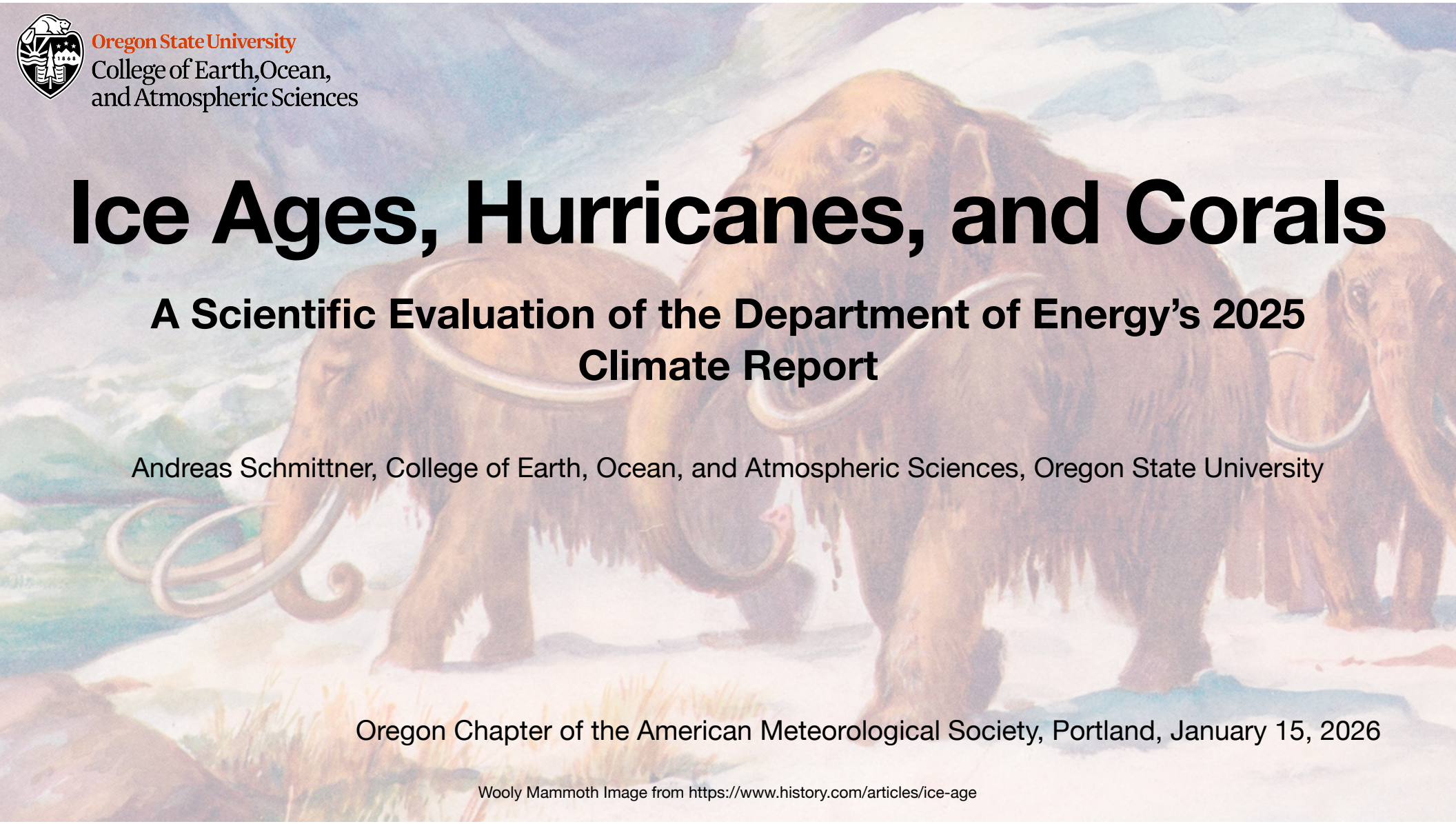


Oregon State University
College of Earth, Ocean, and Atmospheric Sciences

Ice Ages, Hurricanes, and Corals

A Scientific Evaluation of the Department of Energy's 2025 Climate Report

Andreas Schmittner, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University

Oregon Chapter of the American Meteorological Society, Portland, January 15, 2026

Wooly Mammoth Image from https://www.history.com/articles/ice-age

Content

- Personal Introduction and Motivation
- Background Science on Climate Change
- The DOE-Report and Scientists' Response
  - Ice Ages
  - Hurricanes
  - Corals
- Conclusions

What Do You Think About Climate Change?

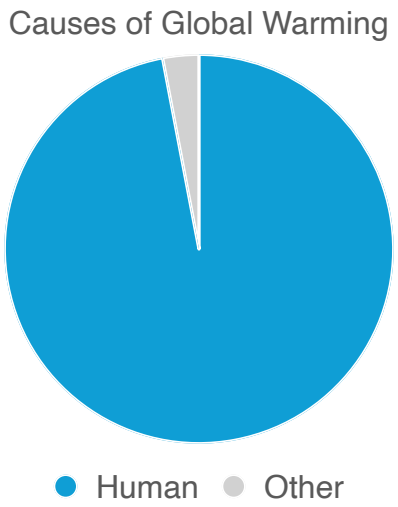
- Is climate changing?
- Cooling, warming, or something else (e.g. cyclical)?
- Causes: natural, human, or both?
- Is is good, bad, or neither?
- Should we do something about it?
- What should we do?

What Do You Think About Climate Change?

Motivation

Scientists

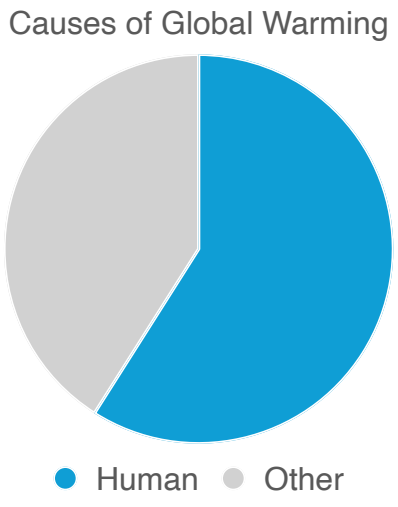
Almost all climate scientists (97%) say global warming is human caused



Myers et al. (2021) https://iopscience.iop.org/article/10.1088/1748-9326/ac2774

US Public

Only 59% of the public believes global warming is caused mostly by humans



https://climatecommunication.yale.edu/visualizations-data/ycom-us/

https://open.oregonstate.education/climatechange/

Introduction to Climate Science

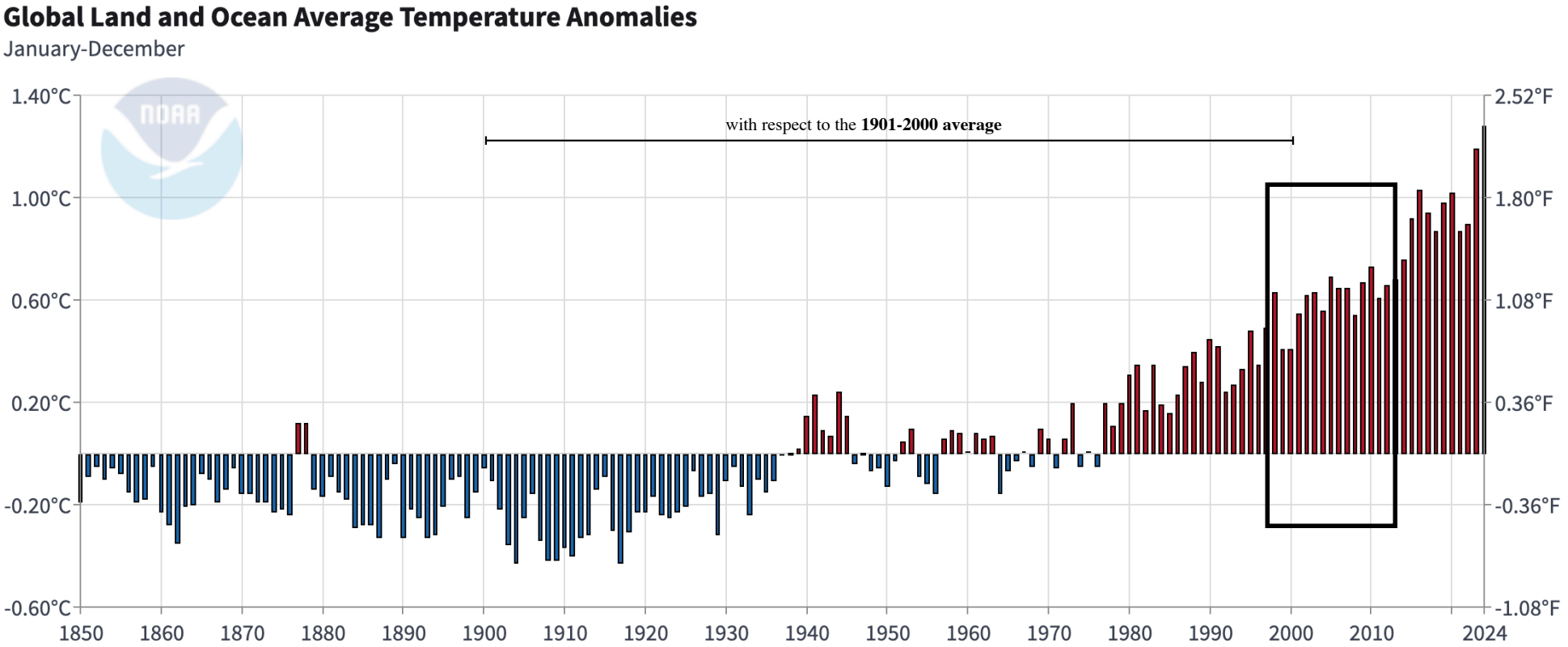
by Andreas Schmittner

This book describes how Earth's climate is changing, how it has been changing in the recent geological past and how it may change in the future. It covers the physical sciences that build the foundations of our current understanding of global climate change such as radiation, Earth's energy balance, the greenhouse effect and the carbon cycle. Both natural and human causes for climate change are discussed. Impacts of climate change on natural and human systems are summarized. Ethical and economical aspects of human-caused climate change and solutions are presented.

Download this book ▼

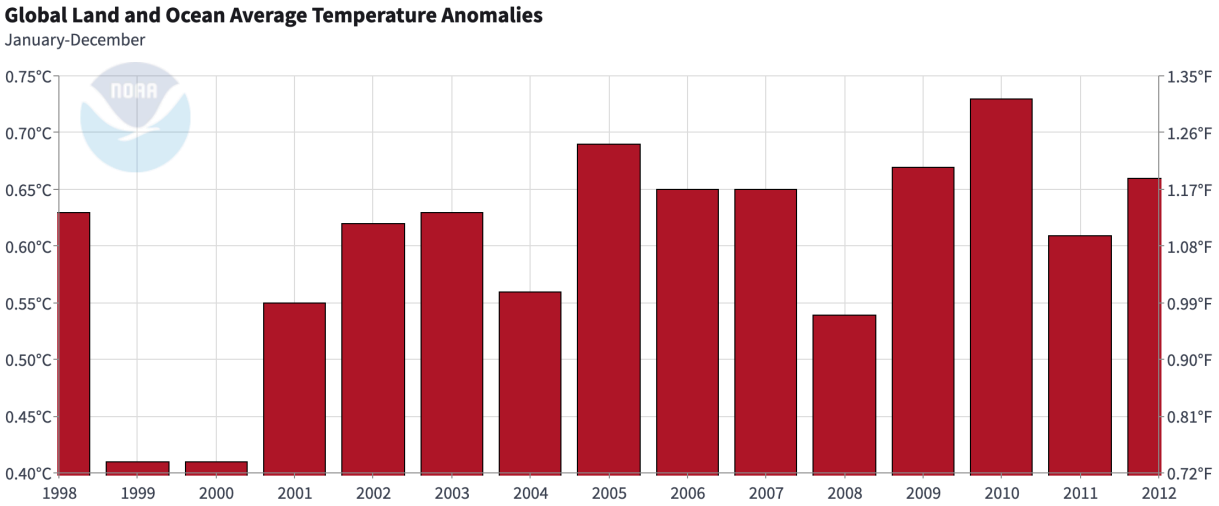
This Presentation

2025 second hottest year on record

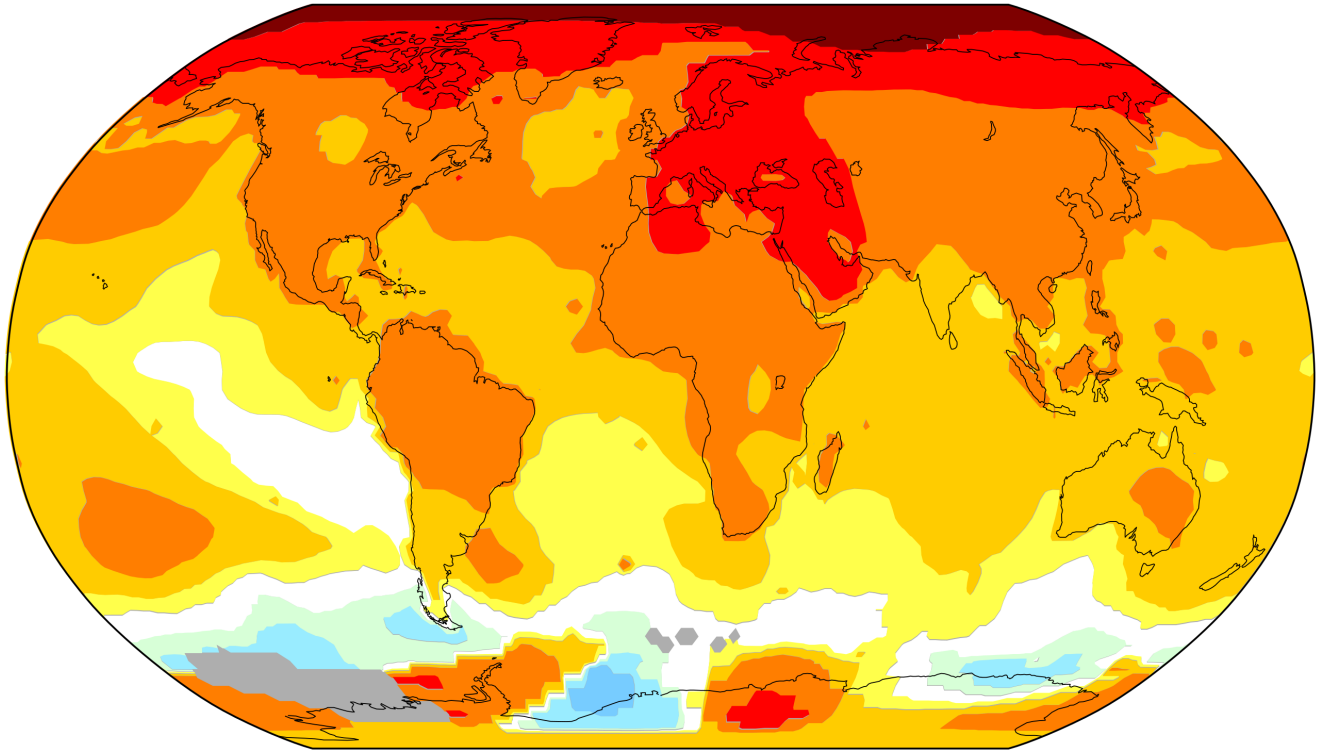


https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/globe/land_ocean/tavg/12/12/1850-2025

Contrarians: “Global Warming Stopped”

