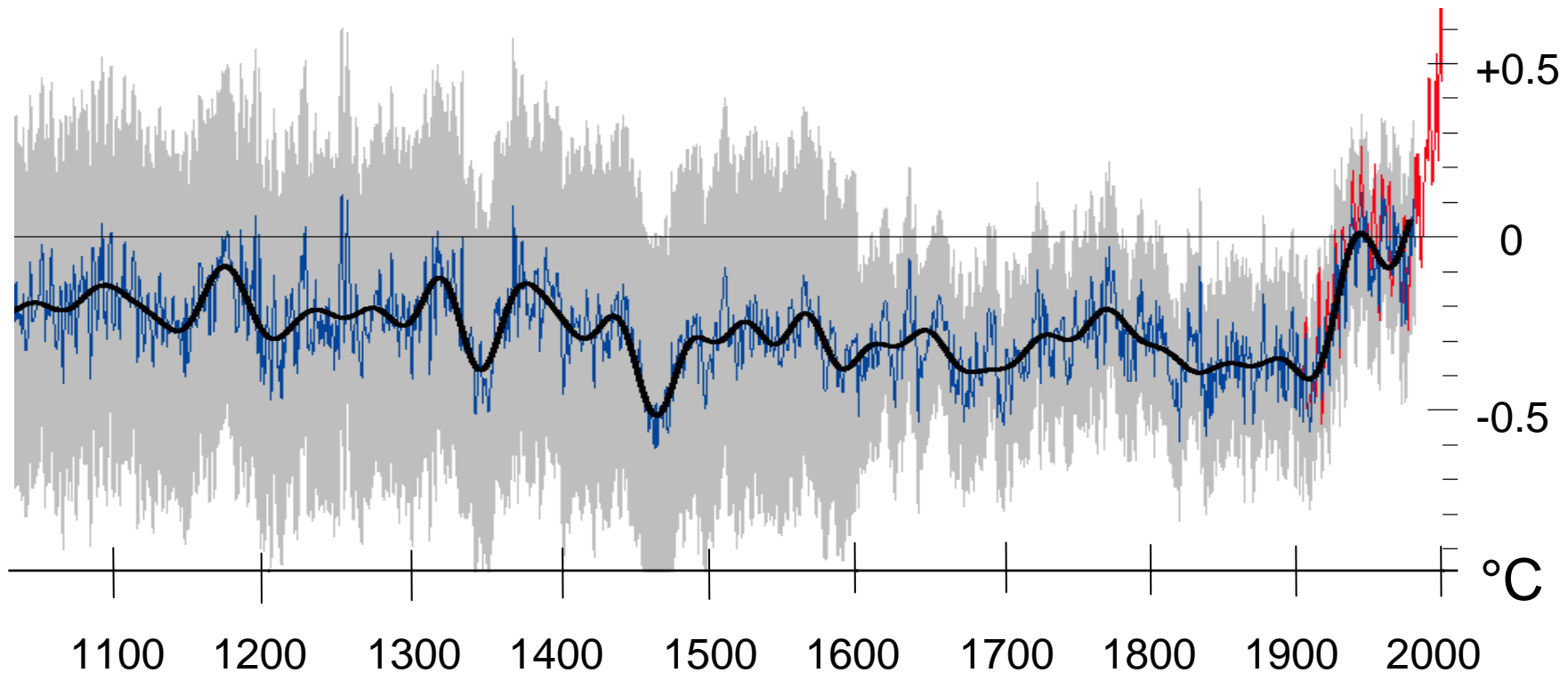
*The basic conclusion of [the hockey stick study] was that the late 20th century warmth in the Northern Hemisphere was unprecedented during at least the last 1,000 years. This conclusion has subsequently been supported by an array of evidence... (p. 3)*

*Surface temperature reconstructions [such as the hockey stick] are consistent with other evidence of global climate change and can be considered as additional supporting evidence. (p. 23)*

# Hockey Stick Basics

## The Mann “Hockey Stick”

A ‘reconstruction’ of average Northern Hemisphere temperature for the last 1000 years

