



Climate Change: The Forgotten Crisis?

Dr. Bill Blair

Dept. of Physics & Astronomy

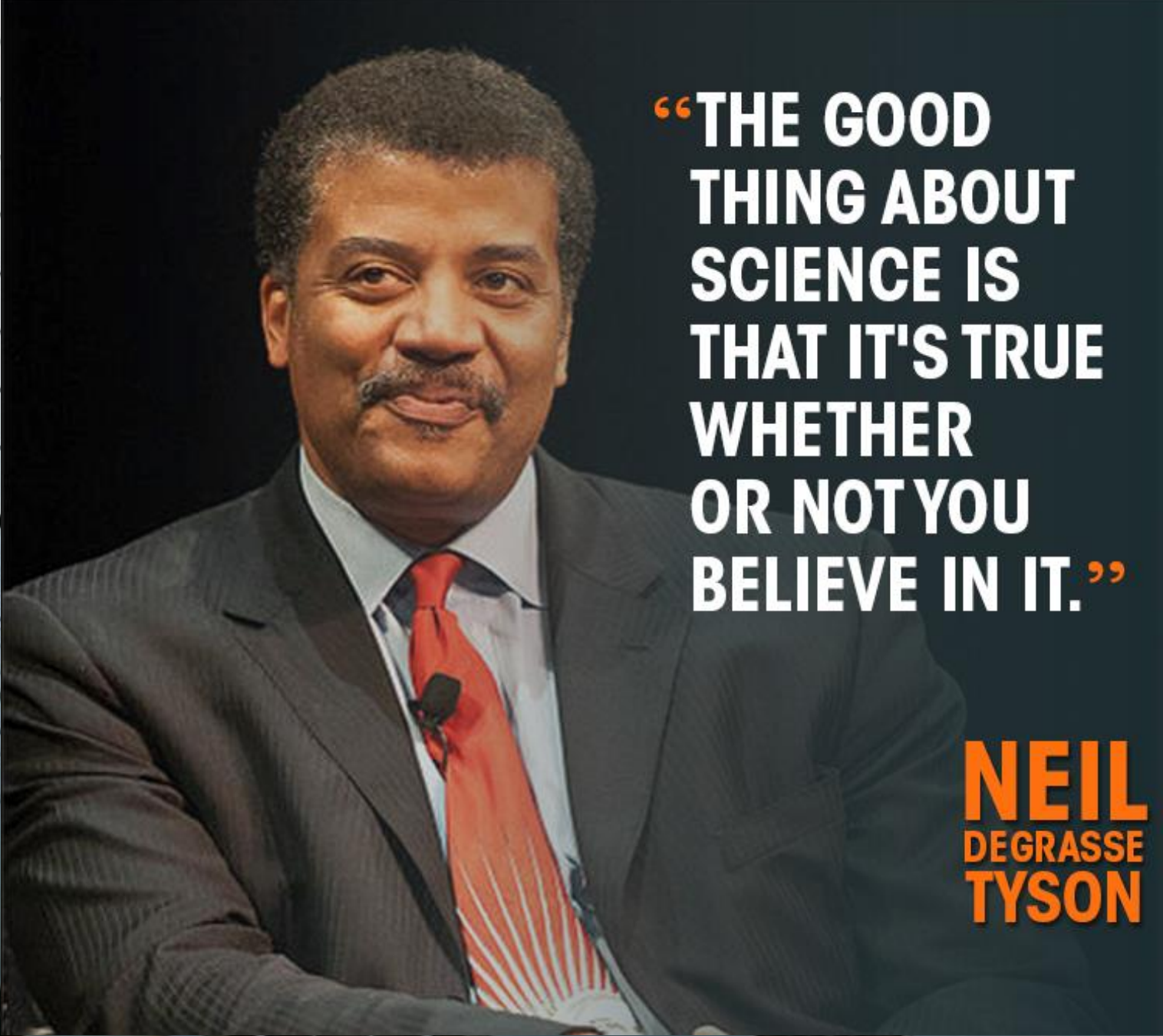
Johns Hopkins University

Quarknet Presentation

July 23, 2026



I DON'T BELIEVE IN
GLOBAL WARMING

A portrait of Neil deGrasse Tyson, an African American man with a mustache, wearing a dark pinstripe suit, a light blue shirt, and a red tie with a white sunburst pattern. He is smiling slightly and looking towards the camera. The background is a dark, solid color. Overlaid on the right side of the image is a quote in white and orange text. The background of the entire image is a blurred photograph of a white building with windows, reflected in a body of water.

**“THE GOOD
THING ABOUT
SCIENCE IS
THAT IT'S TRUE
WHETHER
OR NOT YOU
BELIEVE IN IT.”**

**NEIL
DEGRASSE
TYSON**

A bit of my background...



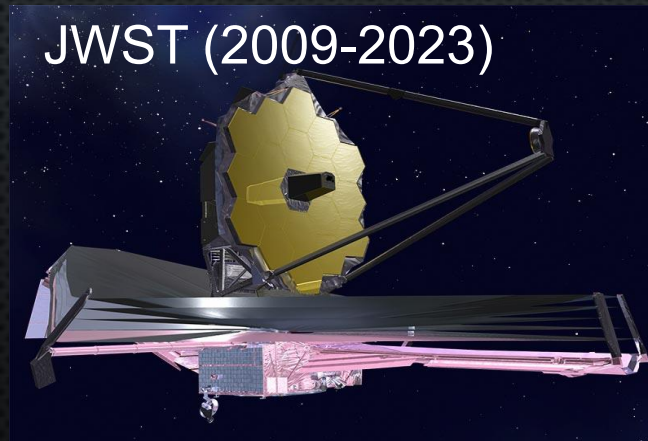
Gemini-South 8.1m
telescope -- Chile



Hopkins Ultraviolet
Telescope (1984-1996)



Hubble Space Telescope



JWST (2009-2023)



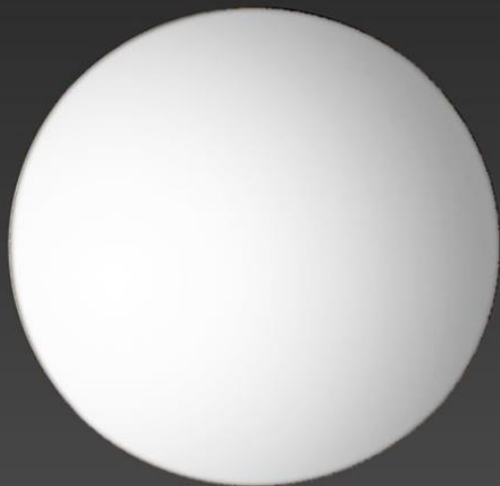
FUSE Ultraviolet
Observatory
(1996-2008)

Climate Change – Potential for Confusion

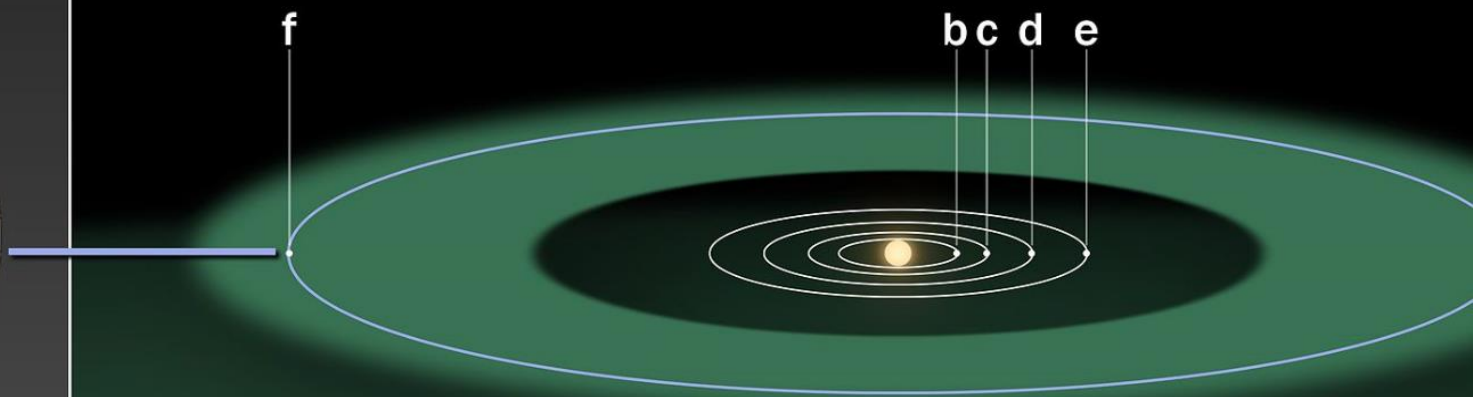
- “Not everybody agrees...” “Not all scientists agree...”
- “Isn’t it just a natural variation?” “It’s the sun.”
- “What difference can a degree or two make?”
- *Global* climate effects versus *local* weather.
- “How can climate change cause both droughts and floods?”
- “Climate models predict things all over the map. How can we believe anything from them?”
- “Wind turbines: kill bats and birds...” or “Mining lithium for batteries is bad,” etc.
- Renewables are not reliable sources of energy.
(Ever heard of batteries? Other ways of storing energy?)
- “China’s not doing anything; why should we?”
- Others?

Earth

Kepler-186f



Kepler-186 System



Earth is in the Habitable Zone...

Earth

Venus

Mercury

Solar System



(...and has been for over 4 **billion** years!)



The Greenhouse Effect

- Sunlight comes through glass.
- Light is absorbed and re-radiated as heat (infrared light).
- Heat is trapped (warms interior of greenhouse).
- Need for “balance” to keep it from getting too hot/cold.

The Greenhouse Effect

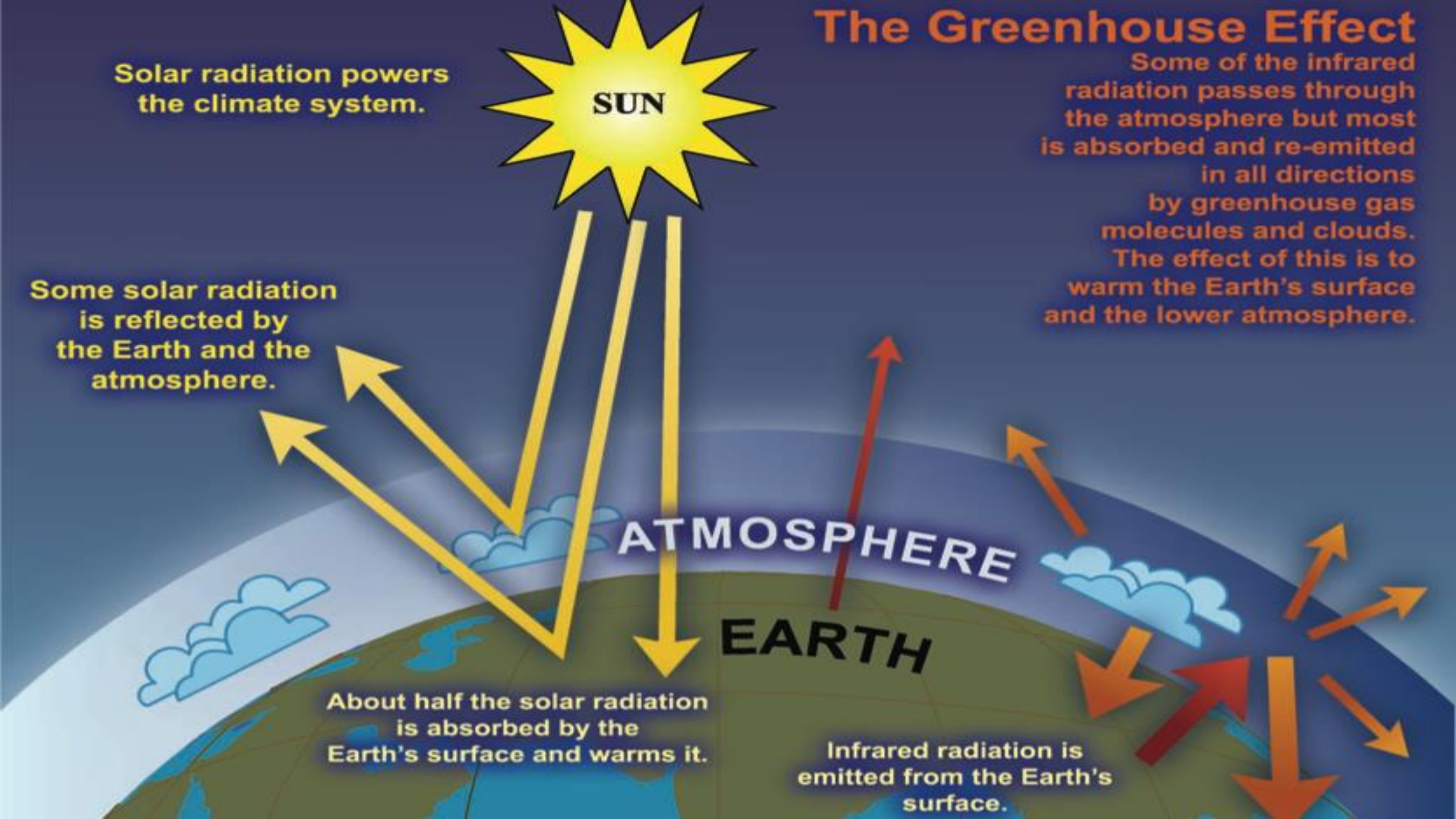
Some of the infrared radiation passes through the atmosphere but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth's surface and the lower atmosphere.

Solar radiation powers the climate system.

Some solar radiation is reflected by the Earth and the atmosphere.

About half the solar radiation is absorbed by the Earth's surface and warms it.

Infrared radiation is emitted from the Earth's surface.



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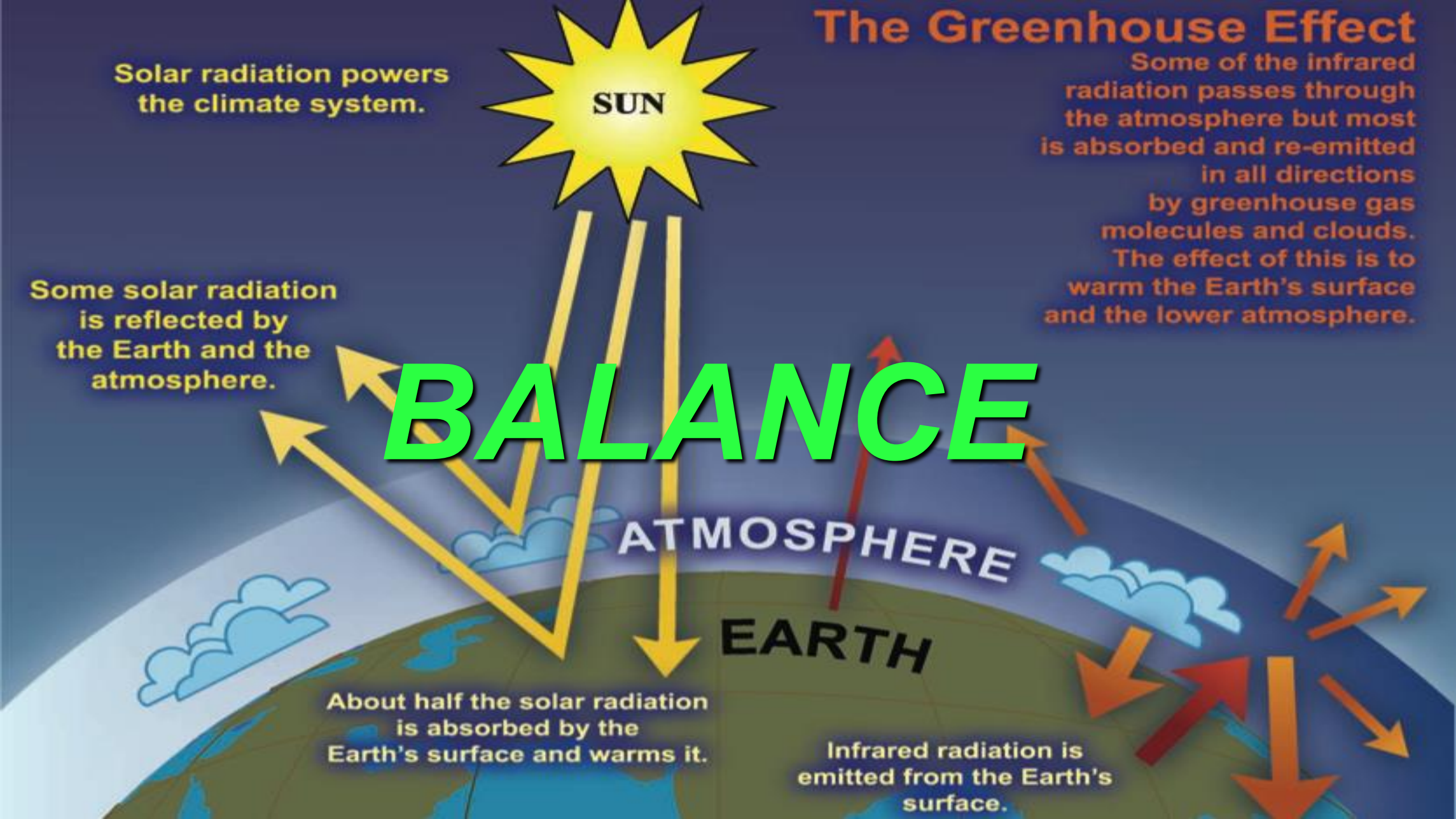
BALANCE

ATMOSPHERE

EARTH

About half the solar radiation is absorbed by the Earth's surface and warms it.