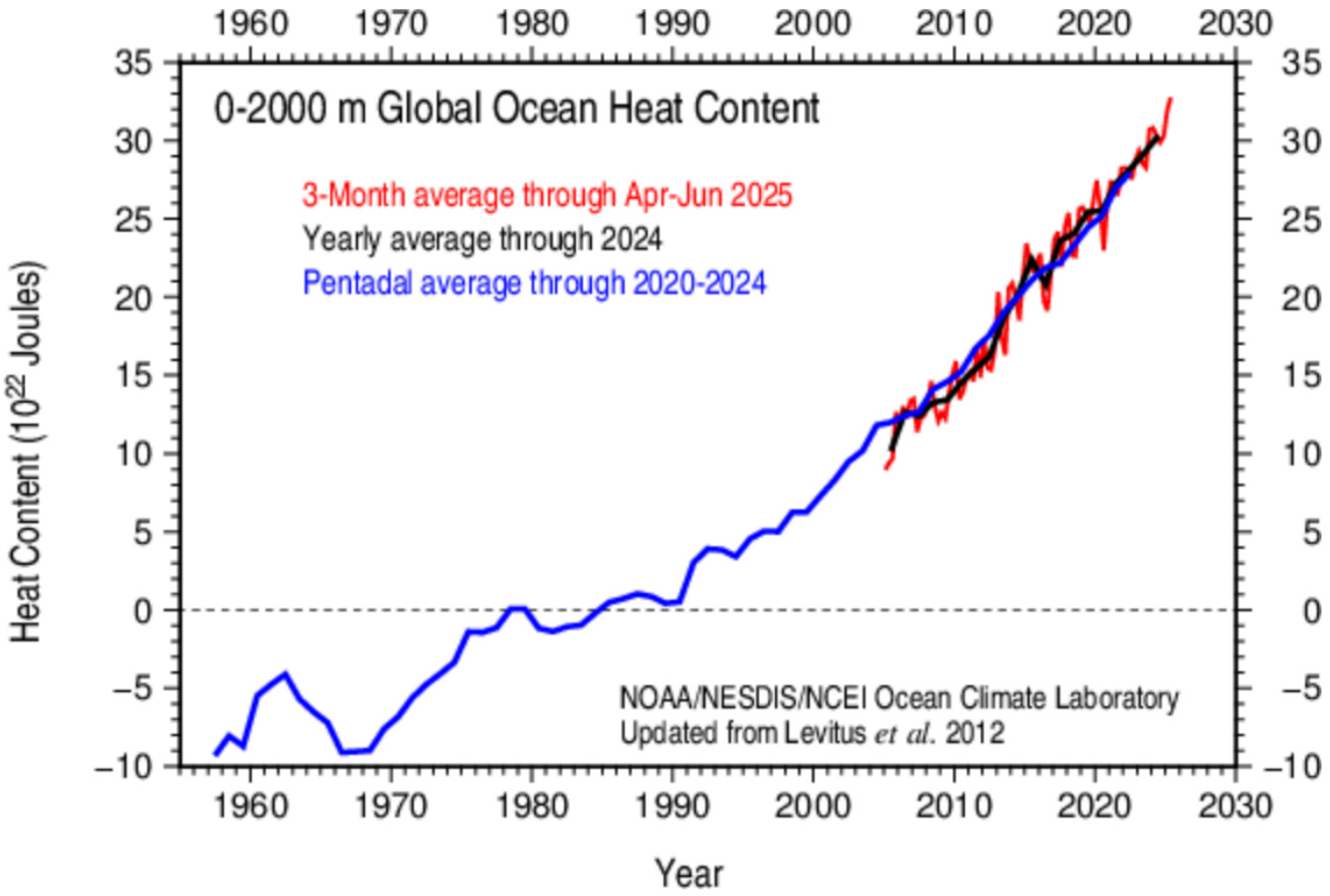


Temperature change over the past 50 years



Trend from 1973 to 2023

-1.0	-0.5	-0.2	+0.2	+0.5	+1.0	+2.0	+4.0°C
-1.8	-0.9	-0.4	+0.4	+0.9	+1.8	+3.6	+7.2°F


0-2000 m Global Ocean Heat Content
3-Month average through Apr-Jun 2025
Yearly average through 2024
Pentadal average through 2020-2024
NOAA/NESDIS/NCEI Ocean Climate Laboratory
Updated from Levitus et al. 2012
Heat Content (10^22 Joules)
Year
1960
1970
1980
1990
2000
2010
2020
2030
35
30
25
20
15
10
5
0
−5
−10

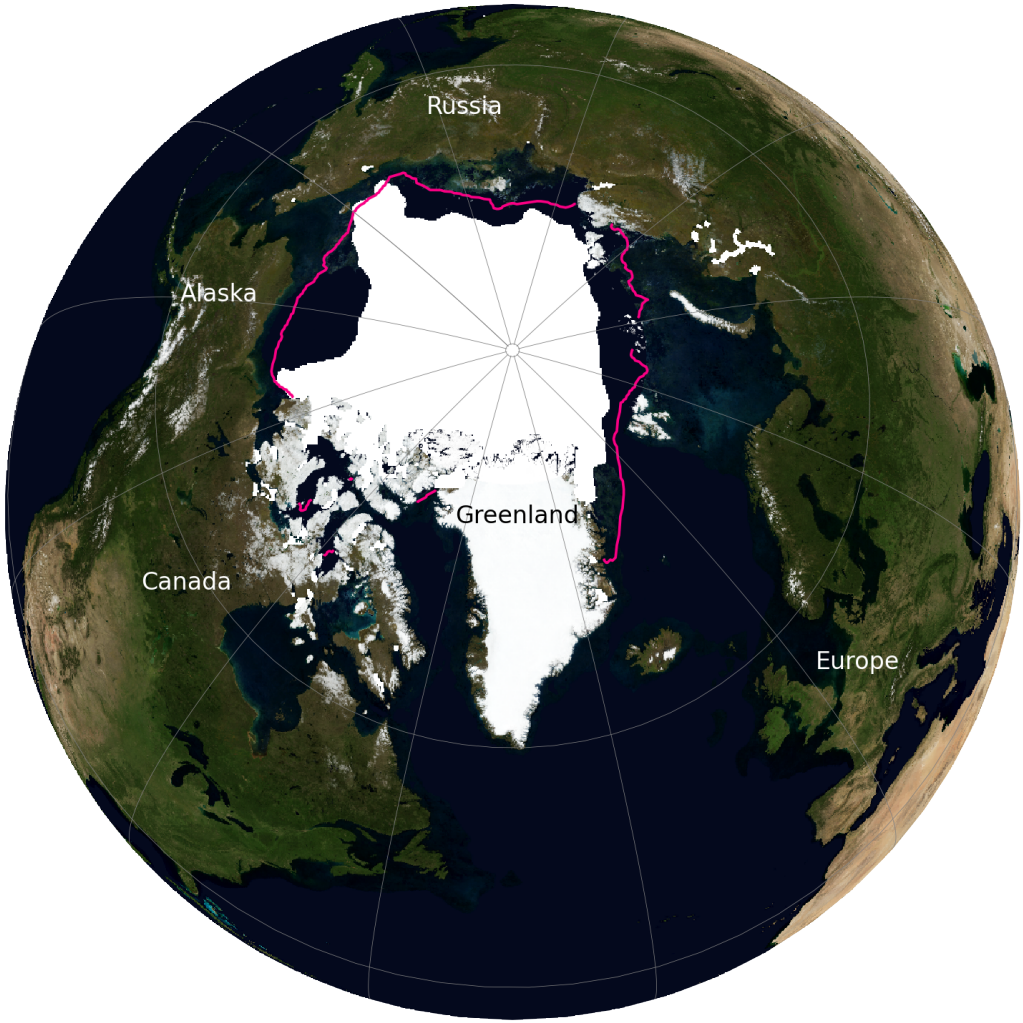
l data

September 1979 Total extent = 7.1 million sq km

median ice edge 1981-2010

https://noaadata.apps.nsidc.org/NOAA/G02135/north/monthly/images/09_Sep/N_197909_extn_blmrbl_hires_v4.0.png

National Snow and Ice Data Center/NASA Earth Observatory



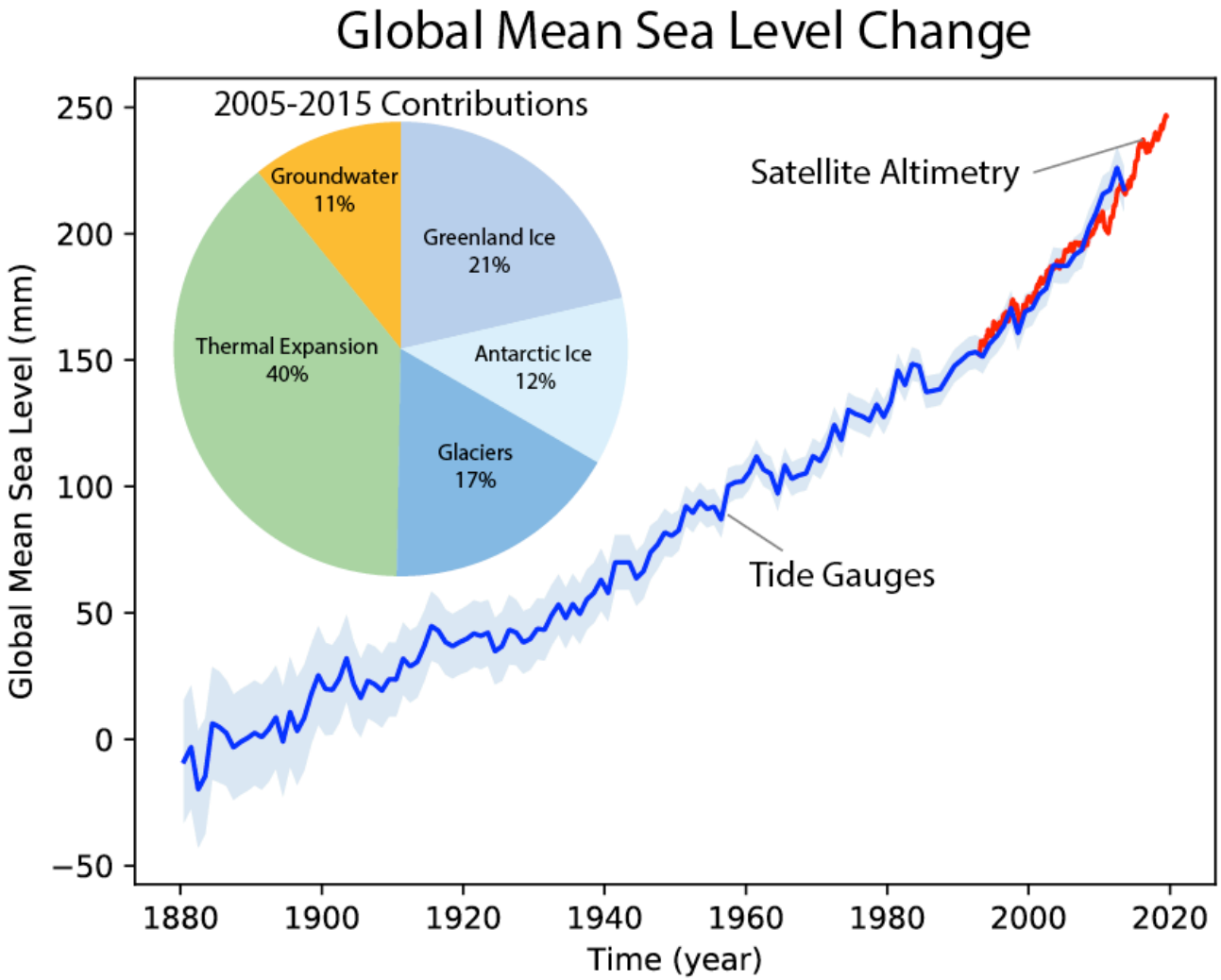
September 2025 Total extent = 4.7 million sq km

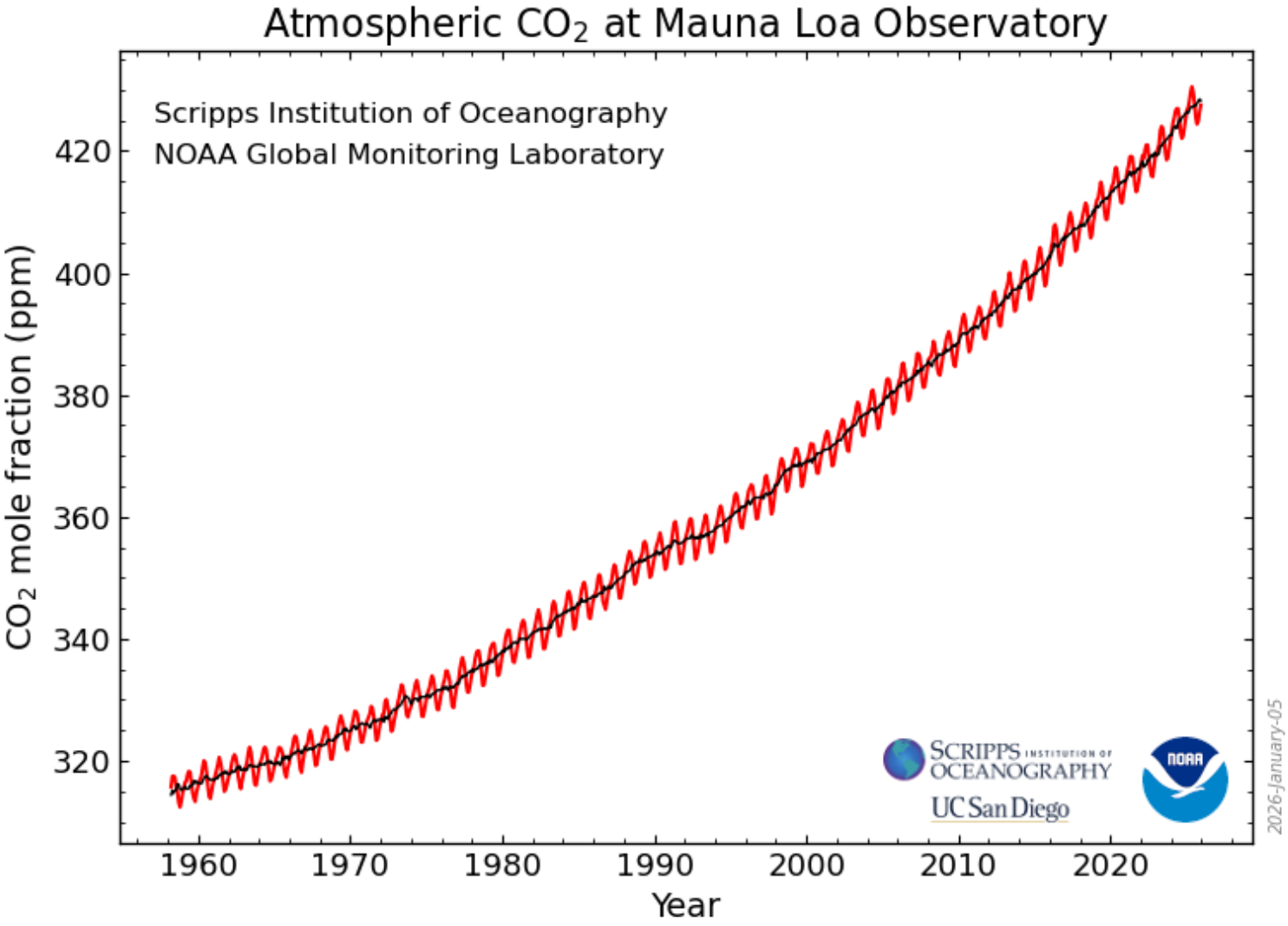
median ice edge 1981-2010

https://noaadata.apps.nsidc.org/NOAA/G02135/north/monthly/images/09_Sep/N_202509_extn_blmrbl_hires_v4.0.png

Figure 7: Muir Glacier in Glacier Bay National Park and Preserve, Alaska. The picture on top is from 1941, that on the bottom from 2004. From the National Snow and Ice Data Center (NSIDC).