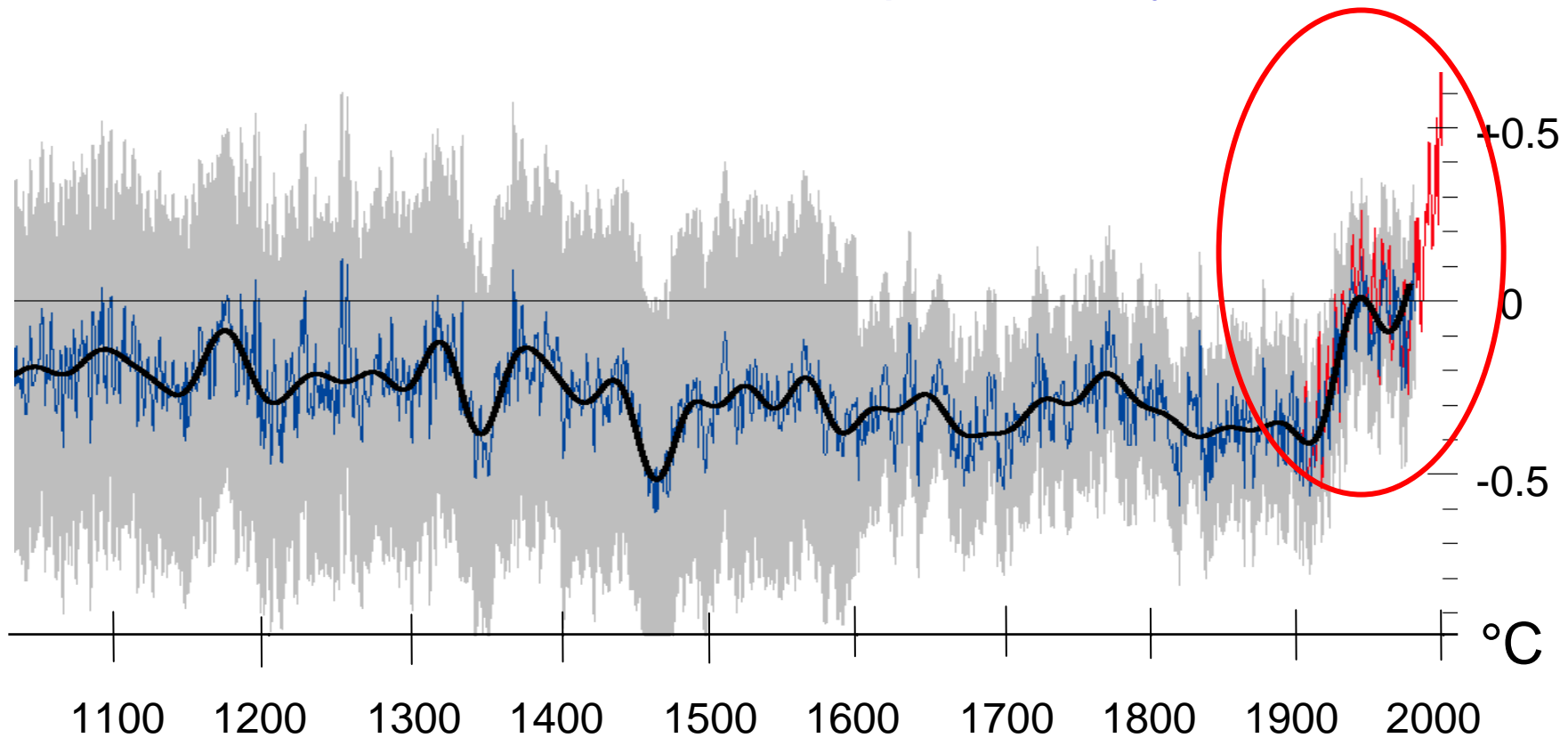


Mann 1998 (*Nature*), 1999 (*Geophysical Research Letters*)

# Hockey Stick Basics

## Main Conclusion

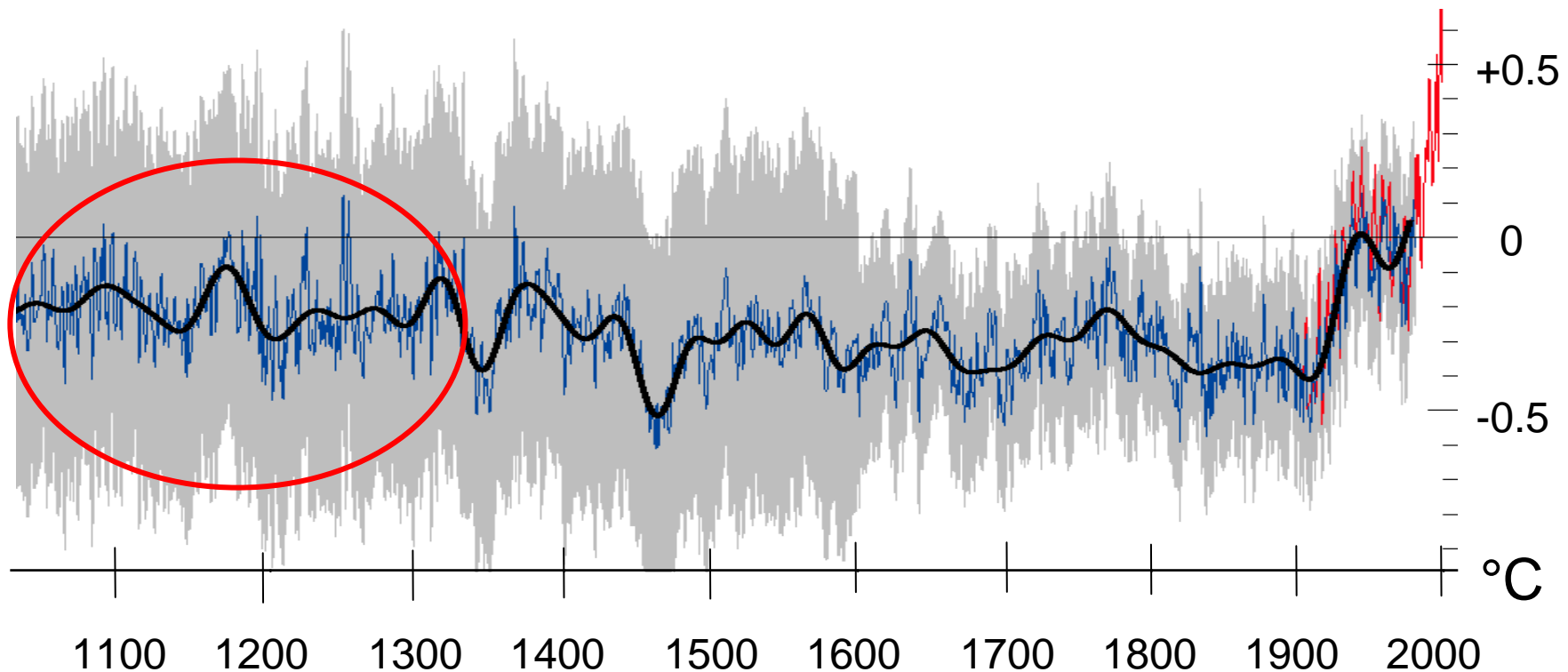
- 20<sup>th</sup> Century warmest in past 1000 years
- 1990s warmest decade in past 1000 years



# Hockey Stick Basics

## McIntyre & McKittrick Complaints

- Statistical methods not applied properly
- Inappropriate data used
- Incorrectly eliminates Medieval Warm Period



# Wegman Report, July 2006

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## Objective of Wegman report:

*“to reproduce the results of [McIntyre & McKittrick] in order to determine whether their criticisms are valid and have merit”*