Infrared radiation is emitted from the Earth's surface.



The Earth is so big...how can we affect things?



The Earth is so big...how can we affect things?

By affecting the
BALANCE



Venus – Earth's Twin?

- Closest planet to earth.
- Nearly the same size as earth, but
- CO₂ atmosphere 100x denser than earth's.
- Surface temp 900 F!
- Example of so-called "Runaway" Greenhouse effect.



Venus – Earth's Twin?*

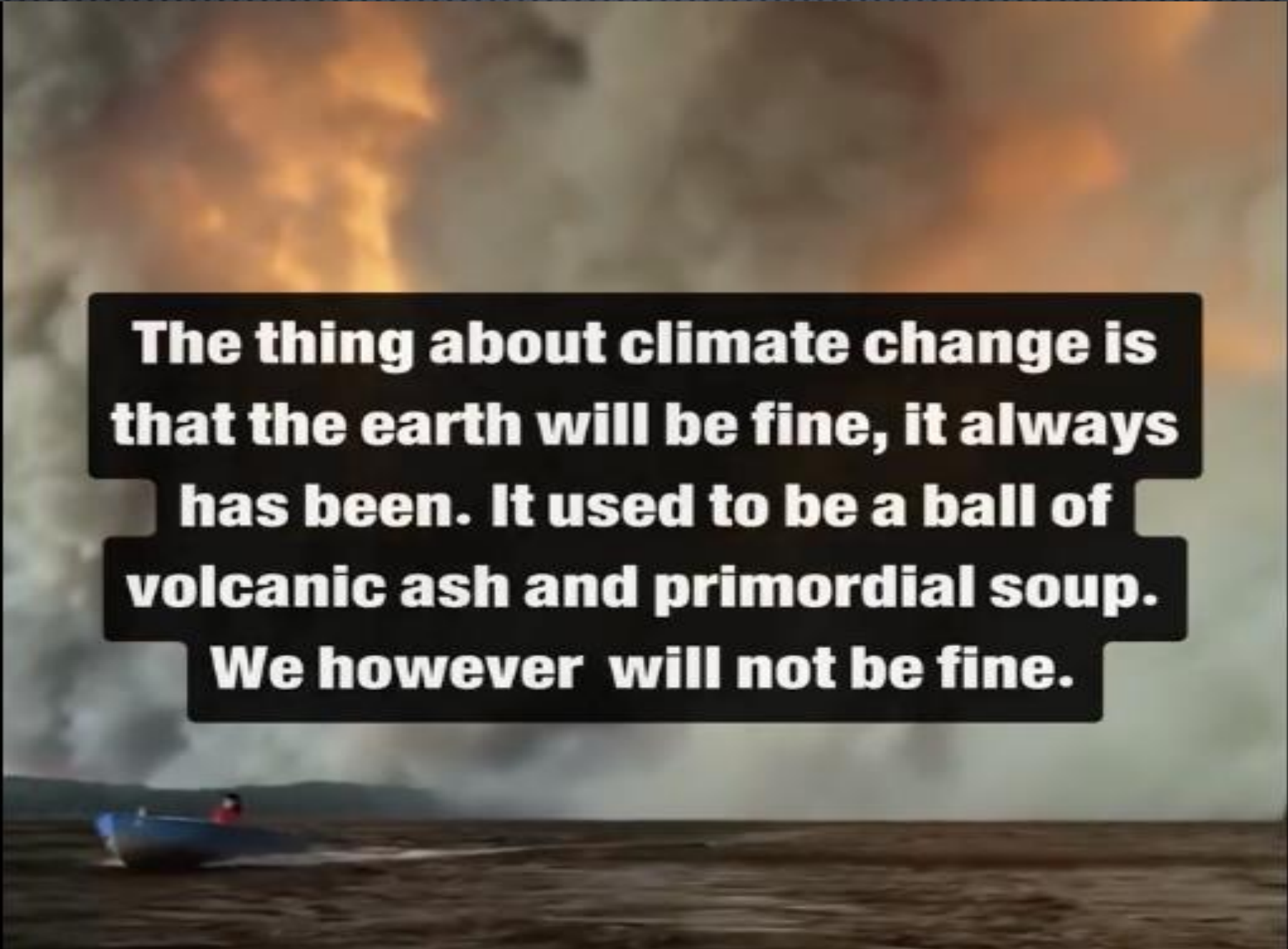
- Closest planet to earth.
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- Surface temp 900 F!
- Example of so-called "Runaway" Greenhouse effect.

*(Let's hope not!)



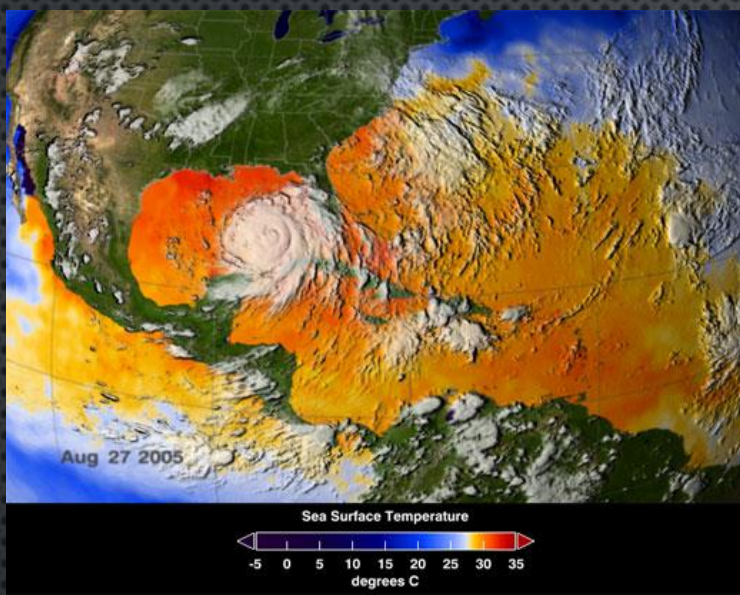
The earth may seem big to us, but it is fragile and it is finite.

Apollo 11, July 1969

A photograph of a volcanic eruption. In the background, a massive plume of dark smoke and ash rises from a volcano, with bright orange and yellow lava visible within the smoke. In the foreground, a small blue boat with a person inside is on a body of water, moving towards the left. The sky is filled with the volcanic ash and smoke.

The thing about climate change is that the earth will be fine, it always has been. It used to be a ball of volcanic ash and primordial soup. We however will not be fine.

Climate Impacts: Everything is connected



Warmer sea temperatures...

- cause stronger storms and affect atmospheric and sea circulation patterns.
- Can cause droughts in some areas and excessive rainfall in others.
- More acidic pH affects sea life, corals
- Add to the rise in sea level.
 - Warm water has a larger volume.

Warmer air temperatures...

- Hold more moisture, more severe storms and flooding.
- Melting of glaciers and permafrost.
 - Water shortages

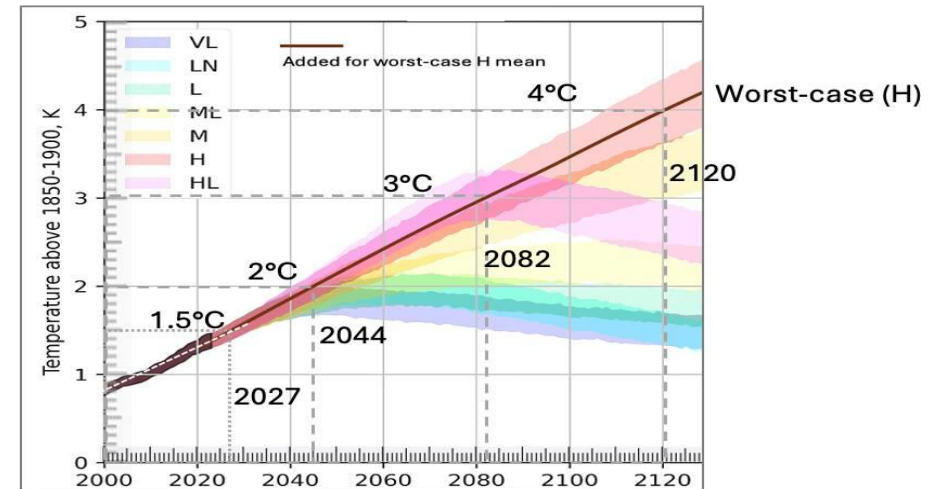
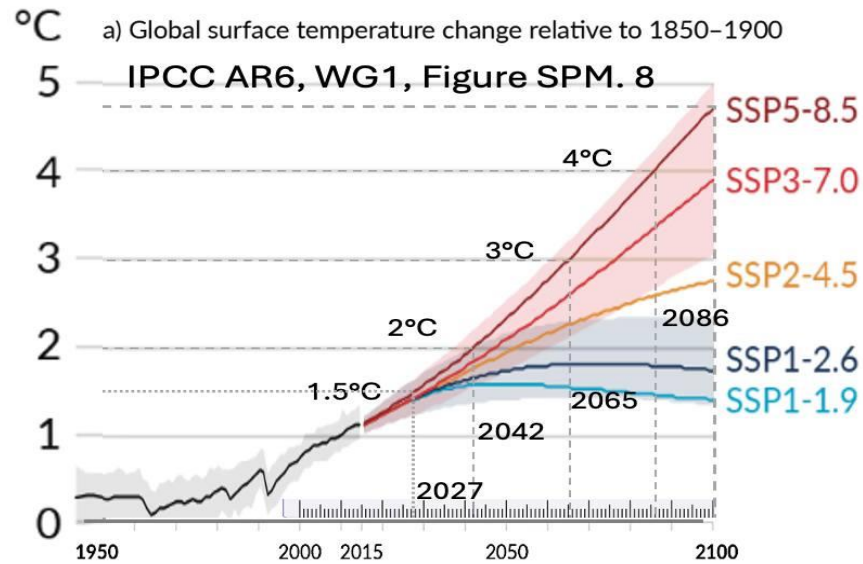
Climate Models are projections based on various assumptions

New CMIP7 worst-case is no better for outlook or policy than 8.5

1.5°C is 2027 for both, so unattainable.

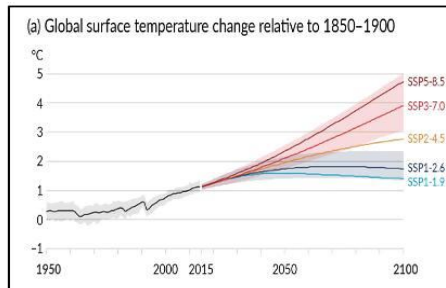
2.0°C is just 2 years later for CMIP7, requires global emissions decline by 2025 (CMIP7 CO2e), so unattainable.

Recent warming trajectory is near CMIP7 worst-case, to over 2°C.

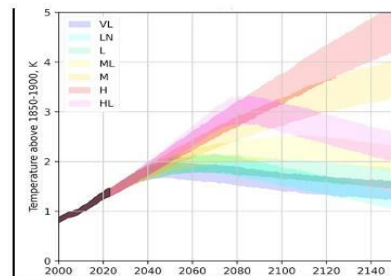


Recent trajectory
is near worst case

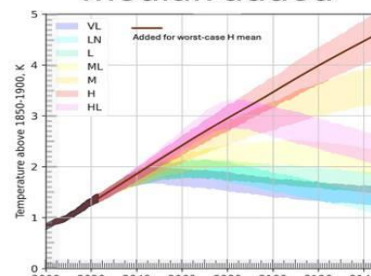
IPCC AR6



CMIP 7



CMIP7 worst-case
median added



SS5-8.5	CMIP7	
1.5C	2027	2027
2.0°C	2042	2044
3.0°C	2065	2080
4.0°C	2086	2120
SS5-8.5. CMIP7		
2100	4.7°C	3.45°C

7 April 2026, The Scenario Model
Intercomparison Project for CMIP7
Detlef P. Van Vuuren et al

Peter Carter, Climate Emergency Institute

Heat-trapping Gases

Water Vapor H_2O

Carbon Dioxide CO_2

- A trace constituent, but one that is very effective at trapping heat.

Methane CH_4

- Like pouring gas on the fire.



Methane is

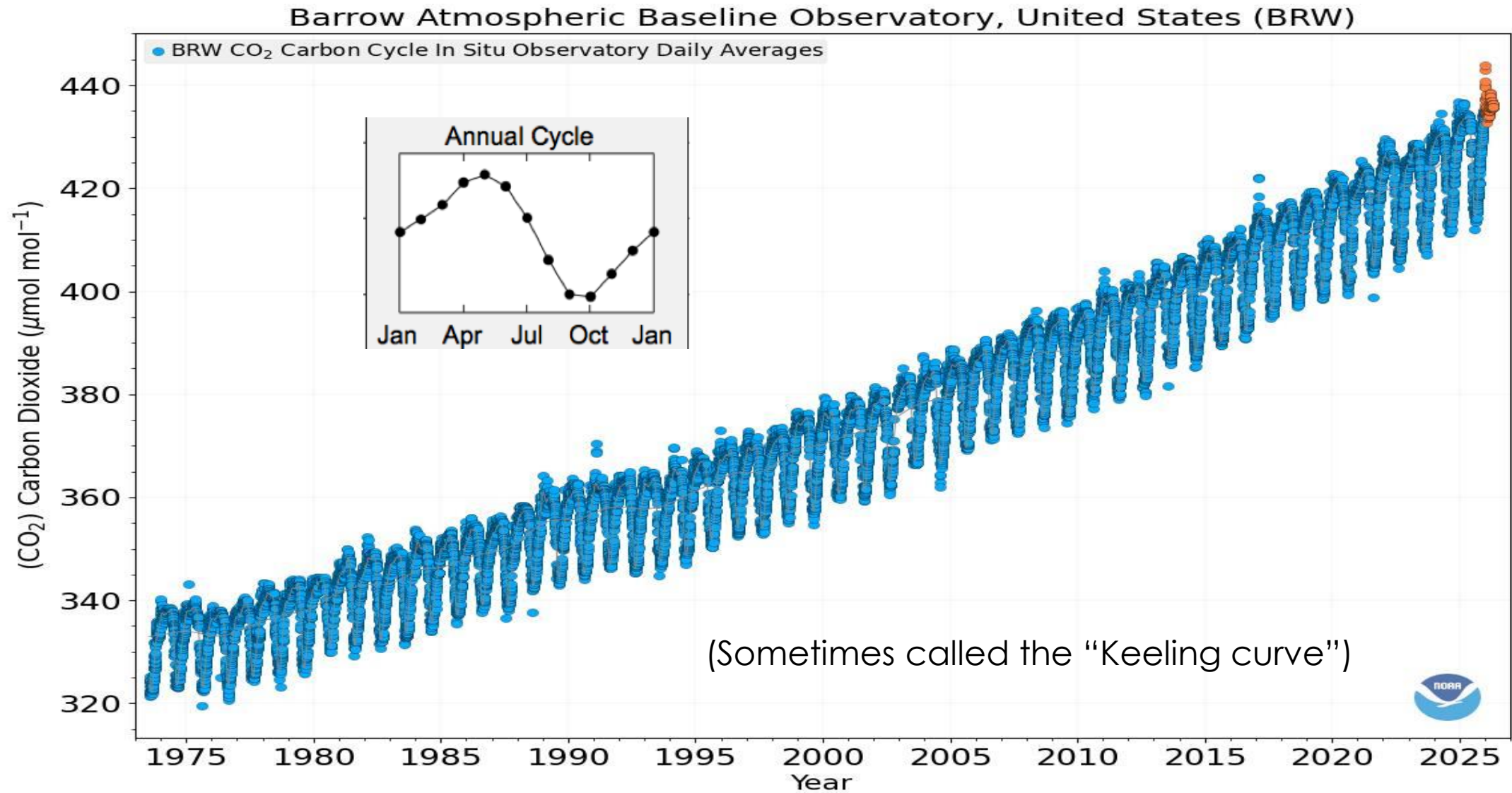
84x more potent
than CO_2 in the short term



Methane



Fact: Atmospheric CO₂ levels are increasing.