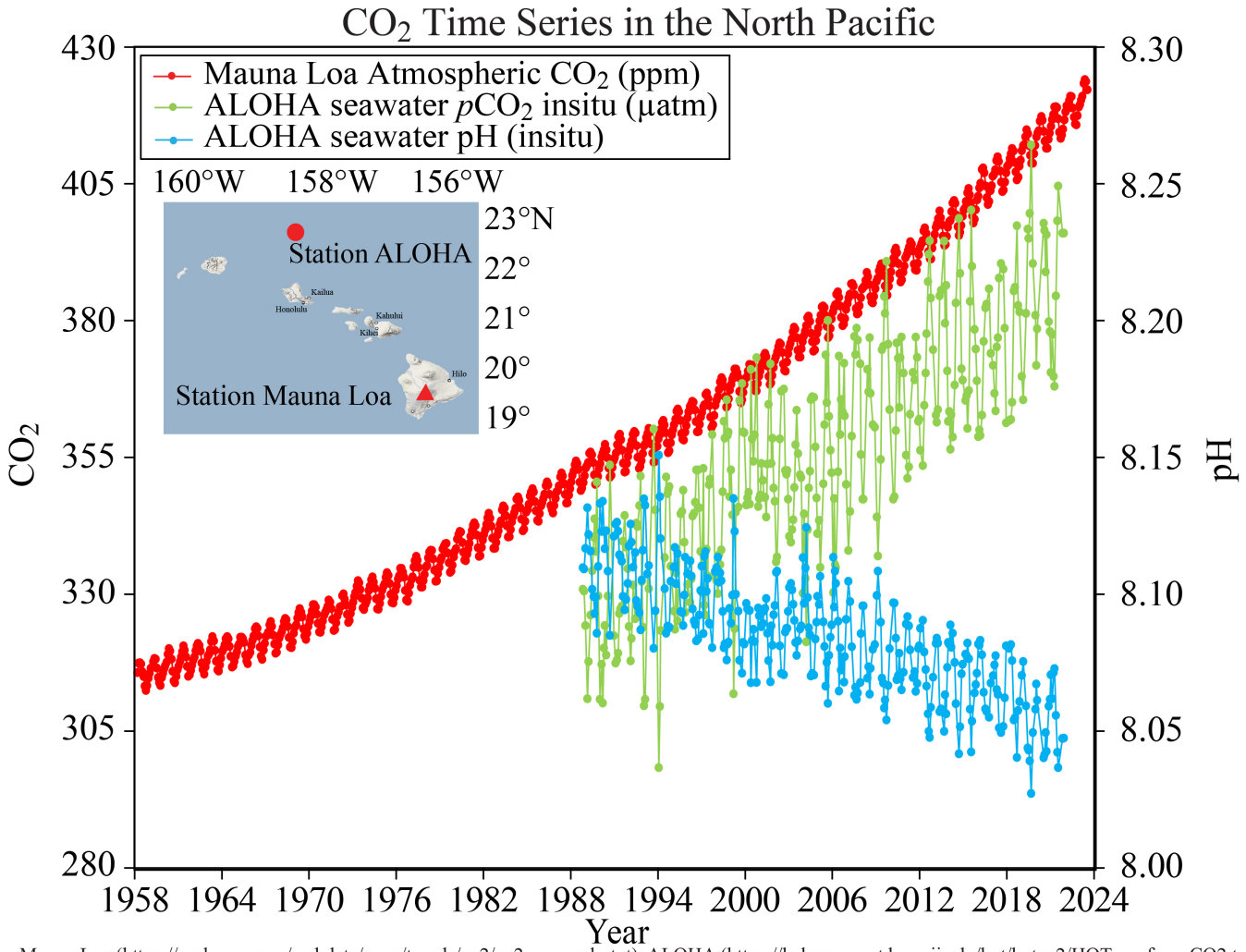
https://open.oregonstate.education/climatechange/chapter/observations/


Global Mean Sea Level Change
2005-2015 Contributions
Groundwater
11%
Greenland Ice
21%
Thermal Expansion
40%
Antarctic Ice
12%
Glaciers
17%
Satellite Altimetry
Tide Gauges
Global Mean Sea Level (mm)
250
200
150
100
50
0
−50
1880
1900
1920
1940
1960
1980
2000
2020
Time (year)



https://gml.noaa.gov/ccgg/trends/

Ocean Acidification



Data: Mauna Loa (https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_mm_mlo.txt) ALOHA (https://hahana.soest.hawaii.edu/hot/hotco2/HOT_surface_CO2.txt)
ALOHA pH & pCO_2 are calculated at in-situ temperature from DIC & TA (measured from samples collected on Hawaii Ocean Times-series (HOT) cruises)
using co2sys (Pelletier, v25b06) with constants: Lueker et al. 2000, KSO4: Dickson, Total boron: Lee et al. 2010, & KF: seacarb

https://www.pmel.noaa.gov/co2/file/Hawaii%20Carbon%20Dioxide%20Time-Series

Poll Results

DOE Report

Background

On July 29, 2025, the Department of Energy (DOE) published a report entitled A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate, evaluating existing peer-reviewed literature and government data on climate impacts of Greenhouse Gas (GHG) Emissions and providing a critical assessment of the conventional narrative on climate change.

Among the key findings, the report concludes that carbon dioxide (CO_2) -induced warming appears to be less damaging economically than commonly believed, and that aggressive mitigation strategies could be more harmful than beneficial. Additionally, the report finds that U.S. policy actions are expected to have undetectably small direct impacts on the global climate and any effects will emerge only with long delays.

The report was developed by the 2025 Climate Working Group, a group of five independent scientists assembled by Energy Secretary Chris Wright with diverse expertise in physical science, economics, climate science and academic research.

Climate Working Group:

John Christy, Ph.D.
Judith Curry, Ph.D.
Steven Koonin, Ph.D.
Ross McKitrick, Ph.D.
Roy Spencer, Ph.D.

140 pages

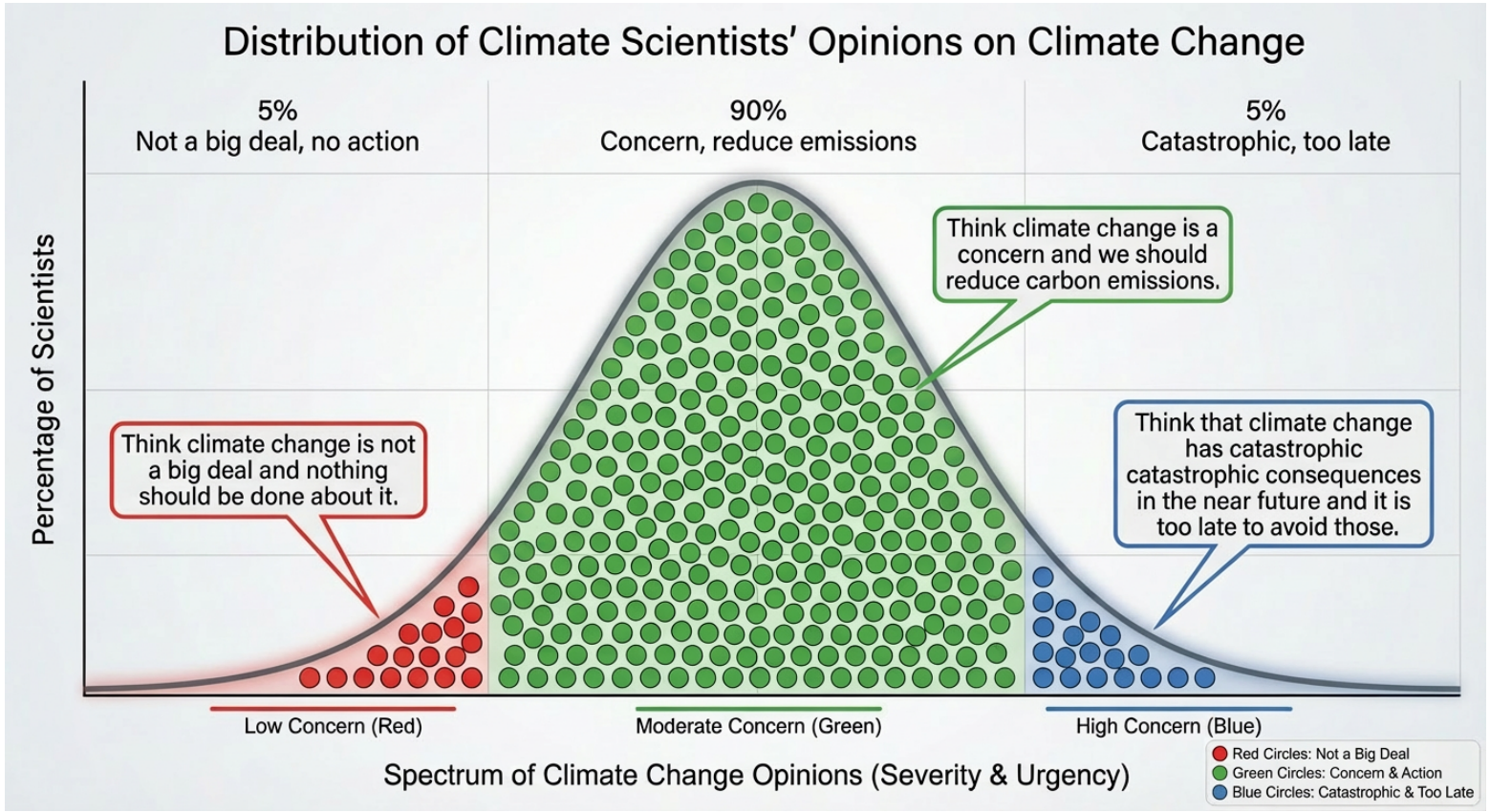
A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate

https://www.energy.gov/topics/climate

Report Name	Number of Authors	Number of Pages	Number of References
IPCC AR6 (full report, all WGs)	721 (across 3 WGs)	~8,000 pages (combined)	~46,500+ (combined)
Fifth U.S. National Climate Assessment (NCA5)	~500 authors & 250 contributors	~1,800 pages	~8,200+ references
Recent DOE Climate Report	5 authors	~140-151 pages	~350 references (approx. 10% self-cited)

Table created by Google AI. Prompt: please list in a table the number of authors, numbers of pages, and the numbers of references in the following climate reports: the most recent full IPCC assessment report (not just the synthesis report), the most recent US National report, and the recent DOE climate report

Author numbers of IPCC and DOE verified by myself. https://www.ipcc.ch/2025/08/18/pr-ar7-authors/


Distribution of Climate Scientists' Opinions on Climate Change
5%
Not a big deal, no action
90%
Concern, reduce emissions
5%
Catastrophic, too late
Percentage of Scientists
Think climate change is a concern and we should reduce carbon emissions.
Think climate change is not a big deal and nothing should be done about it.
Think that climate change has catastrophic catastrophic consequences in the near future and it is too late to avoid those.
Low Concern (Red)
Moderate Concern (Green)
High Concern (Blue)
Spectrum of Climate Change Opinions (Severity & Urgency)
Red Circles: Not a Big Deal
Green Circles: Concern & Action
Blue Circles: Catastrophic & Too Late

DOE Report

Summary

A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate

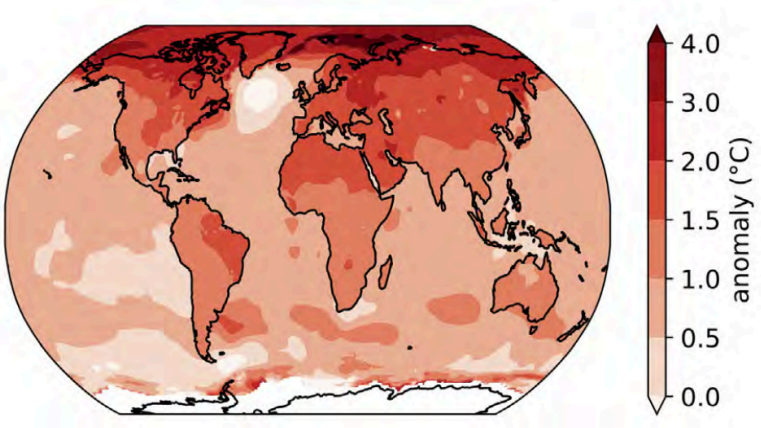
This report:

- Reviews scientific certainties and uncertainties in how anthropogenic emissions of CO_2 and other GHGs have affected, or will affect, the Nation's climate, extreme weather events, and metrics of societal well-being.
- Assesses the near-term impacts of elevated concentrations of CO_2, including enhanced plant growth and reduced ocean alkalinity.
- Evaluates data and projections regarding long-term impacts of elevated concentrations of CO_2, including estimates of future warming.
- Finds that claims of increased frequency or intensity of hurricanes, tornadoes, floods, and droughts are not supported by U.S. historical data.
- Asserts that CO_2-induced warming appears to be less damaging economically than commonly believed, and that aggressive mitigation policies could prove more detrimental than beneficial.
- Finds that U.S. policy actions are expected to have undetectably small direct impacts on the global climate and any effects will emerge only with long delays.

Climate Experts' Review of the DOE Climate Working Group Report

Comment submitted to the U.S. Department of Energy, docket number DOE-HQ-2025-0207, in response to their report "A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate"

As detailed in the over 400 pages of our expert review, the DOE CWG Report exhibits pervasive problems with misrepresentation and selective citation of the scientific literature, cherry-picking of data, and faulty or absent statistics.



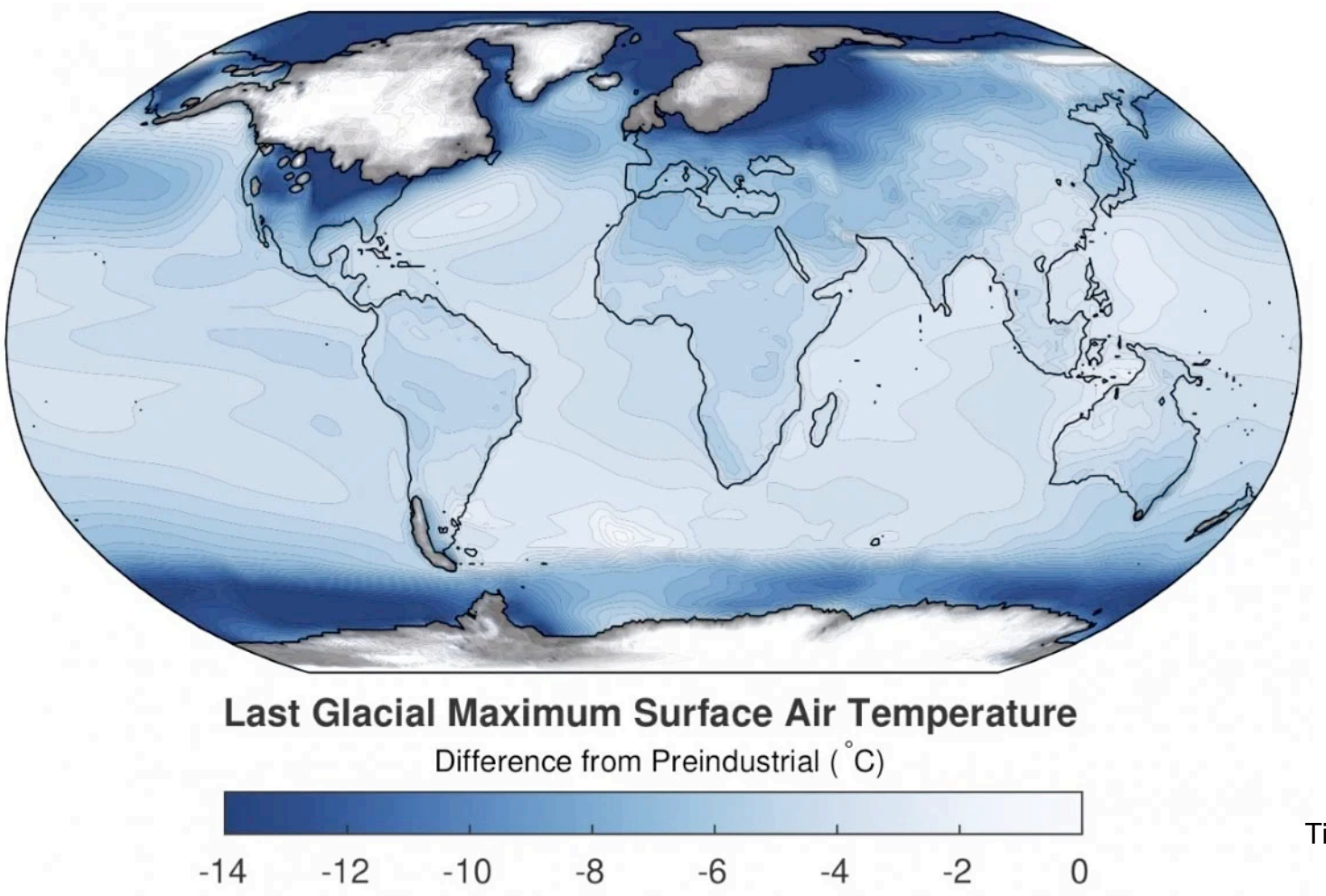
85 Scientists

450 pages

This report may be cited as:
Dessler, A.E. and R.E. Kopp (Ed.). (2025). *Climate Experts' Review of the DOE Climate Working Group Report*. DOI: 10.22541/essoar.175745244.41950365/v2,
https://doi.org/10.22541/essoar.175745244.41950365/v2

https://essopenarchive.org/users/260056/articles/1330312-climate-experts-review-of-the-doe-climate-working-group-report