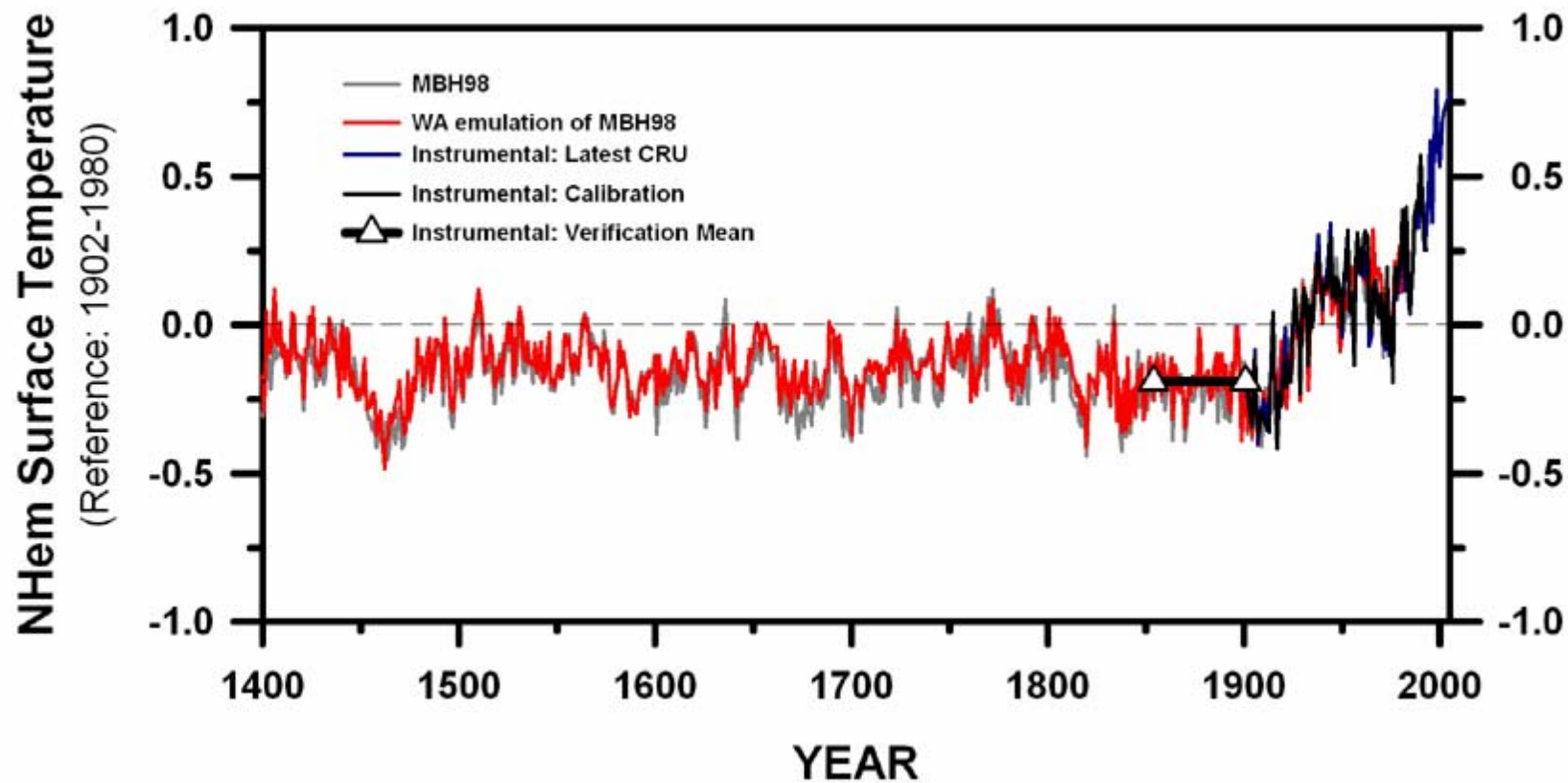
(p. 7)

# Wegman Report, July 2006

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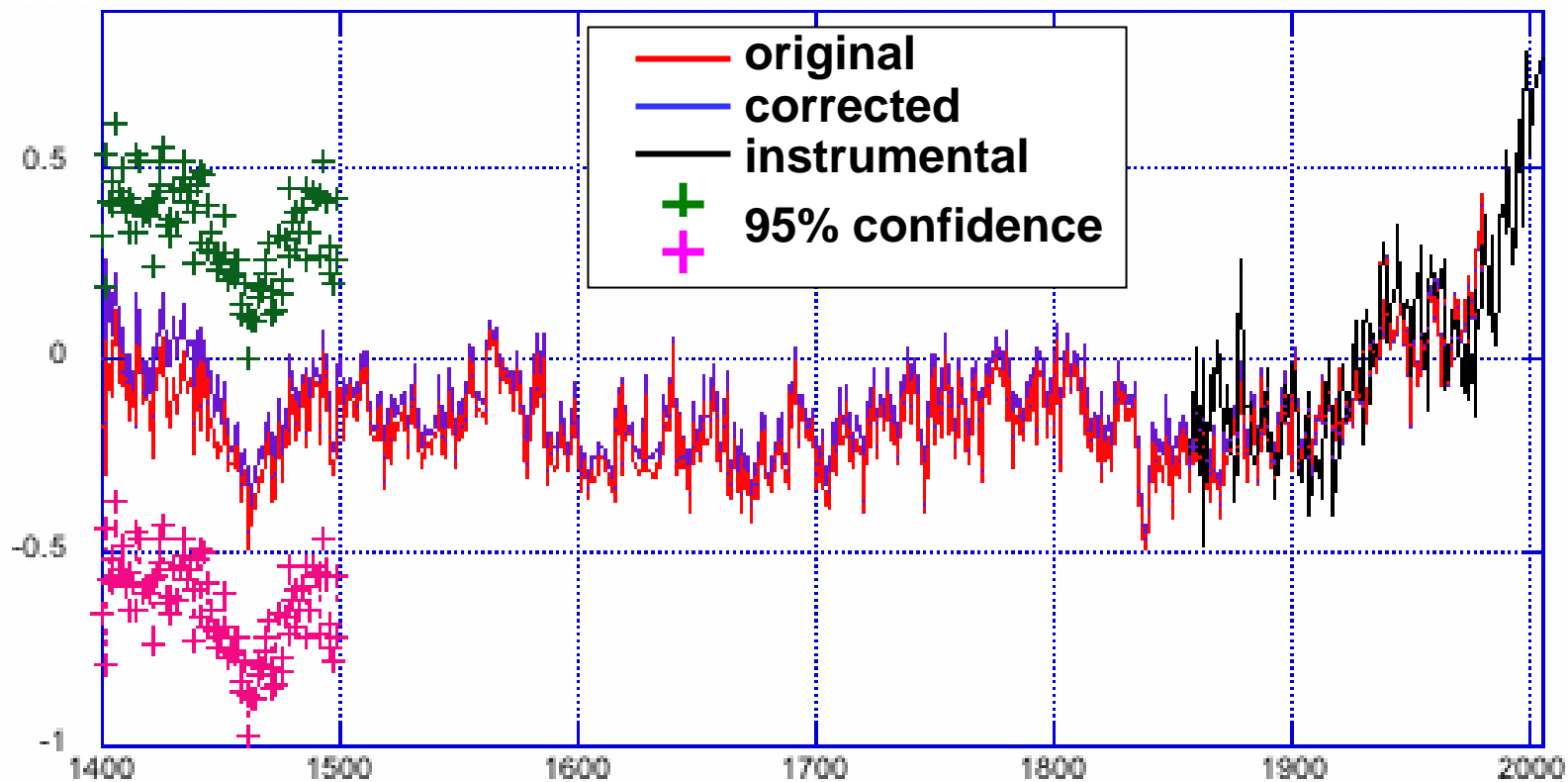
- Mann's newer methods were not tested.
- Mann's claim that McIntyre & McKittrick didn't apply his method correctly was not tested.
- Corroborating evidence was not examined
  - other reconstructions using different methods/proxies
  - evidence from glaciers
- **Wahl & Ammann paper overlooked**
  - **Examined all 4 of MM's main criticisms**
    - Decentering
    - Gaspé tree-ring series
    - Bristlecone/foxtail pine data
    - Verification statistic thresholds