Fact: Globally-averaged Temperatures are increasing

NASA GISS, June 2026: **Record June Global Warming**

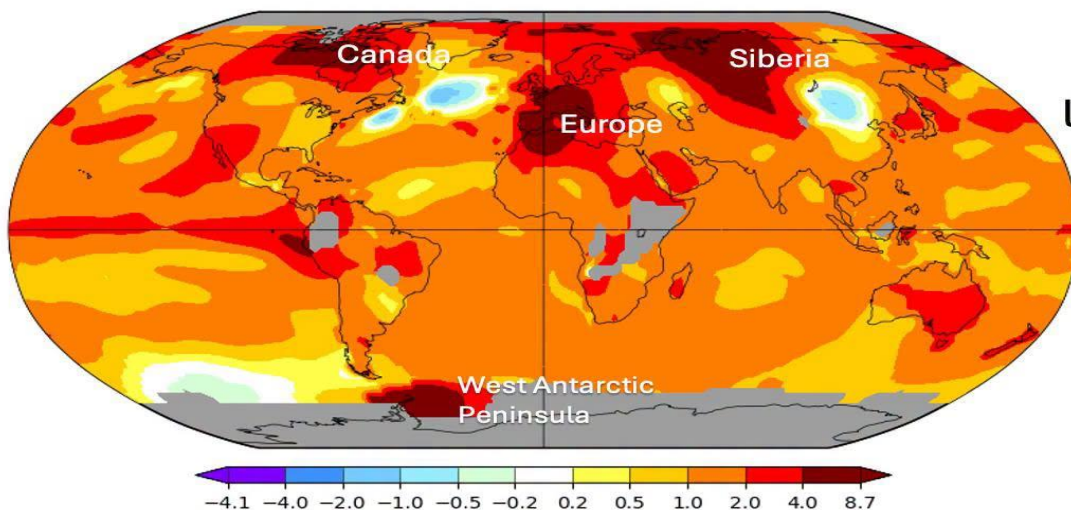
June 2026 **1.52°C**

June 2024 was 1.48°C

June 2026

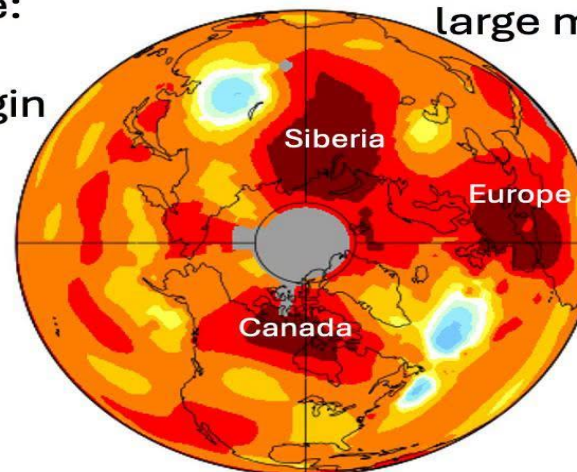
L-OTI(°C) Anomaly vs 1881-1920

1.52 1.52



W. Europe:
Record
large margin

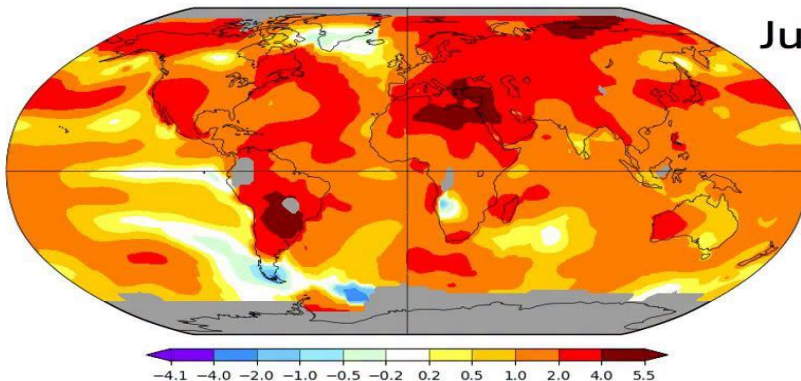
Arctic: Record
large margin



June 2024

L-OTI(°C) Anomaly vs 1881-1920

1.48 1.48



June 2024 1.48°C

The period from April 2025 to March 2026 was the warmest 12-month period ever recorded in the contiguous United States.

Peter Carter, Climate Emergency Institute

Fact: Globally-averaged Temperatures are increasing

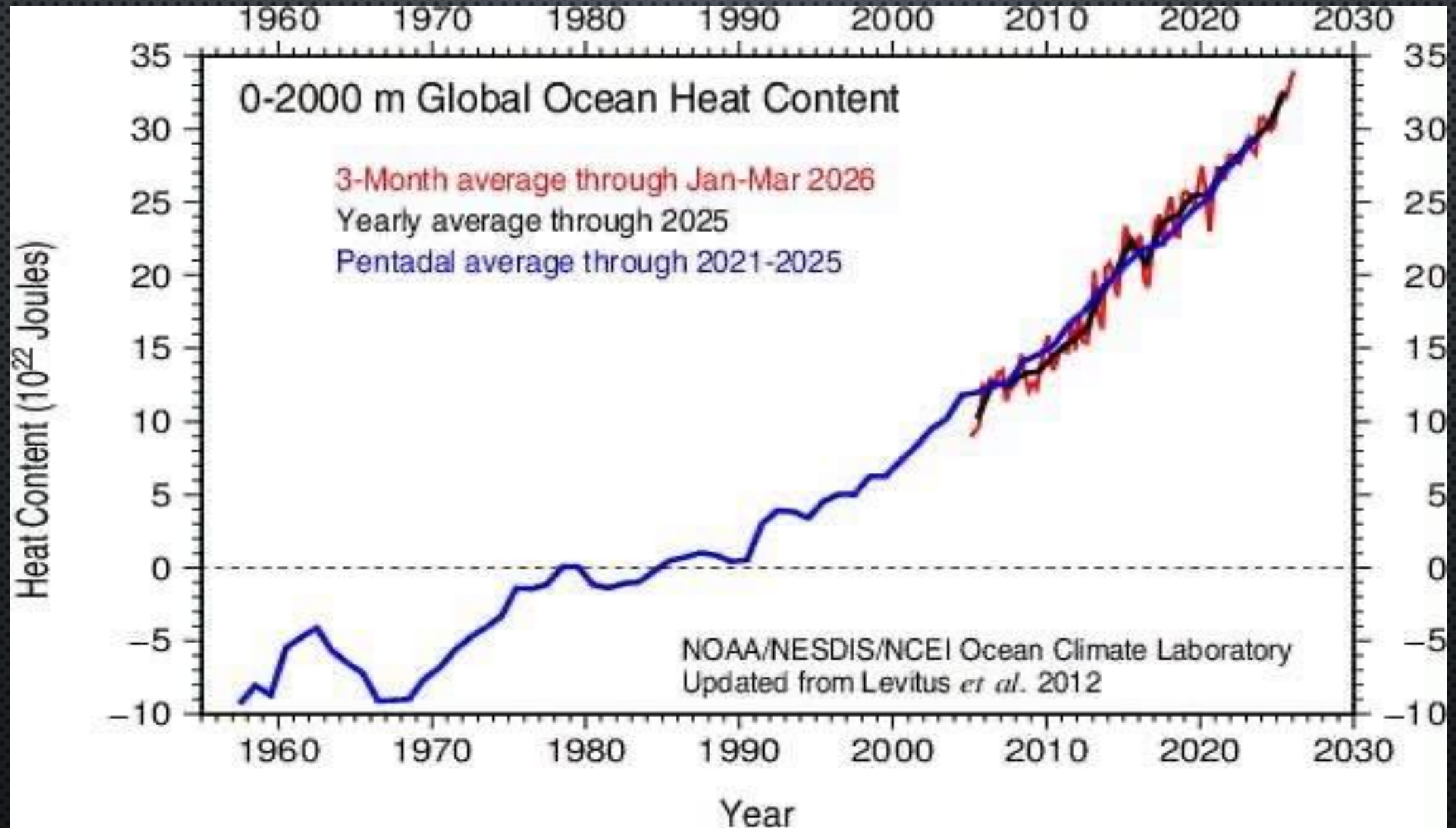
GLOBAL AVERAGE SURFACE TEMPERATURE CHANGE FROM PRE-INDUSTRIAL



DATA: NOAA/ESRL WRTI Tool – updated through December 2025
SOURCE: <https://www.ncsl.noaa.gov/products/land-based-station/noaa-global-temp>
GRAPHIC: Zachary Labe (@ZLabe)

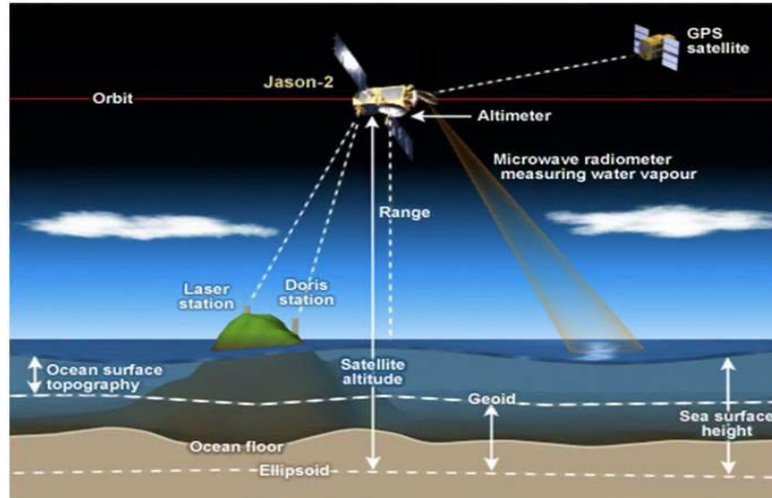
DATA SET: NOAA/NESDIS/NCEI NOAA GlobalTempv6.0.0 (Huang et al. (2022; AIES))
BASELINE: 1850-1900

Fact: Globally-averaged Ocean Temperatures are increasing



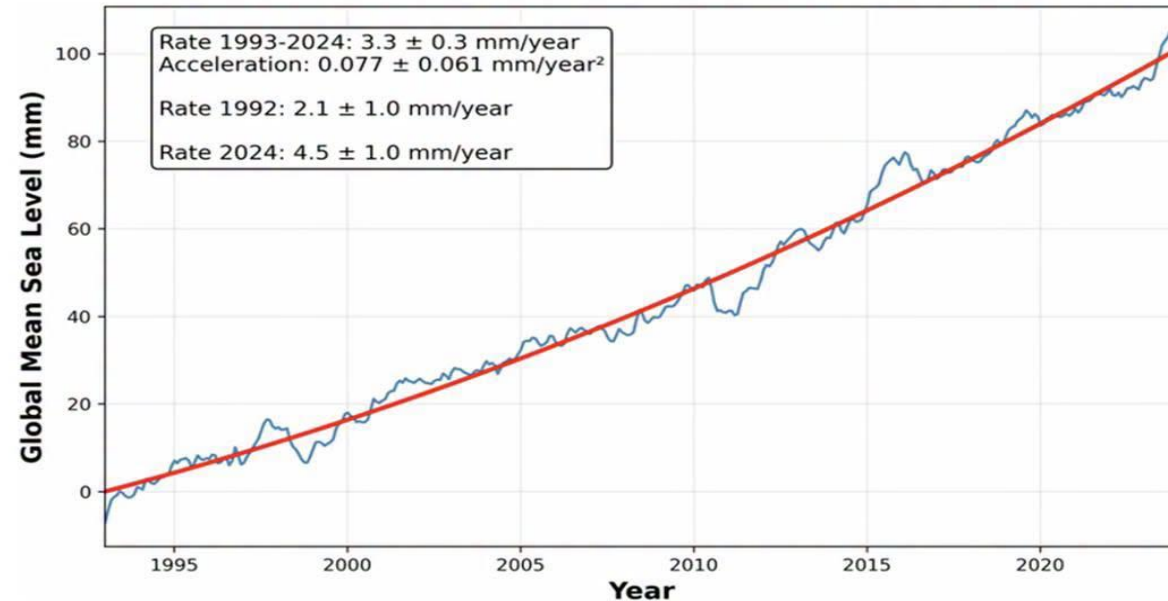
The Rate of Global Sea Level Rise Doubled During the Past Three Decades

NASA



Accelerating sea level rise

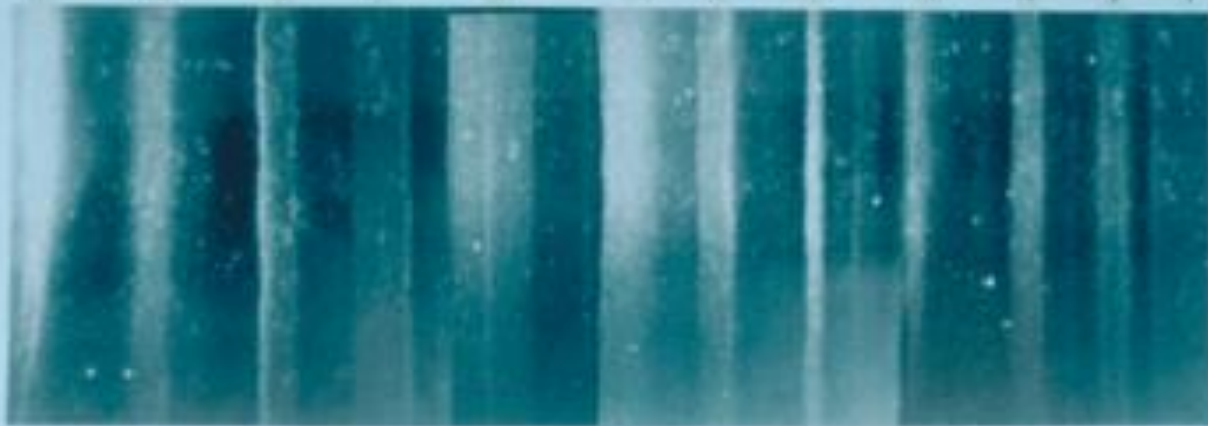
Global Mean Sea Level time series from 1993 to 2023



Seawater thermal expansion represents about one-third of modern-day global mean sea level rise. The other two-thirds of global sea level rise comes from the addition of water from melting ice sheets and glaciers on land. Hence, sea level rise is a reliable indicator of ocean heat increase and global surface warming- both accelerating.

Past Climate: How do we know?

- ✧ Ice core samples: Greenland, Antarctica, etc.
- ✧ Ice traps gas bubbles, dust particles, biological material, and other materials.
- ✧ Chemical isotope ratios are proxies for Temp, CO₂ levels, etc., at various times in the past.



19 cm long section of GISP 2 ice core from 1855 m showing annual layer structure illuminated from below by a fiber optic source. Section contains 11 annual layers.



Scientists Extract 1.2 Million-Year-Old Ice Core In Antarctica After Drilling Nearly 2 Miles!

Layers in ice core are similar to “tree rings” - showing annual cycles.

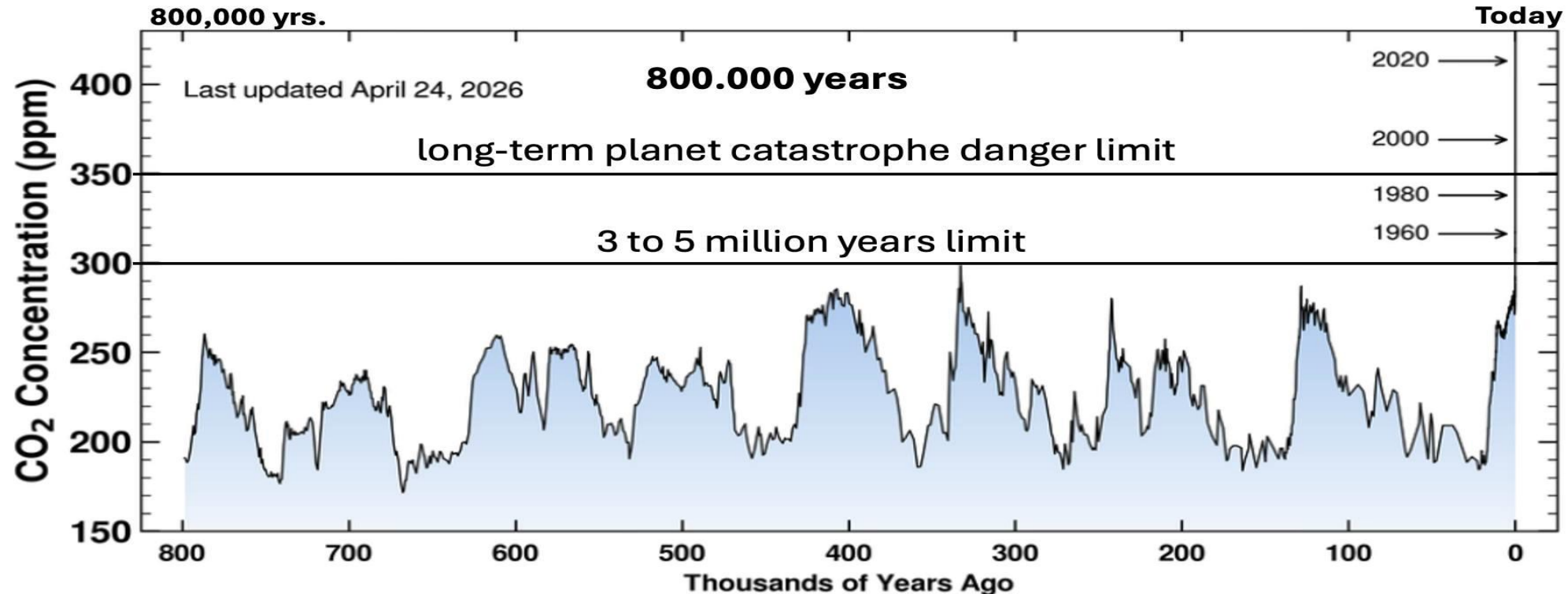
Are we responsible?