Ice Ages

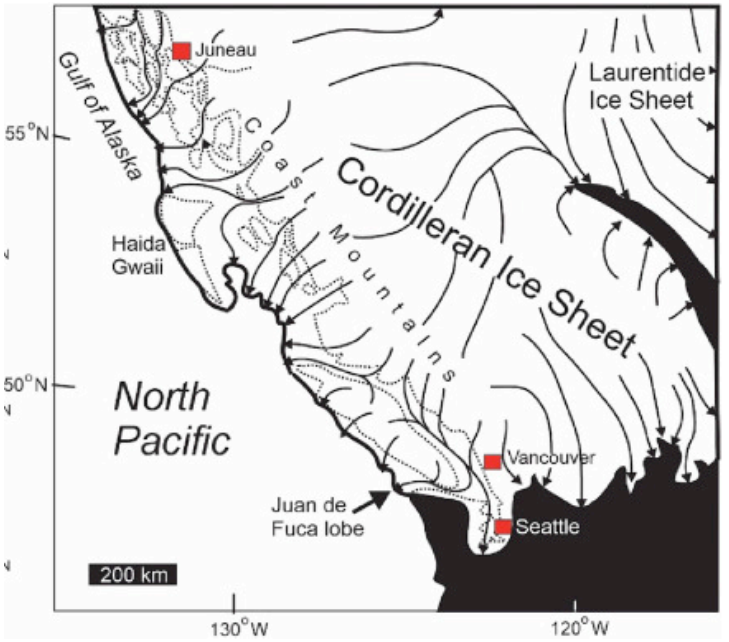


Tierney et al. (2020)

https://scitechdaily.com/how-cold-was-the-last-ice-age-researchers-have-now-mapped-the-temperature-differences-across-the-globe/

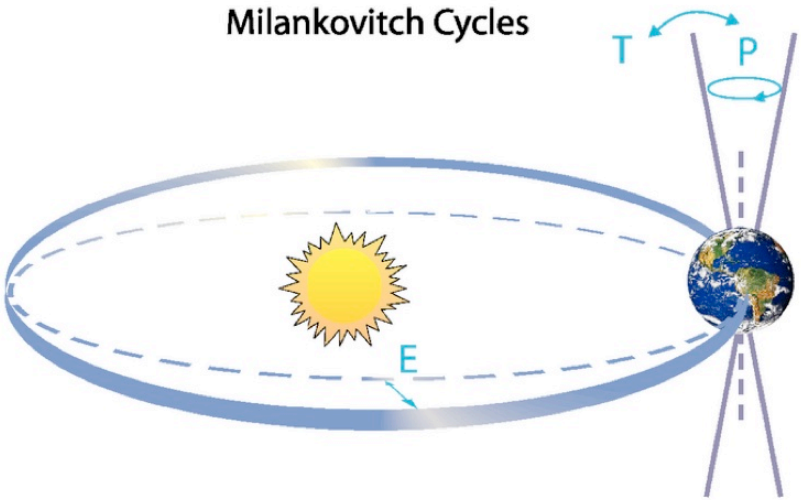
Wallowa Moraines

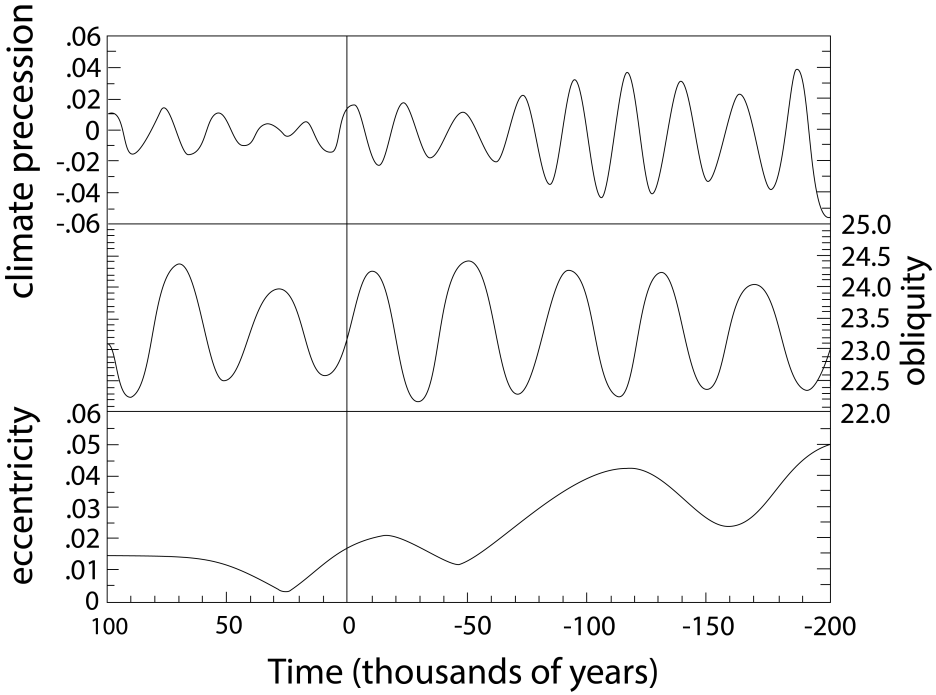
https://open.oregonstate.education/climatechange/chapter/observations/



Mann and Gaglioti (2024)

https://www.sciencedirect.com/science/article/pii/S0012825224001090#bb0145

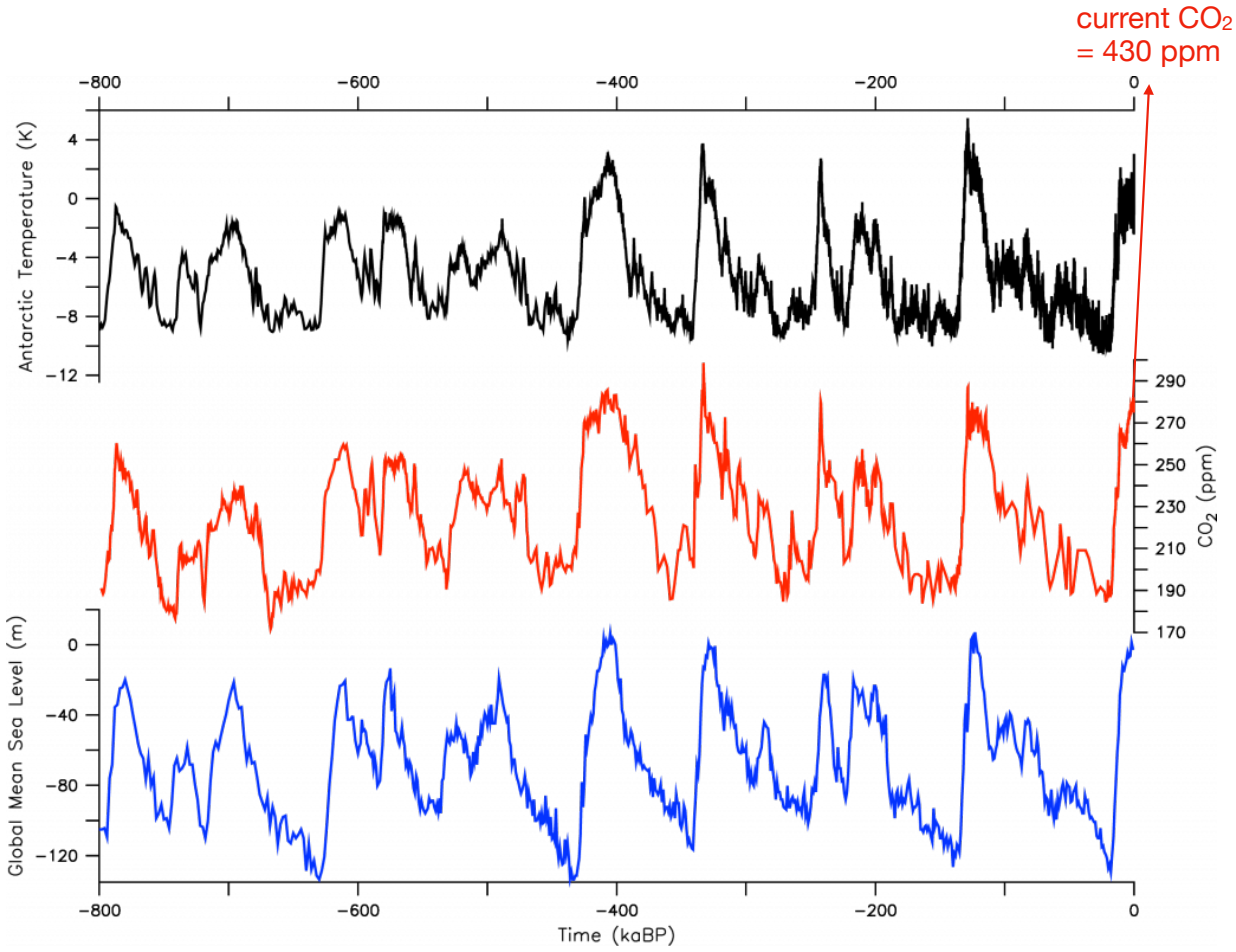

Milankovitch Cycles
T
P
E

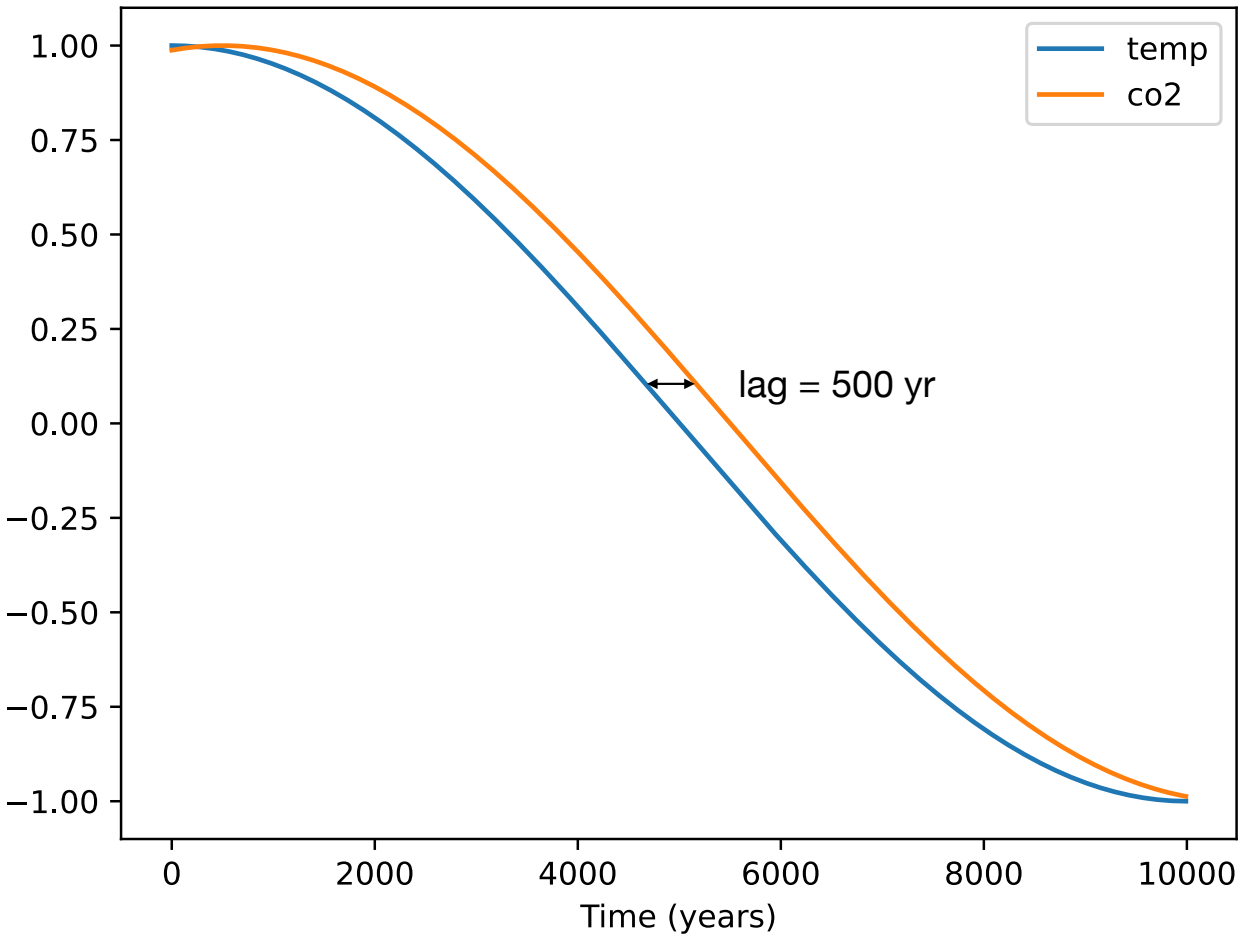

climate precession
.06
.04
.02
0
-.02
-.04
-.06
obliquity
25.0
24.5
24.0
23.5
23.0
22.5
22.0
eccentricity
.06
.05
.04
.03
.02
.01
0
100
50
0
-50
-100
-150
-200
Time (thousands of years)

Ice Ages

DOE Report

"An application to the well-known Vostok ice core data revealed an error in Al Gore's documentary *An Inconvenient Truth*. Gore showed the data and drew attention to the coherence of temperature and CO2 changes over a 440,000 year span, which he asserted was due to CO2 driving temperature changes. But temperature changes can also affect atmospheric CO2 levels. Davidson *et al.* (2015) examined the series and found that temperature Granger causes CO2 but not the reverse. In other words on the time scales represented in the Vostok data, the coherence in the series is primarily due to the influence of temperature on CO2 levels, not the feedback of CO2 levels on temperature."





Transition is much longer (10,000 years) than lag. This does not mean that CO_2 does not influence temperatures.

From time series analysis alone we cannot say which variable influences which by how much.

Plus, lag is within errors of age uncertainty for most of the ice core record.

Ice Ages

Paleoclimate Science

- We know that ocean temperature impacts CO_2.
- Colder water is more soluble and can hold more CO_2.
- However, this effect can only explain 25% to 50% of CO_2 variations during the ice ages.
- Other processes, such as iron fertilization from increased dust supply, and ocean circulation changes explain the other 50% to 75%.

Khatiwala, S., A. Schmittner and J. Muglia (2019)
Air-sea disequilibrium enhances ocean carbon storage during glacial periods
Science Advances, 5(6), doi: 10.1126/sciadv.aaw4981

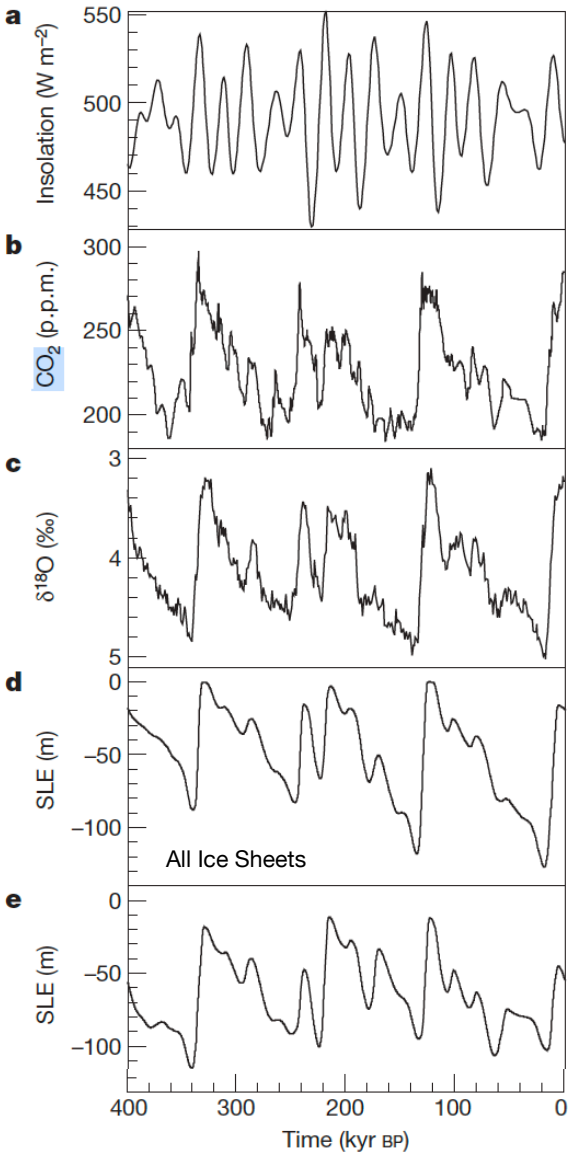
Ice Ages

Paleoclimate Science

- CO_2 variations impacted temperatures during ice ages due to the greenhouse effect
- They caused about half of the global warming (4-5 degrees C)

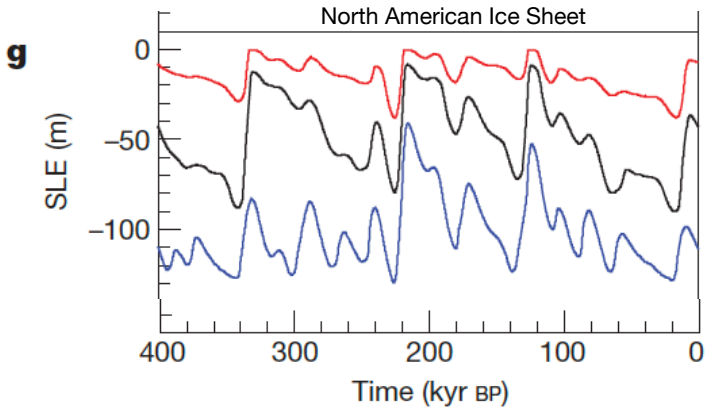
Our response to DOE report:
“This section is contrary to the vast majority of paleoclimate literature, which has established that atmospheric CO2 has an important influence on global temperatures during past ice-age cycles. For example, radiative forcing of CO2 and ice sheets similarly contribute to colder temperatures during the Last Glacial Maximum (Broccoli, 2000; Broccoli & Manabe, 1987; Hansen et al., 1984; Köhler et al., 2010; Schmittner et al., 2011; Weaver et al., 1998) and simulations of glacial cycles with constant CO2 underestimate ice volume changes (Abe-Ouchi et al., 2013; Ganopolski & Calov, 2011). This should be mentioned here, since otherwise it will leave the reader with the false impression that CO2 variations are unimportant for ice age climate changes.“

Effect of CO_2 on Ice Volume Changes



Variable CO_2

CO_2 = 220 ppm



CO_2 = 260 ppm
CO_2 = 220 ppm
CO_2 = 160 ppm

Abe-Ouchi et al. (2013)

https://www.nature.com/articles/nature12374

Ice Ages

Paleoclimate Science

- Another issue is that the Vostok ice core record represents regional temperatures in Antarctica
- Thus, the lead-lag relationship does not tell us anything about global temperatures
- A reconstruction of global temperatures over the last deglaciation shows a lead of CO_2 with respect to global temperature.

