



If you're not a climate scientist—and maybe even if you are—reading news headlines this month has been confounding and a little scary. [*"In First, Earth's Temperature Breached Key Threshold Over a 12 Month Period"*](#) is how the Wall Street Journal put it. [*"Earth Just Experienced 12 Months Of Global Temperatures Above Critical 1.5C Climate Threshold,"*](#) was the version at Forbes. And the Washington Post went with [*"Earth Breached a Feared Level of Warming Over the Past Year. Are We Doomed?"*](#) Oof, we get the picture. If that weren't enough, new research on sea sponges made for a second wave of stories that declared the [*"The World Blew Past 1.5 Degrees of Warming 4 Years Ago."*](#)

My colleague [Professor Ted Parson](#) served as a senior advisor to the Commission on Climate Overshoot. So, I asked him what we should make of this alarming but confusing development in the study of global temperatures.

Q: What exactly is the 1.5 C threshold?

Well, 1.5 Celsius (or 2.7 degrees Fahrenheit) is a target to limit global-average heating that was adopted by nations in the 2015 Paris Agreement. The text of the agreement is actually a little loose. It says the Agreement aims to hold global-average heating "well below 2.0 C,"

and “pursue efforts” to limit heating to 1.5 C, with both those temperature increases defined relative to pre-industrial levels, meaning the period between 1850 and 1900 because that’s how far back reasonably good temperature records go.

Q: Why is 1.5 C important and how was it settled on?

1.5 C is a *political* target, not a scientifically determined limit. But it’s a political target that’s based on a reasonable assessment of science that suggests that harms from climate change are likely to get worse faster after passing 1.5 C. In fact, the 1.5 language was added at the insistence of the highly climate-vulnerable small island states, who recognized that the previous target of 2.0 C, stated at the 2009 COP in Copenhagen and adopted one year later – which was also a non-binding goal – would leave many of them inundated by sea level rise.

Then 1.5 became much more prominent a few years after the Paris Agreement, with the release of an [IPCC Special Report](#) on the target. Where previous IPCC reports had compared projected climate impacts under various uncontrolled scenarios to those with 2.0 C of heating, this report focused on comparing climate impacts at 1.5 C to those at 2.0 C. It found, unsurprisingly, that impacts are much less severe at 1.5 than at 2.0.

Q: Is 1.5 a bright line that’s catastrophic to cross?

Thinking about the 1.5 climate target as a bright line or “point of no return,” or similar images, I find very troubling. Although there are many identified forms of discrete system change in climate and various domains of impact, mostly at large regional rather than global scale, there is no basis for regarding 1.5 as a cliff in global climate that separates “acceptable” from “catastrophic” outcomes.

Aside from being unfounded in scientific knowledge, I find this “cliff-edge” framing morally troubling, in two ways. First, it implies that everything up to 1.5 is fine, as long as you don’t cross the line. That’s obviously false. There are climate-change impacts happening all over the world that are catastrophic for the people and places affected by them – those burned out in supercharged wildfires or flooded out in extreme rainfall events. Second, and even worse, it suggests that once you pass 1.5, all is lost and there’s nothing more to be done. You find this fatalist, despairing stance increasingly in climate commentary. This is profoundly false. The best representation of the severity of climate impacts is that they make a curving surface, like a skateboard ramp. Every step to hotter temperatures gets worse, and does so non-linearly, at an increasing rate. So, 2.5 is worse than 2.0 by more

than 2.0 is worse than 1.5, and so on. But with this understanding, each additional increment of heating is *more* important to avoid as it gets hotter, not less.