**Atmospheric CO₂ has just reached above 430 ppm,
Highest in 3-5 million years**

24 April 2026, Scripps

Latest CO₂ reading: **431.15 ppm**

Atmospheric CO₂ over the past **800,000 years**



24 April 2026, Scripps Keeling CO₂

Peter Carter, Climate Emergency Institute

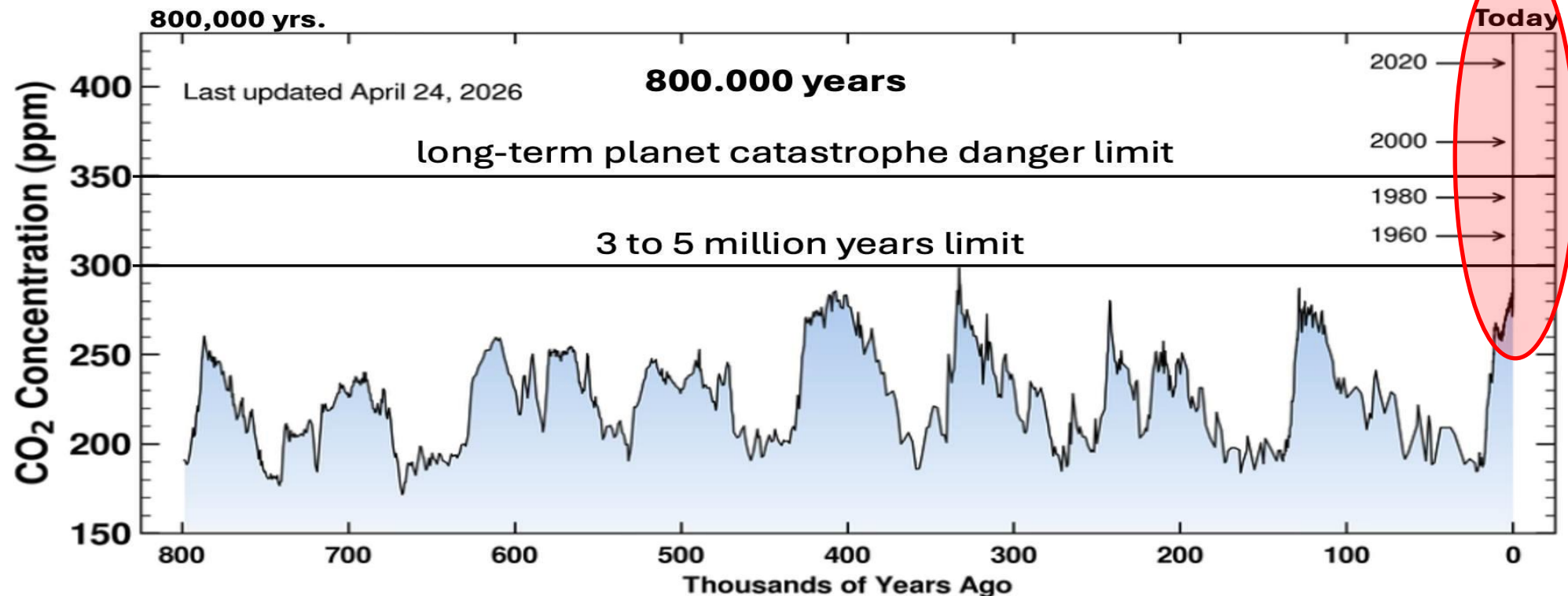
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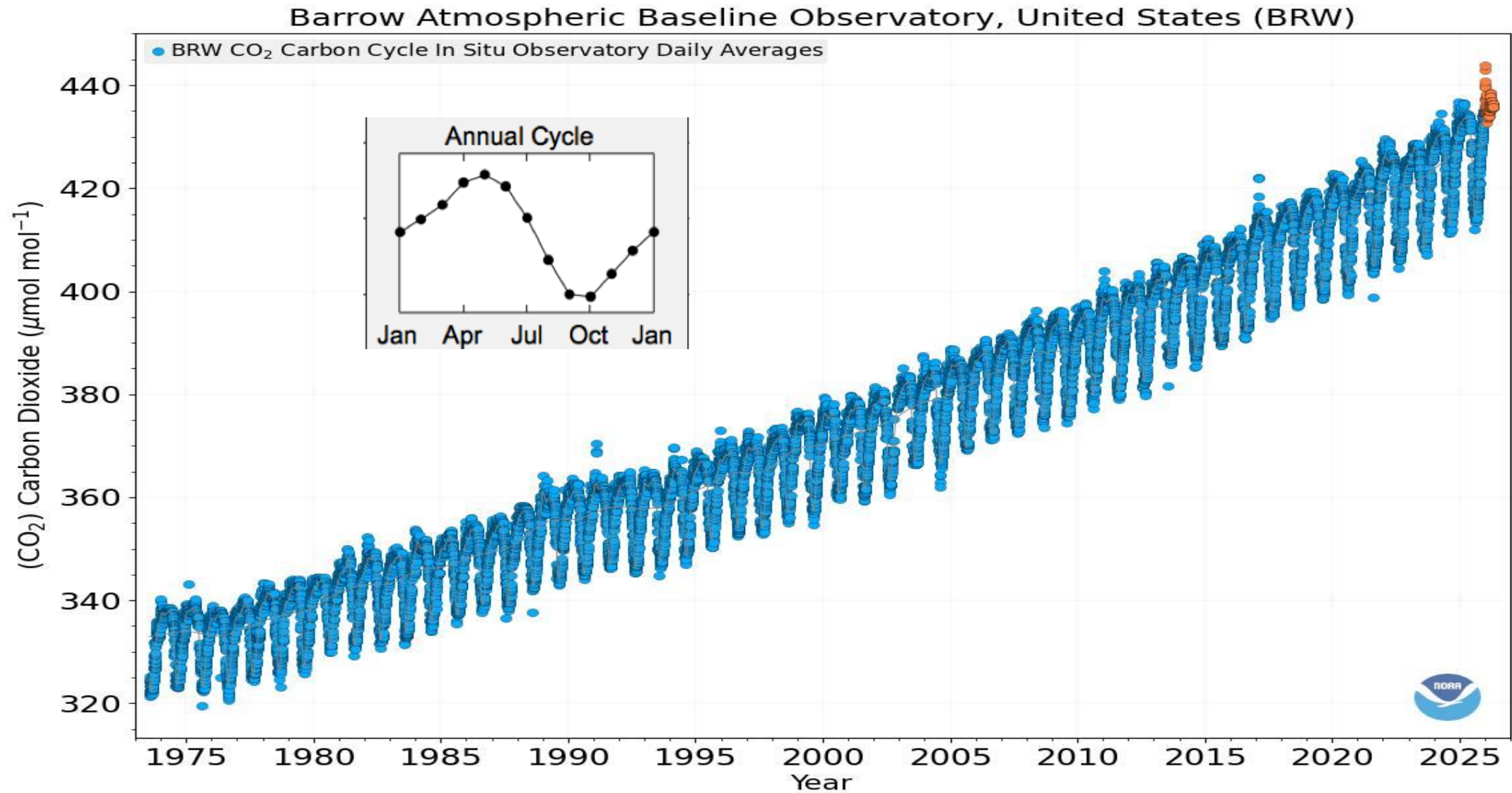
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24 April 2026, Scripps Keeling CO₂

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Are we responsible?

much more power to affect Earth's temperature than the orbital changes do. And in just the past 150 years, humankind has boosted carbon dioxide concentrations by 32 percent. NASA planetary scientist Jim Hansen says that if we continue to increase greenhouse-gas emissions, temperatures will rise between 2 and 3 °C this century, making

Earth as warm as it was three million years ago, when seas were between 15 and 35 meters higher than they are today. His predictions bear weight partly because he can verify his methods: using geological records, he has calculated past temperatures, and his results closely match the measured temperatures shown here. **DAVID TALBOT**

< 2026: 430+

< 2016: 400+

Atmospheric concentrations of **carbon dioxide** have increased 32 percent since 1850.

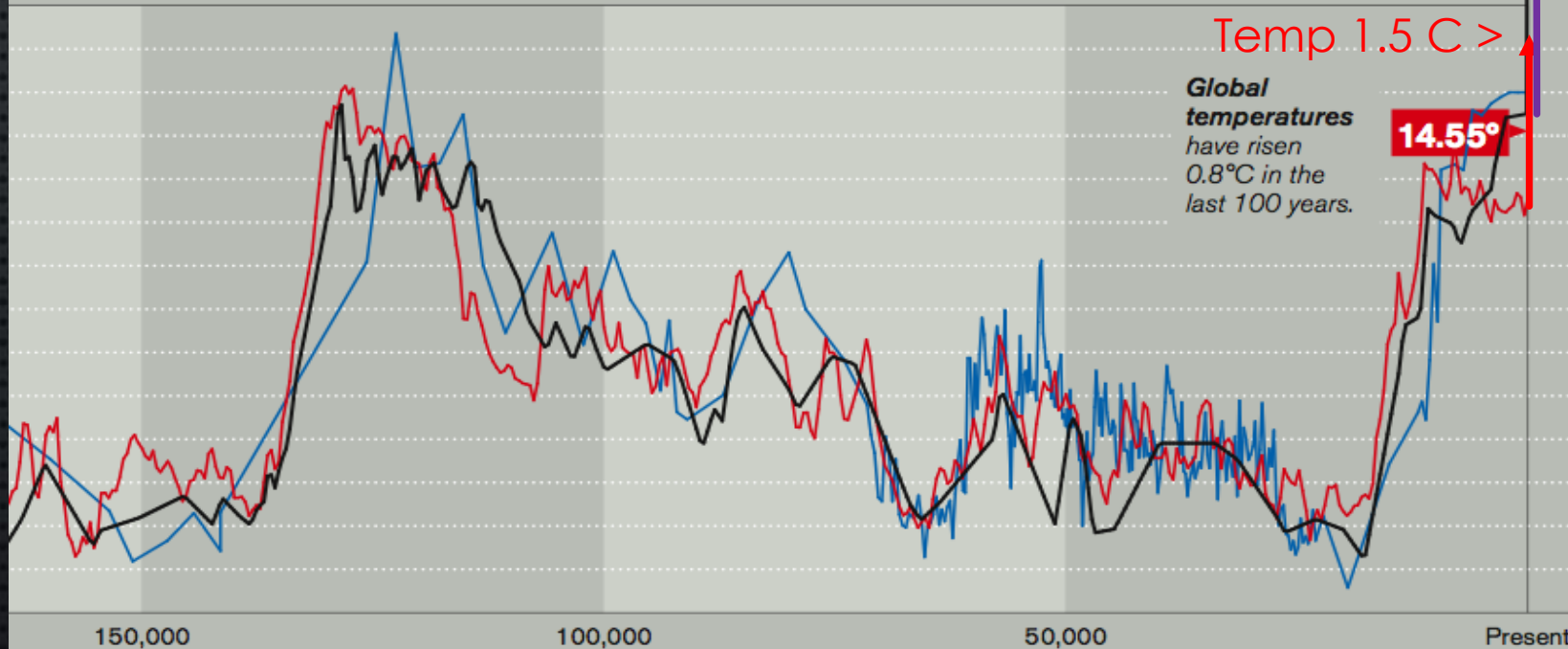
377

Carbon dioxide p.p.m.	Average Earth temp. °C	Sea level meters
300	15.5	10
290	15.0	0
280	14.5	-10
270	14.0	-20
260	13.5	-30
250	13.0	-40
240	12.5	-50
230	12.0	-60
220	11.5	-70
210	11.0	-80
200	10.5	-90
190	10.0	-100
180	9.5	-110
170	9.0	-120

Temp 1.5 C >

Global
temperatures
have risen
0.8°C in the
last 100 years.

14.55°



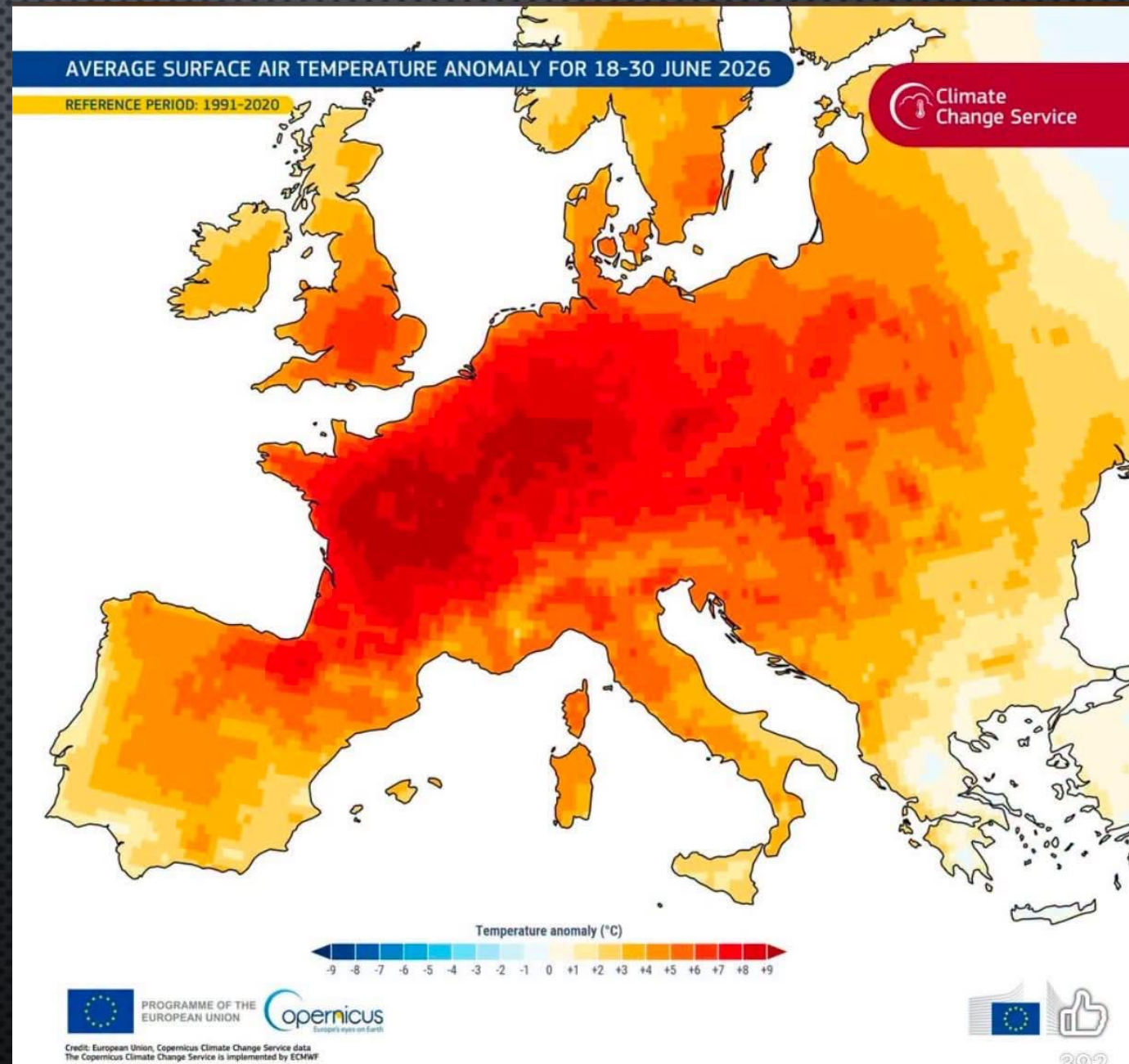
What are the effects?

(Hint: They are no longer subtle...)

CA

The Fossil Fuel Industry Is Burning Us Alive

Republicans want more fossil fuels while Democrats offer half-measures. Without aggressive climate activism, this disaster will only get worse.