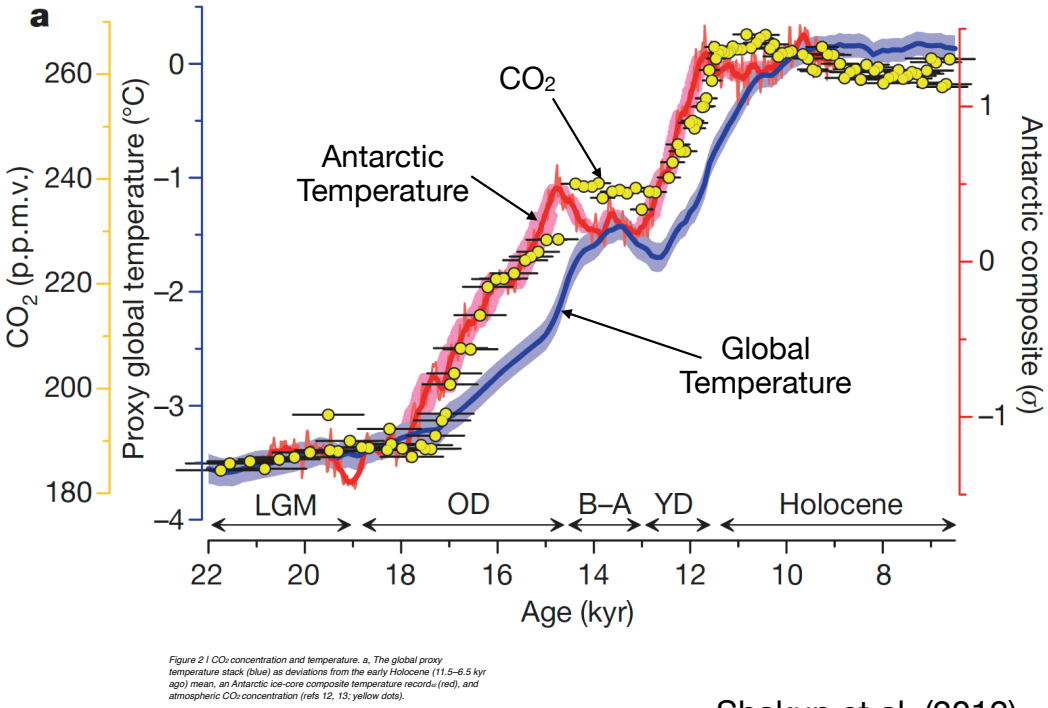


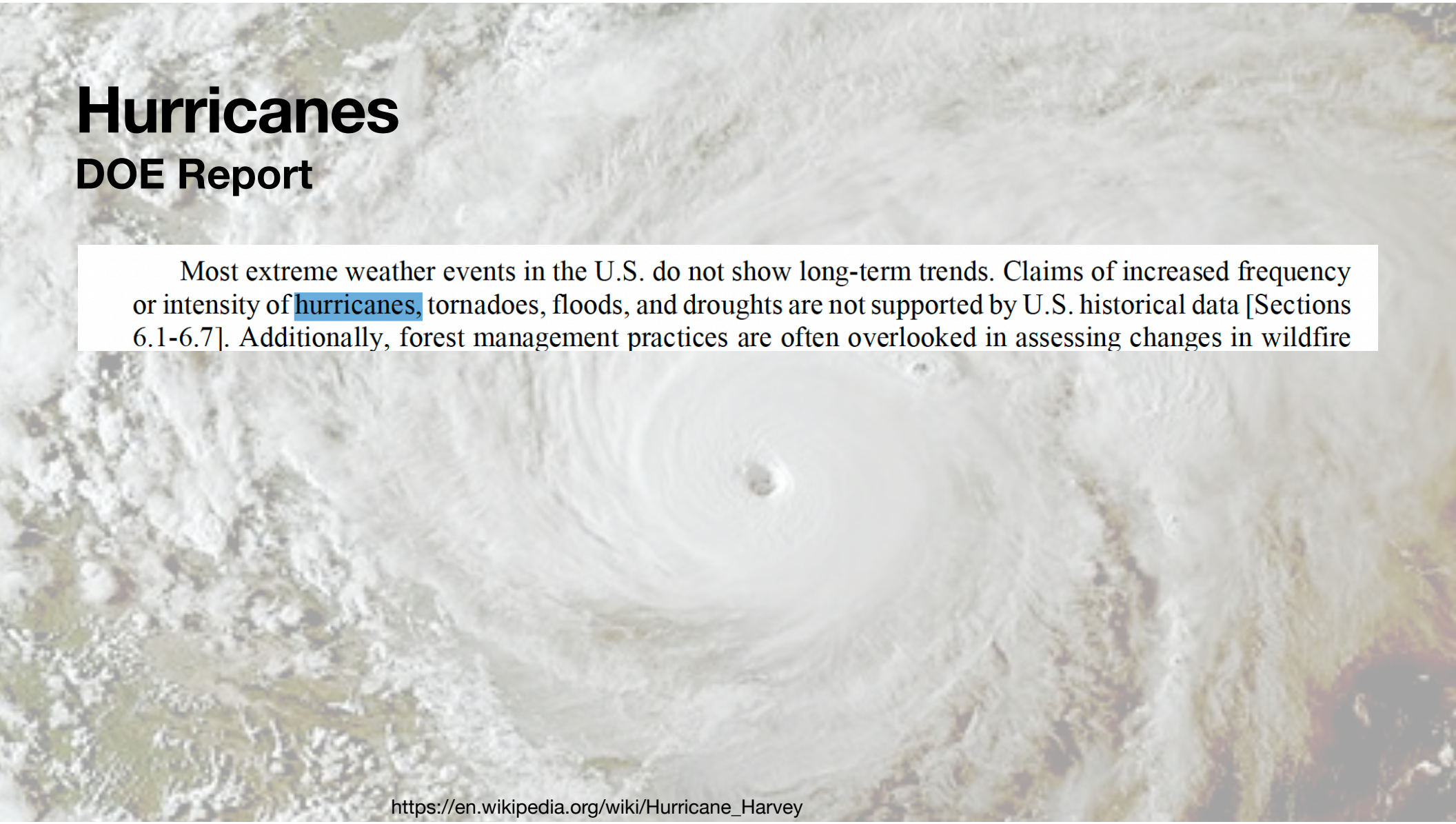
Figure 2 | CO_2 concentration and temperature. a, The global proxy temperature stack (blue) as deviations from the early Holocene (11.5–6.5 kyr ago) mean, an Antarctic ice-core composite temperature record[46] (red), and atmospheric CO_2 concentration (refs 12, 13; yellow dots).

Shakun et al. (2012)

Hurricanes

DOE Report

Most extreme weather events in the U.S. do not show long-term trends. Claims of increased frequency or intensity of hurricanes, tornadoes, floods, and droughts are not supported by U.S. historical data [Sections 6.1-6.7]. Additionally, forest management practices are often overlooked in assessing changes in wildfire



https://en.wikipedia.org/wiki/Hurricane_Harvey

Hurricanes

Scientists

Although no trends in the number of hurricanes making landfall in the U.S. have been detected (and none were expected), hurricanes are becoming more hazardous. They are reaching higher intensity and intensifying more quickly. Higher sea levels are making their coastal flooding more extensive and damaging, and atmospheric warming is leading them to produce more rainfall, which is increasing their inland impacts.

https://en.wikipedia.org/wiki/Hurricane_Harvey

Coral Reefs

- 0.2% of seabed
- 30% of species
- $2.7 trillion per year goods and services provided
- 500 million people rely on coral reefs
- Food, income (fisheries, tourism), coastal protection from storms
- Cancer treatments

Coral Reefs

DOE Report

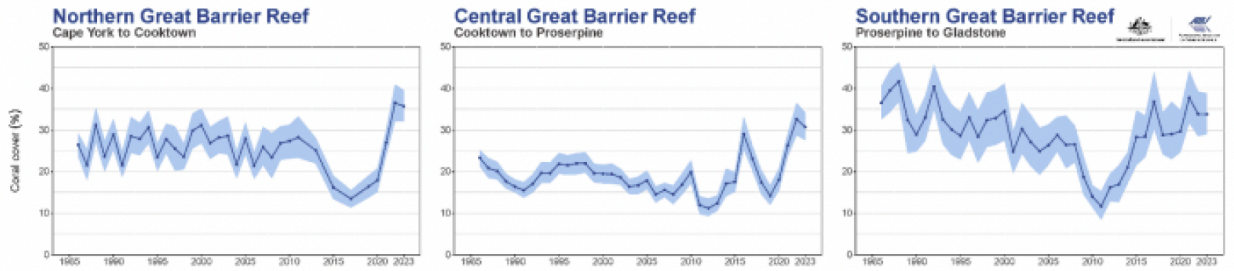


Figure 2.4 Hard coral cover of three regions of the Great Barrier Reef 1985 to 2023. Source: AIMS 2023.

"**Executive Summary:** Elevated concentrations of CO_2 … make the oceans less alkaline (lower the pH). That is possibly detrimental to coral reefs, although the recent rebound of the Great Barrier Reef suggests otherwise [Section 2.2]."

"The most recent annual summary of GBR conditions from the Australian Institute of Marine Science indicates that coral production has rebounded strongly (AIMS, 2023). Figure 2.4 shows the results of the AIMS surveys of hard coral cover, expressed as a percentage of the reef area. Much of the decline in the GBR before 2011 turned out to be due to intense tropical cyclone activity (Beeden *et al.*, 2015) as well as a string of marine heatwaves, agricultural runoff and invasive species (Woods Hole, 2023). Given the reported declines in GBR calcification between 1990 and 2009 and the continued increase in atmospheric CO2 levels, the rebound has surprised some observers."

"In summary, ocean life is complex and much of it evolved when the oceans were acidic relative to the present. The ancestors of modern coral first appeared about 245 million years ago. CO2 levels for more than 200 million years afterward were many times higher than they are today. Much of the public discussion of the effects of ocean "acidification" on marine biota has been one-sided and exaggerated."

Extent and Severity of the 2022 Mass Coral Bleaching Event

Australian Government | Australian Institute of Marine Science

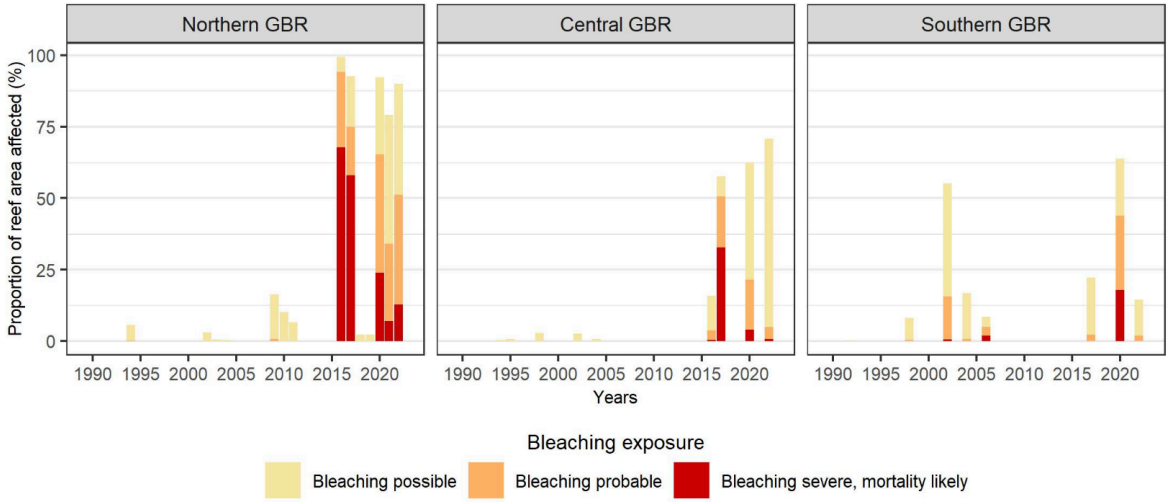


Figure 6: Comparison of accumulated heat stress from 1990 to 2022. Data are the proportion of reefs in each reporting region (Northern, Central and Southern GBR) exposed to heat stress where bleaching is possible (4 – 6 DHW), where bleaching is probable (6 – 8 DHW) and where severe bleaching and coral mortality are likely (>8 DHW).

A point of concern, however, is the increasing frequency and extent of bleaching events. Mass bleaching events are occurring almost annually and pose significant risks to the future condition of the coral reefs in the GBR.

https://www.aims.gov.au/sites/default/files/2022-08/AIMS_LTMP_Report_on%20GBR_coral_status_2021_2022_040822F3.pdf

Coral Reefs

Scientists

- Scientists Confirm Largest Coral Bleaching Event on Record Affecting Nearly 84% of World's Reefs
- Bleaching is when Coral expels their symbiotic algae (zooxanthella) due to warm temperatures, which causes color change and can lead to death of coral if repeated

https://open.oregonstate.education/climatechange/chapter/impacts/

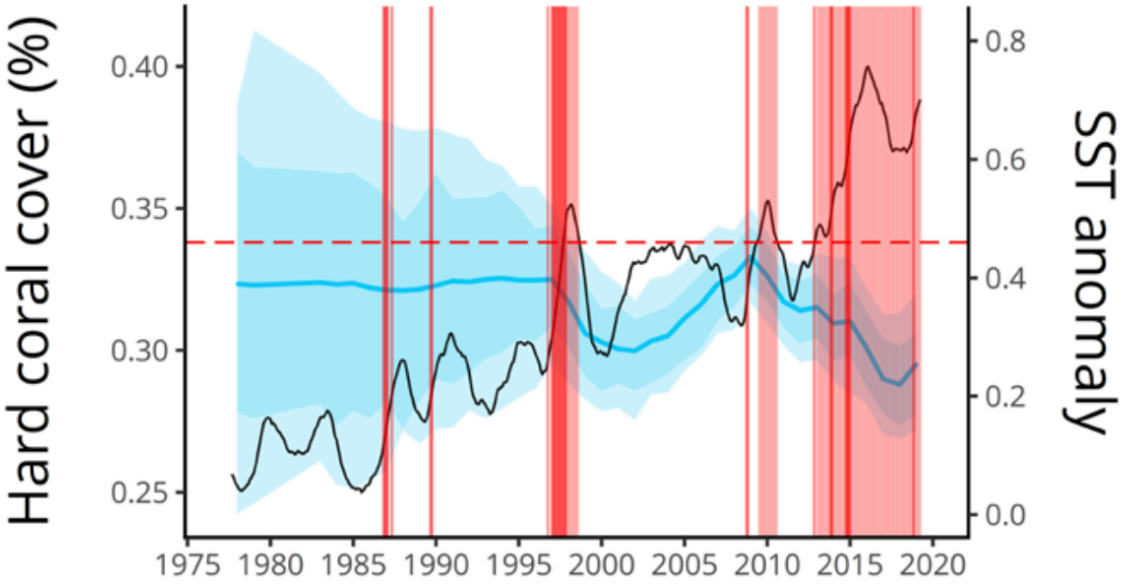
https://www.coralreefwatch.noaa.gov/satellite/research/coral_bleaching_report.php

https://earth.org/year-in-review-the-biggest-climate-headlines-of-2025/

Coral Reefs

Scientists

The report found that between 2009 and 2018 there was a progressive loss of about 14% of the coral from the world's coral reefs



Global coral cover.

