‘Medieval Warm Period’ Pales by Modern Standards

• *By Melanie Lenart*

So these three guys walk into a bar. They sit down and one of them orders a bottle of wine. Then the bartender says, “Good thing you lads waited until now to place your order. We haven’t had homegrown wine in this region for centuries, until now.”

Admittedly, this is no joke. But neither is it a joke that the mild climate required for vineyard production had eluded England since Medieval times, until the global warming of recent decades.

Did global temperatures during the so-called Medieval Warm Period rival the modern warming, which many scientists believe stems from the release of greenhouse gases into the atmosphere? That’s a question Professor Malcolm Hughes and colleagues continue to challenge, using tree rings and a variety of other natural archives.

Professors Hughes, a dendroclimatologist with the Laboratory of Tree-Ring Research, addressed this question in an Oct. 17 commentary in the prestigious journal Science, written with colleagues Raymond Bradley of the University of Massachusetts and Henry Diaz of the National Oceanic and Atmospheric Administration. Dendroclimatology is the science of interpreting climatic variation from tree-ring records.

Their perspective piece cited a variety of research using tree rings and other proxy records to estimate that at the height of the “Medieval Warm Period,” between about 1000 and 1200 A.D, the Northern Hemisphere’s mean temperature appears to have been identical to that of the modern time frame of 1901-1970. In both cases, this would be about 0.6 degrees Fahrenheit cooler than the Northern Hemisphere’s mean temperature of the past 30 years.

This contrasts with a few recent declarations in the journals that the medieval climate was warmer, or at least not detectably different, than today’s climate. In one notorious case, the authors counted records of droughts and floods as well as higher temperatures in any 50-year period between 900 to 1300 A.D. as evidence of a “Medieval Warm Period” that was warmer than today’s climate.

The claims “might seem innocuous,” Dr. Hughes and his colleagues wrote in their perspective. “But for those opposed to action on global warming, it has become a *cause célèbre*: If it was warmer in medieval time than it is today, it could not have been due to fossil fuel consumption.”

Dr. Hughes has spent much of his career grappling with such climate questions. In 1994, he and Dr. Diaz argued in a Climatic Change article that there were warmings and coolings at different times, in different seasons, in various regions around the world.

“This does not constitute compelling evidence for a global ‘Medieval Warm Period,’” they concluded.

“The issue of synchroneity brings us right back to (LTRR founder) Andrew Douglass and dating—the importance of getting the years right,” Hughes added later during an interview in his University of Arizona office. An analysis done for the Science piece showed that the only major cluster of 30-year warm events registered by two dozen proxy records of temperature over the past millennium falls in the 20th Century.

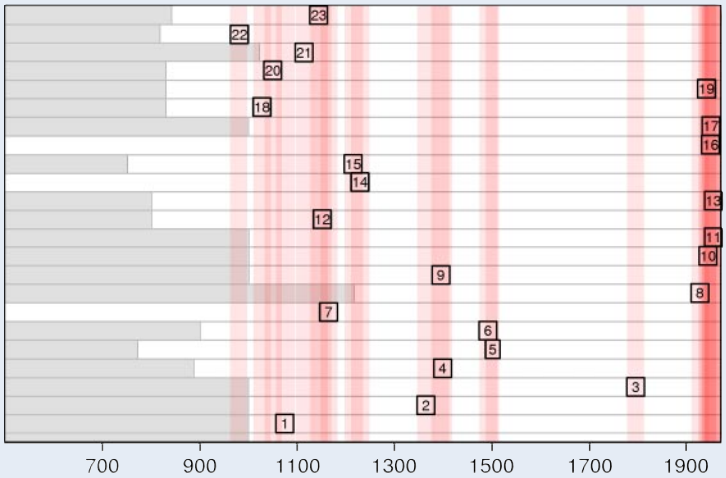
Mean Northern Hemisphere temperature was higher during the late 20th Century than at any other time during the past millennium, Hughes reported in 1998 and 1999 in papers co-authored with Dr. Bradley and lead author Michael Mann of the University of Virginia. They based their conclusions on a multivariate statistical approach that produced one temperature timeline that combined results from tree-ring chronologies with other annual-scale proxy records, such as ice cores and corals.

When the instrumental record was superimposed on their timeline, it showed an accelerated warming since the mid-1970s with annual mean temperatures in the 1990s that surpassed those recorded for the past 1,000 years.

Their work was cited by many, including the Intergovernmental Panel on Climate Change (IPCC), as providing evidence that

An Issue of Synchroneity

The warmest 30-year periods in 23 reconstructed temperature records based on tree rings, ice cores, lake cores, cave deposits, and historical documents were plotted by Raymond Bradley, Malcolm Hughes and Henry Diaz. Timelines are shown in white. Color intensifies as more than one 30-year warm period lines up in time. Timelines extend through 1970, so the intensification in global warming that started in 1976 is not captured in this image. Even so, more records showed their maximum in the 20th Century than in medieval times. For more details on these records, see the Oct. 17 issue of Science.



