CLIMATE METRICS · EDITORIAL

Weather Is Not Climate

Why a cold week cannot cancel a warming planet, and why one heatwave cannot prove it on its own

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Every winter someone points at a snowdrift and asks where global warming went. Every summer someone points at a heatwave and says it proves everything. Both are mixing up two different things. Weather is what the atmosphere is doing today. Climate is the pattern weather makes over decades. Keeping them apart is the first step to reading climate figures well.

Your mood and your personality

Weather is the state of the atmosphere at a particular place and time: the temperature, rain, wind, cloud and humidity outside your window this afternoon. It changes by the hour and is forecast days ahead.

Climate is the statistics of that weather over a long period: the averages, how much it usually varies, and how often extremes turn up. The World Meteorological Organization defines a standard climate "normal" as a 30-year average; the current reference period is 1991 to 2020. An old saying puts it simply: climate is what you expect, weather is what you get.

A useful comparison is mood and personality. One bad day does not tell you much about someone's character. A pattern of behaviour over years does. In the same way, a single cold week says almost nothing about the climate. A thirty-year trend says a great deal.

	Weather	Climate
What it describes	Conditions right now, or over the next few days	Average conditions and their range over decades
Timescale	Minutes to about two weeks	30 years or more (the WMO standard)
Typical question	Will it rain in London on Saturday?	How much wetter are London winters than in 1960?
How it is predicted	Forecasts that start from today's exact conditions	Projections driven by the planet's energy balance
Main limit	Chaos: tiny errors grow, so skill fades after about 10 days	Uncertainty about future emissions and some feedbacks

Why forecasts fail at two weeks but projections work for decades

A common objection goes: "Forecasters cannot tell me next month's weather, so why trust a forecast for 2100?" The answer is that the two are different kinds of prediction.

A weather forecast tries to say exactly what the atmosphere will do next, starting from its exact state now. The atmosphere is chaotic, as the meteorologist Edward Lorenz showed in the 1960s: tiny errors in the starting measurements grow until, after a week or two, the forecast is no better than a guess. No supercomputer can

remove that limit.

A climate projection asks a different question. It does not try to say whether 14 July 2070 will be sunny. It asks how the average and the range of weather change when the planet traps more heat. That depends on the energy balance (sunlight in, heat out, and how greenhouse gases change that balance), not on the exact position of today's storms.

> **You cannot predict the age at which one particular person will die, but insurers can predict average life expectancy with great accuracy. Climate science works the same way: the individual case is uncertain, the statistics are not.**

The scale problem: why your back garden misleads you

The temperature in one place can swing by 10 to 20 °C between a mild day and a cold one within the same week. Against that noise, the long-term warming of the whole planet looks tiny. The global average surface temperature in 2024 was about 1.55 °C above the 1850 to 1900 average, according to the WMO. That was very likely the first calendar year above 1.5 °C. Even so, one year above that mark does not mean the Paris Agreement's 1.5 °C limit has been passed, because that limit refers to a long-term average, usually measured over 20 years.

A rise of a degree and a half sounds small next to a 15-degree daily swing. But it is an average over every place, every season, day and night, land and ocean, for a whole year. Moving that average needs an enormous amount of extra heat, most of which has gone into the oceans. It is also local versus global: a cold spell over one continent is often matched by unusual warmth somewhere else on the same day.

Where weather and climate meet: loading the dice

Climate change does not create weather events from nothing. It shifts the odds. Picture the range of daily temperatures as a bell curve. Nudge the whole curve slightly towards warmer values and the change in the middle looks modest, but the hot tail, where the dangerous heatwaves sit, grows much larger. Days that were once rare become routine, and record-breaking days that were almost impossible become possible.

The IPCC's latest assessment (AR6, 2021) puts numbers on this. A hot extreme that used to happen about once in ten years in the pre-industrial climate now happens about 2.8 times in ten years at 1 °C of warming. The IPCC projects about 4.1 times at 1.5 °C and 5.6 times at 2 °C. Heavy rainfall becomes more intense too, because warmer air holds about 7% more water vapour for every degree of warming.

That is why scientists can now say something about single events, through a field called attribution science. Groups such as World Weather Attribution compare how likely an event is in today's climate with how likely it would have been without human-caused warming. Their study of the 2021 Pacific Northwest heatwave, when Canada recorded 49.6 °C at Lytton, concluded it would have been virtually impossible without climate change.

Four mistakes to avoid

- "It snowed today, so global warming is a myth." One place on one day is weather. Look at the global average over decades.
- "This heatwave proves climate change." One event alone cannot prove a trend. What can be shown is how much climate change made it more likely or more intense; that needs an attribution study.
- "They cannot forecast next week, so they cannot forecast 2100." Weather forecasts and climate projections answer different questions, and chaos limits only the first.

- "A cool year means warming has stopped." Natural swings such as El Niño and La Niña move single years up and down. The trend shows over 20 to 30 years, not over one year.

How to read the figures on this site

Most figures on Climate Metrics are anomalies: the difference between a measurement and a long-term baseline, such as 1850 to 1900 or 1991 to 2020. A single month's anomaly on our live dashboards behaves a lot like weather, with natural ups and downs. The climate signal is in the run of years. When you see a monthly record, check whether it fits a decades-long trend before drawing conclusions. When you see a cold month, do the same.

The bottom line: weather is the noise and climate is the signal. Both matter, because we live through the weather and plan around the climate. Mixing them up leads people to dismiss real risks on a cold day and to overclaim on a hot one. Separating them is how the numbers start to make sense.

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Climate glossary and FAQ · climatemetrics.org/climate-glossary-faq
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Sources

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