This is the print version of the Skeptical Science article 'Medieval Warm Period was warmer', which can be found at http://sks.to/mwp.

How does the Medieval Warm Period compare to current global temperatures?

What The Science Says:
While the Medieval Warm Period saw unusually warm temperatures in some regions, globally the planet was cooler than current conditions.

Climate Myth: Medieval Warm Period was warmer
"For now, though, it is enough just to see the Medieval **WARM** Period shown to be global, and warmer than today." (Musings from the Chiefio)

The Medieval Warm Period spanned between the 10th and 15th centuries, and corresponded with warmer temperatures in certain regions around the world. During this time, ice-free seas allowed the Vikings to colonize Greenland. North America experienced prolonged droughts. Just how hot was the Medieval Warm Period? Was the globe warmer than now? To answer this question, one needs to look beyond warming in a few regions and view temperatures on a global scale.

Prior temperature reconstructions tend to focus on the global average (or sometimes hemispheric average). To answer the question of the Medieval Warm Period, more than 1,000 tree-ring, ice core, coral, sediment and other assorted proxy records spanning both hemispheres were used to construct a global map of temperature change over the past 1,500 years (Mann 2009). The Medieval Warm Period saw warm conditions over a large part of the North Atlantic, Southern Greenland, the Eurasian Arctic, and parts of North America. In these regions, temperature appears to be warmer than the 1961–1990 baseline. In some areas, temperatures were even as warm as today. However, certain regions such as central Eurasia, northwestern North America, and the tropical Pacific are substantially cooler compared to the 1961 to 1990 average.

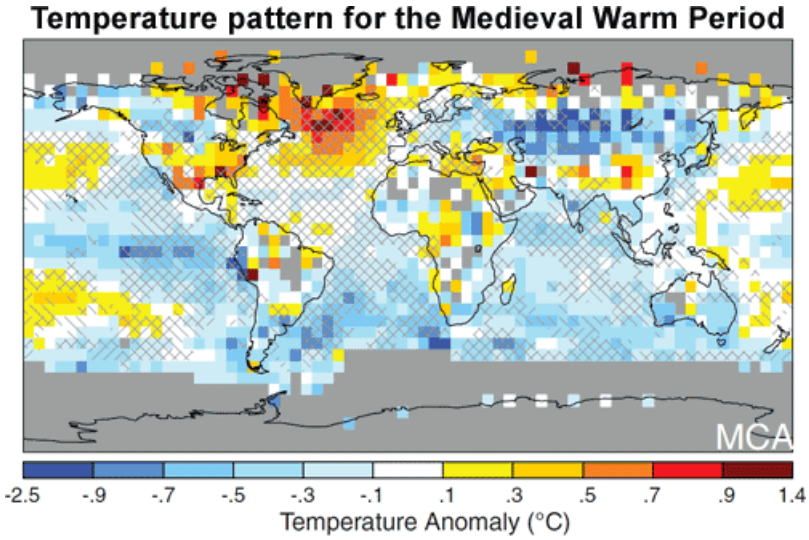

Figure 1: Reconstructed surface temperature anomaly for Medieval Warm Period (950 to 1250 A.D.), relative to the 1961– 1990 reference period. Gray areas indicates regions where adequate temperature data are unavailable.

How does the Medieval Warm Period compare to current conditions? Here is the temperature pattern for the last decade (1999 to 2008). What we see is widespread warming (with a few exceptions such as regional East Antarctic cooling)

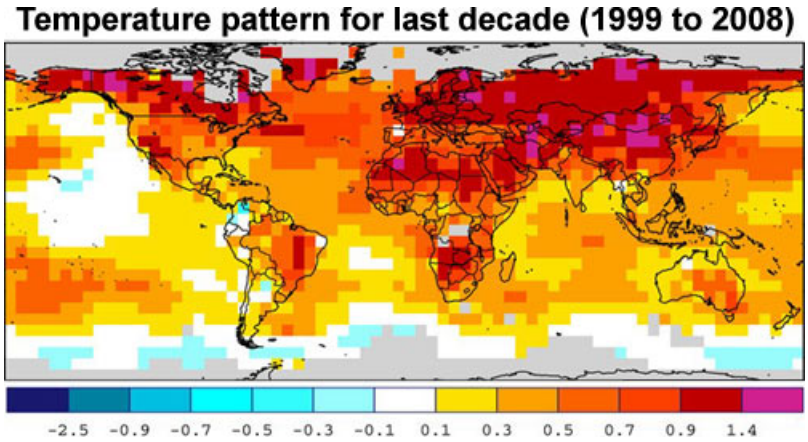

Figure 3: Surface temperature anomaly for period 1999 to 2008, relative to the 1961– 1990 reference period. Gray areas indicates regions where adequate temperature data are unavailable (NOAA).

The Medieval Warm Period was not a global phenomenon. Warmer conditions were concentrated in certain regions. Some regions were even colder than during the Little Ice Age. To claim the Medieval Warm Period was warmer than today is to narrowly focus on a few regions that showed unusual warmth. However, when we look at the broader picture, we see that the Medieval Warm Period was a regional phenomenon with other regions showing strong cooling. What is more, and as can be seen in Figure 4, globally, temperatures during the Medieval Period were less than today.

