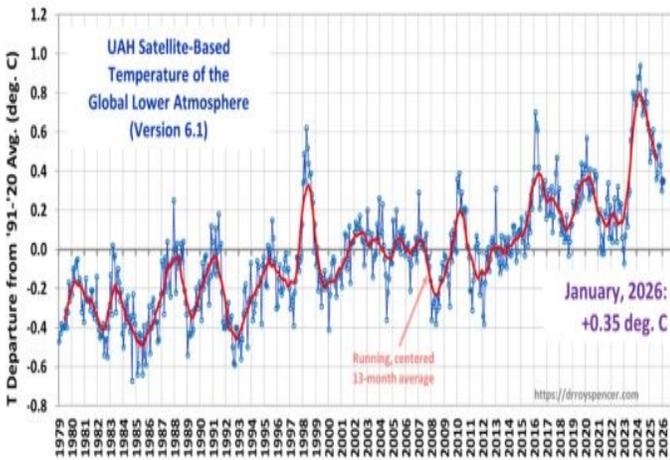


Climate Science and Policy for Nonscientists

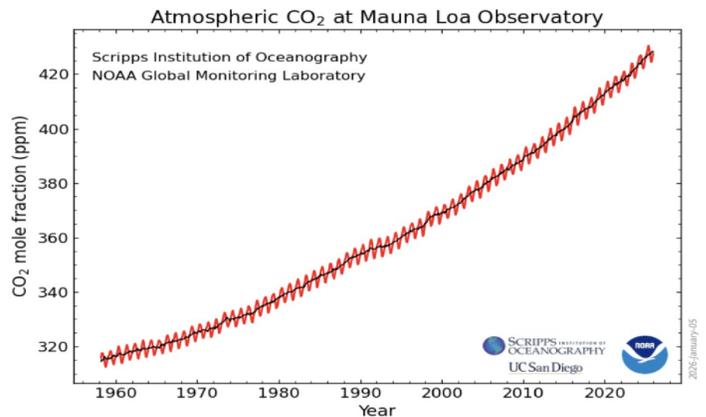
One Picture is Worth a Thousand Words.



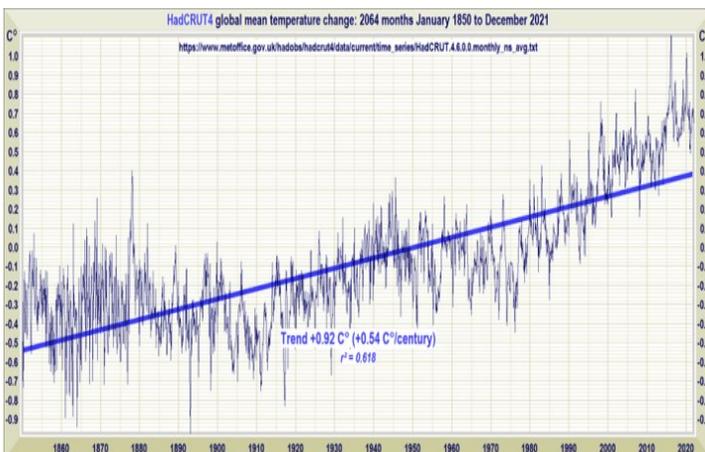
WHERE'S THE CRISIS?

World cooling in the troposphere continued in January. The troposphere is where CO₂ warming is supposed to originate. It has now been 21 months since the temperature peak in April 2024, and the cooling now measures over one degree F, as shown. It is now clear that the rapid temperature rise in 2023-4 was temporary and was not a general acceleration in global warming. The graph presents temperatures since 1979.

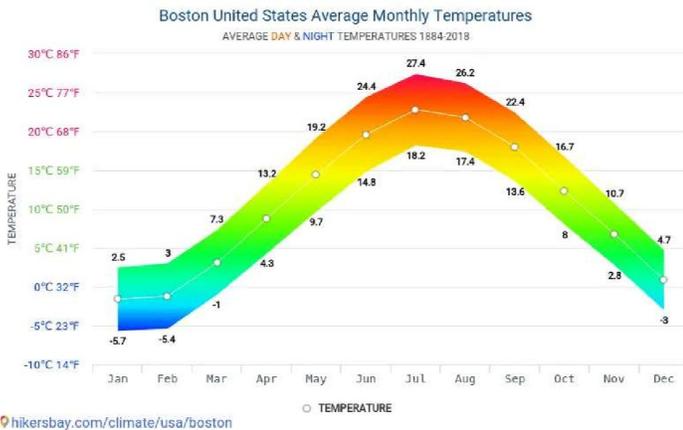
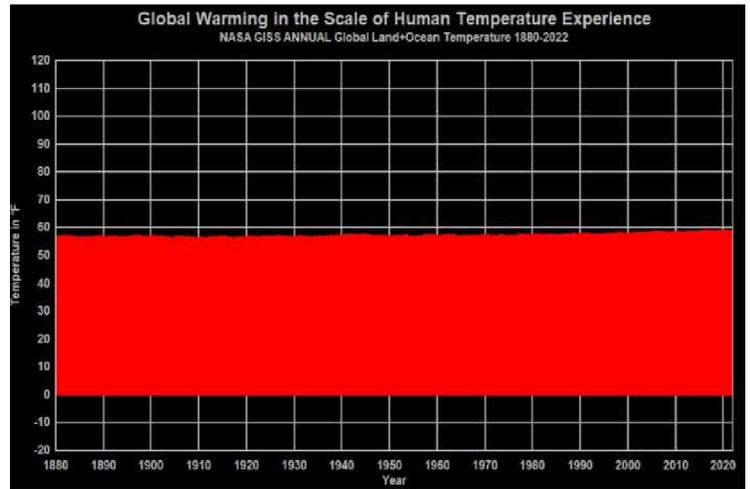
Meanwhile atmospheric CO₂ levels continued their steady, mostly linear, increase, but with a slight increase in the rate of rise. The “CO₂ Control Knob” theory can not explain either the 2023-4 rapid temperature rise nor the decline of the spike. There is no scientific consensus that explains the spike. It was much larger than could have been caused by the El Nino that occurred during the spike.