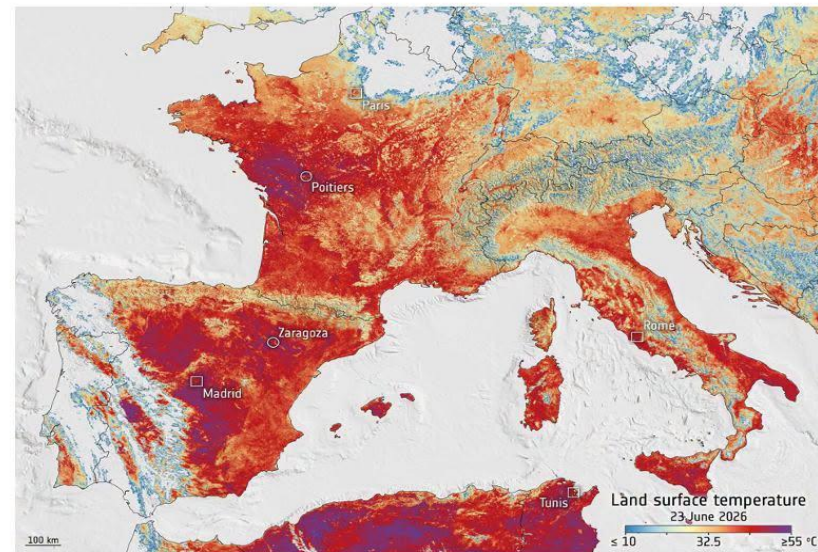
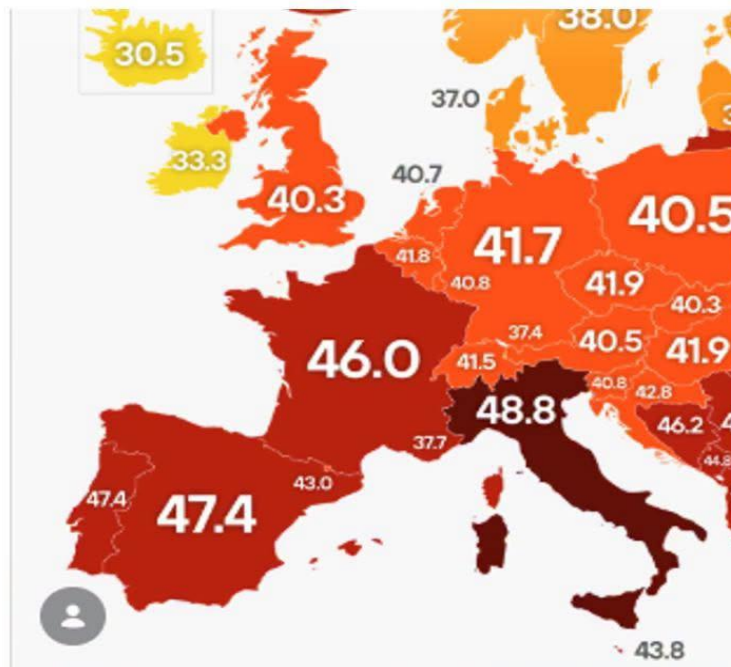
13 June 2026,

Reuters

Europe recorded 10,000 excess deaths during late-June heat wave, data shows

European countries reported more than 10,000 excess deaths during the record-breaking heat wave that engulfed the west of the continent in late June, official data shows

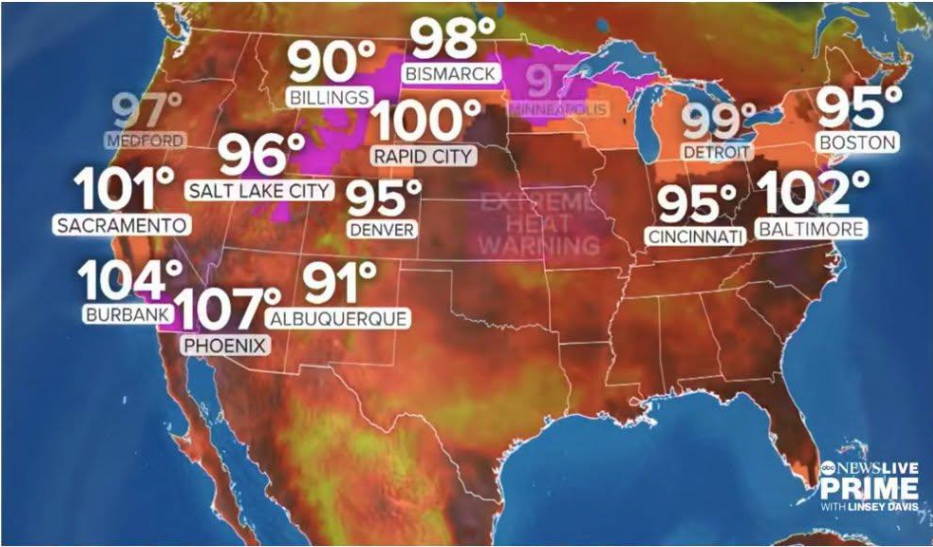
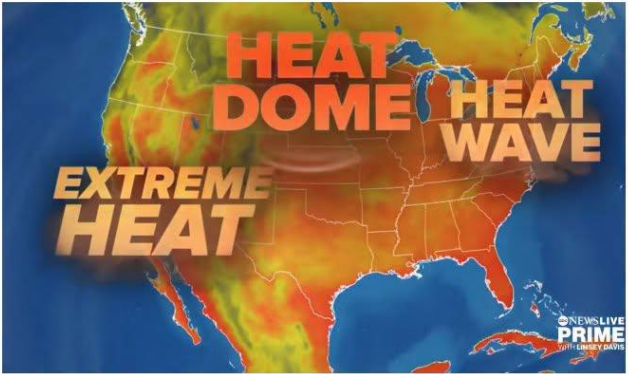
The extreme heat wave at the end of June disrupted power supplies, shut schools and smashed temperature records in France, Spain and the U.K.



Land surface temperature data captured by Europe's Copernicus Sentinel-3 mission on June 23, 2026.

US, Extreme Heat, Extreme Rainfall, Flooding Warnings

14 July, 2026



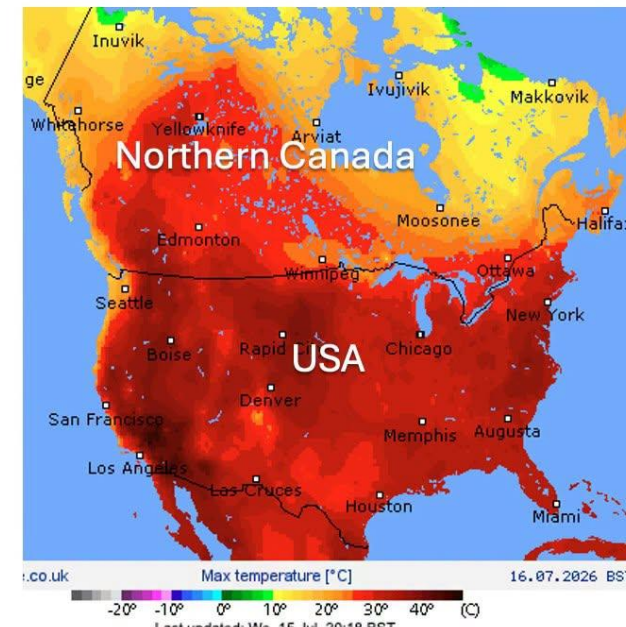
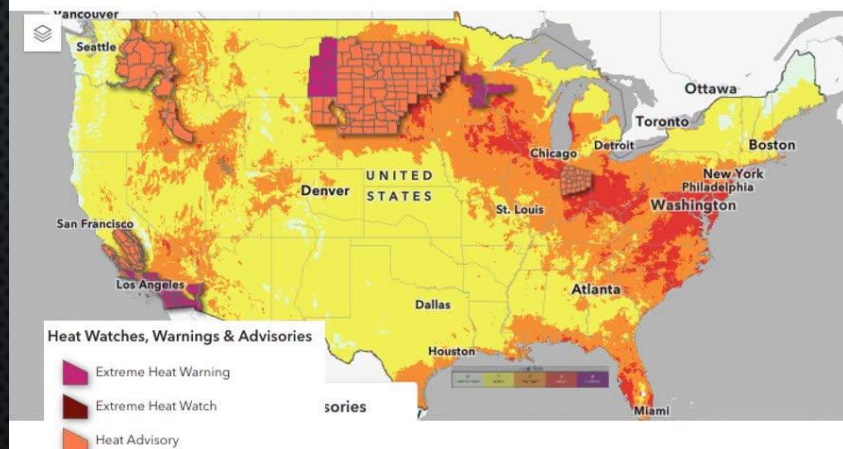
ABC News, 14 July, 2026



15 July, Heat & fires across northern Canada, Smoke pollution to US 19.5 million Americans under heat alert



Extreme Heat, 90,457,477 People under heat alerts



Peter Carter, Climate Emergency Institute

26 April 2026

Himalayan Snow Hits Record Low, Water crisis looms For 2 billion lives

26 April. 2026, HKH SNOW UPDATE 2026 (report)
(The Hindu Kush Himalaya)

27.6% below the monitored average of 2002-2025

The 2025–26 winter evidenced a historically low snow persistence at -27.8%, which is not only below the mean persistence estimated for 2003 to 2025, but also below the record low persistence of -23.6% observed in 2024–25

Snow persistence has been below normal in ten out of the twelve major river basins in the region, with the most alarming decline observed in the Mekong (-59.5%) and Tibetan Plateau (-47.4%), followed by Salween (-41.8%), Yellow River (-35.9%), Amu Darya (-31.8%), and Tarim (-27%).

In the context of such steadily declining persistence of seasonal snow, below-normal precipitation in spring may lead to reduced run-offs, further cascading into increased groundwater extraction and risks of droughts across the region.

The impact goes well beyond the mountains.

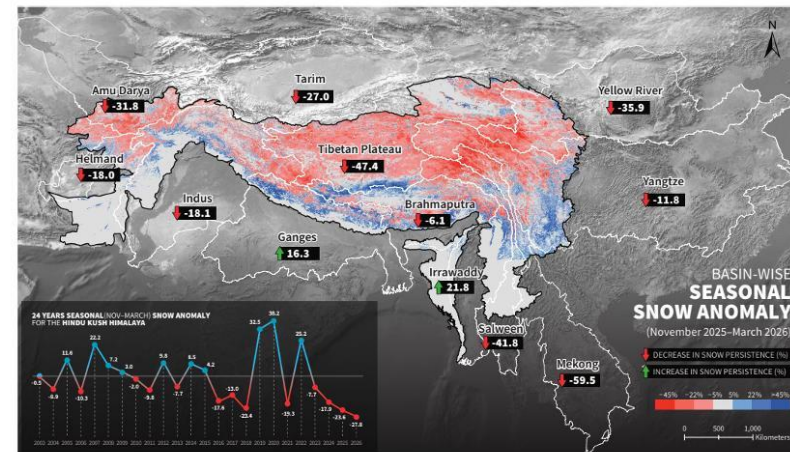
On average, about 23% of the water flowing in the major rivers comes from melting snow.

In the western basins, that figure jumps to a massive 70–80%. For the Indus alone, snowmelt makes up roughly 40% of the river's flow.



Snow cover across the Hindu Kush Himalaya has plunged to its lowest level in more than two decades.
(Photo: Reuters)

FIGURE 1: SNOW COVER PERSISTENCE ANOMALY DURING NOVEMBER 2024–MARCH 2025 (COMPARED TO HISTORIC OBSERVATIONS DURING THE REFERENCE PERIOD 2003–2025)



Note: Map shows the spatial distribution of snow persistence anomaly, and the overlaid graph is the HKH-WIDE average seasonal (November–March) anomaly for the last twenty-three years.

Trouble at the poles...

Greenland Ice Sheet is cracking quicker than scientists predicted



4 February 2025 · 2 Comments

The world's second biggest body of ice - the Greenland Ice Sheet - is cracking open quicker than scientists had previously thought.

Rapid loss of Antarctic ice may be climate tipping point, scientists say

By Reuters

August 20, 2025 11:13 AM EDT · Updated 21 mins ago



Aa



The world's largest iceberg, named A23a, is seen in Antarctica, January 14, 2024, in this picture obtained from social media. Rob Suisted - <http://naturespic.com/via REUTERS/File Photo Purchase Licensing Rights>

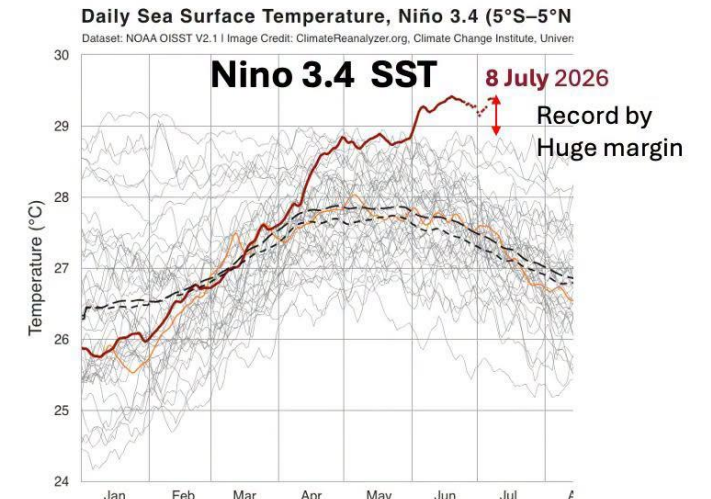
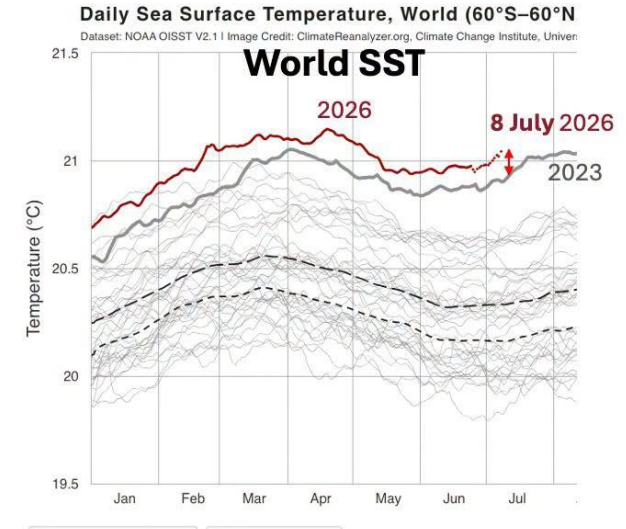
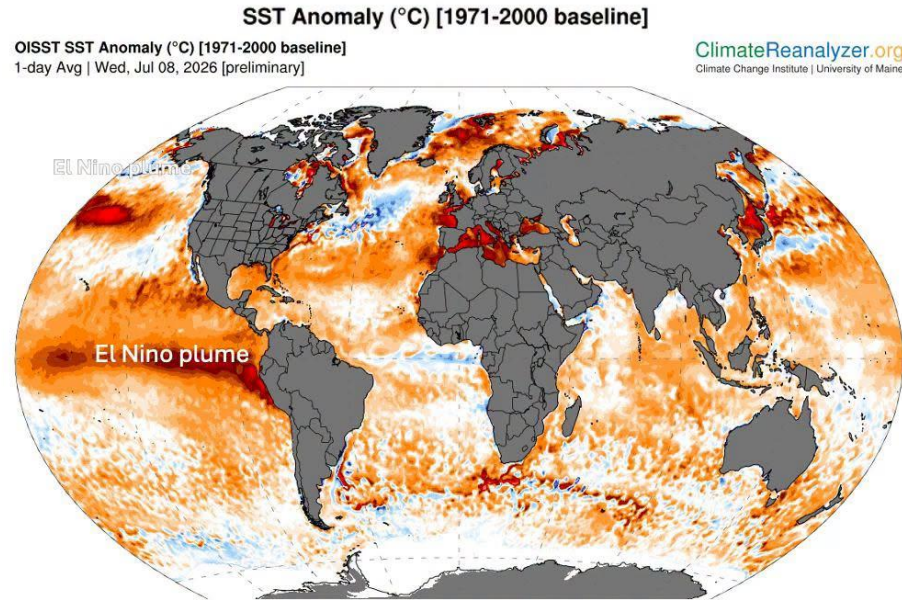
CANBERRA, Aug 21 (Reuters) - Rapid loss of Antarctic sea ice could be a tipping point for the global climate, causing sea level rises, changes to ocean currents and loss of marine life that are impossible to