Comparing Different 2023 Temperature Projections

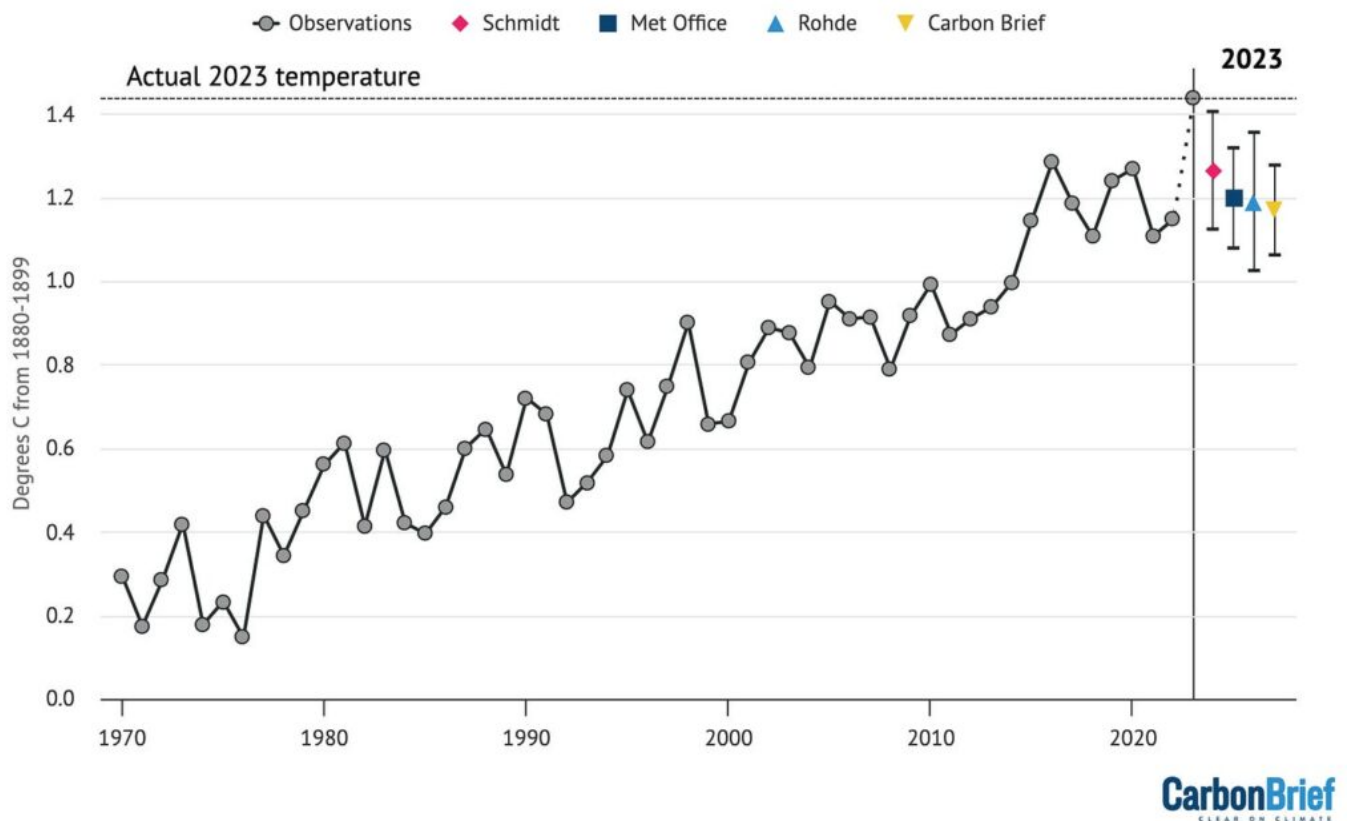


Chart by Carbon Brief.

Q: So, what happened with global temperatures in 2023?

Although this is not stated explicitly, in the Paris Agreement or elsewhere, heating levels and targets to limit them are usually understood as referring to the long-term trend in global-average temperature. Global-average temperature (meaning surface temperature averaged over every place on the Earth's surface) varies over periods of days, months, and years, in addition to the long-term trend being driven by increasing greenhouse gases. So, you can have an unusually hot month or year, which may in turn be followed by a cooler month or year. Even from one year to the next, global temperature can vary by as much as

0.1 or even 0.2 C. The trend is what you see by estimating the change over multiple years, an exercise in fitting a straight line through a wiggly curve. Measured by this longer-term trend, the most recent IPCC report, released in March 2023, projected that we would pass 1.5 C in the 2030s, probably in the earlier part of that decade.

Q: I think many people saw that projection and thought, “That’s not very far away!” But now here comes news that maybe we’re already there, which is what’s so confusing.

Remember, 2023 was a shocker. The annual-average temperature was 1.48 C above the pre-industrial average, just shy of the 1.5 limit – and an astonishing 0.17 C hotter than the second-hottest year to date, 2016.

