

ALFRED, NY Are global temperature changes over the last century indicative of a warming trend related to human action that, left unchecked, could lead to serious consequences? Or are those changes normal, part of a pattern that has existed for centuries? Dr. Eugene Wahl, assistant professor of environmental studies at Alfred University, and Dr. Caspar Ammann, a paleoclimatologist with the National Center for Atmospheric Research (NCAR), have completed research that supports one scientific pillar of the former scenario. In 1998 and 1999, climatologists Michael Mann, Ray Bradley and Malcolm Hughes concluded a reconstruction of Northern Hemisphere surface temperatures over a 1,000-year period from 1,000 AD to the late 20th century. Their findings revealed that temperature patterns placed on a graph resembled a hockey stick the period from 1,000 AD to approximately 1900 showing a slow decrease with relatively little variability (resembling the shaft of a hockey stick), while temperatures began a steady climb around 1900 (resembling the blade of the stick). MBH98 (as the research done by Mann, et. al., first published in the journal *Nature* in 1998, came to be known) supported theories of human-caused global warming, in which natural climate variations driven by volcano explosions and changes in solar output have been relatively small since the beginning of the 20th century, compared to the change resulting from the continuously increasing release of carbon dioxide into the atmosphere (primarily by the consumption of fossil fuels), which is trapping heat inside the earth's atmosphere and causing global temperatures to increase. While several global/hemispheric temperature reconstructions had been done prior to 1998, Wahl said MBH98 "was the first to assimilate several different proxies and put them together in a complex statistical method." Proxies are indirect indicators of climate that are used before the time when information from thermometers was available (for most of the globe before around 1850). Examples range from the measurement of tree rings and polar ice core samples to the presence of fossilized pollen in lake bottoms and bogs. MBH98 was challenged in 2003 by Canadian researchers Stephen McIntyre and Ross McKittrick. Their study, which was presented again with modifications earlier this year, contends that global temperatures during the early 1400s are similar to those in the late 20th century, thus claiming the hockey stick-shaped graph is inaccurate and elevating the magnitude of natural climate variations. Their assertions suggest that the present increase in global temperatures could equally be attributed to natural long-term climate patterns as to human-caused global warming. Controversy surrounds MBH98, Wahl says, because it tends to validate in a visually striking way the theory of global warming. "The blade (in the hockey stick graph) shows that something happened in the 20th century to cause this unusual increase" in global temperatures, Wahl said. That "something," most climate scientists believe, has been an increased release of carbon dioxide and other greenhouse gases, which causes heat to be trapped inside the earth's atmosphere. The levels of carbon dioxide in the atmosphere have, like global temperatures, risen steadily and substantially over the last century, from 295 parts per million in 1900 to a current level of about 380 parts per million. The eventual impact of global warming, some scientists say, could be catastrophic. For example, as polar ice caps melt (especially in Greenland) and as the world's oceans warm up (water expands when heated), sea level would increase, causing major coastal flooding throughout the globe. "Global warming is itself controversial, both from a political and economic standpoint. If we want to do something about global warming, we need to make some very significant changes," Wahl said. "We're talking about different patterns of energy production and use, with changes made in a short period of time." Among the most significant changes would either be a shifting from fossil fuels to more carbon-neutral energy sources or the development of ways to remove and sequester carbon dioxide from emissions, either of which could involve considerable expense. Wahl and Ammann, using a climate reconstruction computer code that they developed, analyzed MBH98 and evaluated the criticism by the two Canadians, McIntyre and McKittrick. They used the same proxy data as MBH98 and also performed a series of climate reconstructions that left out or re-examined various proxies (primarily those involving North American tree ring measurements) that had been characterized by McIntyre and McKittrick either as flawed or derived by improper use of statistical methods. The result of Wahl's and Ammann's research is a climate reconstruction that is strikingly similar to MBH98. They concluded that McIntyre's and McKittrick's criticisms of MBH98 were unfounded, and that the statistical methods for summarizing the North American tree-ring proxies have been properly applied in MBH. "The bottom line is, we found MBH, within its own assumptions and proxy records, to be highly robust," Wahl said. "We didn't find the criticisms (by McIntyre and McKittrick) to have scientific merit, and thus the graphs they developed shouldn't be reported as climatologically valid reconstructions. Fundamentally, the recent warming (especially the last 30 years) is very unusual given the greater perspective of the

last millennium."For more information, Wahl and Ammann have presented a brief summary of their results at the following two websites. (The second can also be reached from within the first by clicking on the top link on the page.)<http://www.cgd.ucar.edu/c...> (scroll to lower part of page)