# Wahl & Ammann (2006)



# Wahl & Ammann (2006)

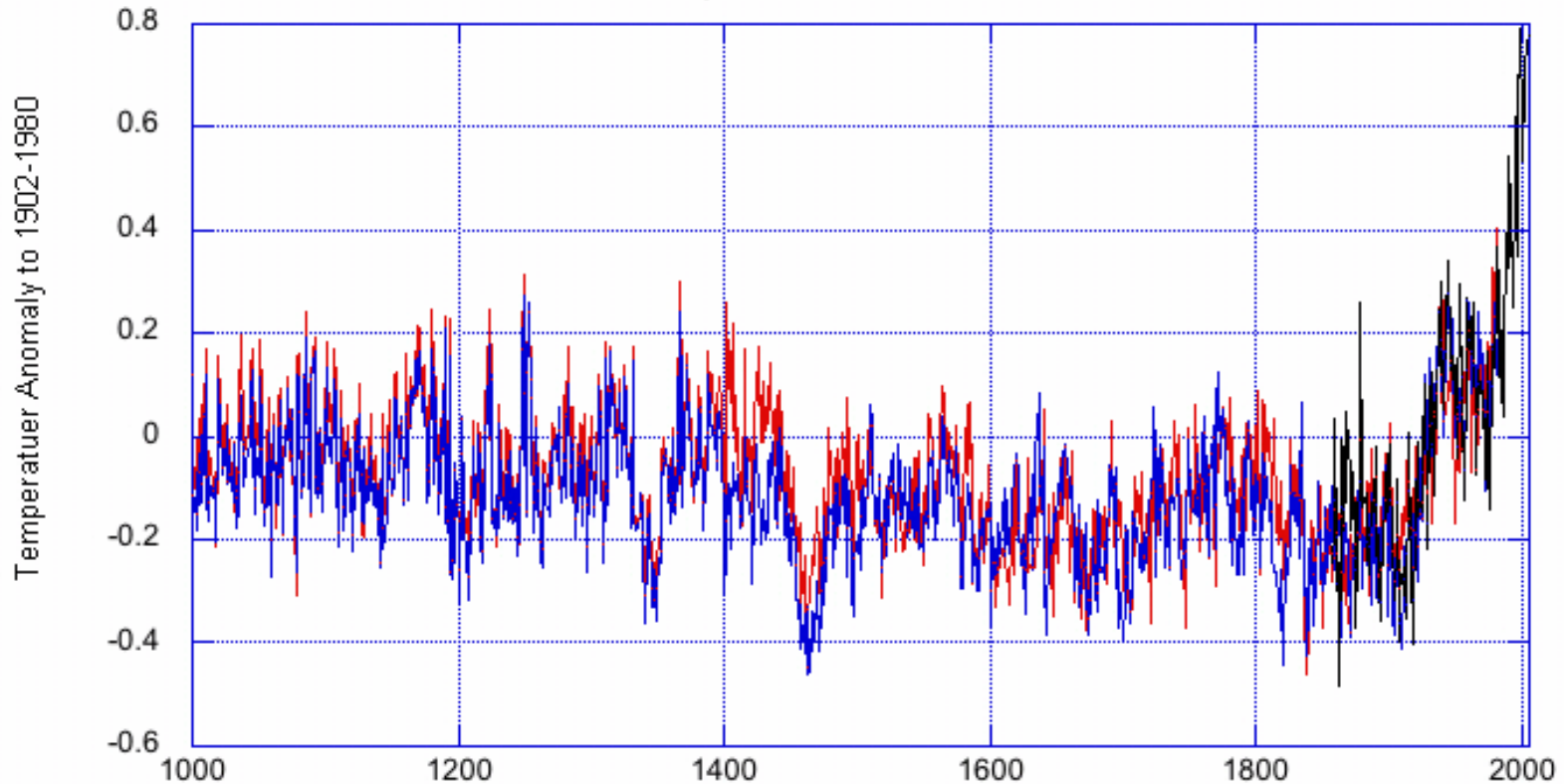
## Correction of MBH98 for decentering and Gaspe tree-ring series



# Ammann & Wahl (submitted)

## Correction of MBH99 for decentering and Gaspe tree-ring series

NHemisphere Temperatures (WA emulation of MBH and MBH-corrected)



# After Corrections to MBH98/9

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- Wahl & Ammann corrected for
  - Decentering
  - Gaspé tree-ring series
- Wahl & Ammann rejected MM's objection about the bristlecone/foxtail pines on grounds they did not affect reconstruction and were necessary
- Corrected reconstructions support the conclusions that late 20<sup>th</sup> century warmth is unique relative to the last millennium.

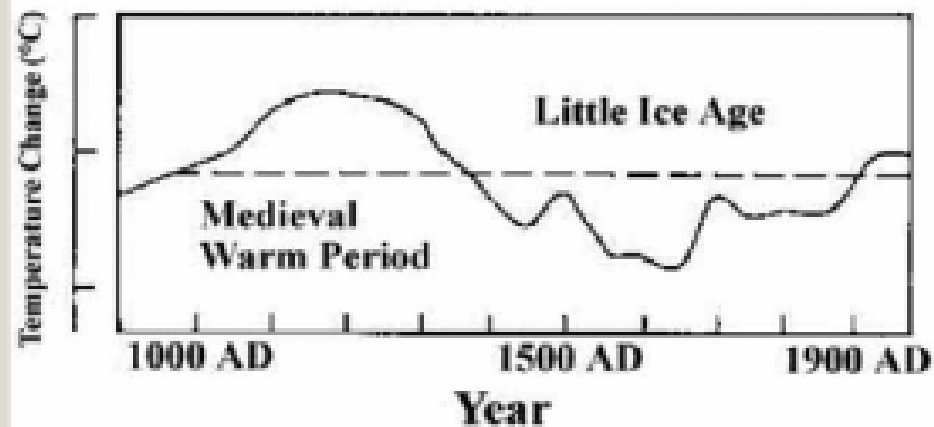
# The Medieval Warm Period

1990 IPCC  
*schematic  
diagram*

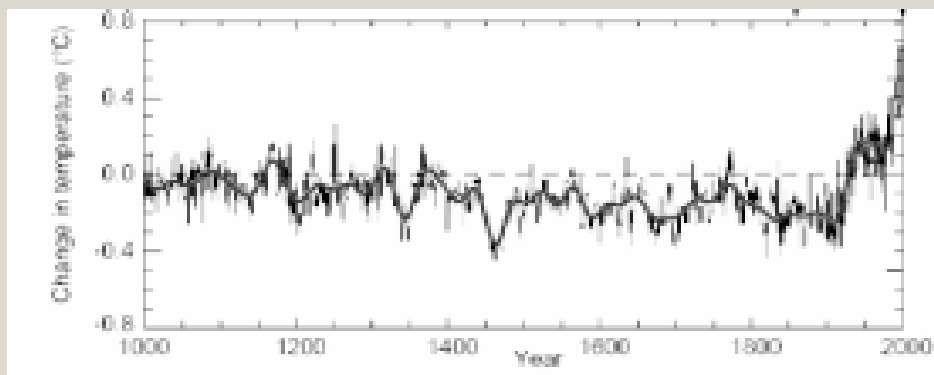
1999 hockey  
stick *graph*

## Climate 'Consensus'

Then ...



