

Environment

Hello!

As global temperature records fell month after month last year, and fires and floods grew in synchronous ferocity, climate scientists grew increasingly alarmed.

By December, it was clear that the world had sweltered through its hottest year in recorded history, the first to be on average 1.5 degrees hotter than the period before the industrial revolution, when we started pumping carbon dioxide into the atmosphere.

Some took comfort that the horrifying streak of hot weather would end in January, with a La Niña weather pattern that would surely begin to cool the planet.

Instead, when the La Niña began to take hold last month, the global average temperature continued to climb. January 2025 was a staggering 1.75 degrees hotter than the pre-industrial period and 0.79 of a degree above the 1991-2020 average, the United Nations has confirmed.

In the Paris Accord of 2015, the world agreed to try to limit global warming to an average of 1.5 degrees above pre-industrial levels, a threshold that most models suggested was still several years away, even under the worst circumstances.

Now, says Bill Hare, Perth-based climate scientist and former lead author for the UN's chief climate body, the Intergovernmental Panel on Climate Change (IPCC), climate scientists are racing to understand what is happening.

Are the climate models wrong, or has the world slipped past one of the tipping points that might accelerate warming beyond our capacity to control it? Have we already slipped past the 1.5 degree limit?

Complicating the analysis is the fact that the Paris Agreement does not make clear what it means to break through the 1.5 degree barrier. Most understand it to suggest that the barrier has been broken when global temperatures rise above the threshold for a period of 20 years, to allow for exceptionally hot years.

Three papers about the question have been published in quick succession, and have become the subject of intense debate among climate scientists.

One, published in [*Nature Climate Change*](#), by a team led by Emanuele Bevacqua at Germany's Helmholtz Centre for Environmental Research – UFZ, looked back over climate records to see what happened when earlier heat thresholds were broken.

It showed that when Earth's temperature rose to 0.6 of a degree, 0.7 of a degree, 0.8 of a degree, 0.9 of a degree and 1 degree above the pre-industrial benchmark, the world had begun a 20-year period of temperatures above that level.

More simply put, recent history suggests there is a chance we have already smashed through the 1.5 degree threshold of the Paris Agreement.

Hare warns that though the finding is ominous, more research is needed to confirm it.

A second paper, by the climate scientist Alex Cannon, also published in [*Nature Climate Change*](#), identified June 2024 as the 12th consecutive month of temperatures above the 1.5 degree threshold, and looked into existing climate simulations to understand what this suggested about possible future temperatures.

“The analysis shows that 1.5°C warming for 12 consecutive months, regardless of recent El Niño conditions, usually occurs after the 1.5°C Paris Agreement threshold has been reached in archived simulations,” wrote Cannon.

Or more simply put, this paper also suggested the Paris Agreement's 1.5 degree target may already have been breached.

The third paper was written by a team led by James Hansen, director of the Program on Climate Science at Columbia University. Hansen was made famous when, as a NASA climate scientist in 1988, he gave testimony before the United States Congress that first alerted much of the world to the cause and consequences of climate change.

Hansen's paper, published in [*Environment: Science and Policy for Sustainable Development*](#), explores the causes of recent extreme heat, and what he believes is an acceleration of climate change.

Hansen comes to the conclusion that Earth's climate system is more sensitive to greenhouse gases in the atmosphere than is properly understood by the IPCC, and that feedback loops – which see climate change causing increased climate change – have already crept into the system.

According to Hansen, human activity is making the planet darker, which means it does not reflect as much heat and light from the sun as it once did, and in turn grows warmer more quickly. This reflectivity is referred to as Earth's albedo.

Hansen's research shows that as greenhouse gases cause warming, snow and ice cover shrinks, less sunlight is reflected into space, and so warming increases. Warming also tends to shrink cloud cover, which also means less light and heat are reflected.

But Hansen is also at the forefront of a new area of research into how new rules reducing aerosol pollutants such as sulphur in the fuel used by the world's shipping fleet, might be reducing Earth's albedo.

According to this research, while carbon dioxide and other greenhouse gases are warming the planet, some actually reflect light and heat back into space. Sulphur in shipping exhaust fumes brightens the clouds above shipping lanes, increasing their reflective capacity and masking some of the impact of climate change. With the sulphur removed, the mask has slipped and warming has stepped up.

"With the change of ship regulations, our first Faustian payment came due," wrote Hansen.

His paper suggests that both the UN and the broader global community may not properly understand the immediate threat the world faces, particularly the threat of the shutdown of the Atlantic Meridional Overturning Circulation (AMOC) within 20 to 30 years.

According to Hansen and his colleagues the AMOC – the Atlantic Ocean's main system of currents – will be shut off by fresh water from ice melt flowing into the North Atlantic.

This in turn would lock heat in the waters of the southern hemisphere that are normally cooled by the flow of the AMOC, and in turn cause metres of sea level rise.

This would mark a "point of no return" says Hansen.

His findings contradict those of the IPCC, whose models do not predict an AMOC shutdown this century.

Some leading climate scientists have been sceptical about some of Hansen's past findings, despite their esteem for his work.

Hare notes that if Hansen is correct that Earth's climate system is more sensitive to greenhouse gas accumulation than the current accepted science suggests, it may also be more sensitive to a reduction in greenhouse gases.

If we act fast on cutting emissions we might get faster than expected reductions in temperature.

That might be as close we get to good news in the analysis of the heat that just keeps breaking records.

And what does Hare think of Hansen's broader findings?

"There are not very many physicists who would bet against Jim Hansen without very careful reflection."

Until next time,



Nick O'Malley

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