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Technology advances push climate debate in new directions

Climate sensitivity is hotly debated.

GRAHAM LLOYD THE AUSTRALIAN 12:00AM September 23, 2017

Confidence is rising in two key aspects of healthy climate scepticism. First, climate models have run “hot” and been wrong in predicting the speed and extent of warming. Second, the extended slowdown in the rate of warming since the turn of the century was real.

The jury is out on whether the so-called pause has ended but the bigger looming battle is whether machine learning and artificial intelligence will challenge the models on which much of the world’s climate understanding is built.

The British Met Office announced this week that temperature rises did slow for the 15 years to 2014.

More remarkable was a paper published in *Nature Geoscience*, by a team of international climate scientists, that says climate models have been “running hot”.

As a result, the team led by Richard Millar from the University of Exeter say the climate budget or amount of carbon dioxide that humans can emit before pushing warming past the aspirational 1.5C threshold is three times bigger than previously thought. This translates to a reprieve of at least 20 years — but the task still will be difficult and remains urgent, they say.

A report on the findings, also published in *Nature*, says the implications of the new research for global policymakers are significant. “Humanity is poised to blow through the IPCC’s (Intergovernmental Panel on Climate Change) carbon budget for a 1.5 C rise within a few years, leading many scientists to declare the goal impossible,” the report says. “But the new analysis suggests that it could be met with a modest strengthening of the current Paris pledges up to 2030, followed by sharp cuts in carbon emissions thereafter.”

The findings, together with the pause — which took place against a background of sharply rising carbon dioxide levels in the atmosphere — and the failure of climate models to predict it, leave a question mark over exactly how sensitive the climate is to rising levels of carbon dioxide.

The issue of climate sensitivity remains hotly debated, as is the role of natural cycles, particularly in the Atlantic and Pacific oceans.

Critics of the latest *Nature Geoscience* paper argue its findings are fundamentally flawed because they centre on a period of slower warming because of the “hiatus” when “natural variability in the climate system temporarily suppressed temperatures”.

The Met Office says the end of the pause is marked by rising temperatures across the past three years. But sceptics argue this uptick in temperatures coincided with El Nino weather conditions and may itself prove temporary.

Alongside debate about the pause, climate sensitivity, ocean cycles and model precision is new research analysing long-term natural cycles and proxy records — sometimes with artificial intelligence computer programs — to take a fresh look at what the past can tell us about the future.

A paper by Geli Wang of the Chinese Academy of Sciences, Beijing, examines natural cycles to try to answer the key question of whether natural events or carbon dioxide are mainly responsible for driving temperatures.

“Causality analysis in climate change is an active and challenging research area that remains highly uncertain,” the paper says.

“The IPCC advocates that human activity is the most important driving force of climate change, while some researchers have argued that natural forces might be the main cause.”

Wang analysed the Central England Temperature record, the world’s longest instrumental temperature record, for clues. “This investigation into the driving forces of climate change reproduces a 3.36-year cycle and a 22.6-year cycle, which may be connected to the El Nino–Southern Oscillation cycle and the Hale sunspot cycle, respectively,” the paper says. “Moreover, these driving forces were modulated in amplitude by signals with millennial timescales.”

Other researchers have used proxy records and artificial intelligence computer programs to look for patterns in warming.

One paper, by John Abbot published in *GeoResJ*, uses a series of historic temperature proxy data sets such as tree rings to project what 20th-century warming would have been if there had not been an industrial revolution. Abbot found the IPCC methods over-estimate the role of human carbon dioxide emissions in temperature increase by a factor of six.

The use of proxy data, markers that scientists use for temperature change including coral, ice cores and tree rings, is widely accepted and formed the basis of the “hockey stick” predictions of runaway warming.

The findings of the Abbot paper, co-authored by Jennifer Marohasy, are supported by other international research.

German researchers Horst-Joachim Ludecke and Carl-Otto Weiss analyse other 2000-year-long proxy records. Like Abbot, they break the record into its component cycles and come to the same conclusion.

Another paper published by the Chinese Academy of Sciences collected a large number of proxies and used them to reconstruct a 2000-year temperature series.

Led by Quansheng Ge, the research found the most rapid warming in China was from 1870-2000, but “temperatures recorded in the 20th century may not be unprecedented for the last 2000 years, as data show records for the periods AD981-1100 and AD1201-70 are comparable to the present”.

Published in *Advances in Atmospheric Science*s, the research illustrates the long-term natural oscillations in global temperatures across the past 2000 years. It clearly shows there was a Medieval Warm Period and then a Little Ice Age, with the medieval period about as warm as temperatures today.

“There is no reason to believe that cycles that have been present for thousands of years suddenly ceased to operate about a century ago,” Abbot says.

The key is to separate the natural cycles from the human influence. Abbot’s work suggests that even if there had been no industrial revolution and burning of fossil fuels, there still would have been some warming through the 20th century — to at least 1980. In short, he says it is possible to argue there was some impact from human activity but it was a lot less than the amount the IPCC required.

Artificial neural networks, or artificial intelligence, are gaining credibility in the climate science and meteorological community.

A report in *Nature* last month says researchers have used AI systems in recent years to help them rank climate models, spot cyclones and other extreme weather events — in both real and modelled climate data — and identify new patterns.

“The pace seems to be picking up,” says Claire Monteleoni, a computer scientist at George Washington University who has helped to pioneer the marriage of machine-learning techniques with climate science.

It represents tough new competition for the general circulation models that are coming under a new level of heightened scrutiny.

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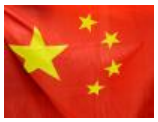

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