Global sea surface warming is record high, by a large margin

Pacific El Nino sea surface is a record, by a **huge** margin

8 June, Climate Reanalyzer

Wed, Jul 08, 2026 Sea surface temperature change



Peter Carter, Climate Emergency Institute

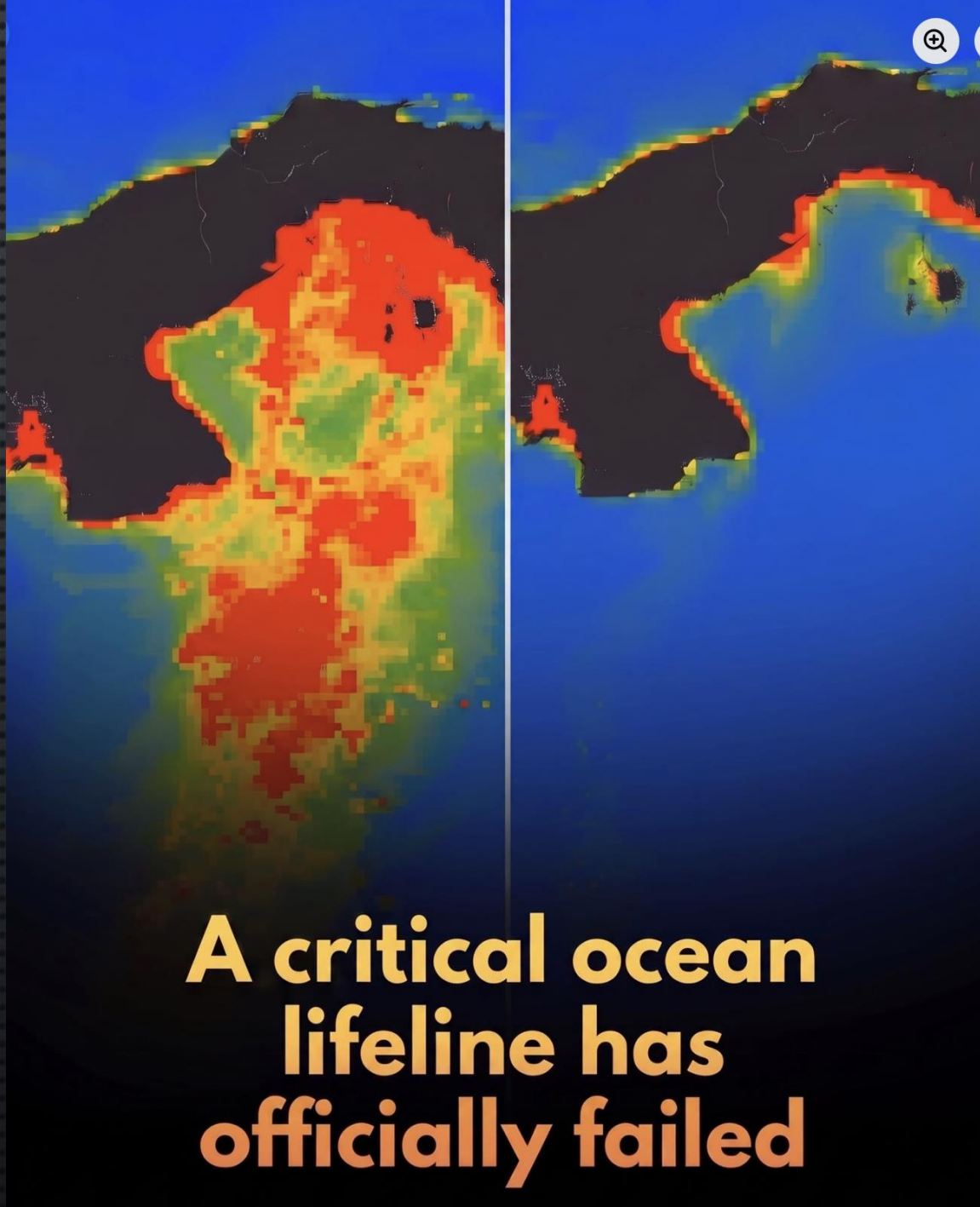
Scientific American
July 2026

July 1, 2026 | 1 min read  Add Us On Google 

Global ocean temperatures are entering “uncharted territory,” climate scientists say

Sea surface temperatures in late June reached nearly 70 degrees Fahrenheit on average, shattering records

2025



A critical ocean lifeline has officially failed

For the first time in over 40 years, Panama's vital ocean upwelling system has failed.

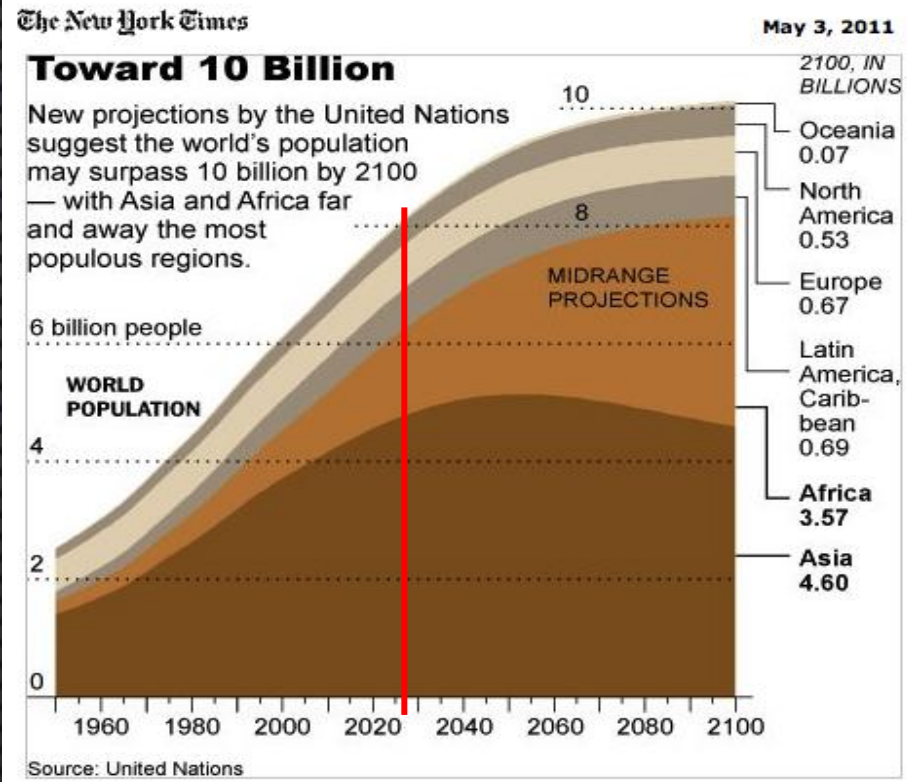
Every year from January to April, strong trade winds drive a critical process called upwelling in the Gulf of Panama, pulling cold, nutrient-rich deep ocean waters to the surface. This seasonal cooling supports robust fisheries, feeds marine life, and shields coral reefs from lethal heat stress.

However, in 2025, this highly predictable natural cycle completely collapsed. Researchers at the Smithsonian Tropical Research Institute reported that Panama's seasonal upwelling failed to develop for the first time in more than four decades of satellite and in-situ monitoring, leaving coastal waters unusually warm and devoid of essential nutrients.

The environmental fallout was immediate: satellite data revealed a massive drop in chlorophyll levels, indicating that the microscopic algae forming the base of the marine food web never bloomed. Scientists attribute the system's collapse to exceptionally weak regional trade winds, and they warn that such disruptions could have catastrophic ripple effects worldwide. Because coastal upwelling systems are among the most productive environments on Earth—powering global fisheries and stabilizing coastal economies—the continuing breakdown of these natural cycles could expose marine ecosystems to unprecedented heat stress, threatening biodiversity and the millions of people who depend on them.

source: O'Dea, A., Sellers, A. J., Pérez-Medina, C., Díaz, J. P., Bloise, A. G., Pöhlker, C., Chiliński, M. T., Aardema, H. M., Cybulski, J. D., Heins, L., Paton, S. R., Slagter, H. A., Schiebel, R., & Haug, G. H. (2025). Unprecedented suppression of Panama's Pacific upwelling in 2025. *Proceedings of the National Academy of Sciences*, 122(36). See

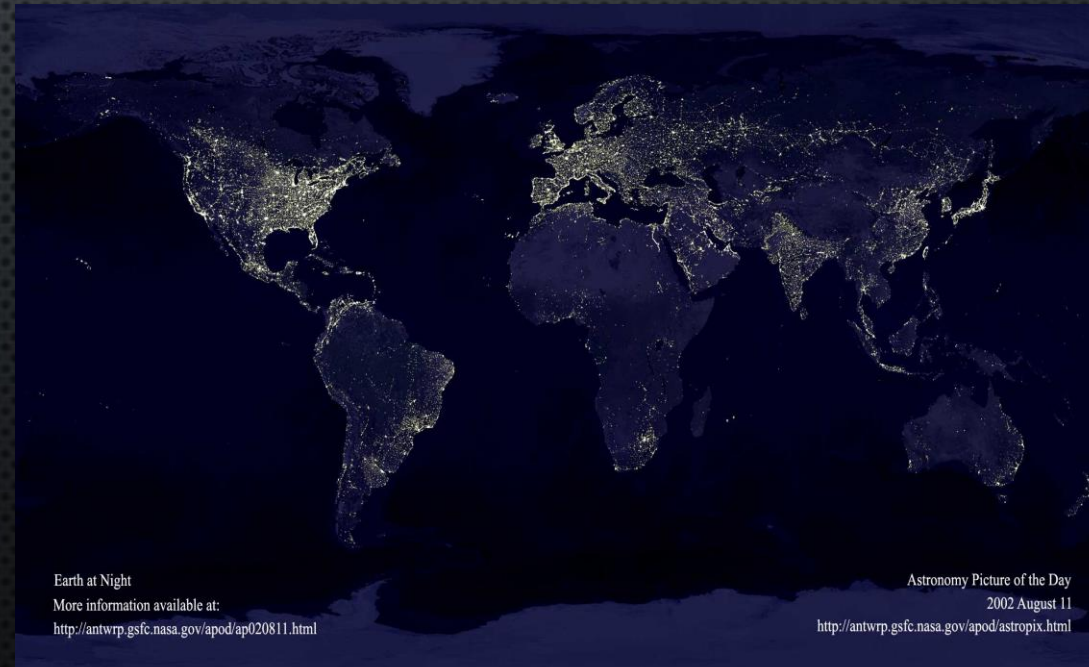
The Contemporary Challenge



Kohlua, India

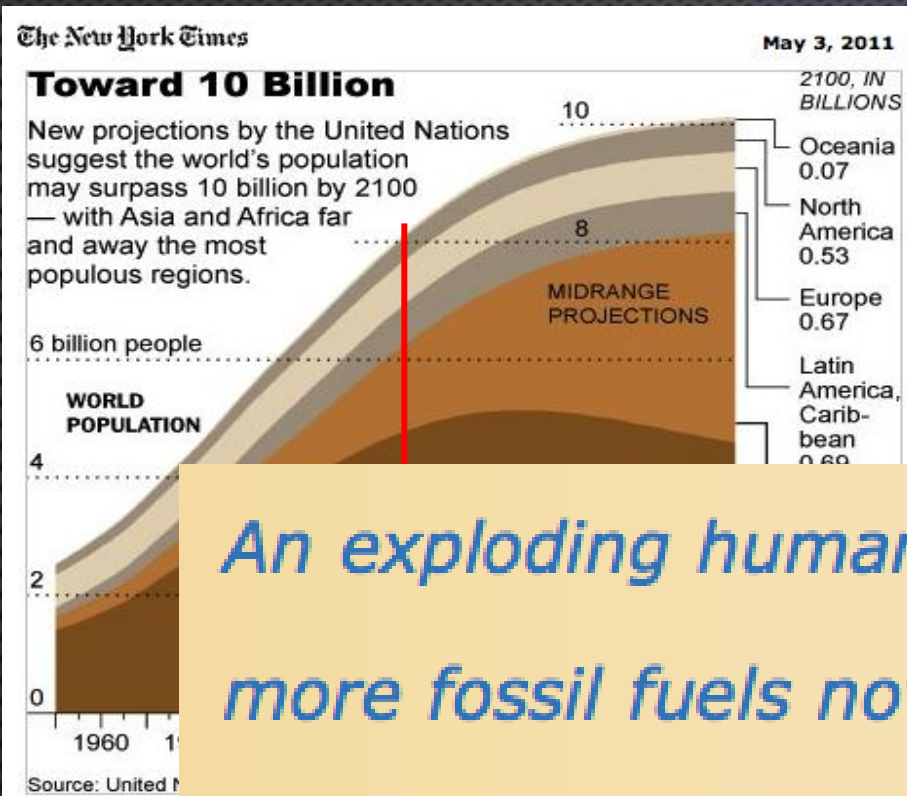


Pollution
getting
worse



Energy
needs
rising

The Contemporary Challenge



An exploding human population burning more and more fossil fuels now has a greater effect on the climate than natural mechanisms.

Pollution
getting
worse



Energy
needs
rising

Earth at Night
More information available at:
<http://antwrp.gsfc.nasa.gov/apod/ap020811.html>

Astronomy Picture of the Day
2002 August 11
<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

APRIL 3, 2006

www.time.com AOL Keyword: TIME

SPECIAL REPORT GLOBAL WARMING

TIME

**BE
WORRIED.
BE **VERY**
WORRIED.**

Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well

EARTH AT THE TIPPING POINT
HOW IT THREATENS YOUR HEALTH
HOW CHINA & INDIA CAN HELP
SAVE THE WORLD—OR DESTROY IT
THE CLIMATE CRUSADERS



This is from April 3, 2006! (20+ years ago now!!)

No excuses.

The science has been clear for quite some *Time*...

So why aren't we doing more about it?

I DO NOT think people understand that global warming doesn't mean "no cold weather ever." It means a warming planet destabilizes weather patterns, causing more extreme weather. This has been explained for decades and people still don't get it.

Our society is not well positioned to understand and act on a crisis that is happening over decades, not over a "news cycle"...

- Poor Science Education
- Intentional misinformation
- Partisan politics
- General distrust of science
- (Inability of scientists to successfully communicate the scale of the problem?)



Incredible! Less than half of Americans know that the cause of climate change is us i.e. ‘human activity’

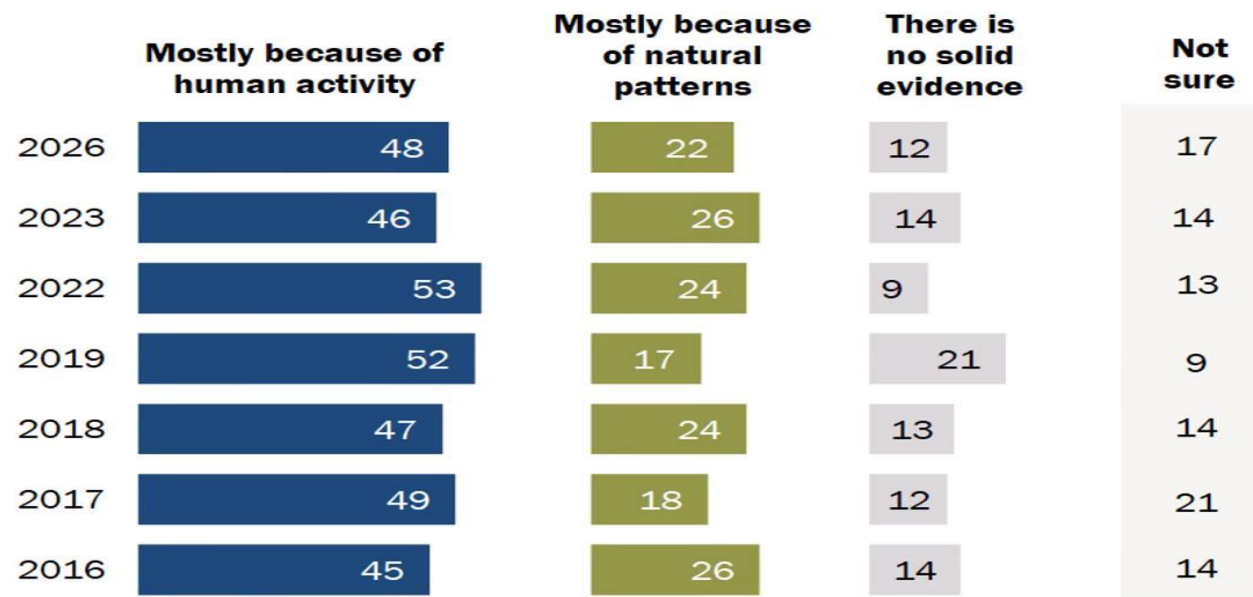
Americans on what causes climate change: Human activity or natural patterns?

28, May 2026, Pew Research Center

The share of Americans who say climate change is mostly the result of human activity has largely not changed in the last decade.

