Prepared Statement Before the U.S. Senate Committee on the Budget

Hearing on "Left Holding the Bag: The Cost of Oil Dependence in a Low-Carbon World"

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This prepared statement is presented to the Committee on the Budget of the U.S. Senate for its hearing titled "Left Holding the Bag: The Cost of Oil Dependence in a Low-Carbon World," March 29, 2023. The central issue addressed by the Committee is the implication of a large structural economic shift away from fossil fuels — "a low-carbon world" — in terms of the market value of the capital stock complementary with the production, transport, and consumption of conventional energy resources. This commonly is termed the "stranded assets" problem for the fossil-fuel sector writ large.

As discussed below, such a structural economic shift can result from either market forces operating through the price mechanism or government policies forcing such a shift, or some combination of the two. That such a large structural shift will be driven by either source is a deeply dubious prospective outcome notwithstanding the assumption in the title of the hearing that "a low-carbon world" looms before us. Accordingly, the title of the hearing assumes the answer to the question, and therefore is deeply misleading. This statement is organized as follows:

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Summary

The "Low-Carbon World" assertion explicit in the title of this hearing assumes a structural economic shift away from conventional energy — fossil fuels — that is virtually certain not to be observed. Because fossil fuels are overwhelmingly the most efficient forms of energy available now or prospectively, market forces will not engender a massive shift away from them toward such unconventional forms of energy as wind and solar power. Such unconventional energy technologies are uncompetitive because they are far more costly and far less reliable than conventional energy. That is why they cannot survive a competitive market test, and it is only large subsidies, both direct and indirect, and other policy-driven subventions that allow them to survive. Accordingly, market forces will not yield a sharp decline in the market value of those significant parts of the capital stock complementary with the production, transport, and consumption of conventional energy, that is, a "stranding" of the relevant respective components of the capital stock. Moreover, any such market shift would take place over many years or decades as part of the long-term process of capital depreciation, investment, and changes in resource allocation. Accordingly, no market-driven "stranding" of capital assets will be observed.

Market-driven shifts in the values of capital assets are not an appropriate focus for government policies given the central principle of resource allocation driven by individual preferences reflected in market prices. Shifts in market conditions always have resulted in changing relative prices and wealth distributions, in particular as a result of technological advances, and there is no principle consistent with support for a market economy that would be

imply a role for government in terms of accelerating or hindering such shifts.

Nor will government policies engender such a massive economic transformation, that is, a "stranding" of capital assets complementary with conventional energy. With the exception of the methane tax included in the Inflation Reduction Act, Congress has never enacted a statute mandating direct reductions in greenhouse gas (GHG) emissions, for the obvious reason that large reductions in such emissions cannot be achieved without sharp declines in the consumption of fossil fuels, that is, a large increase in energy costs that would not be consistent with the political interests of elected public officials. The IPCC in a recent report argues that achievement of the purported 1.5°C "safe" limit on global temperature increases would require implicit taxes equivalent to over $35 per gallon of gasoline by 2030, in constant year 2022 dollars, and rising sharply thereafter. Congress will never enact such policies.

This is true as well at the international level. The Paris agreement, apart from the reality that the Nationally Determined Contributions are meaningless, necessarily contains no enforcement mechanism, and no such international agreement even conceptually consistent with the most basic tenets of national sovereignty could do so.

A regulatory regime sufficiently stringent to create a large-scale "stranding" of conventional energy assets would not survive legal challenges under the Major Questions doctrine.

There is no evidence of a climate "crisis" in terms of temperature trends, polar sea ice, tornadoes, tropical cyclones, wildfires, drought, flooding, or ocean alkalinity. The IPCC is deeply dubious about the various severe effects often asserted as prospective impacts of increasing atmospheric concentrations of GHG. Moreover, NASA reports significant planetary greening as a result of increasing atmospheric concentrations of carbon dioxide, and data from the United Nations Food and Agriculture Organization show that global per capita food production increased 46 percent between 1961 and 2020, and 20 percent for 2000-2020.

The "crisis" narrative is derived wholly from climate models that cannot predict the actual temperature record. In particular, the suite of climate models underlying the IPCC 5^{th} and 6^{th} Assessment Reports overstate the mid-troposphere temperature record by factors of about 2.5. Moreover, the models are fine-tuned in such a way as to deny the importance of natural influences on climate phenomena, but that is inconsistent with a large body of evidence, in particular the substantial warming observed from 1910 to 1945, and the close correlation between the satellite temperature record and the El Niño/Southern Oscillation.

Government policies to reduce GHG emissions would have future climate effects either trivial or indistinguishable from zero, as predicted by the EPA climate model under a set of assumptions that exaggerate the prospective impacts of such emissions reductions. Such policies, whether domestic or international, cannot satisfy any plausible benefit/cost test.

Because such policies cannot be asserted to yield nontrivial future climate impacts, the federal government has resorted to asserting benefits from reductions in GHG emissions driven by calculations of the "social cost of carbon," a deeply problematic analytic framework distorted by the misuse of economic growth projections, the inclusion of co-benefits in the form of reductions

in pollutants already regulated under the Clean Air Act, the incorporation of asserted global benefits, and the use of discount rates artificially low, inconsistent with the interests of future generations, and certain to distort resource allocation within the government sector and between the government and private sectors.

The concept of "risk" implies a range of possible outcomes delineated by a statistical distribution of likelihoods around some mean and with some standard deviation. "Uncertainty" clearly is a more accurate term than "risk" in this context, in that the mean and standard deviation of the relevant statistical distributions are very unlikely to be known. The reality is that the analysis of "climate risk" is deeply speculative, the implication of which is that policymakers should exhibit far more modesty in terms of assumptions about conditions and outcomes. Moreover, the universe of "risks" both severe and low in probability is enormous. Massive volcanic eruptions, asteroid impacts, powerful earthquakes, tsunamis, mass contagion, the use of bioweaponry by terrorists, nuclear war, and gamma ray storms are only a few of the many horrors entirely plausible. Why is climate "risk" the most important? What distortions would result from vastly disproportionate attention to climate change relative to the others?

