

spotlight

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BREAKING THE ‘HOCKEY STICK’ *Global Warming’s Latest Brawl*

S U M M A R Y : Evidence from throughout the world shows that the planet was relatively warm 1,000 years ago during the Medieval Warm Period and relatively cold 500 years ago during the Little Ice Age. When the 1°C (1.8°F) of global warming of the past 100 years is considered in the context of climate variability of the last 1,000 years, the recent warming looks quite natural and nothing out of the ordinary. In 2001, the United Nations Intergovernmental Panel on Climate Change prominently featured an important graph of northern hemispheric temperatures over the past 1,000 years, and the plot resembled a hockey stick. This same graph was recently highlighted in testimony to the North Carolina Legislative Commission on Climate Change. In this graph, the Medieval Warm Period and the Little Ice Age disappeared, and after 900 years of nearly steady temperatures, warming dominates the most recent 100 years. The new “hockey stick” depiction makes the recent warming look highly unnatural, thereby lending credence to the argument that human activities are the driving force behind global warming. The fights over the hockey stick have been among the most vicious in the two decades of heated debate over global warming.

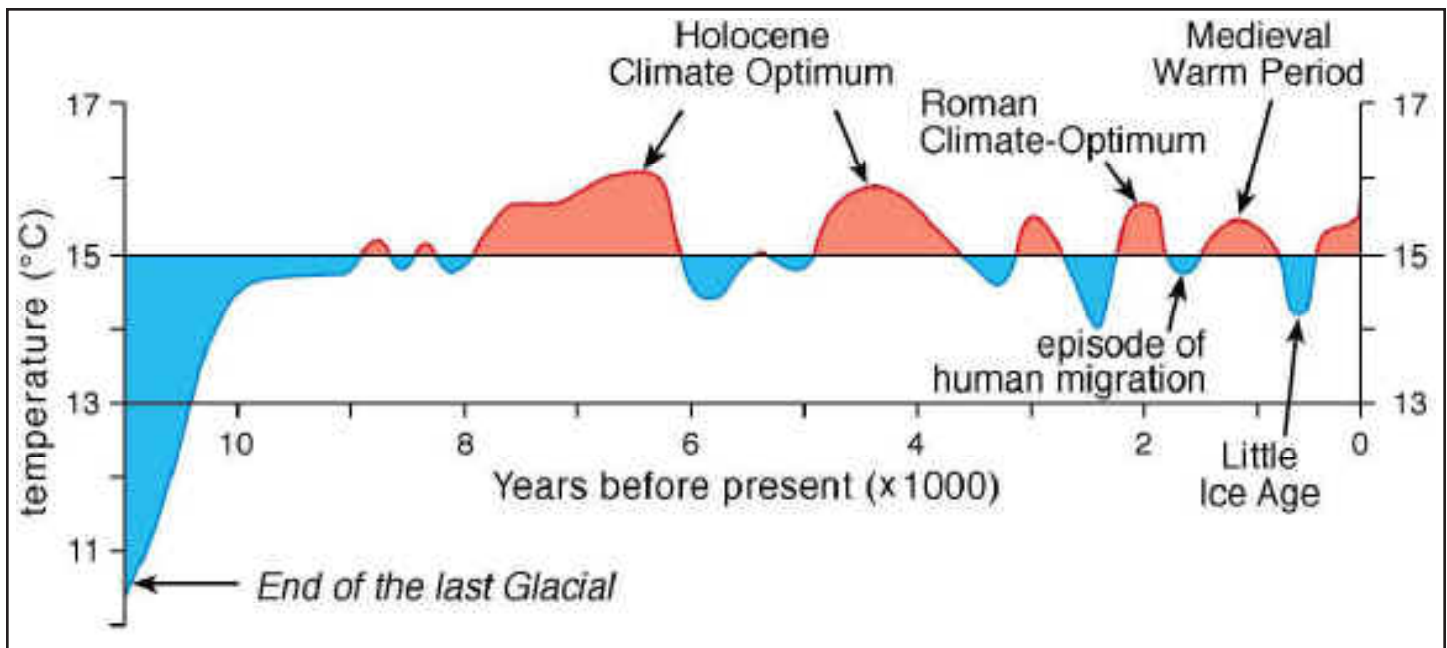
in recent months the issue of global warming has become a focus of attention for North Carolina policy makers. In 2005 the General Assembly established a commission on climate change to determine if the state can adopt policies that would generate net benefits in mitigating possible global warming.