...And Now

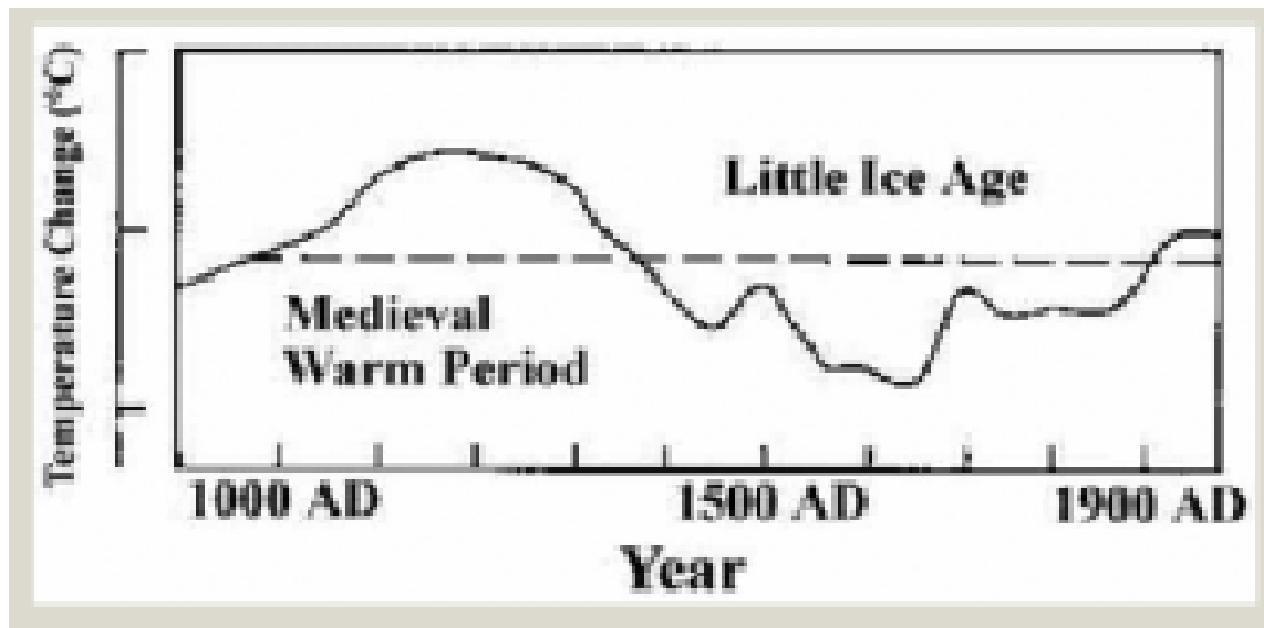


Source: Intergovernmental Panel on Climate Change

# The Medieval Warm Period

1990 IPCC Assessment:

*...it is still not clear whether all the fluctuations indicated [in the diagram] were truly global.*



# The Medieval Warm Period

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WSJ Editorial “Hockey Stick Hokum” (July 14)

*“Prior to Dr. Mann’s work, the accepted view, as embodied in the U.N.’s 1990 report from the [IPCC], was that the world had undergone a warming period in the Middle Ages...”*

*“That CONSENSUS... held that the Medieval warm period was considerably warmer than the present day.”*

*“Mr. Mann’s 1999 paper eliminated the Medieval warm period from the history books, with the result being the [hockey stick]”*

# The Medieval Warm Period

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## Before the 'Hockey Stick'

**1993:** Sukumar et al. (Nature 364:703): “...a wet phase in Southern India about 600 years ago... appears to correspond to the [MWP], which previously was believed to be confined to Europe and North America.”

**1994:** Hughes & Diaz. Was there a Medieval Warm Period, and if so, where and when? (Climatic Change 26:109): “...the available evidence does not support a global [MWP]...”

# The Medieval Warm Period

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## After the 'Hockey Stick'

**2001:** Broecker, Was the Medieval Warm Period Global?" (Science 291:1497): *"[I will try] to make the case that the [MWP] was global rather than regional... Evidence for the [MWP] from other parts of the world (besides the N. Atlantic region) exists but is spotty and/or circumstantial... The case for a global [MWP] admittedly remains inconclusive."*

# The Medieval Warm Period

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From the IPCC Assessments:

**1990, 3 papers cited**

*...the late tenth to early thirteenth centuries appear to have been exceptionally warm in western Europe, Iceland and Greenland... China was, however, cold at this time... but South Japan was warm.*

# The Medieval Warm Period

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From the IPCC Assessments:

**1995, 6 papers cited**

*Recent studies have re-evaluated the interval commonly known as the Medieval Warm Period... The available evidence is limited (geographically) and is equivocal...*

*...a clearer picture may emerge as more and better calibrated proxy records are produced. However, at this point, it is not yet possible to say whether, at a hemispheric scale, temperatures declined from the 11-12th to the 16-17th century.*

*Nor, therefore, is it possible to conclude that the global temperatures in the Medieval Warm Period were comparable to the warm decades of the late 20th century.*

# The Medieval Warm Period

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From the IPCC Assessments:

**2001, 10 papers cited**

*It is likely that temperatures were relatively warm in the Northern Hemisphere as a whole during the earlier centuries of the millennium, but it is much less likely that a globally-synchronous, well defined interval of “Medieval warmth” existed, comparable to the near global warmth of the late 20th century.*

*Marked warmth seems to have been confined to Europe and regions neighboring the North Atlantic.*

# The Medieval Warm Period

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- Mainstream scientific debate on the extent of the Medieval Warm Period continues today.
- Balance of evidence indicates the Medieval Warm Period was not consistent throughout the Northern Hemisphere.
- The MBH99 results simply quantified what the evidence already suggested about the Medieval Warm Period.