With the spike subsiding, long-term world temperature rise again appears roughly linear, although the rate of the rise is debated and depends on the arbitrary decision of the date from which the trend is calculated. The IPCC in its most recent Assessment Report put the rate of rise since the pre-industrial period at roughly 1 C (roughly 2 F) per century. [AR6 WGI p.5 (2021)]. The IPCC found that modern temperatures were “unprecedented” (i.e. the highest at any time since 1850), but there was no finding that the rate of rise was accelerating. (Id at 5-6).

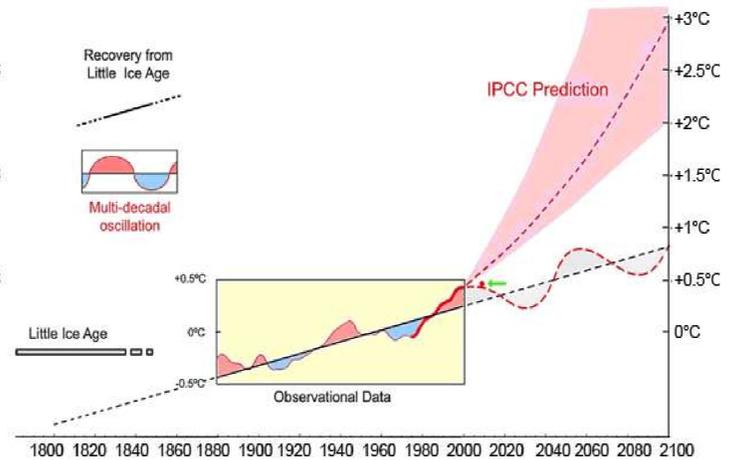


World temperature graphs, such as the two preceding ones, usually present temperature “anomalies,” which are changes of temperature, not actual temperatures. The actual world temperature has risen from 57 F in 1880 to 59 F to-day. If these actual temperatures are graphed (as shown), this temperature rise can hardly be noticed.

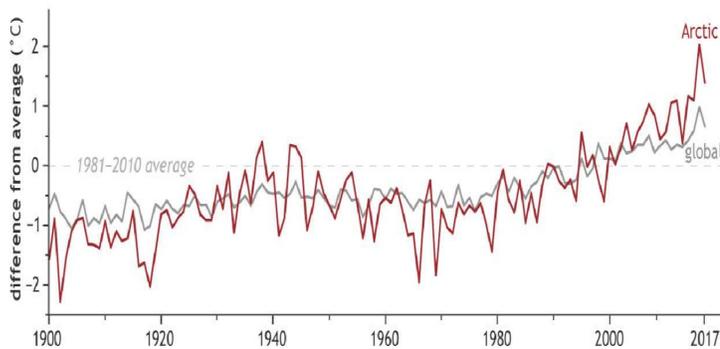


In Boston every year there are commonly summer days in the 90s F and winter days in the 20s F. The annual swing is more than 70 degrees, to which the residents routinely (if not happily) adapt. If this curve rose gradually 2 F over a century, most people would not notice the change.

If the temperature rises at a roughly linear rate of about 1 C (2 F) per century, it is generally accepted that the effects will be readily manageable, if not beneficial. Claims of a climate crisis are based on climate models that show accelerated temperature rise (3 C or more per century). But for over 30 years the accelerating temperature rises predicted by the models have failed to appear.



ARCTIC WARMING TWICE AS FAST AS GLOBAL AVERAGE



While the world on average is warming roughly 1 C per century, the warming is not evenly distributed. It is generally agreed that the Arctic is warming much faster than average, as shown.

But temperatures in the Antarctic have been roughly unchanged.