That this hearing is driven by a question poorly formulated — one that assumes the answer to the underlying economic question — suggests strongly that any forthcoming conclusions will interfere with policymaking consistent with sound economic, environmental, and social outcomes. The Committee would be wise to reorient its focus and assumptions, and begin anew.

I. Because Fossil Fuels Are Efficient, Market Forces Will Not Engender a Massive Substitution Away from Them

Many assert that the "costs of low-carbon energy technologies" are "rapidly falling."[1] If we accept the cost estimates reported by the Energy Information Administration, this might be true, but it is irrelevant in that the appropriate comparison is with the costs of conventional energy and electricity generation. To a substantial degree advocates of a substitution away from conventional energy (fossil fuels) ignore the reliability problems attendant upon unconventional (wind and solar) electricity (and electric vehicles) and thus the costs of backup capacity required to avoid service interruptions.[2] Consider the following estimates of the levelized costs of electric power produced with alternative technologies, as reported by the Energy Information Administration in its annual reports.[3] The table reports the EIA estimates made in 2010, 2016, and

[1] See e.g., the Third-Order Draft of the Fifth National Climate Assessment (NCA5) at https://review.globalchange.gov/nca5-third-order-draft-public-review, p. 1-4. See also Benjamin Zycher at https://www.aei.org/wp-content/uploads/2023/01/NCA5-Zycher-comment-Jan-2023.pdf.

[2] See Benjamin Zycher, *The Green New Deal* at https://www.aei.org/wp-content/uploads/2019/04/RPT-The-Green-New-Deal-5.5x8.5-FINAL.pdf.

[3] For 2010 through 2022, respectively: https://www.eia.gov/outlooks/archive/aeo10/electricity_generation.html, https://www.eia.gov/outlooks/archive/aeo11/electricity_generation.php, https://www.eia.gov/outlooks/archive/aeo12/electricity_generation.php, https://www.eia.gov/outlooks/archive/aeo13/electricity_generation.php, https://www.eia.gov/outlooks/archive/aeo14/electricity_generation.php, https://www.eia.gov/outlooks/archive/aeo15/pdf/electricity_generation_2015.pdf, https://www.eia.gov/outlooks/archive/aeo16/pdf/electricity_generation_2016.pdf, https://www.eia.gov/outlooks/archive/aeo17/pdf/electricity_generation.pdf, https://www.eia.gov/outlooks/archive/aeo18/pdf/electricity_generation.pdf,

2021, but the data are available annually.

Because the EIA estimates do not include important costs in the levelized cost estimates, the actual cost disadvantages of renewable power generation are substantially greater than those shown in the table below. Zycher reports an estimate of about $500 billion per year for an electricity grid comprising "decarbonized" technologies.[4] Holtz-Eakin *et. al.* report a similar cost estimate using a somewhat different methodology.[5] Turner and Lassman report an estimate of annual per-household cost of approximately $50,000 for full implementation of all net-zero programs including electric power, transportation systems, building retrofitting, etc.[6] The usually-implicit (and sometimes explicit) argument from proponents of a "low-carbon world" — the draft NCA5 is typical — that a massive reduction in U.S. GHG emissions would be virtually costless in terms of energy costs is not to be taken seriously.

Levelized Costs of New Generation Resources
(year 2021 dollars per MWh)

	Year		
Technology	2010	2016	2021
Coal	132.78	134.57	163.44
Gas Combined Cycle	99.86	74.33	39.94
Nuclear	144.08	131.52	88.24
Hydroelectric	144.08	86.74	170.39
Onshore Wind Incl Backup	327.81	203.68	158.09
Solar Photovoltaic Incl Backup	624.37	229.53	NA
Solar Standalone Incl Backup	NA	NA	154.35
Battery Storage	NA	NA	128.55

NA: not available.
Source: EIA reports referenced in fn. 3 *supra.*, and author computations

The cost comparisons for electric vehicles (non-internal combustion propulsion systems) yield the same conclusion: Unconventional (low-carbon") energy is uncompetitive.[7] Accordingly, market forces will not engender a massive shift away from fossil fuels, that is, a "stranding" of capital assets complementary with the production, transport, and consumption of energy derived from fossil fuels. Market forces will leave no one "holding the bag" in this context, a central reality

https://www.eia.gov/outlooks/archive/aeo19/pdf/electricity_generation.pdf, https://www.eia.gov/outlooks/archive/aeo20/pdf/electricity_generation.pdf, https://www.eia.gov/outlooks/archive/aeo21/pdf/electricity_generation.pdf, and https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf. The deflator applied to these data is the Producer Price Index for Electricity Generation: Utilities, as reported by the Federal Reserve Bank of St. Louis in the FRED database, at https://fred.stlouisfed.org/series/PCU2211102211104#0.

[4] See Zycher, fn. 2 *supra*.

[5] See https://www.americanactionforum.org/research/the-green-new-deal-scope-scale-and-implications/.

[6] See https://cei.org/studies/what-the-green-new-deal-could-cost-a-typical-household/.

[7] On electric vehicles, see Benjamin Zycher at https://www.aei.org/wp-content/uploads/2022/11/Zycher-Declaration-Ohio-CA-waiver-Oct-2022.pdf.

recognized by the International Energy Agency in its latest *World Energy Outlook*: it projects that by 2050 global oil consumption will be about equal to that in 2015, coal consumption about equal to that in 2010, and natural gas consumption higher than that in 2020.[8]

II. Because Shifts in Climate Phenomena Are Multi-Decadal at a Minimum, Any Market-Driven "Stranding" of Assets Would Be a Normal Adaptive Investment Shift

Professor Judith Curry noted before this Committee on March 22 that "year-to-year variations" in climate phenomena do not allow for inferences about shifts in those phenomena, whether anthropogenic or natural.[9] This is obvious: There is normal variation in any stochastic or nonstochastic process, and any mean or median of a set of observations will be characterized by some statistical variance. That is why a single observation — a temperature measurement for a given year, the wind speeds in a single cyclone, etc. — do not allow for inferences, and the standard rule of thumb for climate phenomena is a minimum of thirty years of observations for purposes of inferences about changes in such phenomena.[10]

Much of the capital stock complementary with fossil fuels is long-lived. As any given component of that capital stock depreciates, investors must make projections and determinations about whether to replace the existing facilities or to direct capital elsewhere. The point here is that the combination of the long-term nature of climate analysis and the long-lived nature of energy infrastructure means that little or no "stranding" of such capital would be observed as a result of market forces. A shift away from fossil fuels would be part of the normal long-term process of capital replenishment.