About half of Americans say the Earth is getting warmer due to human activity

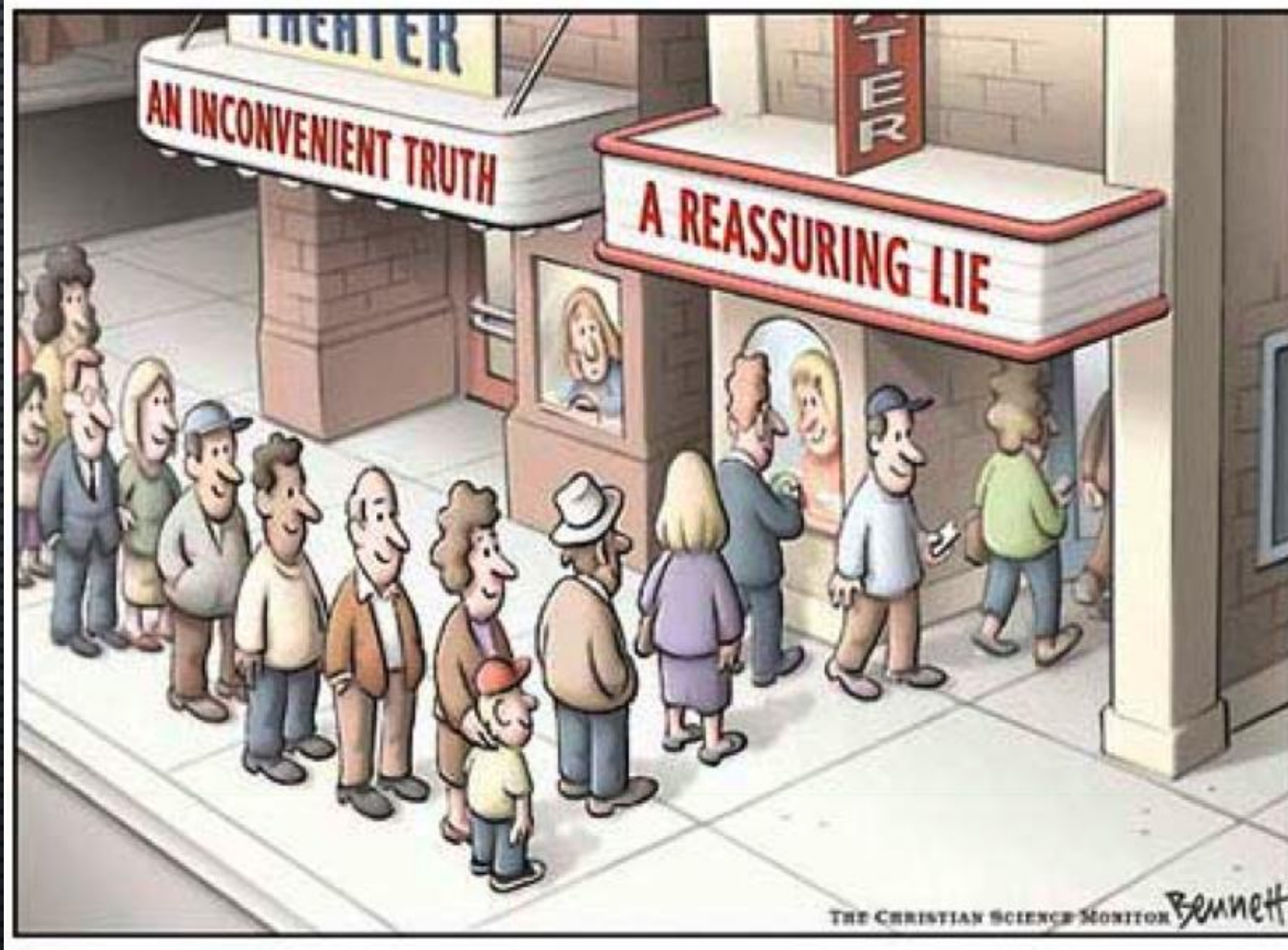
% of U.S. adults who say the Earth is getting warmer ...



Note: Respondents who did not give an answer are not shown.
Source: Survey of U.S. adults conducted March 16-22, 2026.

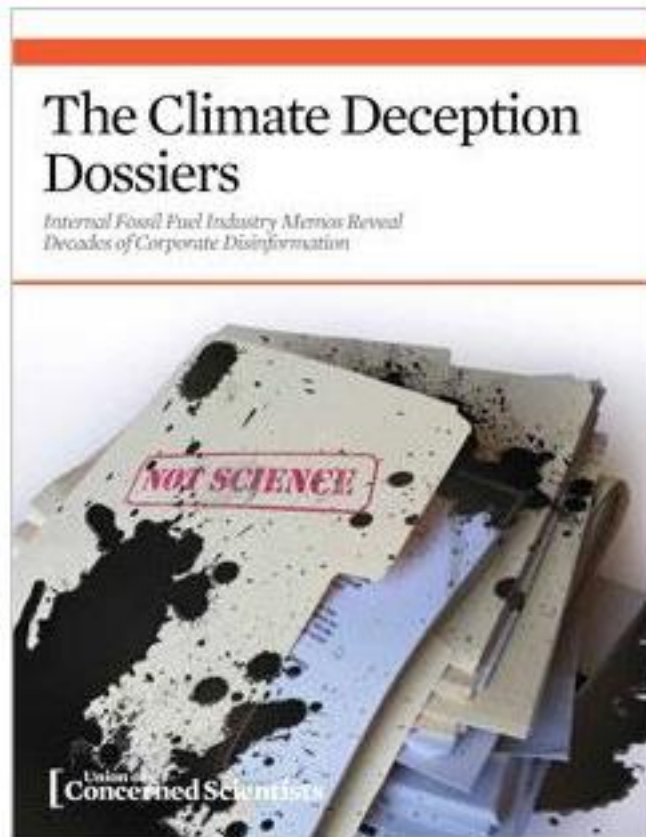
PEW RESEARCH CENTER

Peter Carter, Climate Emergency Institute



We can no longer afford to ignore the science...

The Climate Deception Dossiers



Internal fossil fuel industry memos reveal decades of disinformation—a deliberate campaign to deceive the public that continues even today.

Gov't Policy makes a difference...

Trump promised to bring back American manufacturing. Instead, his policies have stalled or canceled 223 clean energy and manufacturing projects, threatening more than 111,000 jobs.

This month, the Trump administration handed out \$700 million to prop up coal-fired power plants, which spew out deadly air pollution and are a leading source of planet-heating emissions.

Trump has shut down or downsized clean energy projects that would have added an estimated \$55 billion to the US economy each year.

Trump Administration Pays Duke Energy \$129 Million to Halt Offshore Wind Farm

Note: \$2.5 B so far!

It was the fourth such deal struck by the administration to get companies to forfeit their offshore wind leases. June 29, 2026

Listen · 4:59 min

Share full article



103

The New York Times



Duke Energy is one of the nation's largest utilities. Here, a Duke Energy wind farm project in Rolling Hills, Wyoming. Matthew Brown/Associated Press



**THE TRUMP ADMINISTRATION FIRED
THE SCIENTISTS WHO RAN THE
GOVERNMENT'S CLIMATE WEBSITE,
THEN SHUT THE SITE DOWN. THE
SCIENTISTS JUST REBUILT IT WITH
THEIR OWN MONEY AND PUT IT
BACK ONLINE.**



Hashem Al-Ghaili

July 6 at 10:00 AM · 🌐

In defiance of political censorship, laid-off federal scientists have successfully resurrected a massive, shuttered climate data site.

When the federal [climate.gov](#) website was shut down and hundreds of researchers were laid off, a dedicated team of former National Oceanic and Atmospheric Administration (NOAA) employees refused to let decades of public science vanish.

Led by Rebecca Lindsey, the former program director of the original government site, these scientists launched a monumental counter-effort. Rallying over 80 volunteer researchers, the team successfully launched [climate.us](#), a new, independent website that painstakingly recataloged and restored more than a thousand vital climate reports and datasets previously hidden from public view.

This grassroots resurrection was made possible by a powerful mix of public solidarity and collective action. Nearly 2,500 small-scale donors crowdsourced \$250,000—covering one-third of the operational budget—to safeguard critical environmental data.

Climate scientists have lauded the project for helping everyday citizens connect global climate patterns directly to their local communities.

By bypassing political interference, these scientists have established a protected, permanent refuge for the public data necessary to understand and combat our changing world.

source: Bonasia, C. (2026). Fired Scientists Revive the Climate Website Trump Shut Down. The Energy Mix. [See less](#)



Banks Are Financing the Fossil Fuel Industry's Next Growth Strategy

New research shows major lenders are accelerating their investment in Big Oil as the industry turns toward plastics, pesticides, and other petrochemicals.

For the past two years, more than a dozen major banks have been not only reneging on their climate commitments, they've been actively making the crisis worse.

Without consistent international pressure, banks and countries are backing off even previous (insufficient) commitments.

Are there any positive signs? Any hope?



**IN APRIL 2026 WIND
AND SOLAR PRODUCED
22 PERCENT OF GLOBAL
ELECTRICITY WORLDWIDE
BEATING GAS**

Energy economics is now on our side...



Climate Power 

1h · 



Energy Innovation estimates that 170 gigawatts of new solar will come online from 2026 to 2030, along with 43 gigawatts of wind. That's a lot, but it's significantly less than if the tax credits making them even cheaper had remained in place.



**AMERICA'S LARGEST WIND
FARM NOW USES 916
TURBINES TO GENERATE
ENOUGH CLEAN ELECTRICITY
FOR ABOUT ONE MILLION
HOMES EVERY YEAR.**



Scientia

July 5 at 9:50 PM · 🌐



The United States' largest wind farm, the Alta Wind Energy Center in California, operates 916 wind turbines that generate enough clean electricity to power approximately one million homes each year. Spanning thousands of acres in the Tehachapi region, the facility is one of the world's largest onshore wind energy projects and plays a major role in expanding renewable electricity production.

By harnessing the power of the wind, the project helps reduce greenhouse gas emissions and decreases reliance on fossil fuels. The wind farm supplies renewable electricity to California's power grid while supporting the state's long-term clean energy and climate goals.

Large-scale wind projects like this demonstrate how renewable energy can provide reliable electricity for millions of people while protecting the environment. As wind technology continues to improve, similar developments are expected to play an increasingly important role in the global transition to cleaner energy.

Source: U.S. Department of Energy, Alta Wind Energy Center, and the American Clean Power Association (ACP).



Pollution

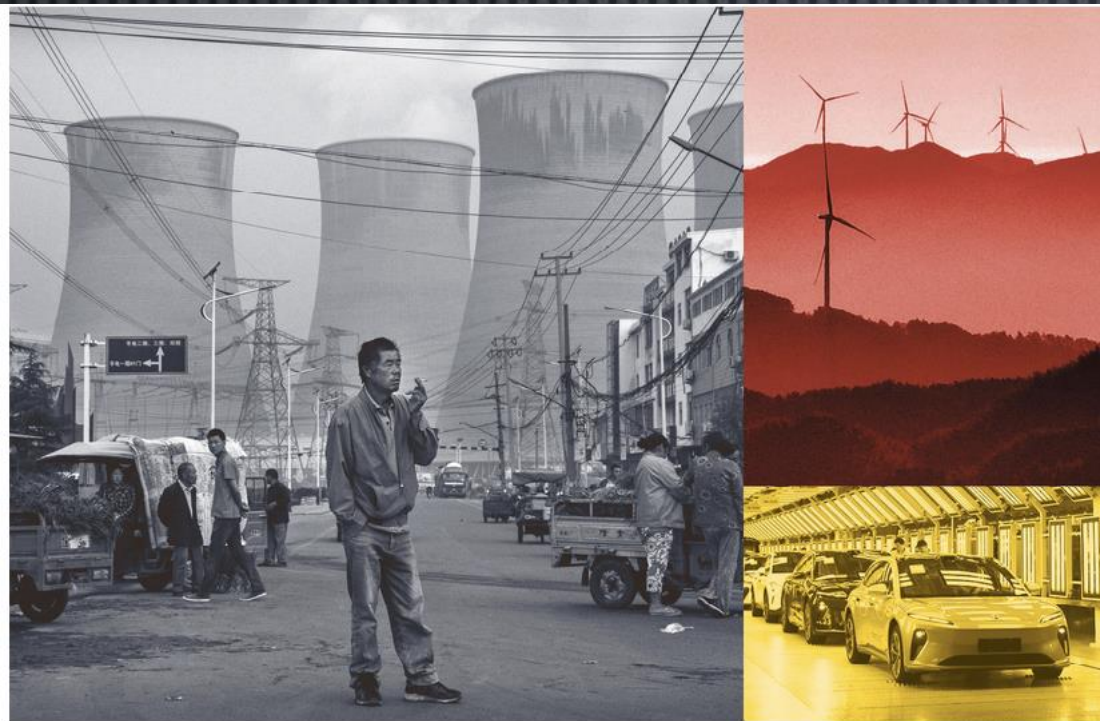
National Security

Unlike fossil fuels, clean energy generation is not dependent on global marketplaces and supply chains that are vulnerable to price spikes, unexpected supply disruptions, and regional conflicts.

There are lots of reasons to get off fossil fuels, many of which have little to do with climate change...



Positive economic driver



Why China is becoming the world's first electrostate

The superpower is dominating the global clean technology sector. It's not all about climate change.

中文版

By climate reporter Jo Lauder

Energy Industry

Tue 12 Aug

In April this year, China installed more solar power than Australia has in all its history. In one month.



Once an 'embarrassment' China's EV industry now leads the world

By China correspondent [Allyson Horn](#), Kat Tse, Angus Llewellyn and Mitchell Woolnough in China



Chinese electric vehicles (EVs) are **the largest and fastest-growing EV market in the world**, dominating over 70% of global EV production. Brands like BYD, Nio, and Xiaomi lead the industry with highly integrated supply chains, cutting-edge LFP and solid-state battery tech, and rapid fast-charging capabilities. [EVs](#) [evsearch.ca](#) +3

**When there's a huge solar energy spill,
it's just called a "nice day"**

www.votesolar.org



Picturesque and essential. Renewable energy sources and lots of them will be essential in the coming decades

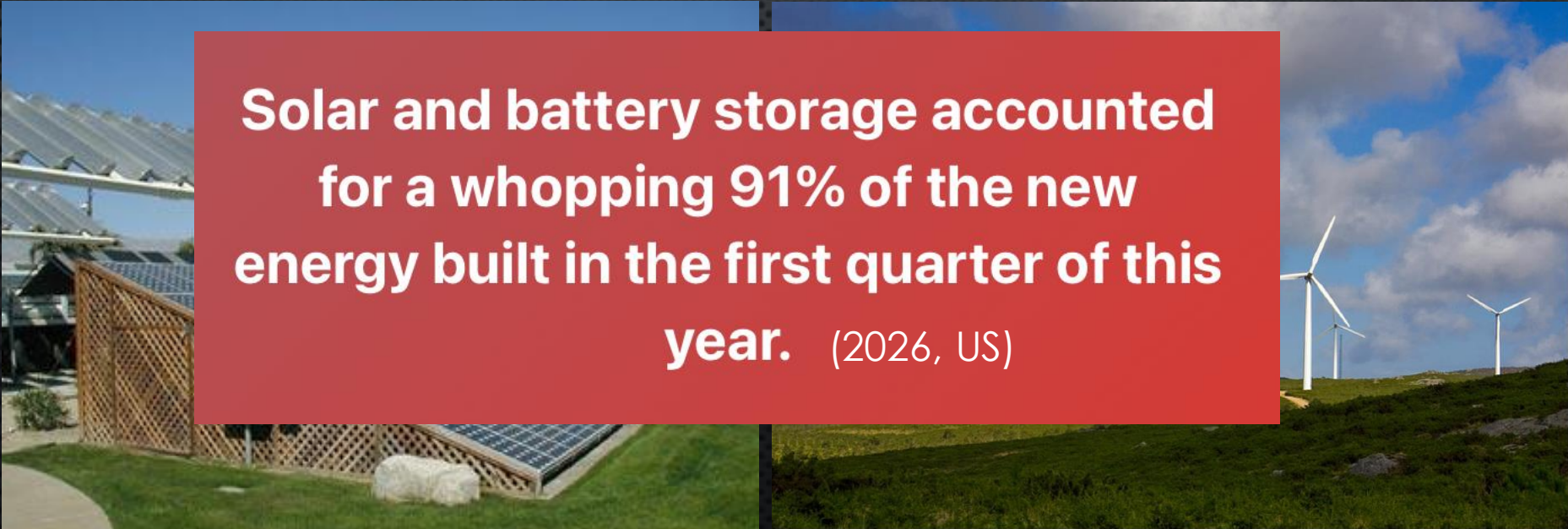
CLOSE X



A billboard with an orange background and black text. The text reads: "When there's a huge solar energy spill, it's just called a 'nice day'". The billboard is mounted on a metal structure with a staircase on the right side. The background shows green trees and a clear sky.

When there's a huge solar energy spill,
it's just called a "nice day"

www.votesolar.org



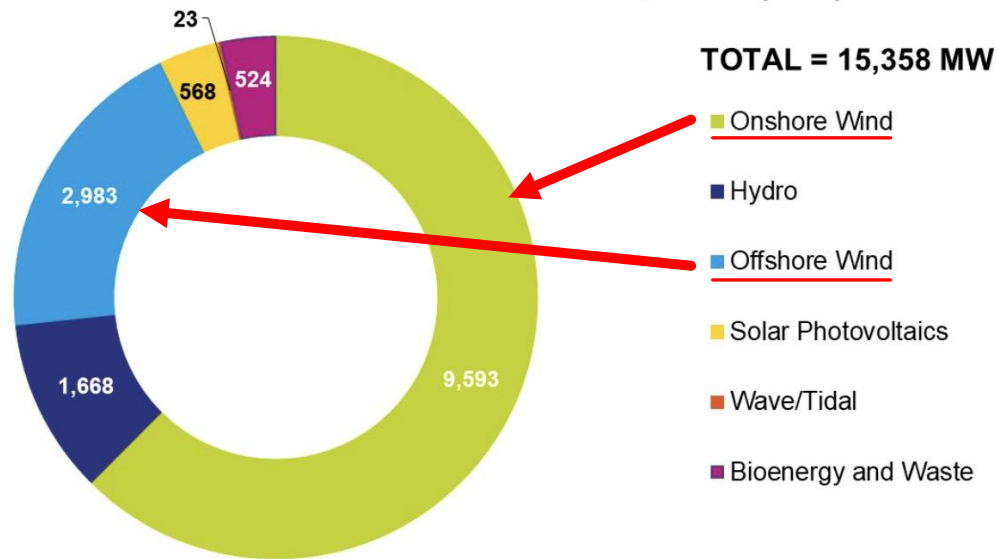
A collage of two images. The left image shows a house with solar panels on the roof and a wooden lattice fence in the foreground. The right image shows a grassy hill with several wind turbines under a blue sky with clouds.