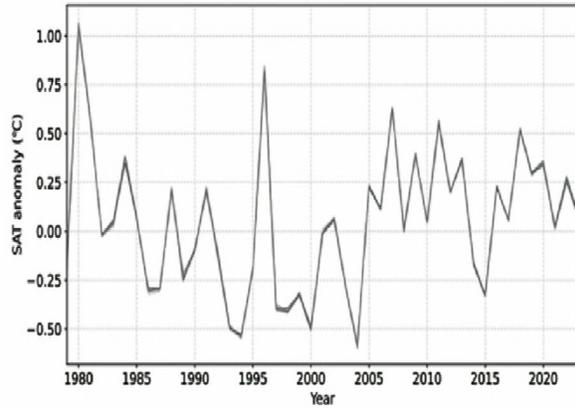
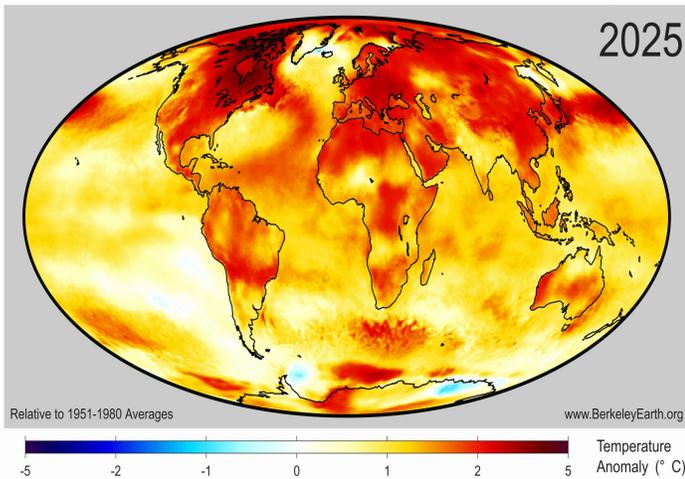
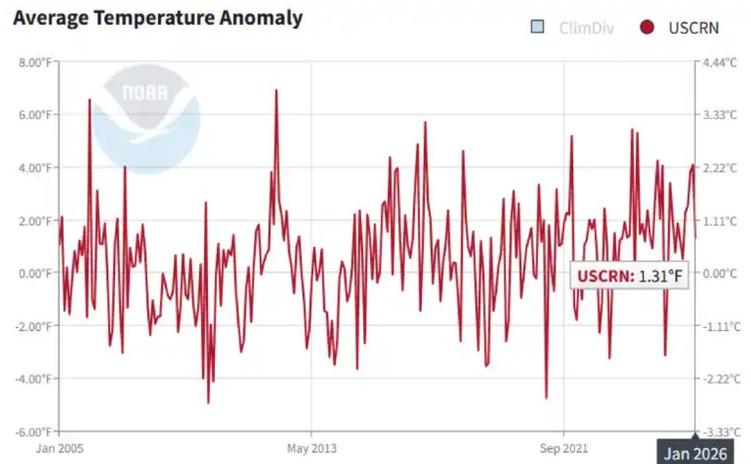


Fig. 4 Annual mean SAT anomalies over 1979–2023 in the Antarctica (south of 60°S) from 10 reconstructions.

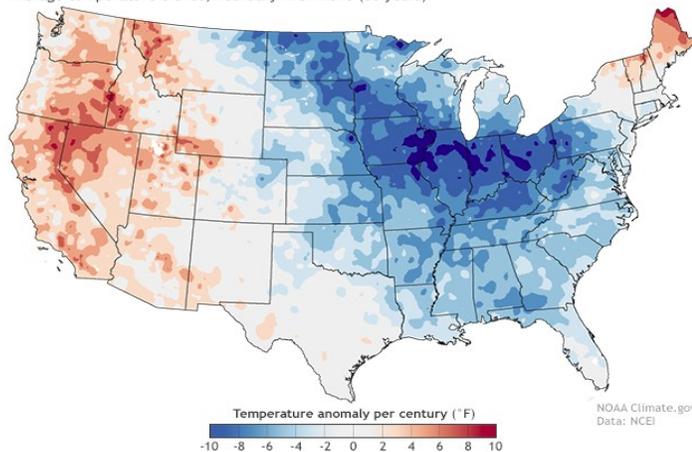


In general, world warming has been uneven and has been mostly in the Northern Hemisphere, which can not be explained by the CO2 Control Knob Theory. CO2 is a “well-distributed” gas, i.e. concentrations are roughly equal all around the world.

According to the most accurate US government dataset (the US Climate Reference Network “USCRN”), the US average temperature has remained roughly unchanged over the last 20 years with significant monthly variations. The USCRN data only goes back to 2005

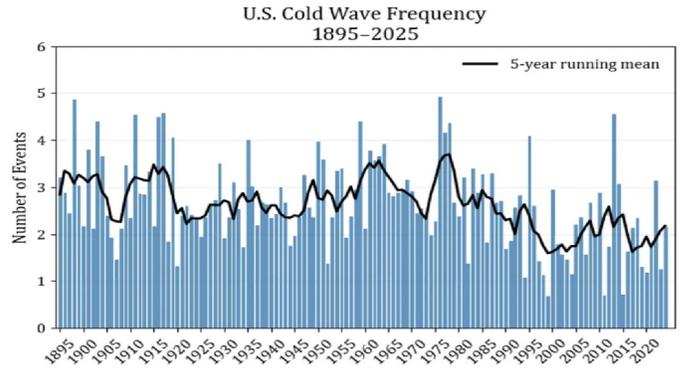


Average temperature trends, February 1987-2016 (30 years)

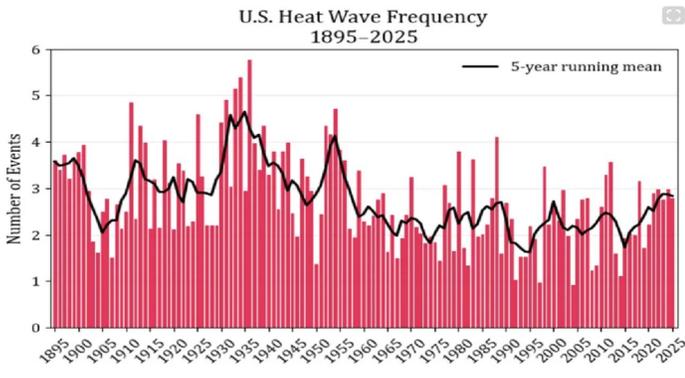


But the average temperature conceals significant regional variations. In general, the East Coast to the Great Plain has been cooling, while there has been warming West of the Rockies and in Northern New England.