The commission held its first meeting on February 3, 2006, where it heard from a number of speakers, all of whom firmly endorsed the idea the state could and should play a role in attempting to alter global temperatures. Part of this discussion focused on a particular record of climate change over the last 1,000 years, graphically represented by what has come to be called “the hockey stick.” This graph suggests that warming of the last 100 years is an anomaly.¹ On the other hand, most other analyses of climate change over this same time period and longer suggest that warming since the turn of the last century is not extraordinary.

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Figure 1. Northern Hemispheric temperature reconstruction for the past 10,000+ years



Ten Thousand Years of Climate Change

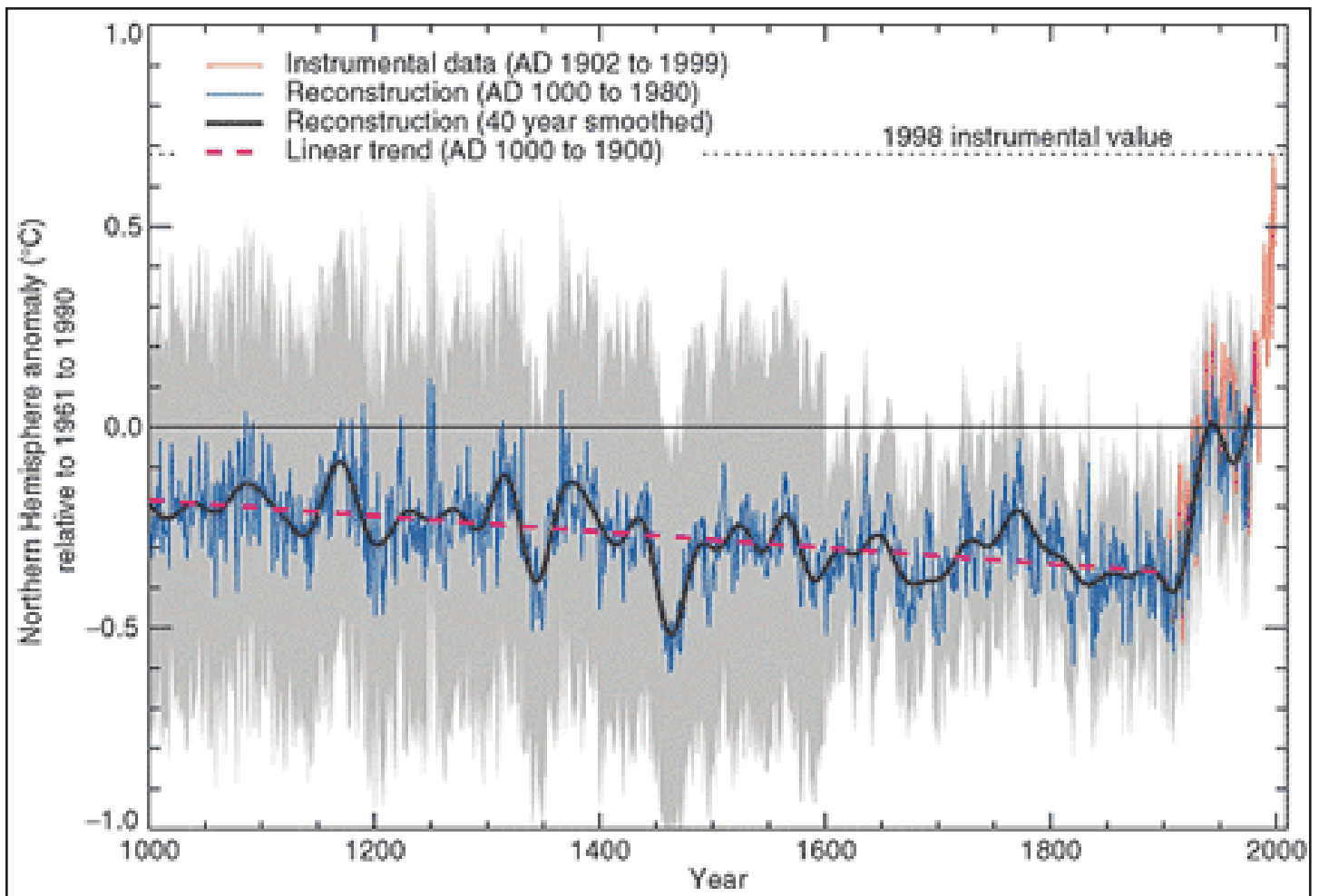
For decades, students of climatology have learned of the existence of substantial variations in the temperature of the Earth since the end of the last major ice age 10,000 years ago (Figure 1). Several “Climate Optimum” periods have graced our present interglacial period and were so named because of the relative ease humans had living in a warm world. Students have been taught that 1,000 years ago, the Earth was in the “Medieval Warm Period” when civilizations of the most northern countries were flourishing. However, approximately 450 years ago, the Earth plunged into the “Little Ice Age” and humanity struggled with no end of crop failures and famines.² This was a time when the Sun had very few sunspots, and many scientists believe the lower output of the Sun contributed mightily to this relatively cold period. Fortunately, the luminosity of the Sun increased, and by 1900, the Earth was clearly rebounding from hundreds of years of cold temperatures.