III. A Market-Driven "Stranding" of Conventional Energy Assets Would Not Be an Appropriate Focus for the Federal Government

Market forces can engender large economic shifts, resulting in large numbers of economic winners and losers. The revolution in computing power and the rise of the internet over the past few decades are obvious examples of this. However enormous in magnitude, obvious, and far-reaching, that shift from a purely analytic perspective does not differ from an ordinary and much less profound shift in consumer preferences, say, from some types of foods to others.

Again, such economic shifts are ubiquitous, creating winners and losers, and the shifts themselves represent a recognition that individual preferences as reflected in market prices are the fundamental basis for resource allocation, a basis that is a central component of individual freedom.[11] Regardless of the incentives inherent in the institutions of representative democracy to offer subventions to interest groups, as a matter of principle the federal government has no business intervening in such market-driven shifts in resource allocation; that is what it means to endorse the principles of a market economy.

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[8] See https://www.iea.org/reports/world-energy-outlook-2022/executive-summary.
[9] See https://www.budget.senate.gov/hearings/risky-business-how-climate-change-is-changing-insurance-markets.
[10] See the IPCC discussion at https://www.ipcc.ch/site/assets/uploads/2018/03/ar4-wg1-chapter1.pdf, p. 96. See also the NOAA discussion of weather versus climate at https://www.ncei.noaa.gov/news/weather-vs-climate.
[11] See Robert Nozick, *Anarchy, State, and Utopia*, New York: Basic Books, 1974.

Accordingly, if such market shifts result in a decline, or collapse, in the value of the capital invested in a given sector — a "stranding" of that capital — that would be a straightforward manifestation of market processes, however unpleasant for the losers. The rise of personal computers inflicted substantial losses upon the producers (and owners) of large mainframe computers, just as the rise of motorized transport imposed large losses upon the owners of horse-drawn carts and carriages, but just as there existed no defensible justification for government to interfere with those processes, none exists to interfere with such shifts in energy sectors, whether to support or to penalize conventional energy. Sections IV through X discuss various dimensions of the GHG justification for such interventions.

IV. "Stranding" of Capital Assets Complementary with the Fossil-Fuel Sector Can Happen Only as a Result of Government Policies that Congress Has Never Enacted and That Have Proven Impossible to Implement on an International Basis

With the exception of the methane tax included in the Inflation Reduction Act, discussed below, Congress has never enacted a statute mandating direct reductions in the emissions of GHG. Instead, Congress has enacted and renewed large subsidy programs for unconventional energy, the most obvious examples of which are the wind production tax credit, the solar production tax credit, the subsidies for the purchase of electric (and plug-in hybrid) vehicles and associated infrastructure, and such other various subventions as the renewable fuel standard and the like.[12]

The closest that Congress has come to enactment of legislation reducing GHG emissions directly was the American Clean Energy and Security Act of 2009 — in brief, a cap-and-trade program with some similarities to a GHG tax — which was passed by the House of Representatives but not by the Senate.[13]

It can surprise no one that such legislation has never gained Congressional approval. Important reductions in GHG emissions cannot be achieved without sharp declines in the consumption of fossil fuels, and an effort to effect that outcome directly would require a large increase in energy costs. That is what it means to say that unconventional energy is uncompetitive (see section I above). But it is an understatement to observe that sharply higher energy costs are not consistent with the political interests of elected public officials.

Consider the IPCC estimates of the cost implications of efforts to achieve the purported "safe" limit of global temperatures no more than 1.5°C higher than those in the pre-industrial period. The IPCC in its *Special Report: Global Warming of 1.5°C*, notes as follows under "price of carbon emissions":

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[12] On the wind PTC and the solar ITC, see, respectively, https://windexchange.energy.gov/projects/tax-credits#:~:text=Renewable%20Energy%20Production%20Tax%20Credit%20(PTC)&text=Wind%20energy%20projects%20placed%20into,10%20years%20of%20electricity%20generation and https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics. On EV subventions, see https://afdc.energy.gov/laws/409. On the RFS, see https://www.epa.gov/renewable-fuel-standard-program. Note that the original justification for the RFS programs was some variant of the pursuit of "energy independence," an argument exceptionally weak but outside the scope of the discussion here.

[13] See https://www.congress.gov/bill/111th-congress/house-bill/2454.

> … estimates for a Below-1.5°C pathway range from 135–6050 USD2010 $tCO_{2\text{-eq}}{}^{-1}$ in 2030, 245–14300 USD2010 $tCO_{2\text{-eq}}{}^{-1}$ in 2050, 420–19300 USD2010 $tCO_{2\text{-eq}}{}^{-1}$ in 2070 and 690–30100 USD2010 $tCO_{2\text{-eq}}{}^{-1}$ in 2100.[14]

Consider the implicit tax per gallon of gasoline for 2030. The IPCC range for that year is $135-6050 per metric ton, in year 2010 dollars. Using the implicit price deflator for GDP, the range is $179-8004 per metric ton in year 2022 dollars. The midpoint of that range is $4092 per metric ton. Assuming 19 pounds of GHG emitted per gallon of gasoline consumed, the implied tax per gallon in 2030 is over $35 per gallon in year 2022 dollars.[15] The implied gasoline tax is substantially higher, in constant dollars, in the later years.