The US in January 2026 experienced a devastating winter storm, Fern. Fortunately the frequency of cold waves is declining. Cold waves kill many more people than heat waves.



Map by **Chris Martz**
Data: NOAA Global Historical Climatology Network-daily
 ncei.noaa.gov/pub/data/ghcn/daily/
 860 stations with ≥100 years of daily temperature data with ≥85% completeness in each site's period of record (POR).



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Paradoxically, despite global warming, the frequency of US heat waves has been declining, because global warming is not evenly distributed through the year and through the day. Warming occurs mostly during winter and in the summer during the middle of the night. As a result day time summer maximum temperatures are not increasing as much as might be expected.

But again, in the US there are significant differences in heat wave days per year between the West and the East-Central regions. In 2025 the frequency in the West (the red line) exceeded the maximum previous average frequency (the black line) during the 1935-1945 period, but the frequency in the East-Central region (the green line) was very significantly less.

The report shows heatwave days (using a standard definition) in the US in the following graph:

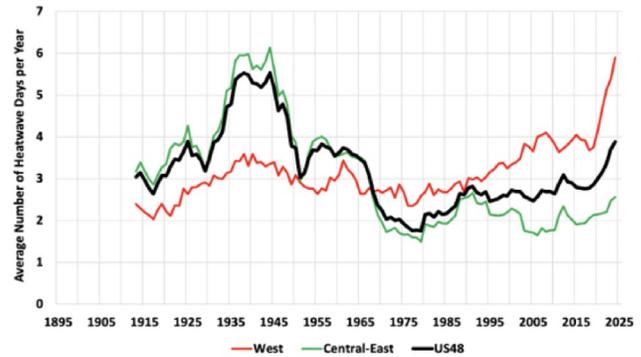
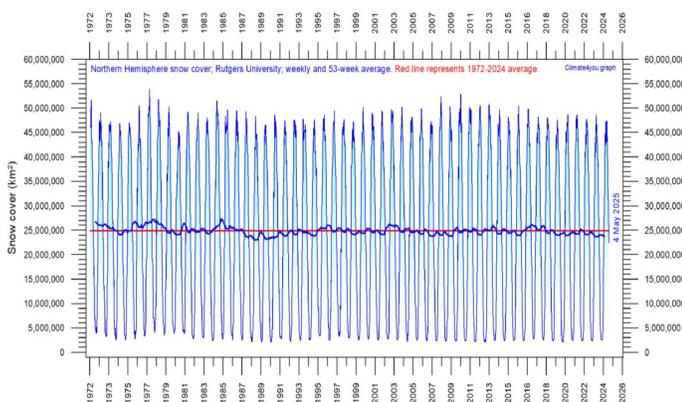


Figure 6.3.6 15-year trailing average of number of heatwave days per year per station in the CONUS (black line) and two regions: West (red), Central-east (green).

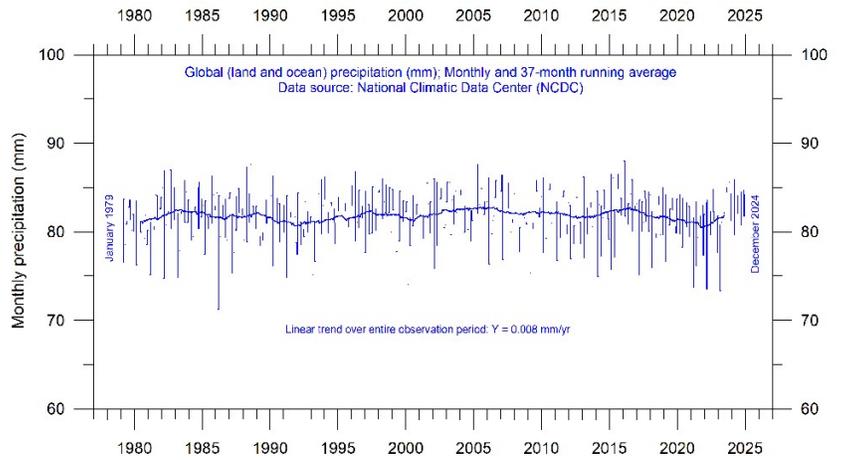
The red line refers to the westernmost one-third of the US and the green line shows the easternmost two-thirds. The black line shows the national average. The 1920s and 1930s stand out as the hottest period due to the intense heat in the east. In the west the last decade stands out, pulling the national average back up.

Snow cover in the Northern Hemisphere (the hemisphere that has had the most warming) has remained virtually unchanged. Snow cover in the Southern Hemisphere is much less than in the Northern.



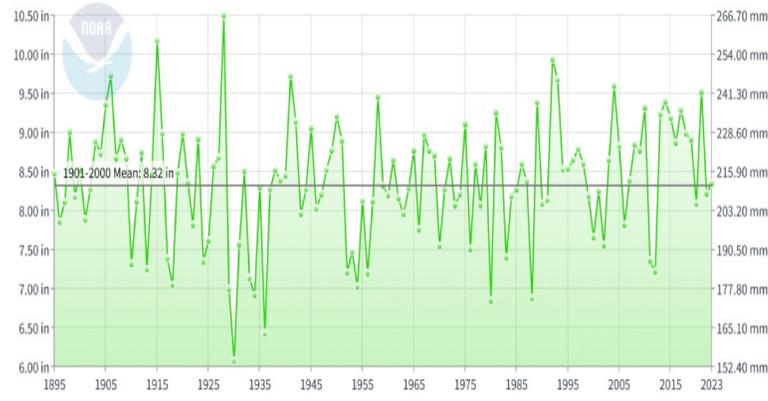
Northern hemisphere weekly snow cover since January 1972 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53-week average (approximately 1 year). The horizontal red line is the 1972-2024 average.