The enormous question facing climatologists today is whether the warming of the past 100 years is part of natural variability of the climate system or a response to the greenhouse gas concentration buildup that corresponded to the industrialization of the planet. Did we industrialize during a period of natural warming, or did our industrialization cause the observed warming?

This question has created an industry for climate scientists and policymakers worldwide, but it has also caused great tension between those who disagree about what has caused the warming and what can we do about the warming. Data are collected and analyzed, numerical climate models are run to simulate future climate, and at first glance, the greenhouse debate seems to be swimming in data and facts. But as Mark Twain once said, “Get your facts first, and then you can distort them as much as you please!” He was no doubt anticipating the global warming debate when that sentence came to his fertile mind!

The evidence for the climate variations over the past 1,000 or even 10,000 years comes from literally thousands of scientists who have carefully examined tree rings, ice cores, historical records, pollen spores, and dozen or more other clever ways to peer into the Earth’s climatic past. Major books and review articles have clearly documented that the major warming and cooling episodes were apparent throughout the entire world,³ and although there are uncertainties in reconstructing past climate patterns, the climate community has long been confident of the existence of a distinct “Medieval Warm Period” and “Little Ice Age.” Along with documenting the existence of these events, climate scientists have spent an equal amount of time explaining the events. Almost all scientists agree that the Little Ice Age was caused by a reduction in solar output, and almost all agree that the warming of the Sun contributed to some extent to the warm-up of the past century. Of course, defining the “extent” is a point of controversy in the field.

Figure 2. IPCC Northern Hemispheric temperature reconstruction for the past 1,000 years



The “Hockey Stick” Controversy

As we look at Figure 1 depicting 10,000 years of climate history, there is nothing unusual about the warming of the 20th century; in fact, the warming is unimpressive compared to other events over this time period. However, five years ago, the United Nations Intergovernmental Panel of Climate Change (IPCC) issued a report entitled *Climate Change 2001: The Scientific Basis*, and a new figure was introduced showing the Northern Hemisphere’s temperature over the past 1,000 years (Figure 2).⁴ The figure was based on research published in 1998 by Michael Mann and two other prominent scientists that appeared in several leading peer-reviewed journals.⁵ The Medieval Warm Period and Little Ice Age vanished, and now the warming of the past 100 years looked completely unlike anything observed for a 1,000 years. The greenhouse advocates made the case that the recent warming was so unnatural that only emissions of greenhouse gases could have caused the rapid global warming. The IPCC plot looked like a hockey stick, and scientists have been fighting about the shape of the curve since the day the IPCC released the report – the penalty box is plenty full of scientists as this fight seems to never end.