No such tax or equivalent direct increase in energy costs would be approved by any group of public officials constrained by political pressures. Consider the methane tax enacted as part of the Inflation Reduction Act.[16] Suppose, *a fortiori*, that the tax were to eliminate all methane emissions from petroleum and natural gas systems, with no increases resulting anywhere else in the world. Such emissions were 78.3 million metric tons (CO2e) in 2019, out of total U.S. GHG emissions of about 6.6 billion metric tons.[17] As discussed below in section IX, net-zero GHG emissions by the U.S. would reduce global temperatures in the year 2100 by 0.173°C, using the EPA climate model under a set of assumptions that exaggerate the effects of changes in GHG emissions. As a first approximation, elimination of all methane emissions from U.S. petroleum and natural gas systems would reduce global temperatures in 2100 by 0.002°C, a figure indistinguishable from zero, and undetectable given that the standard deviation of the surface temperature record is 0.11°C.[18]

In other words, policies that would yield substantial effects on future climate phenomena would impose truly massive economic costs. Just as market forces will not engender a "stranding" of conventional energy capital assets, neither will public policies enacted by public officials subject to the constraints inherent in democratic competition.

This is true as well at the international level. The Paris agreement contains no enforcement mechanism, and no such international agreement even conceptually consistent with the most basic tenets of national sovereignty could do so. That is why the emissions reductions ostensibly to be realized under Paris are a mere sum of the participating nations' promises — the "nationally determined contributions" — offered as the central component of the agreement.[19]

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[14] See IPCC, *Special Report: Global Warming of 1.5°C*, at https://www.ipcc.ch/sr15/chapter/chapter-2/, section 2.5.2.1.

[15] Sources: Fn. 14; Federal Reserve Bank of St. Louis at https://fred.stlouisfed.org/series/A191RD3A086NBEA; Energy Information Administration at https://www.eia.gov/environment/emissions/co2_vol_mass.php; and author computations.

[16] See https://crsreports.congress.gov/product/pdf/R/R47206.

[17] *Ibid.* See also Benjamin Zycher at https://www.aei.org/wp-content/uploads/2023/02/EPA-methane-emissions-climate-rev-EPA-HQ-OAR-2021-0317-1460-Zycher-comment-Feb-13-2023.pdf.

[18] For the EPA climate model, see https://magicc.org/. On the standard deviation of the surface temperature record, see https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/1999JD900835.

[19] See the NDCs at https://unfccc.int/NDCREG.

The unenforceability of the NDCs is only the beginning of the problems with the Paris agreement.[20] Almost all of the NDCs are promises to reduce emissions by some year below an assumed "business as usual" baseline emissions path for the given economy. Changes in GHG emissions are closely correlated with economic growth; this is unsurprising in that stronger economic growth results in more production activity, more energy consumption, more transportation services, and on and on.

Suppose for a given economy that the "business as usual" emissions baseline path is driven by an assumption of future economic growth too optimistic. Suffice it to say that such optimistic paths for assumed economic growth are very far from unusual. The baseline GHG emissions assumption will be higher than that actually emerging over time. As economic growth proves lower than that assumed in the "business as usual" baseline, the same will be true for the baseline path of GHG emissions. Accordingly, a nation easily can achieve its Paris promise — its NDC — with no actual effort to reduce emissions at all! That was the precise effect of the global COVID pandemic, during which global GDP fell by about 3.1 percent from 2019 to 2020.[21] Global GHG emissions fell by 3.7 percent over that period.[22] The individual national promises under the Paris agreement, however aggregated, are meaningless.

V. A Regulatory Framework Creating a Large-Scale "Stranding" of Fossil-Fuel Assets Would Not Survive Legal Challenges Under the Major Questions Doctrine

The Supreme Court has invoked the Major Questions Doctrine in three major cases over the last two years.[23] In brief, the doctrine requires Congress to "speak clearly when authorizing an [executive branch] agency to exercise powers of vast 'economic and political significance.'" Constitutional law scholar Ilan Wurman offers a compelling defense of the doctrine.[24] The more central point here is that there can be no question that regulatory policies intended to engender a massive economic shift away from fossil fuels and more generally a sharp reduction in GHG emissions would represent an exercise of "powers of vast 'economic and political significance.'" That is why this Committee is holding this hearing. Accordingly, it is very unlikely to be the case that the judiciary will allow regulatory policies resulting in a massive reduction in the economic value ("stranding") of major parts of the U.S. capital stock without Congressional authorization, and, as discussed in section IV, it is very unlikely that Congress will authorize such regulatory actions.

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[20] See Benjamin Zycher at https://www.realclearmarkets.com/articles/2020/11/19/the_perversities_of_biden_rejoining_the_paris_climate_agreement_650234.html?mc_cid=de5e2e6646&mc_eid=5a039925c5.

[21] See https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

[22] See Table B.1 at https://www.pbl.nl/sites/default/files/downloads/pbl-2022-trends-in-global-co2-and_total-greenhouse-gas-emissions-2021-summary-report_4758.pdf.

[23] They are *West Virginia et. al. v Environmental Protection Agency et. al.*, at https://www.supremecourt.gov/opinions/21pdf/20-1530_n758.pdf; *Alabama Association of Realtors et. al. v Department of Health and Human Services et. al.*, at https://www.supremecourt.gov/opinions/20pdf/21a23_ap6c.pdf; and *National Federation of Independent Business, et. al. v Department of Labor, Occupational Safety and Health Administration, et. al.*, at https://www.supremecourt.gov/opinions/21pdf/21a244_hgci.pdf.

[24] See Ilan Wurman, "Importance and Interpretive Questions," forthcoming, *Virginia Law Review*, posted March 11, 2023 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4381708.