GCRMN
Global Coral Reef Monitoring Network

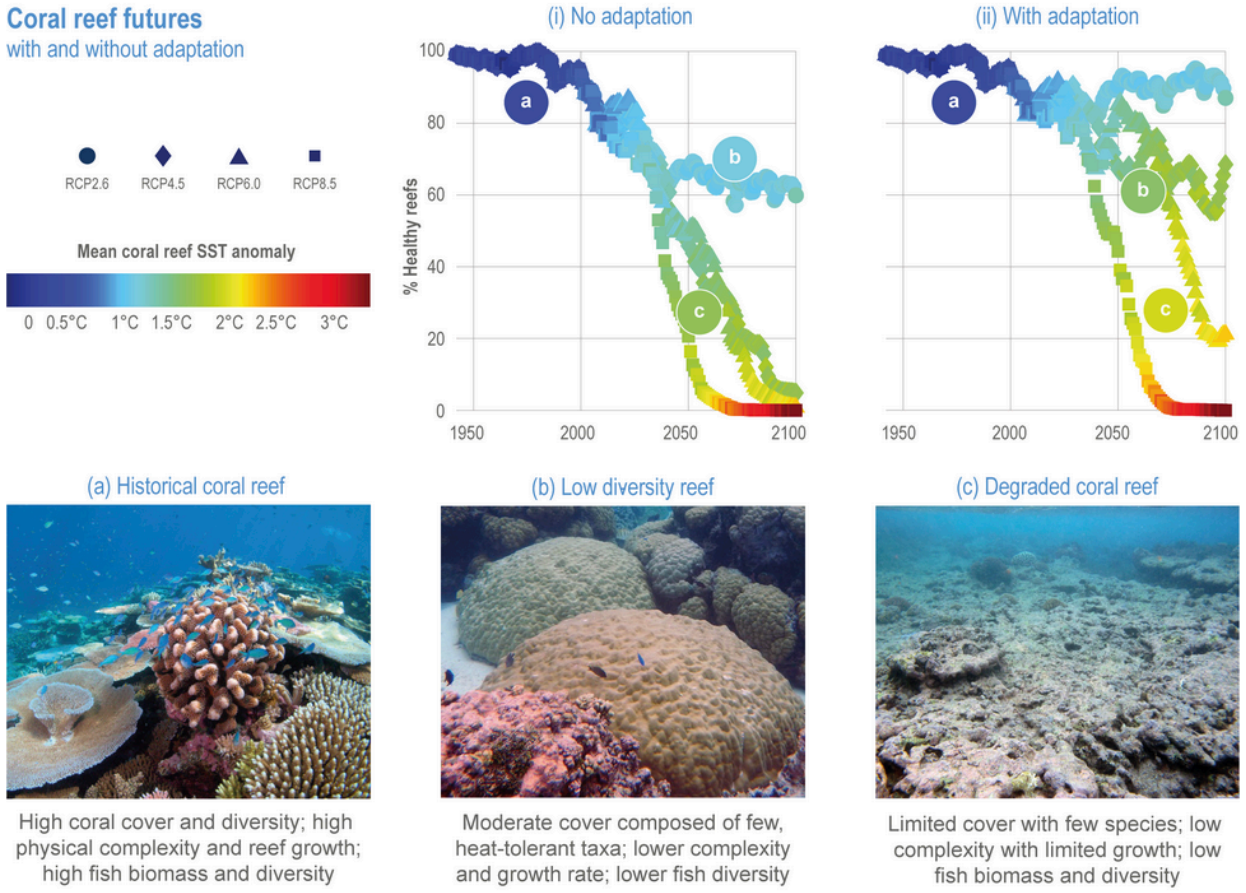
Figure 2: Representation of the trend in global average cover of live coral (blue line and 80/95% credibility ribbons) overlaid with the Sea Surface Temperature (SST) anomaly from 1977 to 2020 (black line: 18 month rolling mean smoothed).

https://gcrmn.net/wp-content/uploads/2022/05/Status-of-Coral-Reefs-of-the-World-2020-Summary-for-Policymakers.pdf

Coral Reefs

IPCC Report

- Dire projections
- 70-90% decline for 1.5 deg C global warming
- 99% for 2 deg C



https://www.ipcc.ch/report/ar6/wg2/downloads/figures/IPCC_AR6_WGII_Figure_3_013.png

So, are corals okay?

A growing number of studies have reported regional scale changes in coral calcification and mortality that are consistent with the scale and impact of ocean warming and acidification when compared to local factors such as declining water quality and overfishing (Hoegh-Guldberg et al., 2007). The abundance of reef building corals is in rapid decline in many Pacific and Southeast Asian regions (*very high confidence*, 1 to 2% per year for 1968–2004; Bruno and Selig, 2007). Similarly, the abundance of reef-building corals has decreased by more than 80% on many Caribbean reefs (1977–2001; Gardner et al., 2003), with a dramatic phase shift from corals to seaweeds occurring on Jamaican reefs (Hughes, 1994). Tropical cyclones, coral predators, and thermal stress-related coral bleaching and mortality have led to a decline in coral cover on the Great Barrier Reef by about 51% between 1985 and 2012 (Figure CR-1E and F). Although less well documented, benthic invertebrates other than corals are also at risk (Przeslawski et al., 2008). Fish biodiversity is threatened by the permanent degradation of coral reefs, including in a marine reserve (Jones et al., 2004).

Future impacts of climate-related drivers (ocean warming, acidification, sea level rise as well as more intense tropical cyclones and rainfall events) will exacerbate the impacts of non-climate–related drivers (*high confidence*). Even under optimistic assumptions regarding corals being able to rapidly adapt to thermal stress, one-third (9 to 60%, 68% uncertainty range) of the world's coral reefs are projected to be subject to long-term degradation (next few decades) under the Representative Concentration Pathway (RCP)3-PD scenario (Frieler et al., 2013). Under the RCP4.5 scenario, this fraction increases to two-thirds (30 to 88%, 68% uncertainty range). If present-day corals have residual capacity to acclimate and/or adapt, half of the coral reefs may avoid high-frequency bleaching through 2100 (*limited evidence*, *limited agreement*; Logan et al., 2014). Evidence of corals adapting rapidly, however, to climate change is missing or equivocal (Hoegh-Guldberg, 2012).

https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-CCboxes_FINAL.pdf

Coral Scientists:

Ove Hoegh-Guldberg https://www.youtube.com/watch?v=8DKxpUFYmnA

Terry Hughes https://www.youtube.com/watch?v=kcQ5A1jlahw

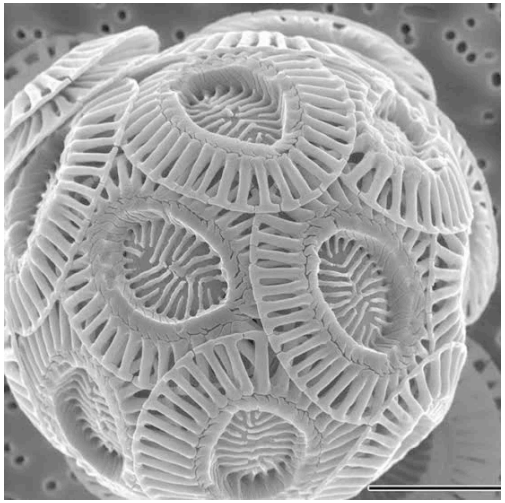
Mark Hixon https://www.youtube.com/watch?v=YiMTGAbCRV8

Ocean Acidification

- CO_2 enters ocean and reacts with sea water to form carbonic acid
- This decreases the pH, which makes it harder for organisms to build calcium carbonate shells, and makes it easier for existing $CaCO_3$ to dissolve

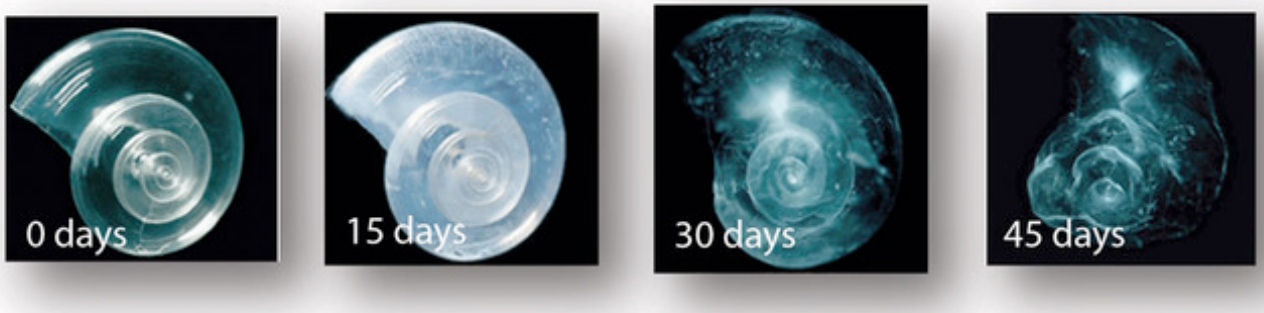
Pteropods

Coccolithophores



Foraminifera

Pteropods



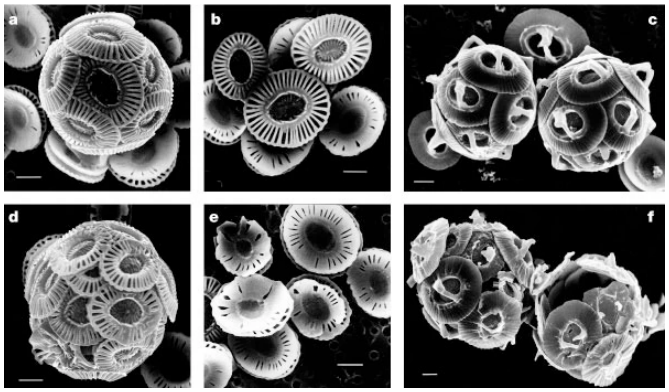
The photos below show that a pteropod's shell dissolves over 45 day when placed in sea water with pH and carbonate levels projected for the year 2100.

https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%253F

Coccolithophorids

$CO_2 = 300$ ppm

$CO_2 = 780–850$ ppm



Riebesell et al. (2000)

https://www.nature.com/articles/35030078

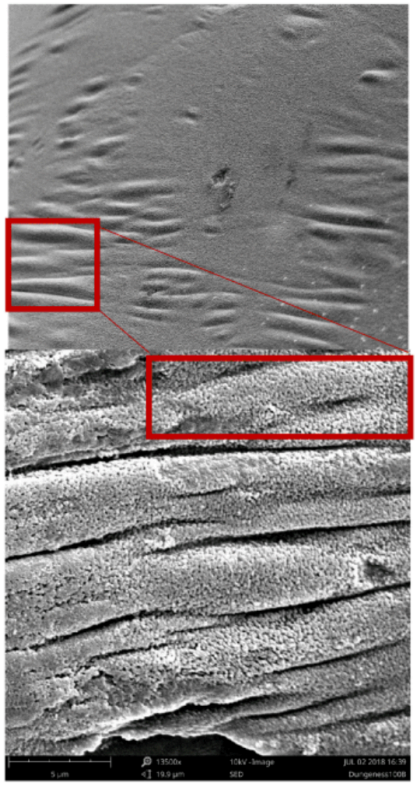
Oysters

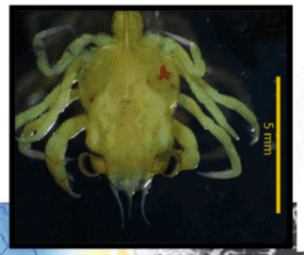
West Coast $117,425,193

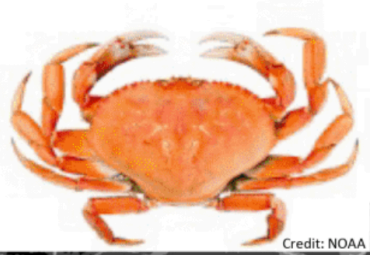
Barton et al. (2015)

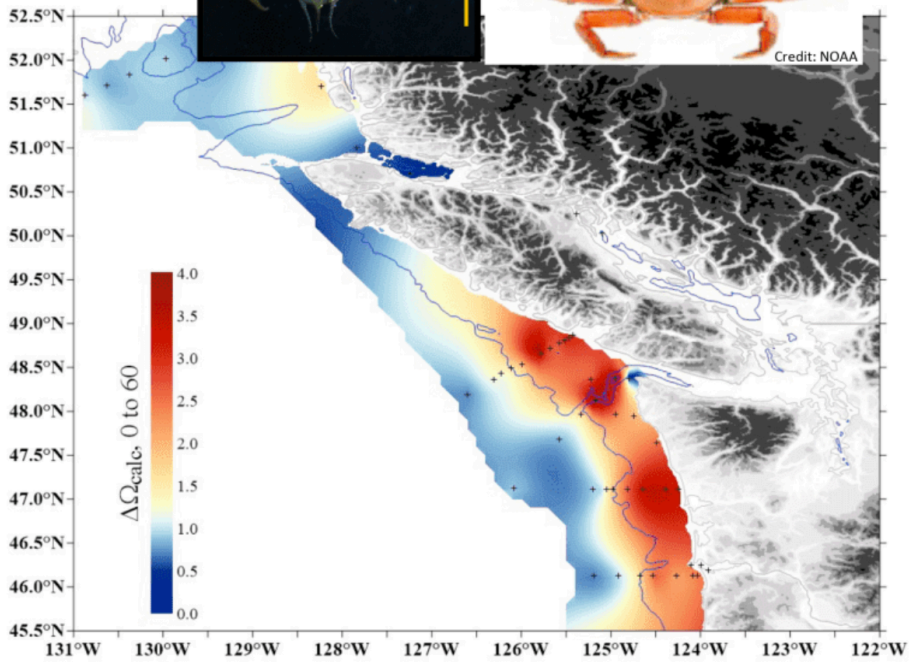
https://www.opb.org/article/2025/07/29/oyster-farming-ocean-acidification/

Exoskeleton dissolution of the larval Dungeness crab resulting in structural deformities