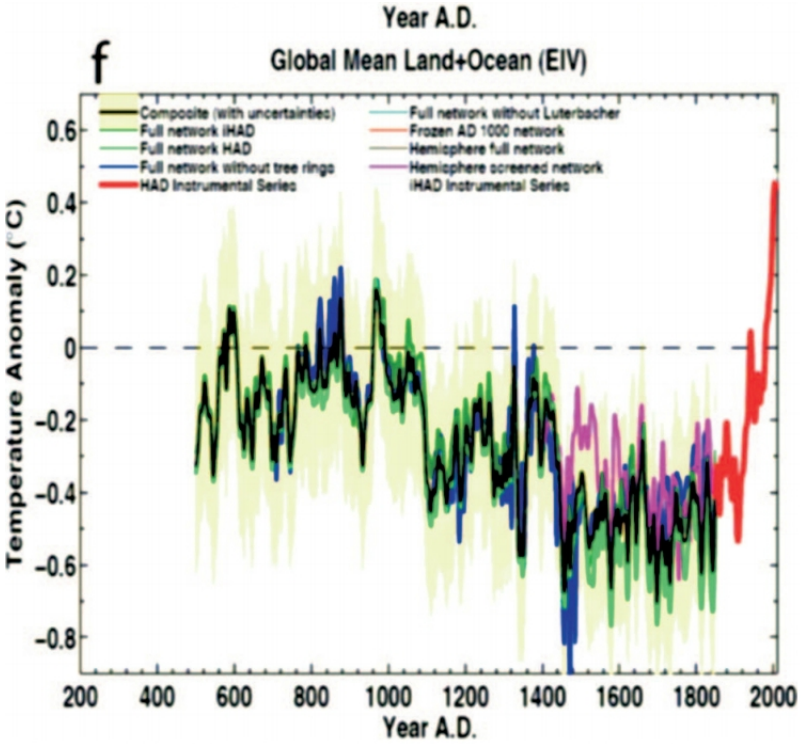

Figure 4: Global surface temperature reconstruction from Mann et al. (2008)

A seminal paper on this subject was published in *Nature Geoscience* in 2013 by the PAGES 2k team, with 78 researchers contributing as co-authors from 60 separate scientific institutions around the world. PAGES (Past Global Changes) is a scientific network which supports research aimed at understanding the Earth's past environment in order to make predictions for the

future. It's funded by the U.S. and Swiss National Science Foundations, and the National Oceanic and Atmospheric Administration.

In 2006, scientists in the PAGES network decided to organize an initiative to reconstruct the climate of the last 2,000 years, which they called The PAGES 2k Network. This network consists of scientists from 9 regional working groups, each of which collects and processes the best paleoclimate (past climate change) data from their respective region. It's a clever approach because it allows the experts in their local proxy data to contribute to a much larger global project.

The PAGES 2k team found that a global surface cooling trend over the past 2,000 years has been erased by the global warming over the past century. Current temperatures are hotter than at any time in the past 1,400 years, including during the Medieval Warm Period (Figure 5).

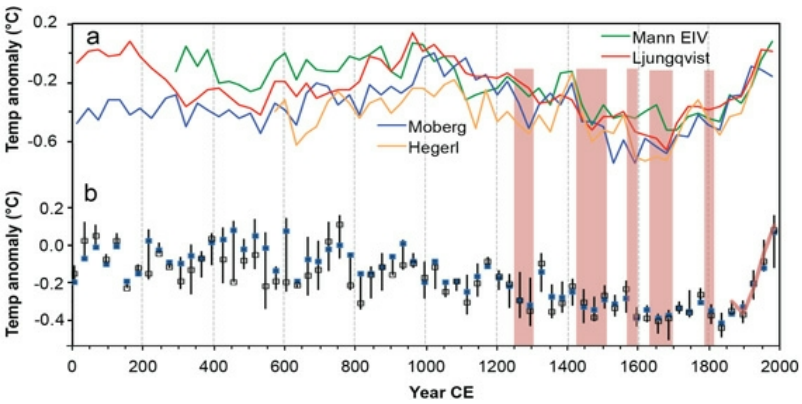

Figure 5: a) Previously published Northern Hemisphere 30-year-mean temperature reconstructions relative to the 1961–1990 reference period. b) Standardized 30-year-mean temperatures averaged across all seven continental-scale regions. Blue symbols are area-weighted averages, and bars show 25th and 75th unweighted percentiles to illustrate the variability among regions; open black boxes are unweighted medians. The red line is the 30-year-average annual global temperature from the HadCRUT4 instrumental time series relative to 1961–1990, and scaled visually to match the standardized values over the instrumental period.

They also found that the warming occurred at different times in different geographical areas.

> "the period from around AD 830 to 1100 generally encompassed a sustained warm interval in all four Northern Hemisphere regions. In South America and Australasia, a sustained warm period occurred later, from around AD 1160 to 1370."
>
> "Our regional temperature reconstructions also show little evidence for globally synchronized multi-decadal shifts that would mark well-defined worldwide MWP and LIA intervals. Instead, the specific timing of peak warm and cold intervals varies regionally, with multi-decadal variability resulting in regionally specific temperature departures from an underlying global cooling trend."

Intermediate rebuttal written by dana1981

Update July 2015:

Here is a related lecture-video from Denial101x - Making Sense of Climate Science Denial

[*see video at* ***this link***.]

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Skeptical Science explains the science of global warming and examines climate misinformation through the lens of peer-reviewed research. The website won the Australian Museum 2011 Eureka Prize for the Advancement of Climate Change Knowledge. Members of the Skeptical Science team have authored peer-reviewed papers, a college textbook on climate change and the book Climate Change Denial: Heads in the Sand. Skeptical Science content has been used in university courses, textbooks, government reports on climate change, television documentaries and numerous books.

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