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It just got harder to deny climate change drives extreme weather

The link between human activity and unusual jet stream patterns associated with extreme weather events is getting stronger

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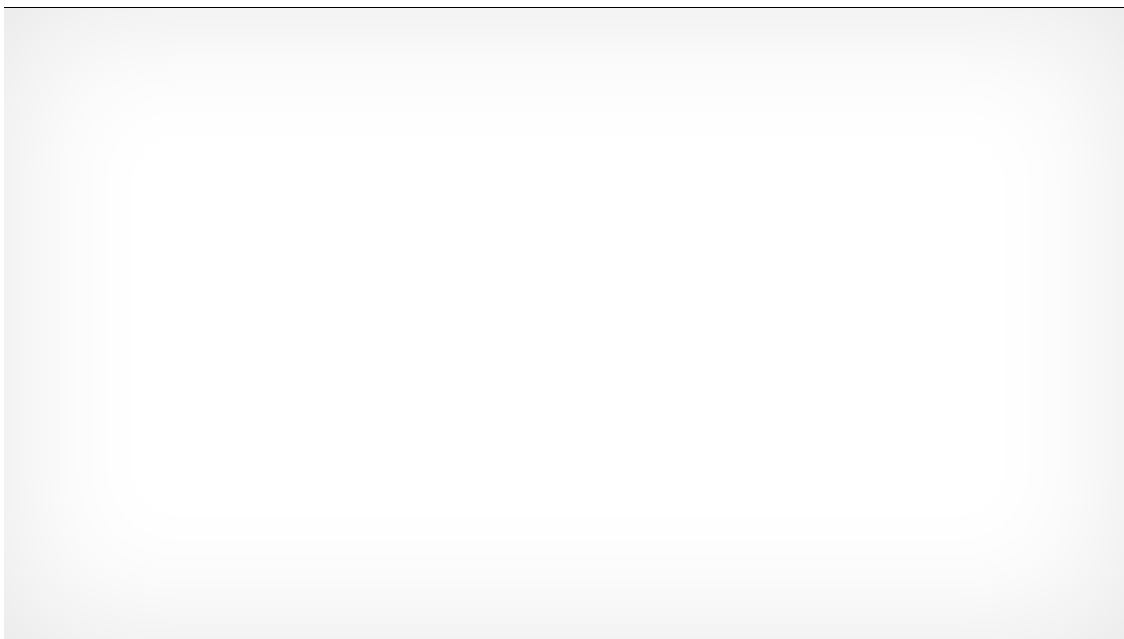
In convincing the public of the dangers of climate change, nothing would be more powerful than being able to link extreme weather events with our unbridled love for fossil fuels.

But that's hard, even though we know that the likelihood of dangerous cold snaps, [floods](#) and droughts increases the more greenhouse gases we emit.

The best evidence for this includes sophisticated climate models used to analyse the odds of such events with and without human-induced climate change. They show that warming increased the likelihood of a heatwave of the sort that hit [Europe in 2003](#) – claiming an estimated 35,000 lives – by 40 per cent. Likewise, it makes [droughts like that in California](#) in recent years twice as likely.

However, saying human activity is implicated in any one event is notoriously difficult, in part because the Earth's climate varies naturally, a fact long seized upon by climate sceptics.

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Perhaps they won't be able to get away with that much longer. Another strand of evidence bolsters the scientific case, and it comes from our improving grasp of the complex ways in which rising levels of greenhouse gases tinker with large-scale systems that drive weather.

As it turns out, emissions don't just alter Earth's average temperature or the amount of water vapour the atmosphere can hold; they can fundamentally rearrange systems that determine how and where heat and moisture are distributed on our fragile planet.

Diversion brings havoc

The latest work on this, published this week, is led by [climatologist Michael Mann](#) at Pennsylvania State University. It bolsters the idea that the polar jet stream can be diverted by global warming, potentially bringing weather-related havoc to the northern hemisphere.

by global warming, potentially bringing weather-related havoc to the northern hemisphere in spring and summer. This high-altitude, fast-flowing atmospheric river usually follows a set route, driven by the Earth's rotation and by temperature differences between the equator and the poles.

But the [Arctic is now warming faster](#) than any other part of the planet, lessening this temperature gradient. This can cause the polar jet stream to get stuck in an unusual, slower-moving, more meandering pattern. When that happens, sometimes for weeks at a time, a persistent weather event such as flooding or drought is more likely.

The study used dozens of climate models, plus real-world temperature data going back to the 1870s, to identify the specific temperature patterns that coincide with this phenomenon. Those temperature conditions have become more prevalent in the past 40 years.

Crucially, Mann says this stalled jet stream and its connection to human-induced climate change makes this the closest we have yet come to demonstrating a direct link between carbon emissions and recent extreme weather.

The study says that many events, such as the 2003 European heatwave, the 2010 Pakistan floods (pictured, top) and prolonged California drought, tally with a change in position of the jet stream.

It's encouraging to see scientists grasp – at such an impressive speed – the influence of greenhouse gases in unravelling Earth's most complex systems. It is also deeply worrying in its implications.

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