VI. There Is No Evidence of a Climate "Crisis"

The ubiquitous assertions of an existing or looming climate "crisis" are summarized well in the most recent draft of the NCA5:

> Since the 1970s, there has been a marked acceleration in the cause of climate change (human caused greenhouse gas emissions) and its effects, including increasing temperatures[,] rising sea levels, melting ice, ocean warming and acidification, changing rainfall patterns, and shifts in timing of seasonal events. Human activities have increased the frequency and intensity of many extreme events, as well as the likelihood of sequential and concurrent extreme events.[25]

Similarly, the Council on Environmental Quality in its Interim Guidance to federal agencies argues as follows, with specific references to assertions made by the U.S. Global Change Research Program:

> The United States faces a profound climate crisis and there is little time left to avoid a dangerous—potentially catastrophic—climate trajectory. Climate change is a fundamental environmental issue, and its effects on the human environment fall squarely within NEPA's purview. Major Federal actions may result in substantial GHG emissions or emissions reductions, so Federal leadership that is informed by sound analysis is crucial to addressing the climate crisis. Federal proposals may also be affected by climate change, so they should be designed in consideration of resilience and adaptation to a changing climate. Climate change is a particularly complex challenge given its global nature and the inherent interrelationships among its sources and effects. Further, climate change raises environmental justice concerns because it will disproportionately and adversely affect human health and the environment in some communities, including communities of color, low-income communities, and Tribal Nations and Indigenous communities. Given the urgency of the climate crisis and NEPA's important role in providing critical information to decision makers and the public, NEPA reviews should quantify proposed actions' GHG emissions, place GHG emissions in appropriate context and disclose relevant GHG emissions and relevant climate impacts, and identify alternatives and mitigation measures to avoid or reduce GHG emissions. CEQ encourages agencies to mitigate GHG emissions associated with their proposed actions to the greatest extent possible, consistent with national, science-based GHG reduction policies established to avoid the worst impacts of climate change.[26]

Almost every assertion in those passages is incorrect. Anthropogenic climate change is "real" — increasing GHG concentrations are having detectable effects — and incontrovertible, but that does not tell us the magnitude of the observable impacts, which must be measured empirically.

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[25] See fn. 1 *supra.*, at p. 1-10.

[26] See the CEQ Interim Guidance at https://www.govinfo.gov/content/pkg/FR-2023-01-09/pdf/2023-00158.pdf, p. 1197. See also Benjamin Zycher at https://www.aei.org/wp-content/uploads/2023/03/Zycher-comment-CEQ-NEPA-GHG-Climate-Guidance-RIN-0331-AA06-3-10-2023.pdf.

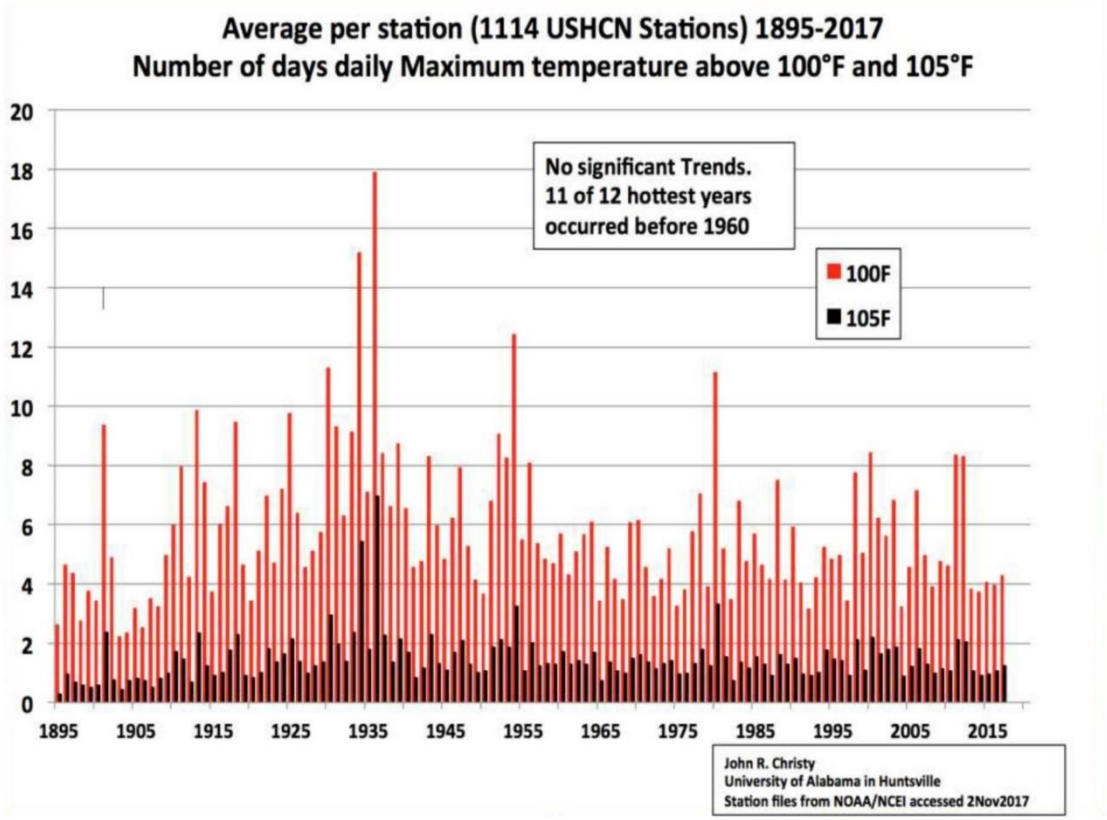
Temperatures are rising, but as the Little Ice Age ended no later than 1850, it is not easy to separate natural from anthropogenic effects on temperatures and other climate phenomena, as discussed below in section VII.[27] The latest research in the peer-reviewed literature suggests that mankind is responsible for about half of the approximate temperature increase of 1.1 degrees C since 1880.[28]

There is little trend in the number of "hot" days for 1895–2017; eleven of the 12 years with the highest number of such days occurred before 1960, as shown in the following chart.[29]

[27] On the Little Ice Age, see Michael E. Mann, "Little Ice Age," in *Encyclopedia of Global Environmental Change, Volume 1: The Earth System: Physical and Chemical Dimensions of Global Environmental Change*, ed. Michael C. MacCracken, John S. Perry and Ted Munn (Chichester, England: John Wiley & Sons, 2002), http://www.meteo.psu.edu/holocene/public_html/shared/articles/littleiceage.pdf.