**Solar and battery storage accounted
for a whopping 91% of the new
energy built in the first quarter of this
year. (2026, US)**

Scotland leading the way...

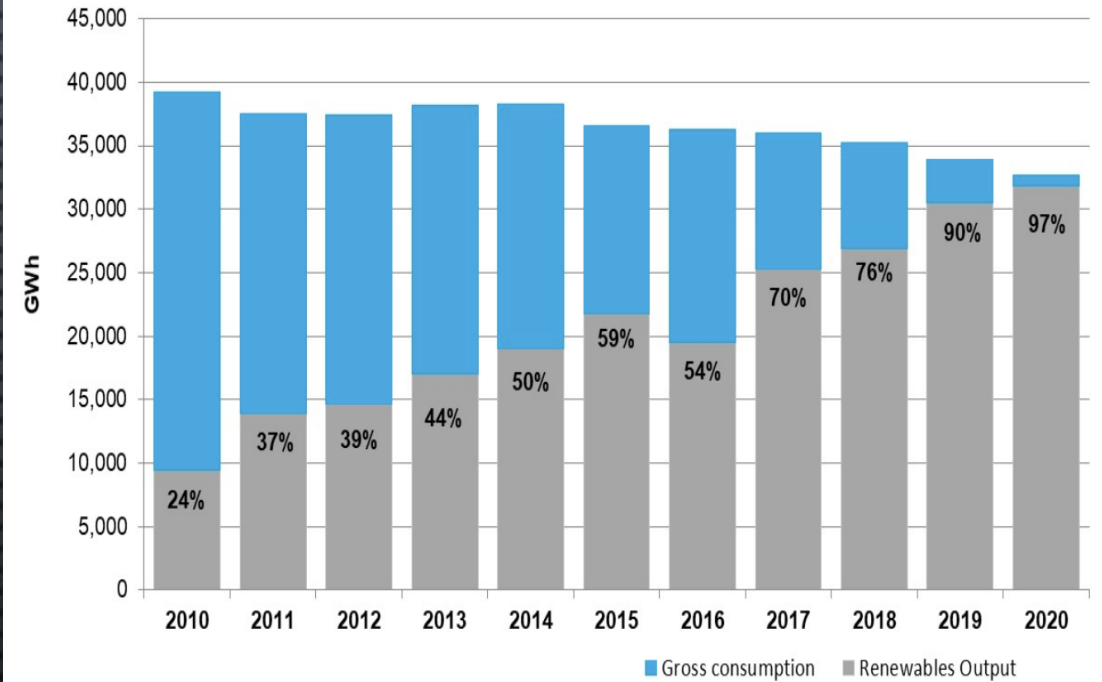
Chart 2: Current Installed Capacity of Renewable Electricity (Q3 2023)

CURRENT INSTALLED CAPACITY BY TECHNOLOGY Q3 2023 (MW)



Note: Bioenergy and Waste includes biomass (273 MW), landfill gas (116 MW), energy from waste (68 MW), anaerobic digestion (60 MW) and sewage, sludge digestion (8 MW).

GROSS ELECTRICITY CONSUMPTION AND % RENEWABLES OUTPUT



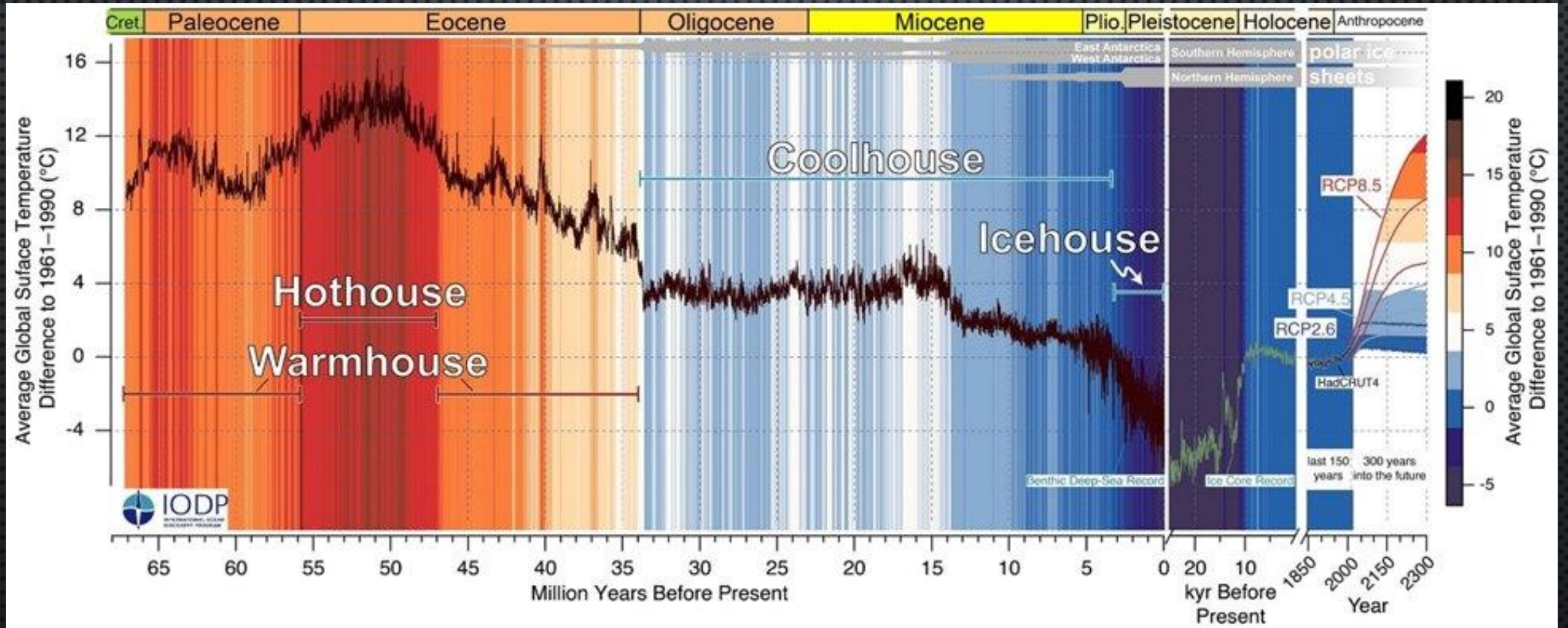
Wind alone accounts for more than 75% of Scotland's electric needs.



Thanks for listening! Questions? Comments?

Extra slides

Long range past Earth Climate



(See next slide for description)

Past and future trends in global mean temperature spanning the last 67 million years. Oxygen isotope values in deep-sea benthic foraminifera from sediment cores are a measure of global temperature and ice volume. Temperature is relative to the 1961-1990 global mean. Data from ice core records of the last 25,000 years illustrate the transition from the last glacial to the current warmer period, the Holocene. Historic data from 1850 to today show the distinct increase after 1950 marking the onset of the Anthropocene. Future projections for global temperature for three Representative Concentration Pathways (RCP) scenarios in relation to the benthic deep-sea record suggest that by 2100 the climate state will be comparable to the Miocene Climate Optimum (~16 million years ago), well beyond the threshold for nucleating continental ice sheets. If emissions are constant after 2100 and are not stabilized before 2250, global climate by 2300 might enter the hothouse world of the early Eocene (~50 million years ago) with its multiple global warming events and no large ice sheets at the poles. Credit: Westerhold et al.,

CENOGRID

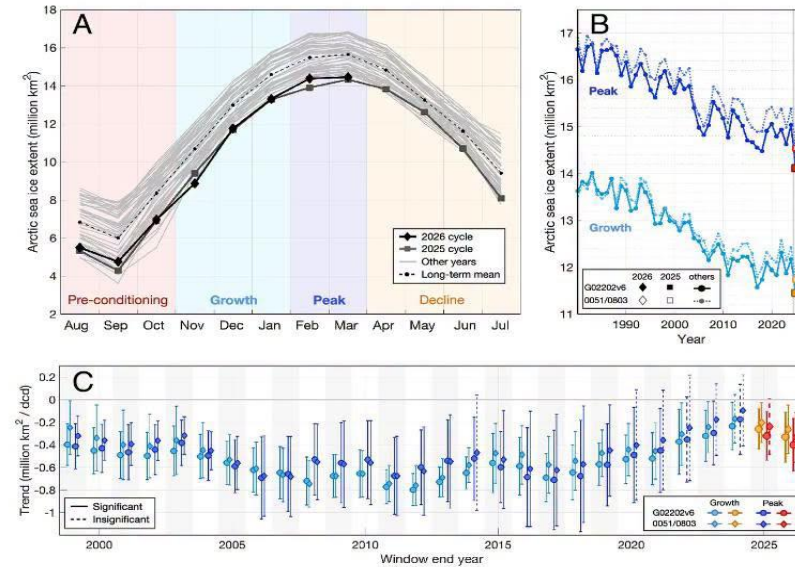
Winter Arctic Sea Ice Returns to Record-low 2025, 2026

Chan July 2026,

2025, 2026 reverses 2020 period
of no winter sea ice decline

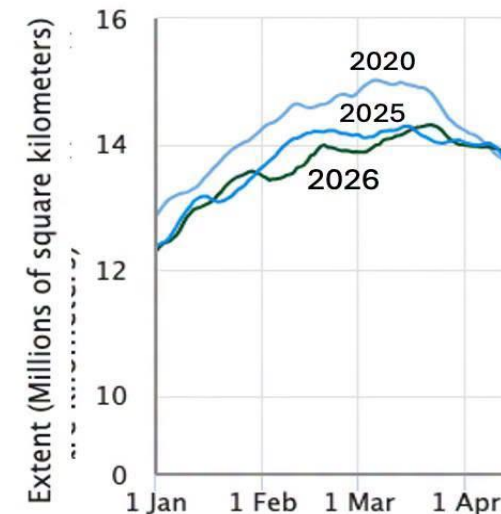
The rate of Arctic winter sea-ice extent decline
weakened in the early 2020s, with 20-year
trends becoming statistically insignificant.

Here up-to-date observations show that the
exceptionally low 2025 and 2026 ice extent
winters reversed this picture, with sea-ice extent
during the growth and peak phases returning to
record lows.



NSIDC
Charctic
July 2026

(Added,
not in the paper)



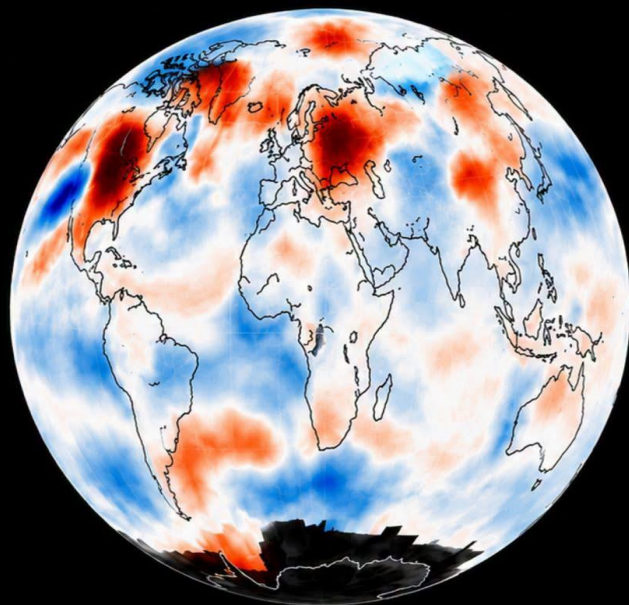
20 July 2026, Record-low 2025 and 2026 ice extents
restore Arctic winter sea-ice decline, Duo Chan et al

Peter Carter, Climate Emergency Institute

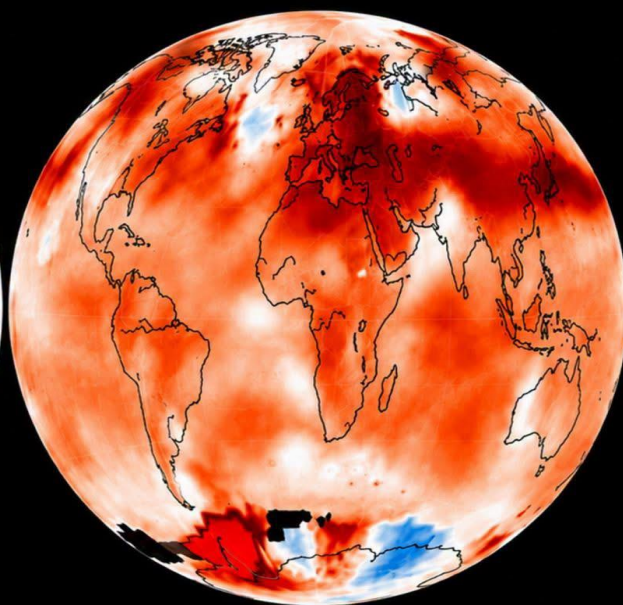


JULY 1936

JULY 2025



TEMPERATURE ANOMALIES



TEMPERATURE ANOMALIES



Hot spots versus global warming...

**TODAY'S GLOBAL CLIMATE IS
WARMER THAN DURING THE 1936
DUST BOWL DESPITE THAT ERA'S
RECORD U.S. HEAT.**

Actions at the individual level can have an immediate and significant positive impact.

- ✧ Conserve!
- ✧ Recycle!
- ✧ Insulate!
- ✧ Change a light bulb!
- ✧ Walk or bike.
- ✧ Carpool or public transportation.
- ✧ Buy a car that gets better gas mileage.
- ✧ Be aware, spread the word, change the culture.



What Needs to Happen?

- We need to act...individually, collectively, locally, nationally, globally.
 - “Procrastination is Decision.”
- GOAL: Keep CO₂ levels below 2x pre-industrial levels (<560 ppm) by 2050 and continue to reduce thereafter.
- In principle, *no new technology is needed to do this!* (Only the collective will to do it is missing.) However,
- New technology development is an important part of the solution.
(R&D dollars are needed!)

What Needs to Happen, con't.

- The United States has to take a *LEADERSHIP* role in reducing heat-trapping gas emissions.
 - **Nothing** will happen globally if we do not act.
 - It is in our country's best interest to do so.
 - Economically
 - Socio-politically

The U.S. is responsible for 23% of the world's CO₂ emissions, yet has only 5% of the world's population.

Support Green Technologies and Alternative Energy Sources



Energy (Un-)Sustainability:

- ✧ **US per capita energy consumption** [hence, CO₂ production] is roughly **32x** that of the developing world.
 - ✧ The US consumes the energy equivalent of 10 BILLION people in the developing world!
- ✧ If the developing world rises to our level of consumption, the energy needs are *immense*.
 - ✧ If they do it with fossil fuels, **we are toast!**
- ✧ This indicates that our level of energy consumption using fossil carbon **is not sustainable**.



We are dumping carbon dioxide into the atmosphere at a rate the earth hasn't seen since the great climate catastrophes of the past. The ones that led to mass extinctions. We just can't seem to break our addiction to the kinds of fuel that will bring back the climate last seen by the dinosaurs, a climate that will drown our coastal cities and wreak havoc on the environment and our ability to feed ourselves. All the while, the glorious sun pours immaculate, free energy down upon us, more than we will ever need. Why can't we summon the ingenuity and courage of the generations that came before us?

The dinosaurs never saw that asteroid coming.

What's our excuse?

Neil deGrasse Tyson



"Can anyone believe it is possible to lay down such a barrage of poison on the surface of the earth without making it unfit for all life? Man is a part of nature, and his war against nature is inevitably a war against himself."

-Rachel Carson, *Silent Spring*

Quote from our *Mother Earth* book - Order at www.thegirlgod.com



Arboreal forest, Alberta



Tar sands operations, Alberta



Joao Silva for The New York Times

A communal well at a Malawi village was contaminated in January by floodwaters that swept away homes and crops.

Many of the world's poorest people, who lack the resources to respond to the impacts of climate change, are likely to suffer the most.

—Joint science academies' statement on sustainability, energy efficiency, and climate protection (May 2007)

MAY 30, 2014

SCIENTISTS CONSIDER NEW NAMES FOR CLIMATE CHANGE

BY ANDY BOROWITZ



NEW HAVEN ([The Borowitz Report](#))—After a report from the Yale Center on Climate Change Communication showed that the term “climate change” elicits relatively little concern from the American public, leading scientists are recommending replacing it with a new term: “You will be burnt to a crisp and die.”

Other terms under consideration by the scientists include “your cities will be ravaged by tsunamis and floods” and “earth will be a fiery hellhole incapable of supporting human life.”

CLIMATE

World's Glaciers Melting Faster Than Ever Before Recorded, Study Finds

BY SAMANTHA PAGE  AUG 5, 2015 1:02PM

SA

Scientific American magazine

22 hrs · 

The Arctic is a portent for climate change, as it is warming at a faster rate than the rest of the planet.



Arctic Sea Ice Dwindles to New Record Winter Low

The polar ice cap is changing fast

SCIENTIFICAMERICAN.COM | BY GAYATHRI VAIDYANATHAN, CLIMATEWIRE



Gentoo penguins stand on rocks on the Antarctic peninsula. Forty-nine billion tons of ice (nearly 45 billion metric tons), is lost here