This record heat has scientists puzzled. A couple of scientific colleagues have published analyses trying to attribute the record heat, examining potential causes like the strongly positive El Nino now fading, recovery from the cooling effect of the 2022 volcanic eruption in Tonga, and the ongoing reductions in emissions of reflective aerosols from sulfur pollution, particularly from ships, as well as anthropogenic greenhouse gases. [They concluded](#) that none of these, not even human emissions, can account for all the observed heating, so they conclude that part of it must be some extreme natural variability.

Q: Wait, didn’t the headlines last week say we had already passed 1.5?

Ah, sharp eyes. That’s right, 2023 on average was 1.48 C. The new announcement last week came from the EU’s [Copernicus Agency](#), which publishes a continuous 12-month running average of global temperature in addition to year-by-year averages. Because the Earth warmed a lot through 2023 – December was 0.5 C hotter than January – and because January 2024 was also exceptionally hot, their 12-month running average went above 1.5 C when that 12-month average rolled over from being January through December 2023, to being February 2023 through January 2024. It provides a new epilogue or bonus chapter to the hottest year on record, which we’d already read about during the holidays of 2023.

Moreover, there’s enough uncertainty and variation across sources in these data that you can’t put much stock in differences of a few hundredths of a degree. For example, one

prominent recent paper argues that we've been counting the pre-industrial baseline wrong because surface temperature records don't go back far enough, so the point we measure from is already inflated by human heating - and that relative to the correct, lower baseline, the world passed 1.5 C in 2020. That's [the sea sponge study](#) that made headlines last week.

Q: Does this mean we've breached the Paris Agreement target?

In a word, no. But that's oversimplified. Remember, defining when the target will be passed is an exercise in curve-fitting to estimate a long-term trend. The extreme heat of 2023 will deflect the fitted line up and thus advance the time it's projected to pass 1.5. Probably not by so much as to say we've already passed it. That said, we *will* pass 1.5, and soon. Given the lags in the system, there's no way to stop that.

Q: Is this the "climate overshoot" that the Commission you advised last year was trying to prepare for?

Yes, this is the start of climate overshoot. There's a lot of confusion about what overshoot means. Even the Overshoot Commission struggled with defining it clearly. Overshoot scenarios first appeared in the models that project emissions trends and responses, starting when the possibility of large-scale removal of atmospheric CO₂, and thus negative emissions and net-zero targets, was first recognized. In an overshoot scenario, a target like 1.5 or 2.0 is first exceeded, but later emissions cuts and CO₂ removals drive net emissions negative, pulling concentrations and temperatures back down to return to the target that was initially exceeded after a century or so. Of course, exceeding the target doesn't mean that you'll automatically peak, turn the corner, and come back down either. That takes the same hard work of rapidly cutting emissions and expanding removals to drive net emissions negative as would have been required to avoid exceeding the target in the first place.

Q: I wrote last year that [the IPCC should declare the 1.5 C target dead](#). There has been resistance in climate reporting and climate science to go that far. Why do

you think that is, and is it counter-productive?

There's been a powerful push, for years, to frame the climate issue as "last clear chance, must act now." This is related to the exaggeration of any particular limit, 1.5 or other, as a bright line, a sharp clear boundary between everything is fine and catastrophe.

We saw this on the Overshoot Commission. You see it very strongly in the recent IPCC report, as you move from the very stark projections of future heating down in the meat of the main chapters, framed increasingly as a positive message as you move up toward the more prominent summary text: "we can avoid this, but we must do X and do it right now." This is not falsification, because both statements are correct; it's grasping for a message that aims to motivate effective response by saying things can be OK if we act strongly and immediately. As for why this happens, I don't really know. Some combination of psychological processes by which we all want to be able to say things can be OK and guesses of what kind of message is most effectively motivating politically.

It's acutely important to move faster on cutting emissions, on building up removals, on moving toward serious adaptation to climate change. Progress is mounting on all these fronts, and it's reasonable to expect a lot more. The scale of effort, investment, and innovation going into clean fuels now is astonishing, something like 2% of world GDP. These efforts are doing a lot to make the most dire projected climate futures increasingly unlikely. But they are coming much too late to avoid exceeding 1.5 and may well be too late to avoid exceeding 2.0. Mainstream recent projections of how much heating we're in for this century, by the IPCC, the UN Environment Programme, and the International Energy Agency, range from 1.7 C to 2.8 C, with some projections still exceeding 3.0 C. If maximally rapid build-up of emissions cuts and removals still point to heating that is judged intolerable, the only way to cut it further is solar geoengineering - but that is a topic for another conversation.