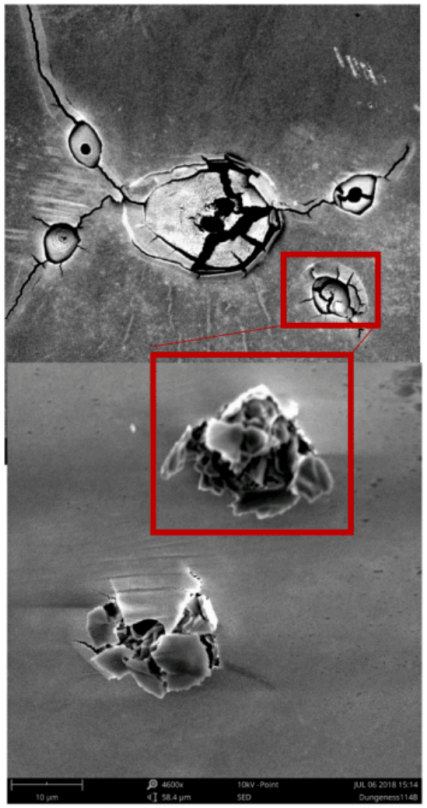






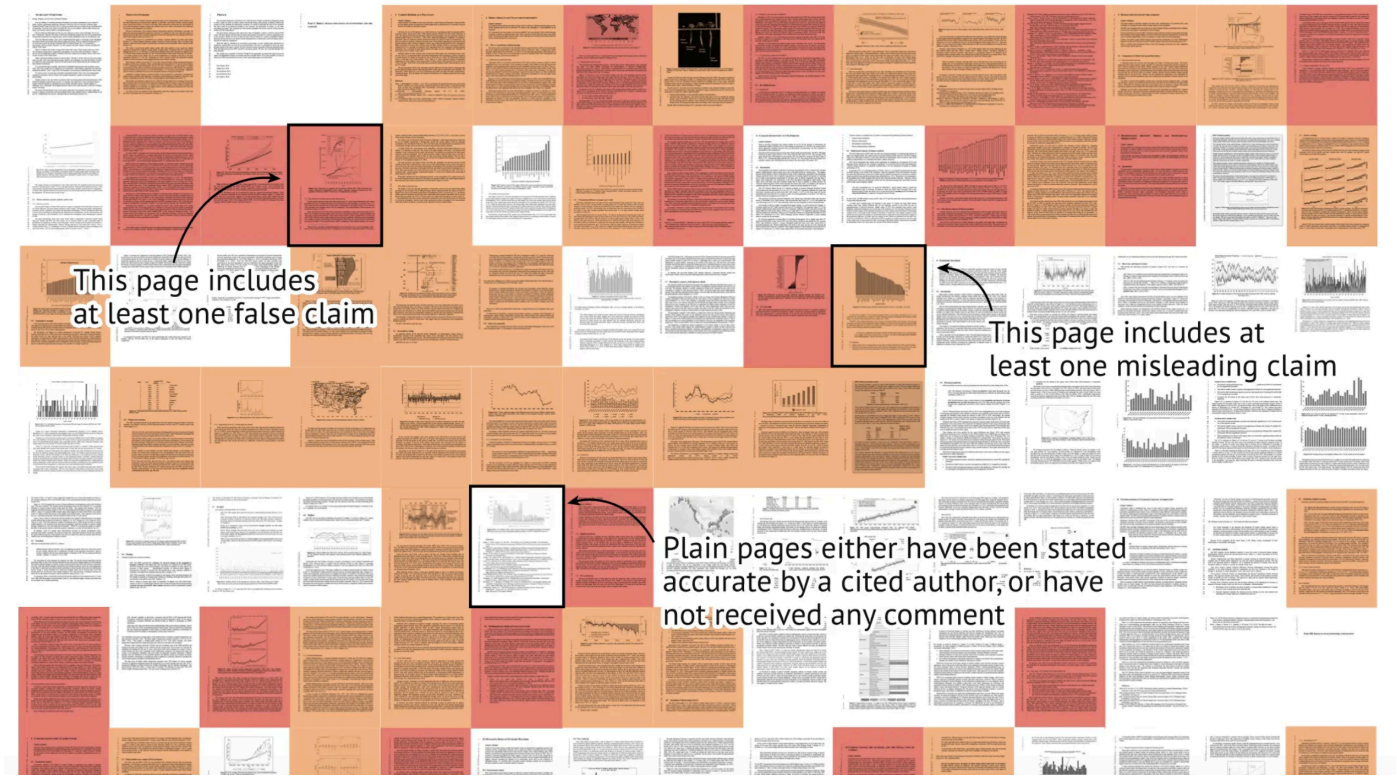
The ocean acidification hotspots, as defined by the steep calcite vertical gradients, where larvae Dungeness crab are most affected by dissolution

Dissolution also causes damaged or missing mechanoreceptors



https://research.noaa.gov/dungeness-crab-larvae-already-showing-effects-of-coastal-acidification/

Factcheck: Trump's climate report includes more than 100 false or misleading claims



https://interactive.carbonbrief.org/doe-factcheck/index.html

A Statement of the American Meteorological Society

(Adopted by the Executive Committee of the AMS Council on 27 August 2025)

Here we identify five foundational flaws in the Department of Energy's (DoE's) 2025 Climate Synthesis report[1]. Each of these flaws, alone, places the report at odds with scientific principles and practices. For the report to accurately characterize scientific understanding and to be useful as a basis for informed policy and decision making, the DoE must first rectify all five flaws and then conduct a comprehensive assessment of scientific evidence. Were DoE to do so, the result will almost certainly be conclusions that are broadly consistent with previous comprehensive scientific assessments of climate change, such as those from the National Academies of Sciences, Engineering, and Medicine (NASEM); American Association for the Advancement of Science (AAAS); Intergovernmental Panel on Climate Change (IPCC), American Meteorological Society (AMS), and a wide-range of other scientific organizations.

The Department of Energy's recent attempt to synthesize climate science has five foundational flaws as a scientific effort:

1. **Lack of breadth across scientific fields**. The science of climate change spans dozens of fields and sub-fields within the physical, natural, and social sciences relating to the Earth and environment. These include (but are not limited to): atmospheric physics; atmospheric chemistry; oceanography (physical, chemical, and biological); cryology; glaciology; biology; physiology; biogeography; biogeochemistry; health; and economics; among others. Each of these disciplines has hundreds of practicing scientists—tens of thousands of scientists overall. No group of five scientists can possess the disciplinary breadth encompassed by all who study climate change[2]. To be credible, scientific assessments must include authors who can characterize the full breadth of scientific evidence.

2. **Lack of depth within scientific fields and specific topics**. Comprehensive assessment of any specific scientific topic must account for the full range of scientifically defensible views among the relevant subject matter experts—those who are familiar with the evidence of that specific topic[3]. For virtually any specific scientific field or topic within that field, five authors would be insufficient to capture the depth of knowledge and range of views, even if all were narrowly focused on that specific topic and independent of one another.

   To be credible, scientific assessments must include authors who reflect the full range of defensible views among the subject matter experts within every specific area of science that is included in the assessment.

3. **The DoE Report is based on an unrepresentative group of subject matter experts**. The five DoE authors do not appear to be a random sample of climate scientists but a biased selection. They seem to have been chosen based on a shared disagreement with the larger community of subject matter experts.

   Unusual perspectives and disagreement are important within the scientific process because they can generate alternative plausible explanations; identify needs for additional inquiry; or challenge the thinking of the larger community of subject matter experts. However, scientific assessments that emphasize unusual views are unrepresentative of the larger community of subject matter experts.

   Valid assessments need to consider all evidence and all views and weigh them only on their merits. Scientific merit increases with independent replication, corroboration, and conclusions that withstand the scrutiny of those who know the subject. Scientific merit decreases with obvious flaws in logic or experimental design, biased selections of scientific evidence (i.e., cherry picking), or emphasis on weakly supported evidence.

   Notably, the views put forth in the DoE report are not new. They have been thoroughly tested and considered by the larger community of scientists. Those views have been incorporated in previous comprehensive assessments—to the extent justified by their scientific merit. In contrast, robust conclusions of the larger scientific community that follow from comprehensive assessment of the evidence, are not represented in the DoE report. To be credible, scientific assessments must be representative of expert judgement that is based only on the scientific merit of the evidence.

NATIONAL ACADEMIES Sciences Engineering Medicine

News and stories › National Academies Publish New Report Reviewing Evidence for Gre

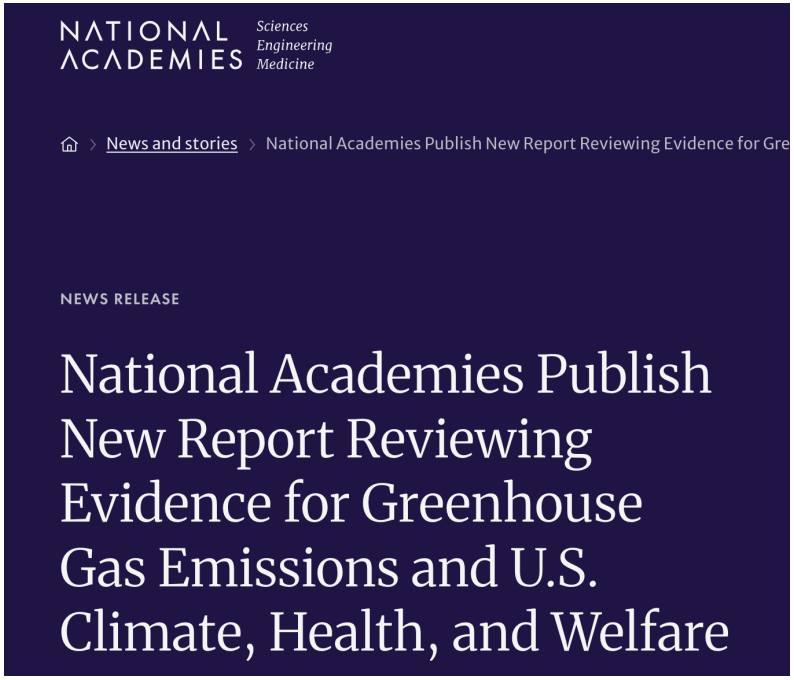
NEWS RELEASE

National Academies Publish New Report Reviewing Evidence for Greenhouse Gas Emissions and U.S. Climate, Health, and Welfare

- **Emissions of greenhouse gases (GHGs) from human activities are increasing the concentration of these gases in the atmosphere.** Human activities, such as the extraction and burning of fossil fuels, cement and chemical production, deforestation, and agricultural activities, emit greenhouse gases, which include carbon dioxide, methane, nitrous oxide, and fluorinated gases, into the atmosphere. Total global GHG emissions continue to increase, even though U.S. emissions of CO2 have decreased slightly in recent years largely due to changes in energy production and consumption. Multiple lines of evidence show that greenhouse gas emissions from human activities are the primary driver of the observed long-term warming trend. No known natural drivers, such as incoming solar radiation or volcanic emissions, can explain observed changes.
- **Improved observations confirm unequivocally that greenhouse gas emissions are warming Earth's surface and changing Earth's climate.** Longer records, improved and more robust observational networks, and analytical and methodological advances have strengthened detection of observed changes and their attribution to elevated levels of greenhouse gases. Trends observed include increases in hot extremes and extreme single-day precipitation events, declines in cold extremes, regional shifts in annual precipitation, warming of the Earth's oceans, a decrease in ocean pH, rising sea levels, and an increase in wildfire severity.

Overarching Conclusion: EPA's 2009 finding that the human-caused emissions of greenhouse gases threaten human health and welfare was accurate, has stood the test of time, and is now reinforced by even stronger evidence. Today, many of EPA's conclusions are further supported by longer observational records and multiple new lines of evidence. Moreover, research has uncovered additional risks that were not apparent in 2009.

https://www.nationalacademies.org/news/national-academies-publish-new-report-reviewing-evidence-for-greenhouse-gas-emissions-and-u-s-climate-health-and-welfare



- **Changes in climate resulting from human-caused emissions of greenhouse gases harm the welfare of people in the United States.** Climate-driven changes in temperature and precipitation extremes and variability are leading to negative impacts on agricultural crops and livestock, even as technological and other changes have increased agricultural production. Climate change, including increases in climate variability and wildfires, is changing the composition and function of forest and grassland ecosystems. Climate-related changes in water availability and quality vary across regions in the United States with some regions showing a decline. Climate-related changes in the chemistry and the heat content of the ocean are having negative effects on calcifying organisms and contributing to increases in harmful algal blooms. U.S. energy systems, infrastructure, and many communities are experiencing increasing stress and costs owing to the effects of climate change.

- **Human-caused emissions of greenhouse gases and resulting climate change harm the health of people in the United States.** Climate change intensifies risks to humans from exposures to extreme heat, ground-level ozone, airborne particulate matter, extreme weather events, and airborne allergens, affecting incidence of cardiovascular, respiratory, and other diseases. Climate change has increased exposure to pollutants from wildfire smoke and dust, which has been linked to adverse health effects. The increasing severity of some extreme events has contributed to injury, illness, and death in affected communities. Health impacts related to climate-sensitive infectious diseases — such as those carried by insects and contaminated water — have increased. New evidence is developing about additional health impacts of climate change, including on mental health, nutrition, immune health, antimicrobial resistance, kidney disease, and negative pregnancy-related outcomes. Groups such as older adults, people with preexisting health conditions or multiple chronic diseases, and outdoor workers are disproportionately susceptible to climate-associated health effects. Even as non-climate factors, including adaptation measures, can help people cope with harmful impacts of climate change, they cannot remove the risk of harm.

- **Continued emissions of greenhouse gases from human activities will lead to more climate changes in the United States, with the severity of expected change increasing with every ton of greenhouse gases emitted.** Despite successful efforts in many parts of the world to reduce emissions, total global greenhouse gas emissions have continued to increase, and additional warming is certain. All climate models — regardless of assumptions about future emissions scenarios or estimates of climate sensitivity — consistently project continued warming in response to future atmospheric GHG increases. Applying fundamental physics of the Earth system leads to the same conclusion. Continued changes in the climate increase the likelihood of passing thresholds in Earth systems that could trigger tipping points or other high-impact climate surprises.

4. **The DoE Report selectively emphasizes a small set of unrepresentative findings, particularly those that might appear beneficial on superficial examination. This "cherry picking" also downplays and excludes scientific findings that might be widely understood to be harmful**. For example, the document focuses simplistically on one of the direct effects of carbon dioxide on photosynthesis and does not consider other important aspects of biological responses to carbon dioxide[4] or the impact that warming is having on organisms and biological systems, which include altering: species locations; timing of key life events; and the provision of goods and services from natural and managed systems[5]. The report also downplays or ignores the impact of warming on the physical characteristics of the Earth (weather patterns; where land meets ocean; where ice and snow occur; the location, amount, and timing of water flows)[6]; and impacts of climate change on virtually every aspect of social and economic life, including: public health; agricultural productivity; transportation; energy supply and demand; and national security.[5]

   Notably, the writing team of this report does not appear to include any authors with subject matter expertise in biology (foundational flaw 1) and does not seem to reflect the views of biologists with respect to the impacts of carbon dioxide and climate change (foundational flaw 2). Both flaws likely contribute to the report reaching conclusions so inconsistent with the conclusions of comprehensive assessments (see IPCC WG 2, for example).

5. **The DoE Report extrapolates from a limited subset of findings to reach conclusions that do not follow from comprehensive consideration of the scientific evidence.** The impacts of climate change will be vast and will touch virtually every aspect of our lives. Given the vastness of impacts, it is not surprising that a small fraction of impacts may be beneficial (or seem beneficial with cursory examination). However, it is misleading to extrapolate from a small and biased selection of potential impacts to suggest the outcomes for humanity will be positive.

   Why are negative impacts from global-scale environmental disturbance vastly more likely? The changes in climate that people are causing are larger and faster than any humanity is known to have endured over the last 10,000 years[7]. Furthermore, physical, biological, economic, and social systems are tuned to climate and highly sensitive to climate change. A wide range of harmful impacts are already occurring and are expected to greatly outnumber and outweigh positive outcomes (as described above).

   To be credible, scientific assessments cannot: extrapolate from a small and unrepresentative subset of potential outcomes; emphasize contentious or weakly supported scientific evidence; dismiss scientifically robust contradictory evidence; or ignore—in the case of climate change—the wide range of harmful impacts that are occurring and expected.

The five foundational flaws described here demonstrate that the report is inconsistent with the scientific principles and practices needed to accurately assess evidence. Furthermore, the total number of foundational flaws at least suggests that the underlying motivation of the report was not to comprehensively assess the science of climate change—wherever the evidence may lead—but to arrive at pre-drawn conclusions that are at odds with comprehensive assessments of scientific evidence. Therefore, its representation of scientific understanding and its conclusions are not scientifically defensible. As such, the report findings cannot be used as the basis for informed decisions about climate change, including with respect to emissions policy, adaptation, and investments in infrastructure.

Notably, the evidence relating to climate change has been comprehensively assessed hundreds of times by independent subject matter experts and scientific organizations that are motivated to be scientifically accurate (whose credibility increases with scientific accuracy or diminishes with scientific errors).[8]

Five conclusions are robust when accounting comprehensively for the scientific evidence. They have been consistently reaffirmed by independent subject matter experts and independent scientific institutions worldwide. Decades of intensive research on climate change demonstrate that:

1. **Climate is changing, and the rate and magnitude of change are unusual in human experience.**
2. **People are the primary cause of modern climate change, mostly through burning fossil fuels.**
3. **Climate change is harmful to humanity, and the threats to people and all life are increasing.**
4. **A wide range of response options is available that can reduce the dangers of climate change.**
5. **Those who study the scientific evidence overwhelmingly agree.**

AGU Leads Effort to Defend EPA Endangerment Finding

In July 2025, the Trump administration **proposed to overturn** the U.S. Environmental Protection Agency's (EPA) **endangerment finding**— a landmark science review that clearly demonstrates that greenhouse gases are a danger to the public's health and welfare.

This finding is grounded in decades of rigorous, peer-reviewed climate science and is essential for the EPA to regulate greenhouse gas emissions. If overturned, the federal government would lose one of its most powerful tools to curb climate change, leaving communities more vulnerable to dangerous heatwaves, worsening air quality, extreme storms, and other climate-driven hazards.