World precipitation has remained virtually unchanged.



Contiguous U.S. Precipitation

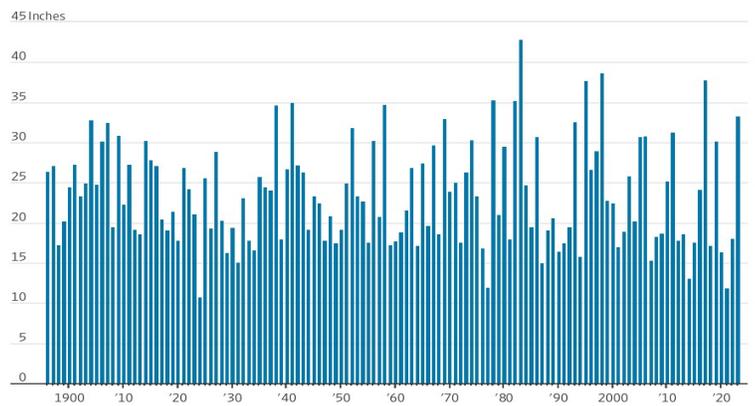
June-August



US precipitation has remained virtually unchanged with significant variability from year to year.

Precipitation in California varies even more from year to year. This has nothing to do with CO₂, but is caused by the El Nino/La Nina cycle. This annual variability significantly increases wildfire risks in California, where wildfire frequency has been increasing. (See CliSciPol Science Topic: California)

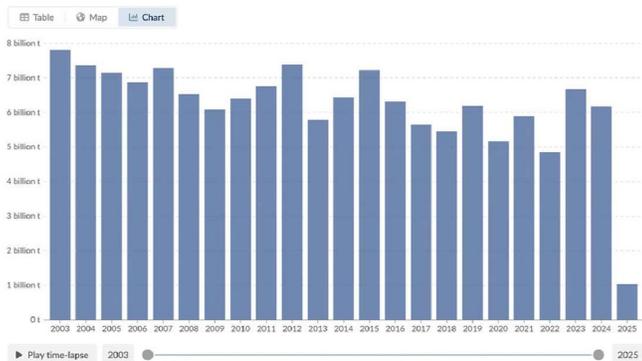
California Annual Precipitation, 1895-2023



Source: State of California

Annual CO₂ emissions from wildfires, World, 2003 to 2025

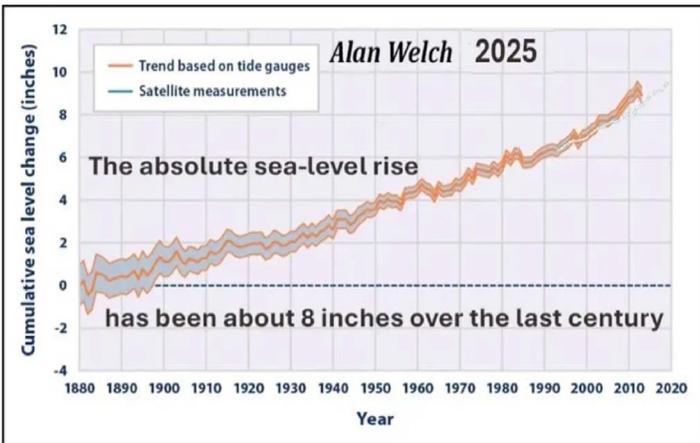
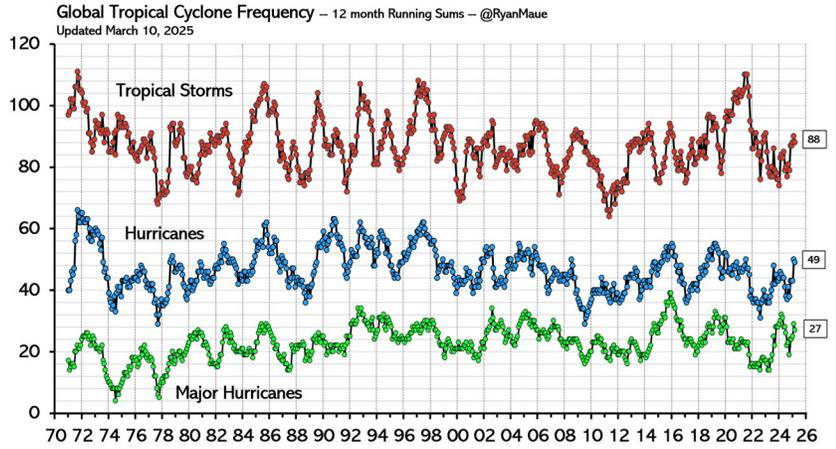
Carbon dioxide released by wildfires in tonnes. The 2025 data is incomplete and was last updated 25 April 2025.