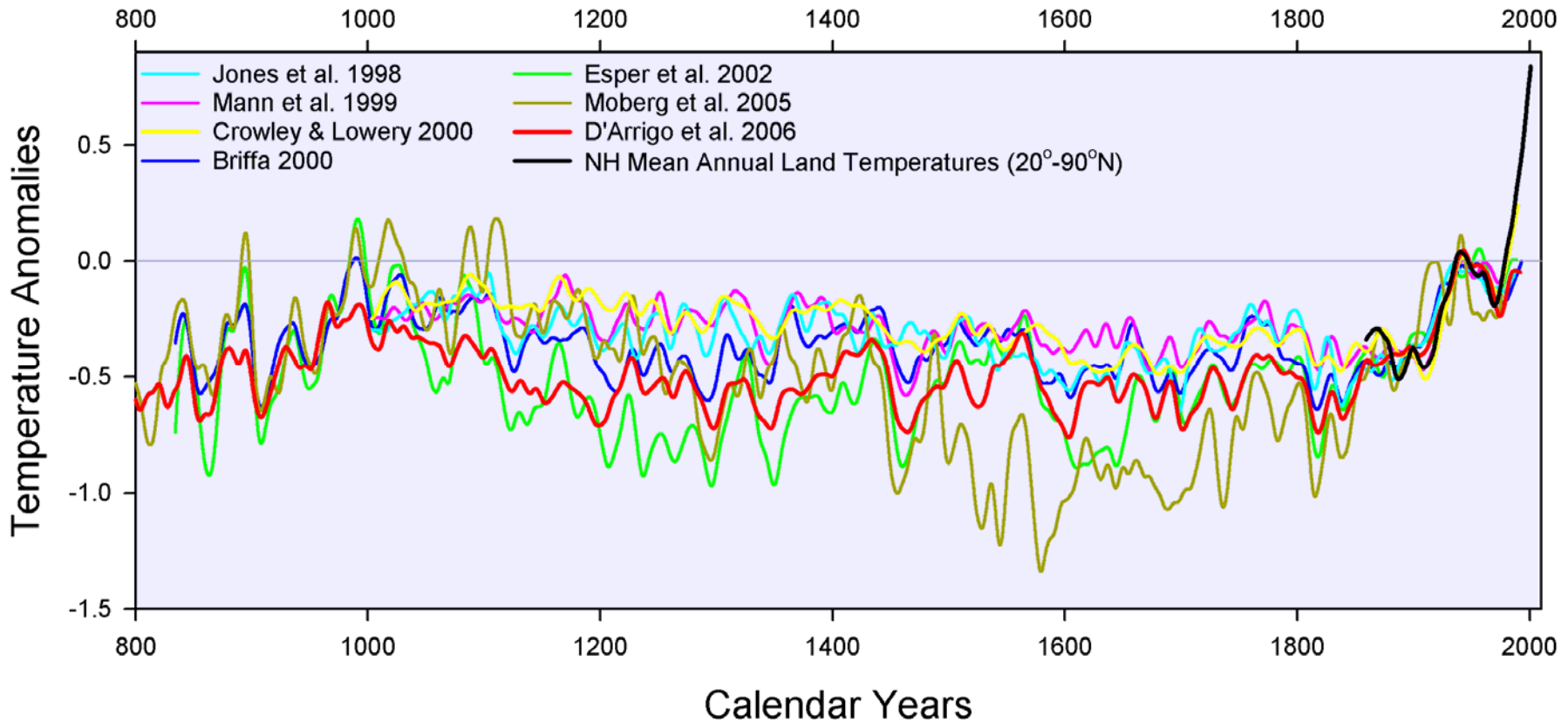
# Climate Change Assessments

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- The assessment of the state of climate science that led to the improper use of a schematic drawing from the 1990 IPCC report to support the existence of a strong Medieval Warm Period, is incorrect.
- Through time, successive IPCC reports accurately reflected the state of knowledge about the climate of the past 1000 years.
- These assessments work, and the alternative assessment that has been offered by Mr. McIntyre is not accurate.
- The assessment of climate science is best performed by those with geophysical understanding of climate.

# Hockey Stick Basics

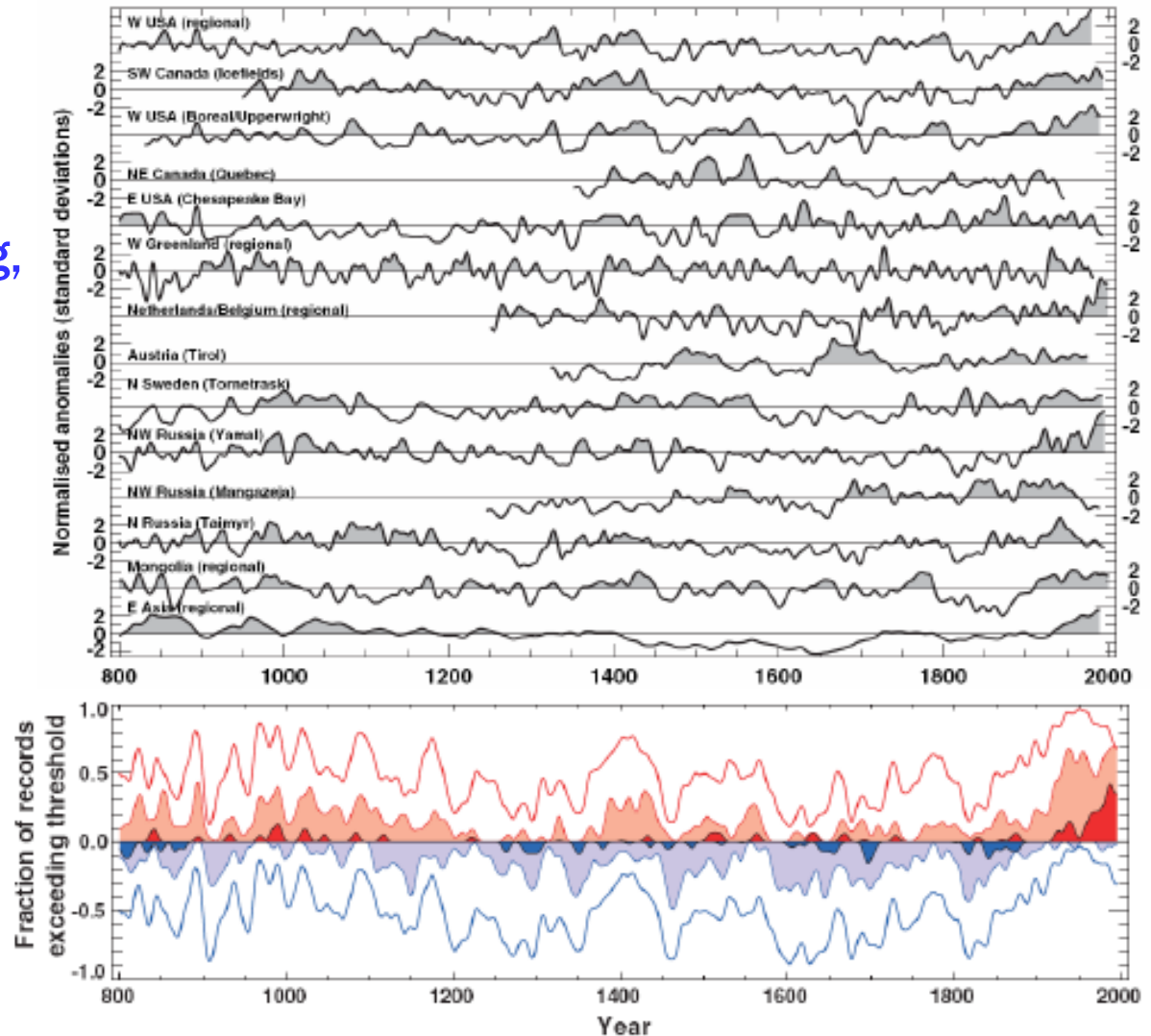
- Regardless of criticisms, Mann's main conclusions stick
- All reconstructions to date support the hockey stick study