[28] See, e.g., Nicholas Lewis, "Objectively Combining Climate Sensitivity Evidence," *Climate Dynamics*, September 19, 2022, at https://link.springer.com/article/10.1007/s00382-022-06468-x; Ross McKitrick and John Christy, "A Test of the Tropical 200- to 300 hPa Warming Rate in Climate Models"; Nicholas Lewis and Judith Curry, "The Impact of Recent Forcing and Ocean Heat Uptake Data on Estimates of Climate Sensitivity," *Journal of Climate* 31 (August 2018): 6051–71, https://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-17-0667.1; and John R. Christy and Richard McNider, "Satellite Bulk Tropospheric Temperatures as a Metric for Climate Sensitivity," *Asia-Pacific Journal of Atmospheric Sciences* 53 (2017): 511–18, https://link.springer.com/article/10.1007/s13143-017-0070-z. For a chart summarizing the recent empirical estimates of equilibrium climate sensitivity as reported in the peer-reviewed literature, see Patrick J. Michaels and Paul C. Knappenberger, "The Collection of Evidence for a Low Climate Sensitivity Continues to Grow," Cato Institute, September 25, 2014, https://www.cato.org/blog/collection-evidence-low-climate-sensitivity-continues-grow.

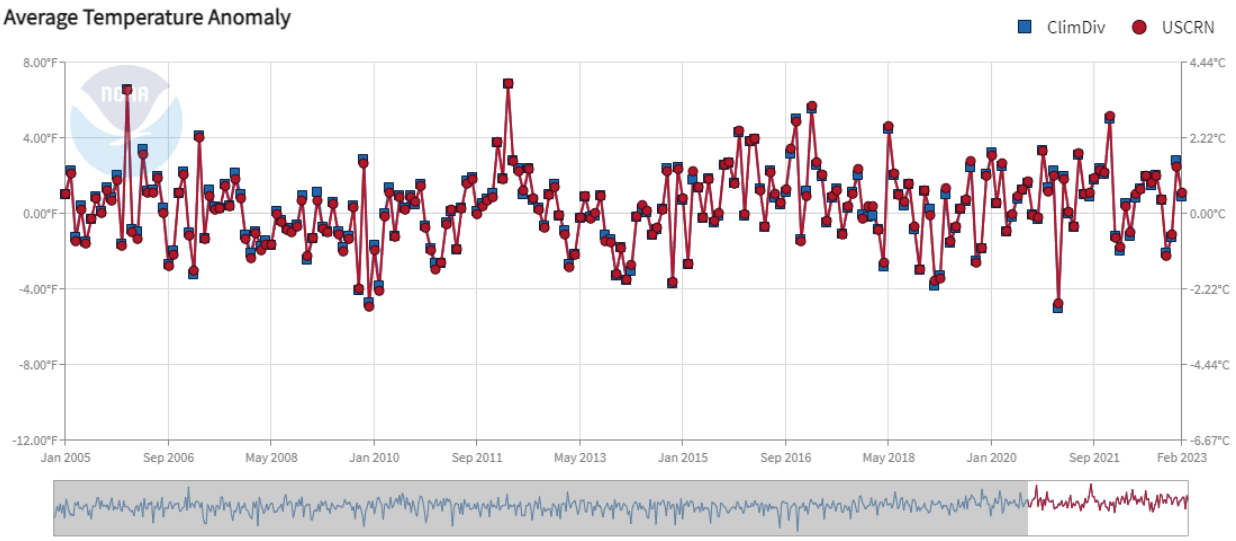
[29] For the reconstruction of the NASA data, see John R. Christy, "Average per Station (1114 USHCN Stations) 1895–2017: Number of Days Daily Maximum Temperature Above 100˚F and 105˚F," drroyspencer.com, http://www.drroyspencer.com/wp-content/uploads/US-extreme-high-temperatures-1895-2017.jpg.



NOAA has maintained since 2005 the U.S. Climate Reference Network, comprising 114 meticulously maintained temperature stations spaced more or less uniformly across the lower 48 states, 21 stations in Alaska, and two stations in Hawaii.[30] They are placed to avoid heat island effects and other such distortions as much as possible; the reported data show no trend over the available 2005–2023 reporting period, as shown in the following chart.[31]

[30] For the Climate Reference Network program description, see National Centers for Environmental Information, "U.S. Climate Reference Network," https://www.ncdc.noaa.gov/crn/.

[31] For a visualization of a prototypical station, see Willis Eschenbach, "NOAA's USCRN Revisited—No Significant Warming in the USA in 12 Years," *Watts Up with That?*, November 8, 2017, https://wattsupwiththat.com/2017/11/08/the-uscrn-revisited/. For the monthly data and charts reported by the National Oceanic and Atmospheric Administration (NOAA), see National Oceanic and Atmospheric Administration, "National Temperature Index," https://www.ncdc.noaa.gov/temp-and-precip/national-temperature-index/time-series?datasets%5B%5D=uscrn&parameter=anom-tavg&time_scale=p12&begyear=2005&endyear=2020&month=8, and the monthly data at https://www.ncei.noaa.gov/access/monitoring/national-temperature-index/time-series/anom-tavg/1/0.