Data source: Global Wildfire Information System (2025) - Learn more about this data
OurWorldInData.org/wildfires | CC BY

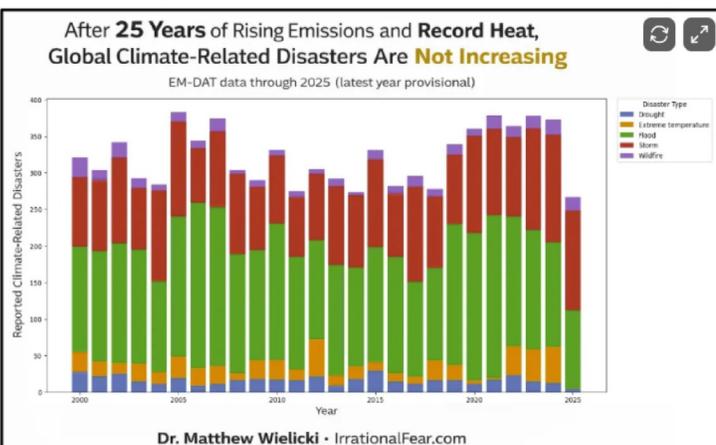
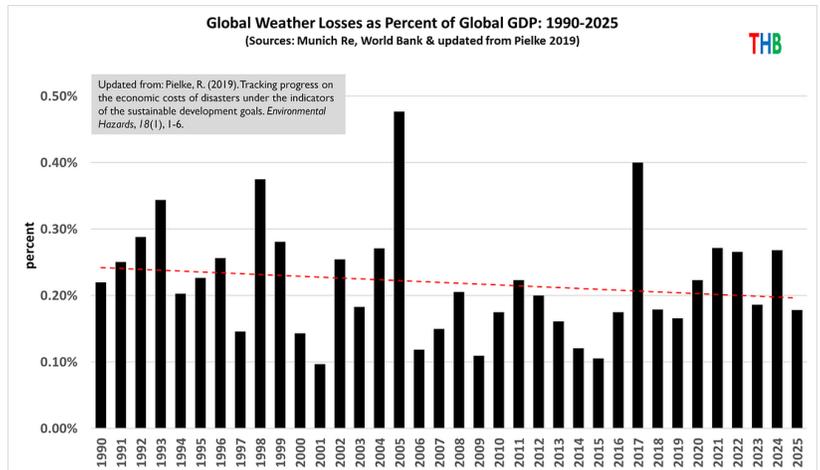
But worldwide wildfires, as measured by total CO₂ released, have been decreasing. (See CliSciPol Science Topic: Wildfires). A number of experts blame the increase of wildfires in California on poor forest management. This is disputed, and there is probably some contribution to the increase from climate change in California.

There has been no increase in tropical storms, hurricanes, or major hurricanes for over 50 years. The most unusual thing about the 2025 hurricane season was that zero hurricanes hit the US mainland. (See CliSciPol Science Topic: Hurricanes)



Coastal sea levels as measured by tide gauges have been rising at a steady rate of 8 inches per century, which has been readily manageable except in a few particular places, such as Charleston. (See CliSciPol Science Topic: Sea Levels, and Policy Topic: Coastal Cities, and the September 2023 newsletter). Studies have shown that low-lying ocean islands are increasing in land area, not decreasing. [AR6 WGII, p.2055 (2021)]

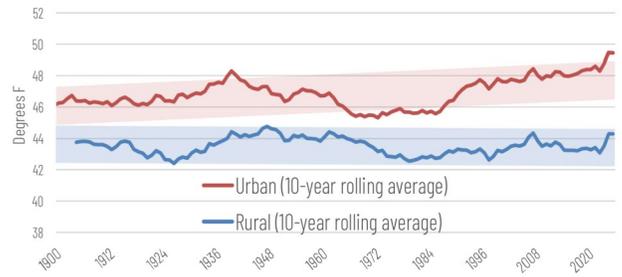
Global financial losses due to weather as a percentage of GDP have steadily declined over the last 35 years.



The number of climate-related disasters per year in 2025 was smaller than any year 2020-2024, and, if anything, there is a slight downward trend.

There is an increasing number of climate studies of particular US states. For example, a study of Wisconsin was published February 18, 2026. These studies, for the most part, are consistent with the US data, showing no climate crisis. Wisconsin rural temperatures are virtually unchanged over more than 100 years while urban temperatures have risen 1.7 F, which is slightly less than 1 C (1.8 F). This data supports the proposition (much disputed) that the Urban Heat Island Effect causes much of the measured temperature rises measured around the world during the last century.

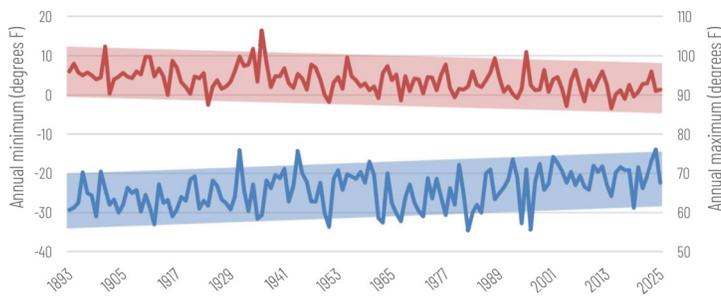
Urban Wisconsin warms 1.7°F per century while rural temperatures stagnate



Source: National Centers for Environmental Information. "Past Weather: Wisconsin." NOAA. Accessed January 19, 2026.