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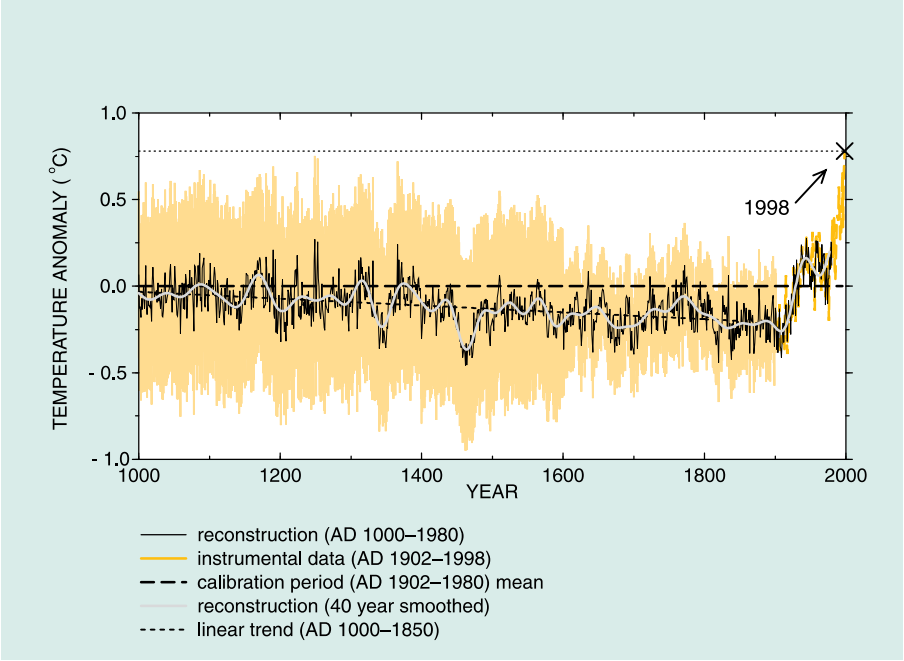

A temperature reconstruction by Michael Mann, Raymond Bradley and Malcolm Hughes shows the recent period of warming in the northern hemisphere followed a downward trend. The record, based on tree rings, ice cores, coral reefs, and sediments, was published in the March 15, 1999, issue of Geophysical Research Letters.

Graphic adaptation of the timeline was done by Martin Munro.

humans have contributed to a global warming through greenhouse gas production. Since then, close to a dozen other researchers have published similar results. The IPCC and others have used the findings to make a case for curbing greenhouse gas emissions from industry and automobiles.

While Professor Hughes recognizes the political implications of his research, he considers them secondary to getting to the truth of the matter.

"Our job as scientists is to address the scientific questions," he maintains.

To that end, the research trio of Mann, Bradley and Hughes continues to push their famous timeline backward and forward and test its veracity, with assistance from others, including LTRR Research Associates Fenbiao Ni and Kurt Kipfmueller. The proxy records used for their earlier papers typically began near or after 1000 A.D., and most of the records ended around 1980, well before a series of record-breaking years in the 1990s.

"We've got a lot more records now that come out to the late 1990s," Professor Hughes said, adding that preliminary results indicate the warming trend registered by the instrumental record is reflected in the natural archives.

"Also, we'll be able to do a better job of the last millennium, maybe go back another few centuries," he explained. "We'll see how far back we can go before error explodes."

Potential error, a statistical measure of variation, increases as the number of individual records contributing to a timeline shrinks.

Another statistical concern involves accounting for variations that are related to something other than climate. For instance, annual rings tend to be smaller when a tree is old because of growth trends, while annual ice core layers tend to be smaller when the ice is old because of compaction.

The method used to "standardize" the data to remove these non-climatic trends can be controversial, however. Professor Hughes noted that the research team is testing different methods of standardizing the data, including age banding, to make sure the observed climatic trends transcend the type of standardization applied.

Age banding involves lumping timelines from similar-aged individual trees together before applying the statistical maneuvers that remove the typical decline in ring width that occurs as a tree ages and becomes more massive. Some researchers recommend this approach, developed by Keith Briffa of England's University of East Anglia, when trying to distinguish climate trends for a timescale longer than the life of the average tree in the record.

Even when considering all these issues carefully, however, creating a temperature timeline of the past millennium poses challenges because it requires working in previously uncharted territory.

"Until 20 or 30 years ago, studies of past climate were pretty much the province of geologists and oceanographers," Hughes explained. "They were working on big changes—large-scale changes in boundary conditions of the climate system. When a change is that big, where the whole Earth is moving in one direction, you can capture it in a few records."

Climate records derived from ocean sediment cores, for example, tend to consistently show the ups and downs of global temperature during the large-scale ice ages and interglacial periods of the last 2 million years.

"We're starting from the other end in regard to time," he continued. "We're accustomed to working with small global changes and large local ones."

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> –Malcolm Hughes

Tree-ring records, for example, excel at detecting temperature or precipitation changes at the scale of the mountain or watershed where the trees live. Often these local changes can be related to larger scale patterns of atmospheric circulation.

"A change of that size is not big enough to make every place change at the same time," Professor Hughes said, adding, "The question of the slow change of the last millennium falls right between these two ways of looking at climate."

Even so, there is evidence beyond these types of proxy records that the climate warming occurring in modern times exceeds any occurring in the past millennium and more, he said. For instance, ice core records confirm that tropical glaciers in Kilimanjaro and the Andes have remained at below-freezing temperatures for thousands of years.

"Some of those places are not staying frozen now," Hughes reminded. "The ice is melting and disappearing. That strikes me as being evidence that something is changing, at least at 6,000 meters and up in the tropical latitudes."