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Not just warmer: it's the hottest for 2,000 years

Widest study yet backs fears over carbon dioxide

Ian Sample, science correspondent
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The earth is warmer now than it has been at any time in the past 2,000 years, the most comprehensive study of climatic history has revealed.

Confirming the worst fears of environmental scientists, the newly published findings are a blow to sceptics who maintain that global warming is part of the natural climatic cycle rather than a consequence of human industrial activity.

Prof Philip Jones, a director of the University of East Anglia's climatic research unit and one of the authors of the research, said: "You can't explain this rapid warming of the late 20th century in any other way. It's a response to a build-up of greenhouse gases in the atmosphere."

The study reinforces recent conclusions published by the UN's intergovernmental panel on climate change (IPCC). Scientists on the panel looked at temperature data from up to 1,000 years ago and found that the late 20th century was the warmest period on record.

But the IPCC's report was dismissed by some quarters in the scientific community who claimed that while the planet is undoubtedly warming, it was warmer still more than a thousand years ago. So warm, in fact, that it had spurred the Vikings to set up base in Greenland and led to northern Britain being filled with productive vineyards.

To discover whether there was any truth in the claims, Prof Jones teamed up with Prof Michael Mann, a climate expert at the University of Virginia, and set about reconstructing the world's climate over the past 2,000 years.

Direct measurements of the earth's temperature do not exist from such a long time ago, so the scientists had to rely on other indicators of how warm - or not - the planet was throughout the past two millennia.

To find the answer, the scientists looked at tree trunks, which keep a record of the local climate: the rings spreading out from the centre grow to different thicknesses according to the climate a tree grows in. The scientists looked at sections taken from trees that had lived for hundreds and even thousands of years from different regions and used them to piece together a picture of the planet's climatic history.

The scientists also studied cores of ice drilled from the icy stretches of Greenland and Antarctica. As the ice

forms, sometimes over hundreds of thousands of years, it traps air, which holds vital clues to the local climate at the time.

"Drill down far enough and you could use the ice to look at the climate hundreds of thousands of years ago, but we just used the first thousand metres," said Prof Jones.

The scientists found that while there was not enough good data to work out what the climate had been like in the southern hemisphere over that period, they could get a good idea of how warm the northern hemisphere had been.

"What we found was that at no point during those two millennia had it been any warmer than it is now. From 1980 onwards is clearly the warmest period of the last 2,000 years," said Prof Jones.

Some regions may well have been fairly warm, especially during the medieval period, but on average, the planet was a cooler place, the study found.

Looking back over a succession of earlier centuries, the temperature fluctuated slightly, becoming slightly warmer or cooler by 0.2C in each century. The temperature has increased by at least that amount in the past 20 or so years, the scientists report in the journal Geophysical Research Letters.

"It just shows how dramatic the warming has been in recent years," said Prof Jones.

Scientists who do not believe that carbon dioxide is driving climate change are unlikely to run up the white flag just yet, however.

Dr Sallie Baliunas at the Harvard College Observatory in Massachusetts, for example, maintains that the recent warming could all be down to changes in the strength of sunlight falling on the planet.

She concluded that during the 20th century, earth went through a cycle of natural climatic change. According to her data, from 1900 to 1940 the planet warmed slightly, then cooled from 1940 until 1970, then warmed up again from 1970 onwards. Given that 80% of the world's carbon dioxide emissions have been pro duced since 1940, the expected effect, if carbon dioxide was causing global warming, would be higher temperatures not lower, she said.

Dr Baliunas's data also concluded that the period of warming between 1900 and 1940 must have been due to natural causes, most likely increased sunlight hitting the earth's surface, since carbon dioxide emissions were negligible at the time. The evidence, she said, pointed to variations in the sun's brightness being the cause of the planet's warming up, not carbon dioxide.

But other climatologists have welcomed the new study as the most conclusive evidence to date that the increase in temperature is a result of human activity.

"The importance of the finding is that it shows there's something going on in the climate system that's certainly unusual in the context of the last 2,000 years, and it's likely that greenhouse gases are playing the major role," said Prof Chris Folland of the Met Office's Hadley Centre. "If you look at the natural ups and downs in temperature, you'll find nothing remotely like what we're seeing now."

Debunked: cold water on climate claims

Not everyone agrees that climate change is largely driven by human activity. Some believe the warming the planet is experiencing now is part of a natural cycle. Historical anecdotes are sometimes used to support their case, but the new study debunks these claims.

· There were vineyards in the north of Britain<

There were indeed vineyards in Britain in the 10th and 11th centuries, but only 50 to 60. There are now more than 350 in this country, with some as far north as Leeds.

· The Vikings went to Greenland

In AD980, Erik the Red and his crew headed from Iceland to Greenland, but it wasn't for the good weather. Erik had been kicked out of Iceland for murder so he took his crew westward where, they were told, they would find land.

· The Thames used to freeze over more often

The river's tendency to freeze over frequently in the 16th and 17th centuries is often cited as evidence that the climate used to be more erratic. But, according to the new study, the major cause was the original London Bridge, completed in the 13th century, which had very small spans between its supports for the Thames to run through. The result was that the river was tidal only as far as the bridge, causing the water to freeze over. When the bridge was rebuilt to a different design in the 1820s, the water flowed more easily and therefore became less prone to ice.

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