Extreme temperatures moderating in Wisconsin



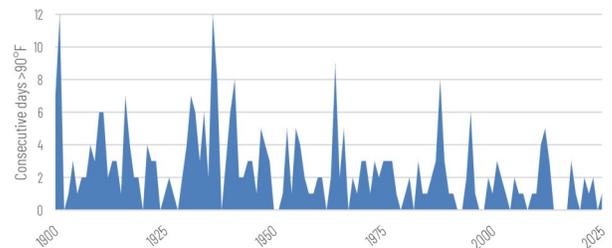
Source: NOAA (National Oceanic and Atmospheric Administration). 2025. "Past Weather: Wisconsin." National Centers for Environmental Information. Accessed February 3, 2026.



Extreme hot temperatures are declining, and extreme cold temperatures are not as cold as they used to be.

Heat wave durations are declining.

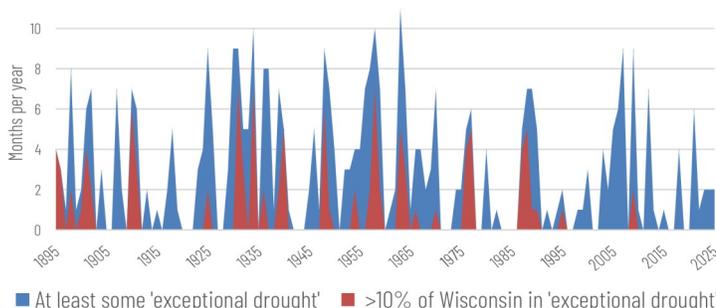
Wisconsin heatwave durations have fallen 71% since 1900



Source: NOAA (National Oceanic and Atmospheric Administration). 2025. "Past Weather: Wisconsin." National Centers for Environmental Information. Accessed February 3, 2026.



Wisconsin's "exceptional droughts" are declining



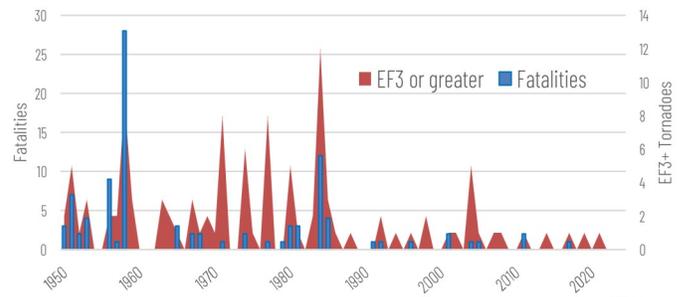
Droughts are declining.

Source: Wisconsin State Climatology Office. "Drought in Wisconsin." Accessed January 12, 2026.



Wisconsin does not get hurricanes, but it does get tornadoes. Tornado activity and deaths are declining.

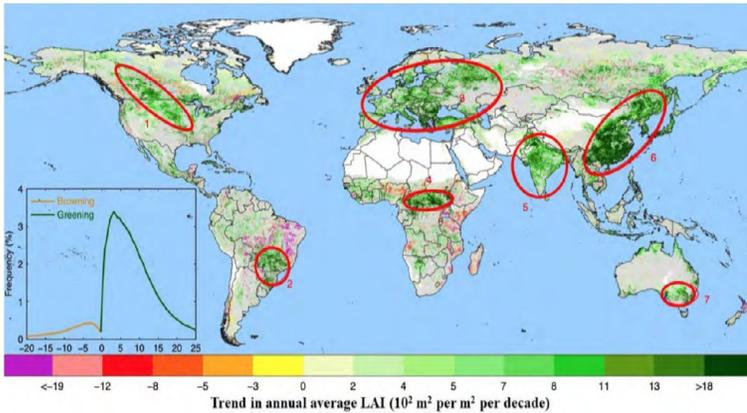
Powerful tornadoes and related fatalities in Wisconsin, 1950-2024



Source: Milwaukee Journal Sentinel. "Wisconsin Tornado Archive." Accessed January 12, 2026.



Figure 20: Trend in annual average leaf area



Source: Chen (2019)

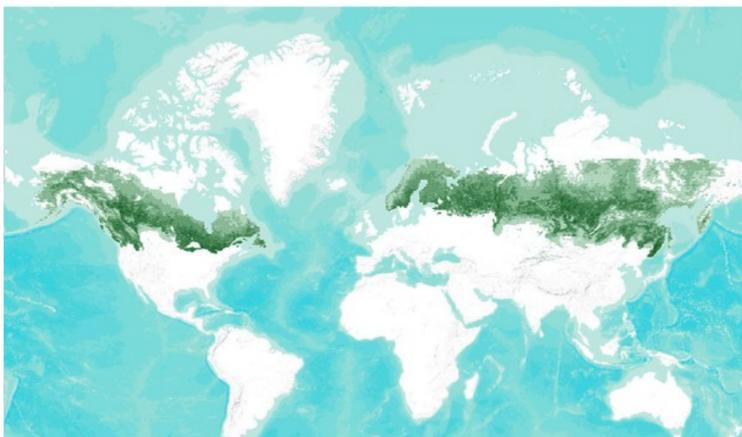
CO₂ is not only plant food; it is also plant fertilizer. Rising CO₂ levels promote not only global greening, but also increased crop yields per acre. Overall the earth is greening due to the rising CO₂ levels and the mildly rising temperatures, which lengthen the plant growing season. One major study (results shown here) concluded that greening is occurring and accelerating over 55% of land area, and desertification is increasing over 7%. (See CliSciPol Science Topic: Greening World)

Using satellite images, Venter et al. 2018 found an eight percent increase in woody vegetation in sub-Saharan Africa over the last three decades, underscoring the global "greening trend".