D'Arrigo 2006

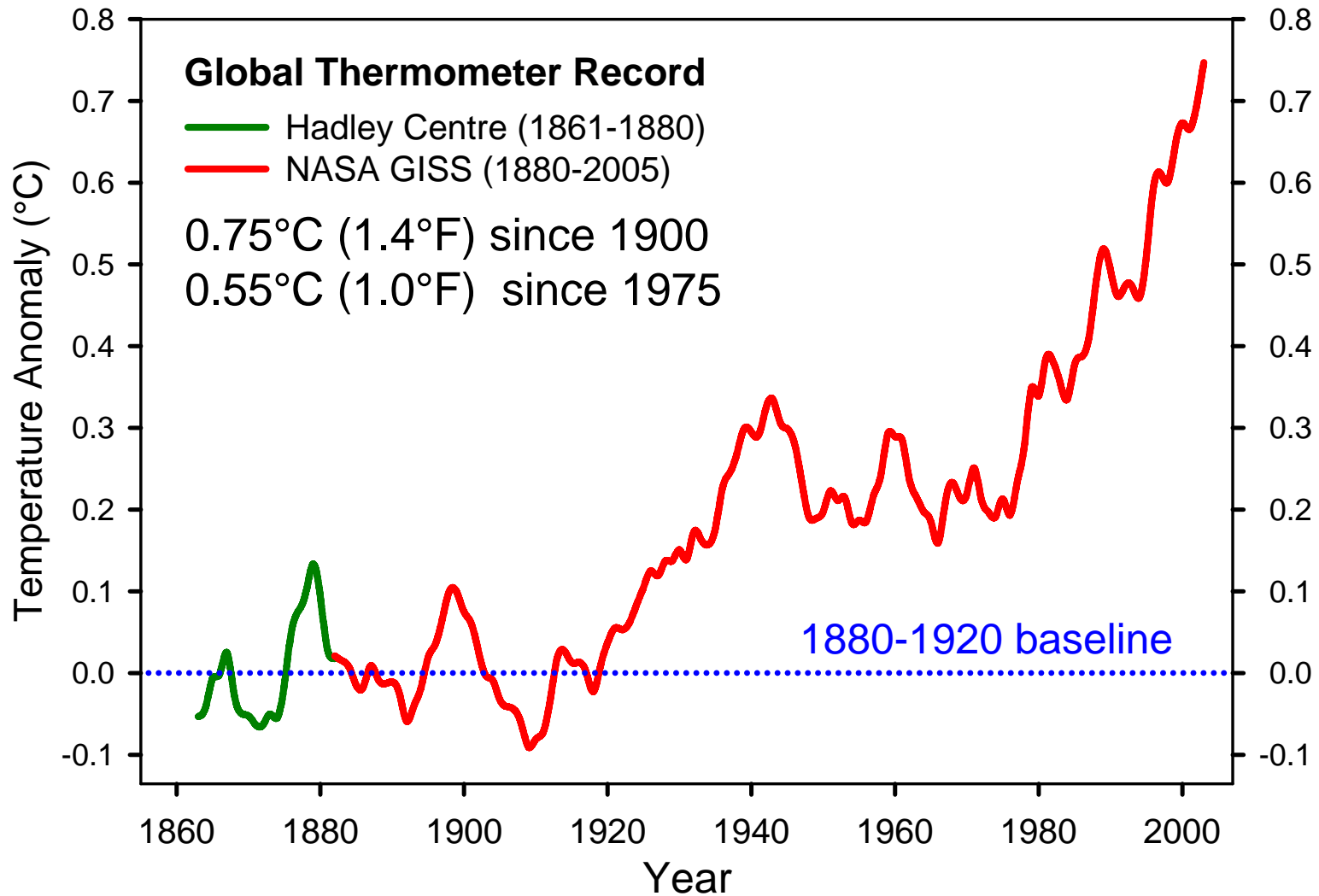
# Hockey Stick Basics

A new study using no fancy statistics, just simple averaging, supports the original Mann conclusions.