Koonin notes for the U.S. as follows for 1900 through 2019:

> … the average coldest temperature of the year has clearly increased since 1900, while the average warmest temperature has hardly changed over the last sixty years and is about the same today as it was in 1900.[32]

A NOAA reconstruction of global temperatures over the past one million years, using data from ice sheet formations, shows that there is nothing unusual about the current warm period.[33]

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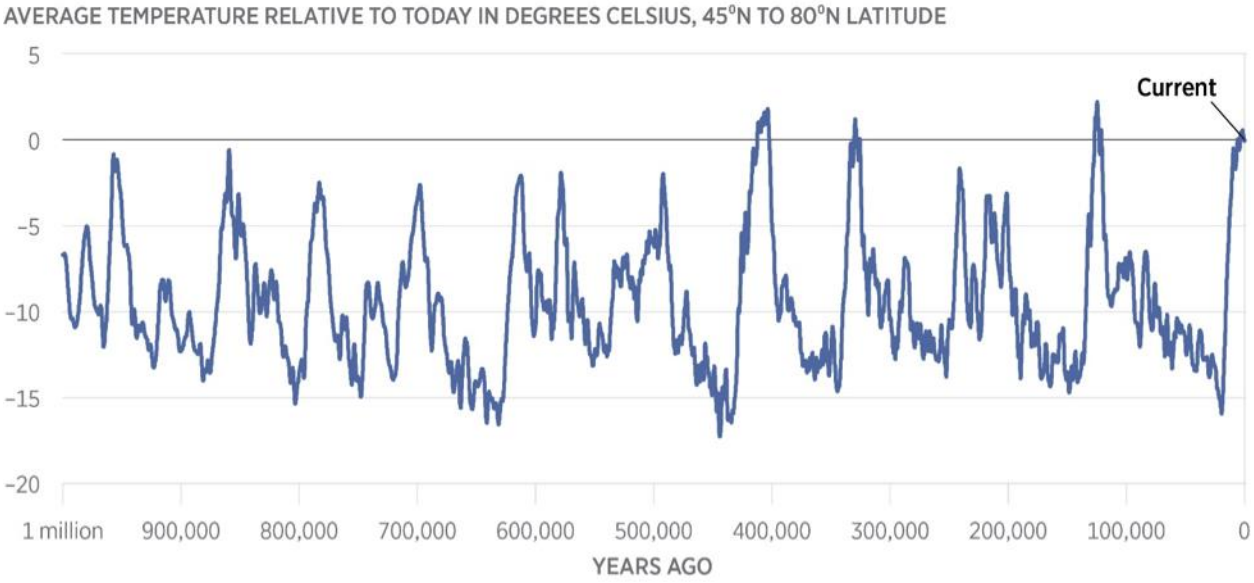
[32] See Steven E. Koonin, *Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters*, Dallas: BenBella Books, 2021, at p. 102.

[33] See https://www.instituteforenergyresearch.org/wp-content/uploads/2020/03/temperature-flucturations.png, from R. Bintanja and R. S. W. van de Wal, "North American Ice-Sheet Dynamics and the Onset of 100,000-Year Glacial Cycles," *Nature* 454, no. 7206 (August 14, 2008): 869–72, https://www.researchgate.net/publication/23171740_Bintanja_R_van_de_Wal_R_S_W_North_American_ice-sheet_dynamics_and_the_onset_of_100000-year_glacial_cycles_Nature_454_869-872. NOAA published the underlying data at R. Bintanja and R. S. W. van de Wal, "Global 3Ma Temperature, Sea Level, and Ice Volume Reconstructions," National Oceanic and Atmospheric Administration, August 14, 2008, https://www.ncdc.noaa.gov/paleo-search/study/11933.

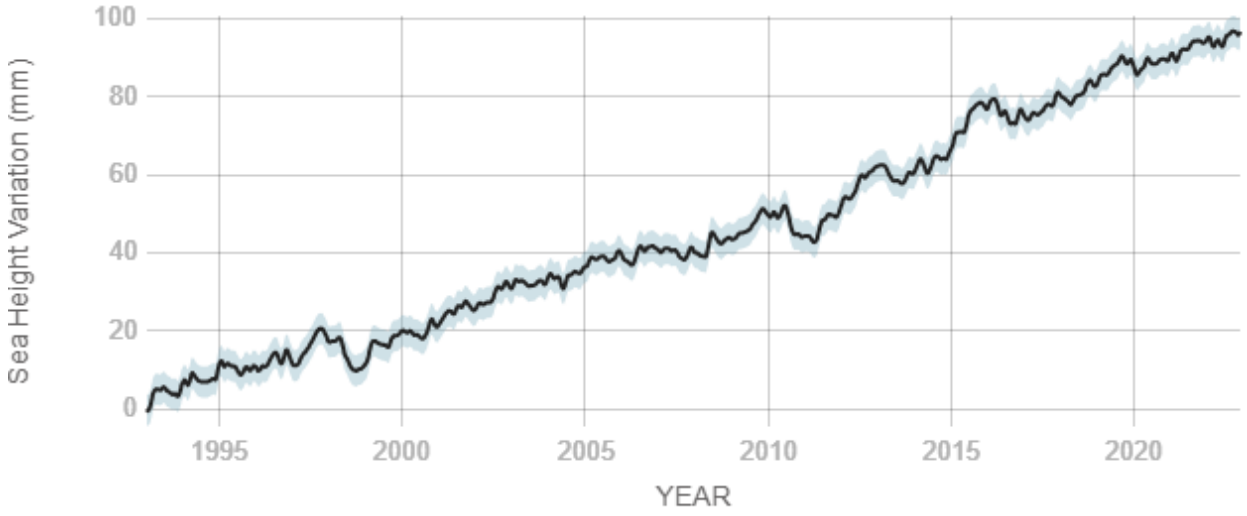
Temperature Fluctuations Over the Past Million Years



SOURCE: R. Bintanja and R.S.W. van de Wal, "Global 3Ma Temperature, Sea Level, and Ice Volume Reconstructions," National Oceanic and Atmospheric Administration, August 14, 2008, https://www.ncdc.noaa.gov/paleo/study/11933 (accessed April 5, 2016).