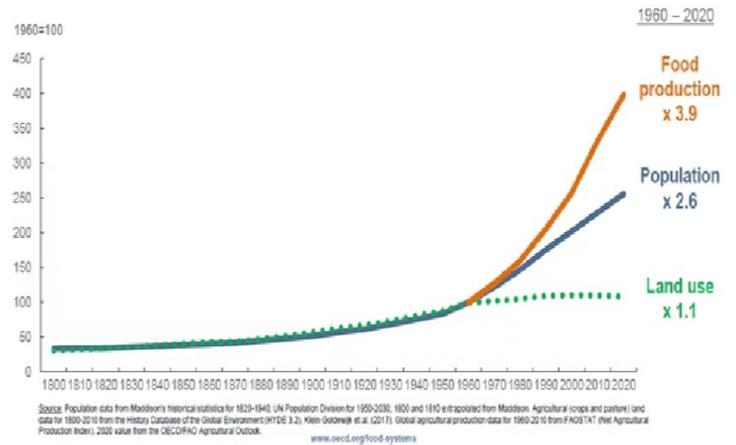
Recent study by Venter et al finds that the Sahara has shrunk by 8% over the past three decades. NASA image, public domain.

Here is a specific example of the greening world—over a recent 30 year period the Sahara Desert shrank by 8% as its entire Southern rim greened.



Another example of the effect of the modest global warming and the rising CO₂ levels: A recent study concluded that from 1985 to 2020 boreal forests have expanded 12% in area while moving slightly Northward.

World food production has been rising faster, and continues to rise faster, than world population growth, and yield per acre of crop land has been improving with the result that there has been virtually no increase in land acreage required to grow the food. Climate change has been a major contributor to these positive developments.



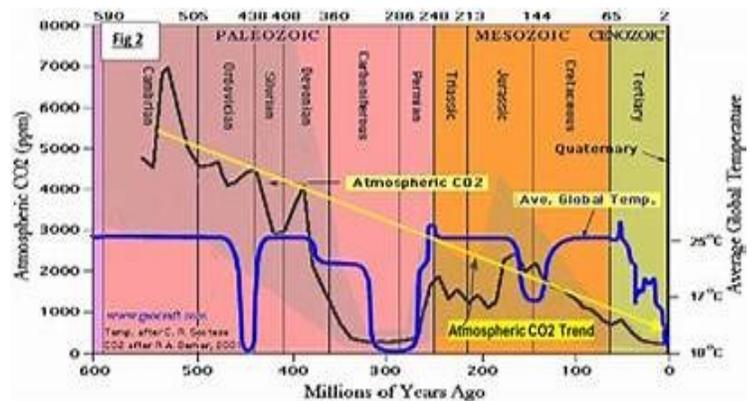
Source: OECD (2021), Making Better Policies for Food Systems, OECD Publishing, Paris, <https://doi.org/10.1787/ddfba4de-en>.



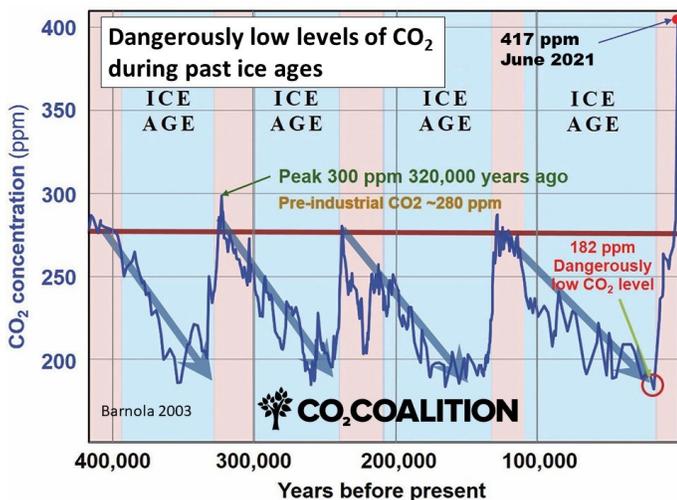
CONCLUSION

In light of the foregoing, the US EPA’s action of February 13, 2026, repealing the CO₂ endangerment finding makes good sense. Massive amounts of CO₂ exist in the world due to natural processes and causes. Such amounts are much, much larger than the amounts than humans have created since the Industrial Revolution. For humans CO₂ is a harmless, odorless, tasteless gas. Humans create CO₂ in their bodies during normal metabolism, and every day the average human exhales roughly two pounds of CO₂ into the atmosphere. (See CliSciPol Science Topic: CO₂ Facts.

Atmospheric CO₂ concentrations today are approximately 430 ppm, but for most of the last 600 million years atmospheric CO₂ concentrations have been much higher. They have routinely been over 1,000 ppm, and have been as high as 7,000 ppm. There is a pronounced long term downward trend in such levels. And for most of the last 600 million years earth’s average temperature has been much higher than today’s.



In the last glaciation 20,000 years ago CO₂ levels were so low that plants were threatened by starvation. Plants die without CO₂ to eat. Optimal CO₂ levels for plant growth are over 1,000 ppm, which is part of the reason the world is greening as CO₂ levels rise. To justify an endangerment finding under the Clean Air Act a substance must “contribute to air pollution” and must “reasonably be anticipated to endanger public health or welfare.” CO₂ is not such a substance.





All are to the Intergovernmental Panel on Climate Change's publication, Climate Change 2021 The Physical Science Basis, the first part (Working Group I) of the Sixth Assessment Report (AR6).