While there were squabbles throughout the climate community over the “hockey stick” from the time it first appeared in 1998, the situation exploded in 2003 when a paper was published in the scientific journal *Climate Research* by Harvard scientists Willie Soon and Sallie Baliunas.⁶ Their controversial paper was a review of hundreds of papers showing global evidence of the Medieval Warm Period and the Little Ice Age. They concluded that “Across the world, many records reveal that the 20th century is probably not the warmest nor a uniquely extreme climatic period of the last millennium.” Outrage was expressed by many leading climate scientists and questions were raised about how the paper survived the peer-review process. The editor of the journal resigned as did other members of the editorial board – the associate editor who handled the paper was severely attacked, and leading executives from the publishing

company wrote to the scientific community reassuring that the highest review standards would be the rule of the day. Nonetheless, that paper certainly documented overwhelming evidence that the Earth's temperature was anything but a flat line followed by an anomalous upward trend.

The second major brawl involved a pair of Canadians named Stephen McIntyre and Ross McKittrick who began to question both the data and the multivariate statistical techniques used by the Mann group in constructing the hockey stick. McIntyre and McKittrick set out to reproduce the results but immediately recognized that *the statistical methodology would generate a hockey-stick curve given almost any inputs*. They claimed to have found errors in Mann's data, errors in the computer code used to assemble the data, and errors in the application of the statistical methods.⁷ Furthermore, they felt that the Mann team was not cooperating in sharing data and their analytical methods despite the fact that their research had been publicly funded by the National Science Foundation. In November 2003, McIntyre and McKittrick conducted a briefing on Capitol Hill, elected officials got involved, and the spotlight was brighter than ever on shortcomings of the hockey stick. In 2005, a major journal of the American Geophysical Union published a McIntyre and McKittrick paper in which they severely criticized how the hockey stick temperature graph was developed⁸ – stay tuned, because the IPCC and many leading scientists are not about to concede that the hockey stick is broken!

Conclusion

The global warming issue is certain to heat up even more in the coming months. Former Vice President Al Gore has a new book on the greenhouse effect, entitled *An Inconvenient Truth*, about to hit the streets and the global warming debate will be back on the front burner. Gore is a big fan of the hockey stick, and I suspect the fight over the existence of the Medieval Warm Period and Little Ice Age will be in high gear this coming summer.

A clear point that the North Carolina policymakers should take from all this is that despite the claims of many who advocate for strong policies to combat global warming, *the science is not settled*. Any policy that the state decides to adopt needs to be carefully considered in light of this fact.

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Notes

1. See, William Schlessinger, "Science of Climate Change," at http://www.ncleg.net/Committees/legislativecomm_/meetingdocument_/3february2006_/presentations_/default.htm, slide 5.
2. Grove, J. M., 1988: *The Little Ice Age*. Methuen.
3. Lamb, H. H., 1982: *Climate, History and the Modern World*. Methuen.
4. This graph was presented to the N.C. Legislative Commission on Global Climate Change.
5. Mann, M. E., R. S. Bradley, and M. K. Hughes, 1998: Global-scale temperature patterns and climate forcing over the past six centuries. *Nature*, **392**, 779-787. See also Mann, M. E., R. S. Bradley, and M. K. Hughes, 1999: Northern Hemisphere temperatures during the past millennium: Inferences, uncertainties, and limitations. *Geophys. Res. Letters*, **26**, 759-762.
6. Soon, W. and S. Baliunas, 2003: Proxy climatic and environmental changes of the past 1000 years. *Clim. Res.*, **23**, 89-110.
7. McIntyre, S. and R. McKittrick, 2003: Corrections to the Mann et al. (1998) proxy data base and northern hemispheric average temperature series. *Energy & Environment*, **14**, 751-766.
8. McIntyre, S. and R. McKittrick, 2005: Hockey sticks, principal components, and spurious significance. *Geophys. Res. Letters*, **32**, 10.1029/2004GL021750.