The administration is justifying its proposal by citing a new Department of Energy report that selectively omits the overwhelming body of peer-reviewed research, relying instead on outdated and disproven claims.

https://www.agu.org/science-policy/endangermentletter

DOE Report

Background

On July 29, 2025, the Department of Energy (DOE) published a report entitled A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate, evaluating existing peer-reviewed literature and government data on climate impacts of Greenhouse Gas (GHG) Emissions and providing a critical assessment of the conventional narrative on climate change.

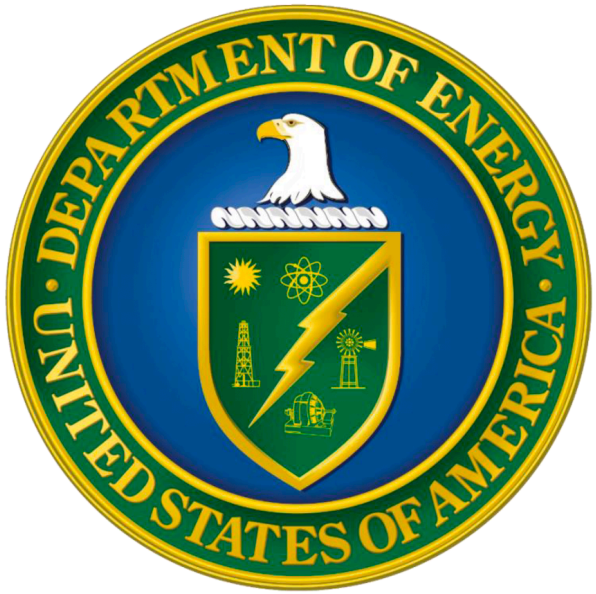
Among the key findings, the report concludes that carbon dioxide (CO_2) -induced warming appears to be less damaging economically than commonly believed, and that aggressive mitigation strategies could be more harmful than beneficial. Additionally, the report finds that U.S. policy actions are expected to have undetectably small direct impacts on the global climate and any effects will emerge only with long delays.

The report was developed by the 2025 Climate Working Group, a group of five independent scientists assembled by Energy Secretary Chris Wright with diverse expertise in physical science, economics, climate science and academic research.

Climate Working Group:

John Christy, Ph.D.
Judith Curry, Ph.D.
Steven Koonin, Ph.D.
Ross McKitrick, Ph.D.
Roy Spencer, Ph.D.

140 pages



A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate

https://www.energy.gov/topics/climate

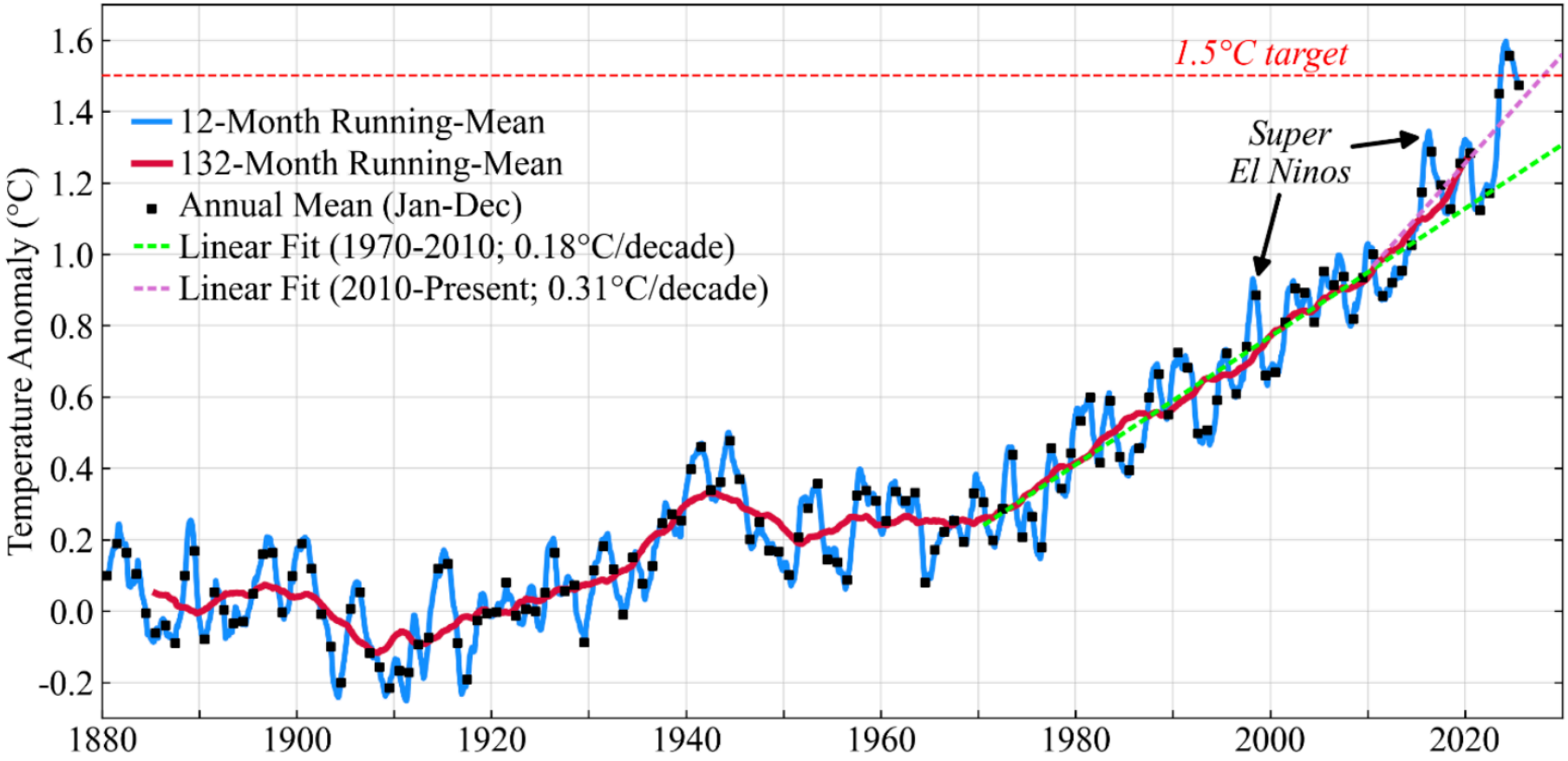
Conclusions

- DOE Climate Report is a sham
- It downplays and trivializes the risks from global warming
- It misrepresents the science
- Government is source of misinformation and cannot be trusted
- Fits with other efforts of this administration to distort the truth (anti-vaxxer) and go after reason, universities, scientists, NCAR, NOAA
- Trump calls climate change “hoax” and “con job”
- Propaganda should not be tolerated
- Scientists need to speak up

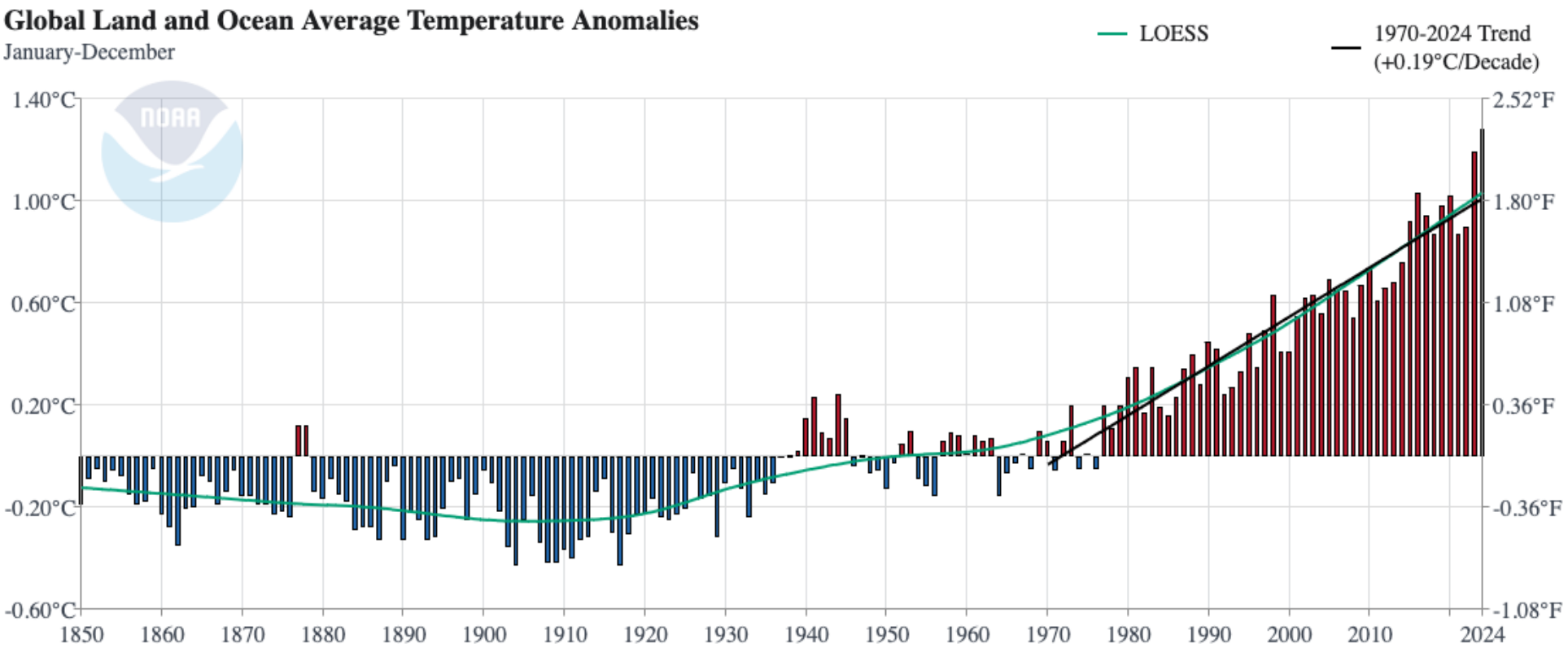
Thank You!


1990
SO, THIS CLIMATE CHANGE THING COULD BE A PROBLEM...
IPCC
1995
CLIMATE CHANGE: DEFINITELY A PROBLEM.
IPCC
2001
YEP, WE SHOULD REALLY BE GETTING ON WITH SORTING THIS OUT PRETTY SOON...
IPCC
2007
LOOK, SORRY TO SOUND LIKE A BROKEN RECORD HERE...
IPCC
2013
WE REALLY HAVE CHECKED AND WE'RE NOT MAKING THIS UP.
IPCC
2019
IS THIS THING ON?
TAP TAP TAP
IPCC

Fig. 1. Global surface temperature (relative to 1880-1920 base period).[1]



https://www.columbia.edu/~jeh1/mailings/2025/GlobalTemperaturePrediction2025.12.18.pdf


Global Land and Ocean Average Temperature Anomalies
January-December
LOESS
1970-2024 Trend
(+0.19°C/Decade)
1.40°C
1.00°C
0.60°C
0.20°C
-0.20°C
-0.60°C
2.52°F
1.80°F
1.08°F
0.36°F
-0.36°F
-1.08°F
1850
1860
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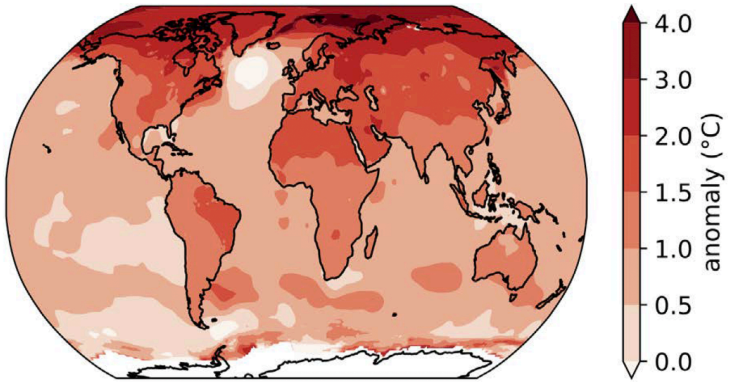
Scientists' Response

Climate Experts' Review of the DOE Climate Working Group Report

Comment submitted to the U.S. Department of Energy, docket number DOE-HQ-2025-0207, in response to their report "A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate"

"On July 29, 2025, the Department of Energy (DOE) published a report from its Climate Working Group (CWG). This report features prominently in the EPA's reconsideration of its 2009 Endangerment Finding. In response, over 85 scientists have come together to write a comprehensive review, which is being submitted to the DOE, EPA, and National Academy review.

Our review reveals that the DOE report's key assertions—including claims of no trends in extreme weather and the supposed broad benefits of carbon dioxide—are either misleading or fundamentally incorrect. The authors reached these flawed conclusions through selective filtering of evidence ('cherry picking'), overemphasis of uncertainties, misquoting peer-reviewed research, and a general dismissal of the vast majority of decades of peer-reviewed research."



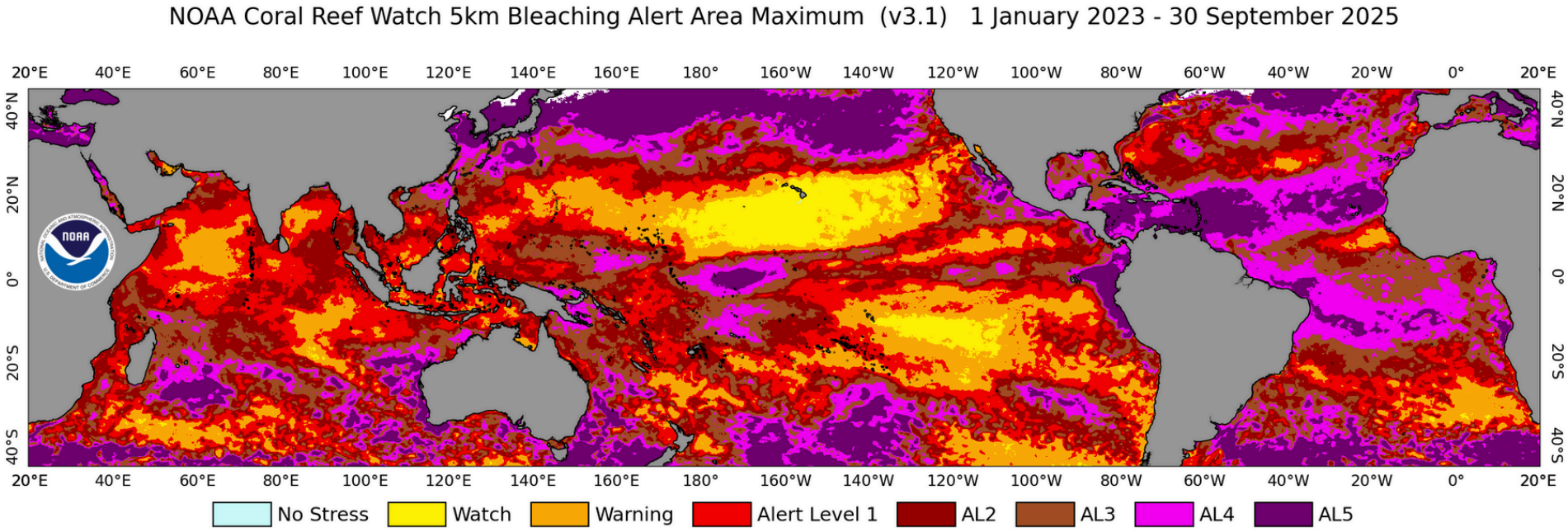
This report may be cited as:
Dessler, A.E. and R.E. Kopp (Ed.). (2025). *Climate Experts' Review of the DOE Climate Working Group Report*. DOI: to be assigned, URL to be assigned

85 authors

460 pages

https://sites.google.com/tamu.edu/doeresponse/home

This three-panel image shows a boulder star coral in St. Croix, USVI, as it shifted from healthy (May 2023), to bleached (October 2023), to recovered (March 2024), following extreme marine heat stress throughout the Caribbean basin in 2023. (Image credit: NOAA)



NOAA CRW's 5km Bleaching Alert Area Maximum product, for the period January 1, 2023 - Septemebr 30, 2025. This map displays the maximum accumulated heat stress experienced by coral reefs around the world since January 1, 2023. The dark red/brown areas show the accumulated heat stress capable of causing reef-wide bleaching with mortality of heat-sensitive corals. The light brown (Alert Level 3), pink (Alert Level 4), and dark purple (Alert Level 5) areas on the map indicate locations where the magnitude of extreme heat stress exceeds the Bleaching Alert Level 2 threshold, and can lead to multi-species or near complete mortality on a coral reef.