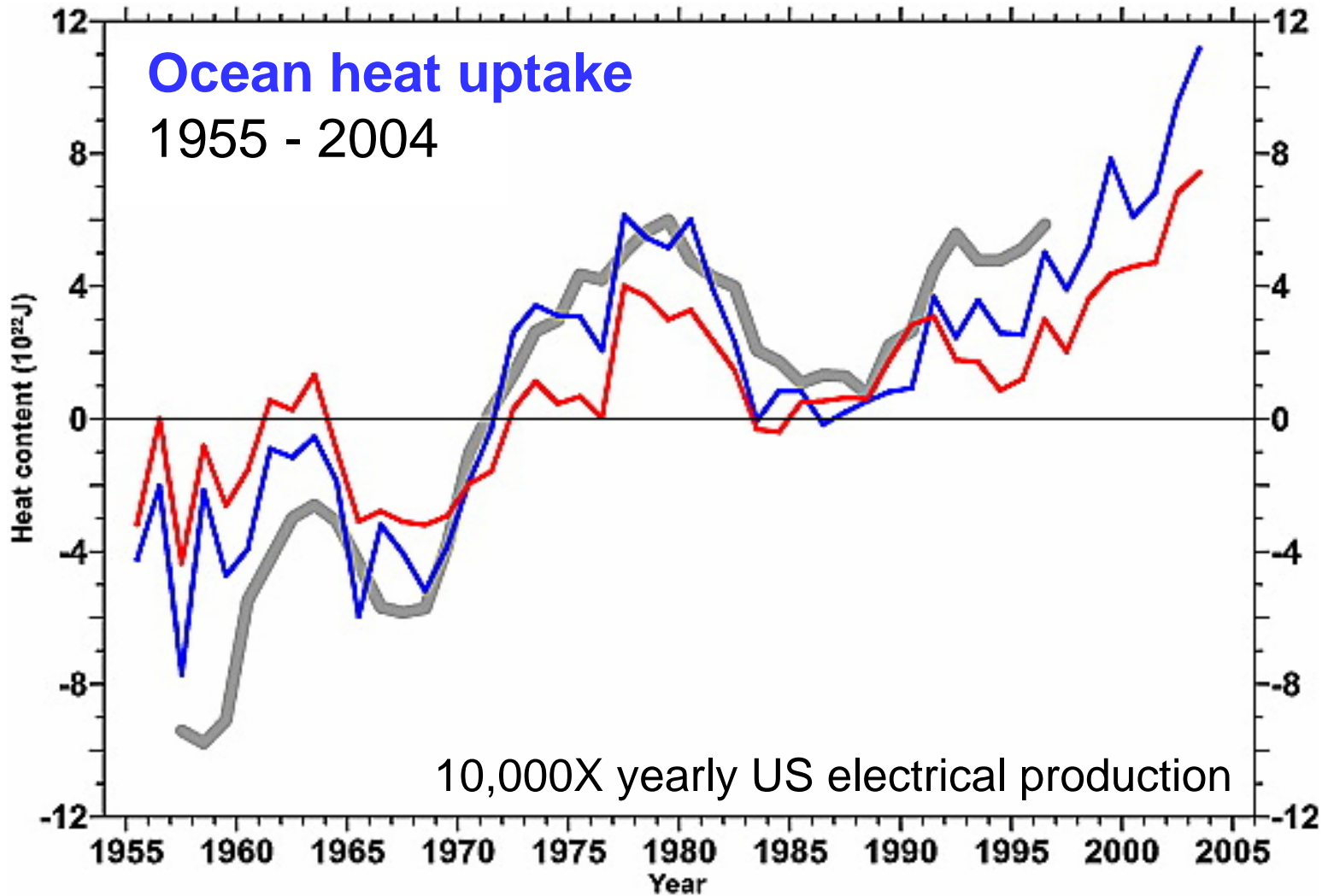


Osborn 2006, *Science* 311:841

# Global Climate Change Basics

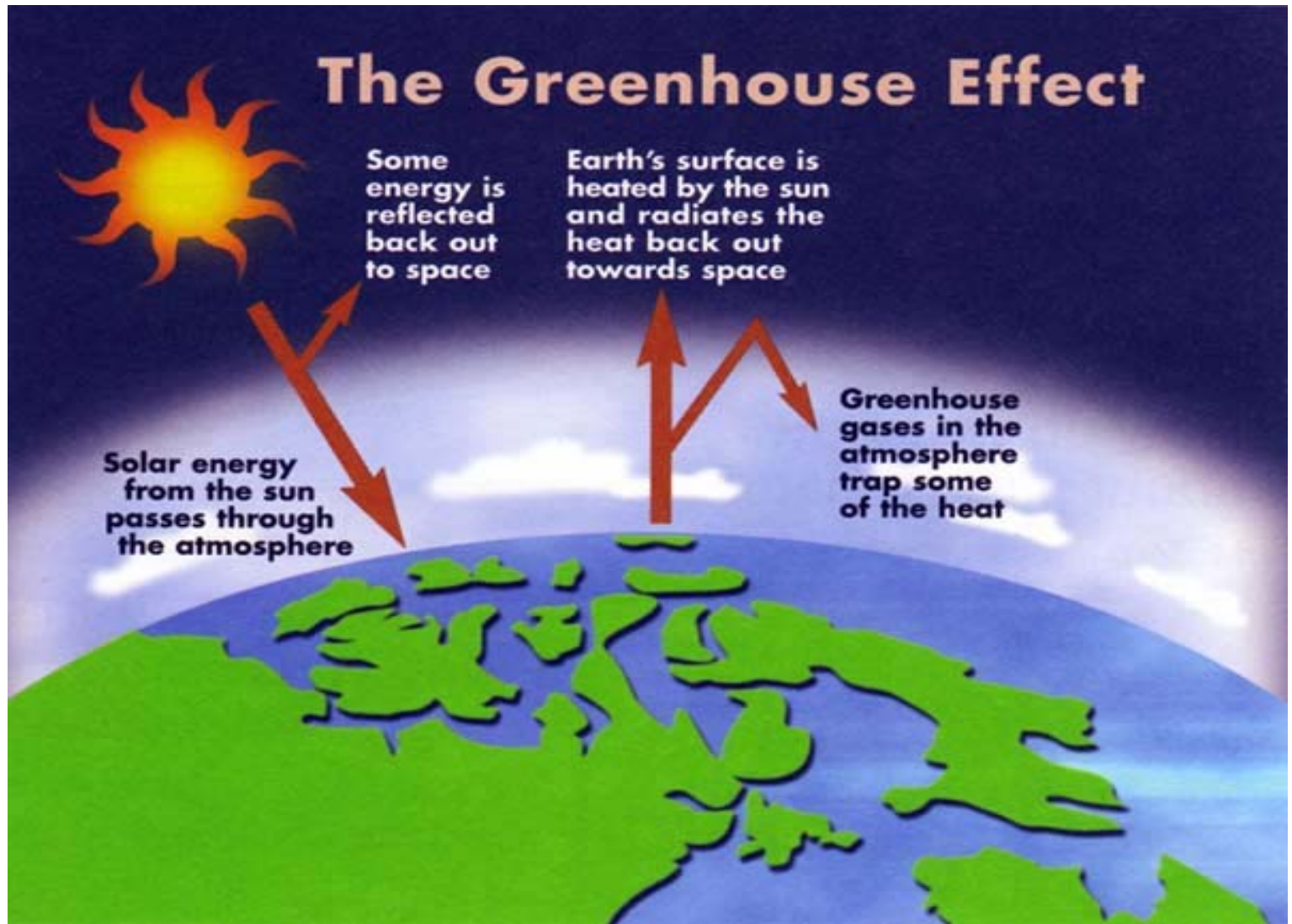


# Global Climate Change Basics



Levitus 2005, *Geophysical Research Letters*

# Global Climate Change Basics



# Global Climate Change Basics