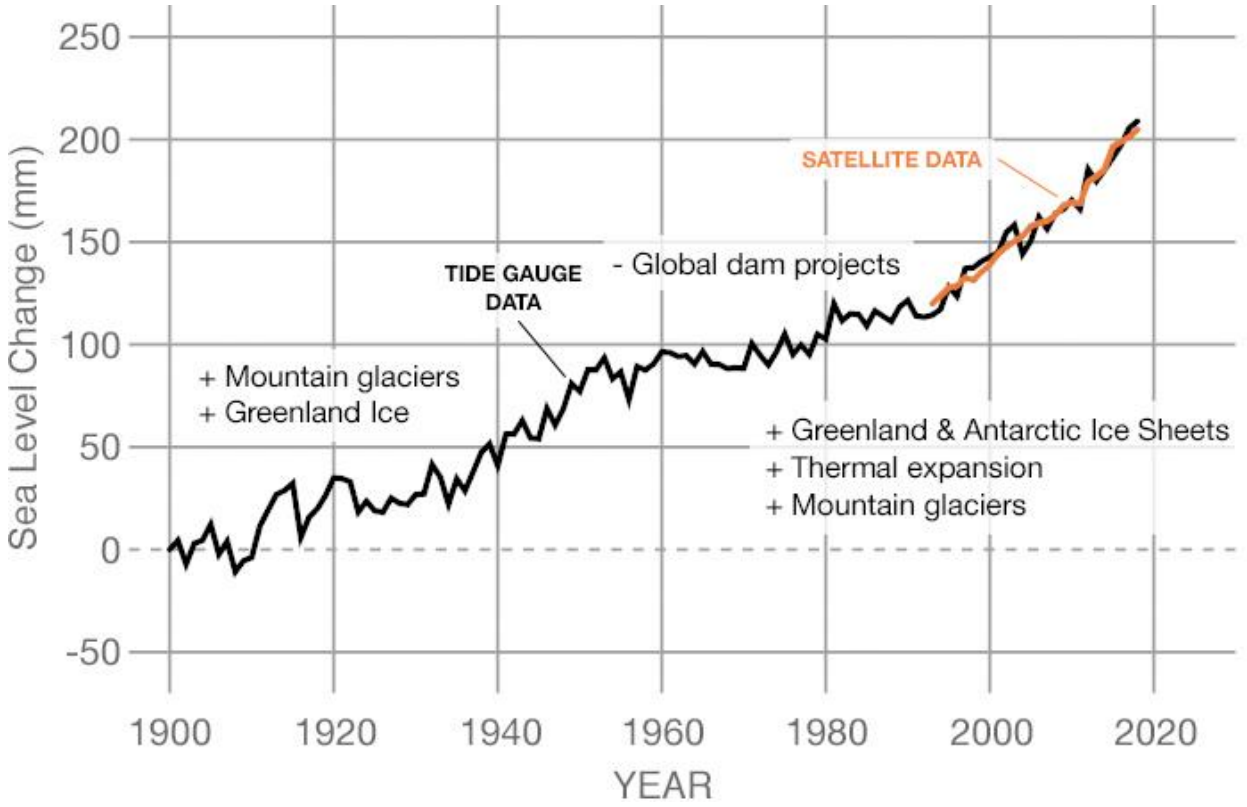
Global mean sea level has been increasing at about 3.3 mm per year since satellite measurements began in 1993, as shown in the following chart from NASA.[34] That ongoing sea level rise would be about 13 inches over the course of a century, an outcome very unlikely to prove a "crisis," in particular given the time available for adaptation.

[34] NASA reports 96.7 millimeters of sea level rise for the period 1993-2022. See the NASA data at https://climate.nasa.gov/vital-signs/sea-level/.



Source: climate.nasa.gov

The tidal-gauge data before the altimeter era show annual increases of about 1.8 mm per year, as shown in the following chart.[35]



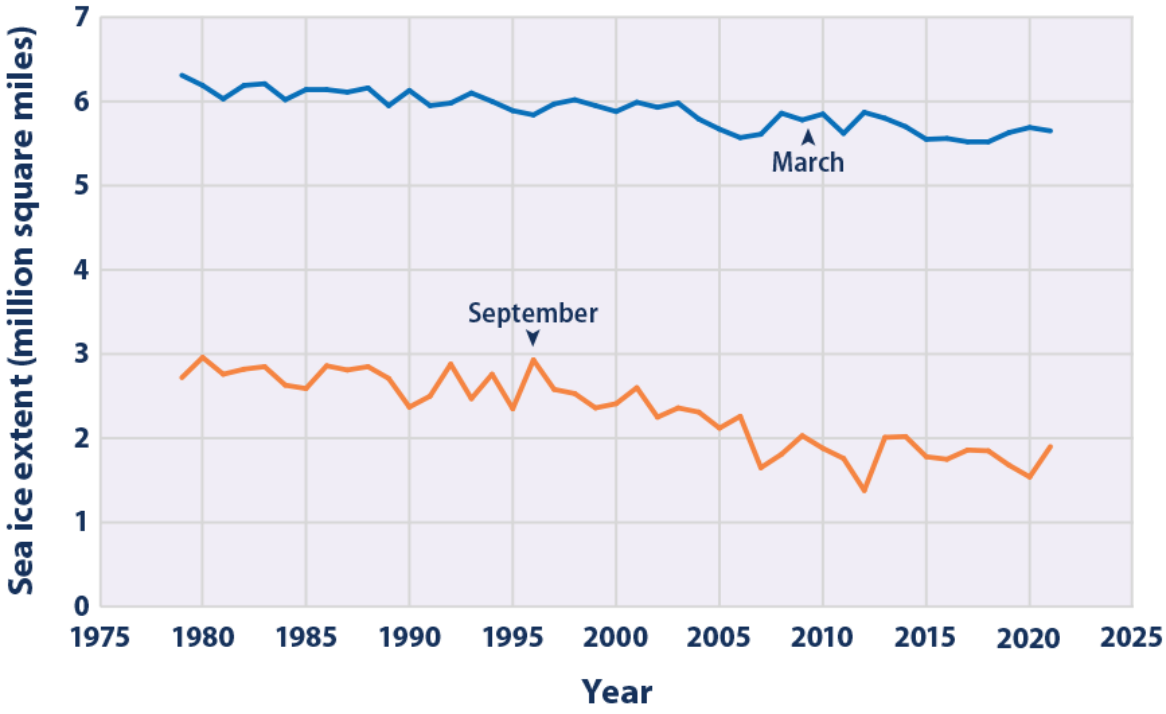
[35] *Ibid.*

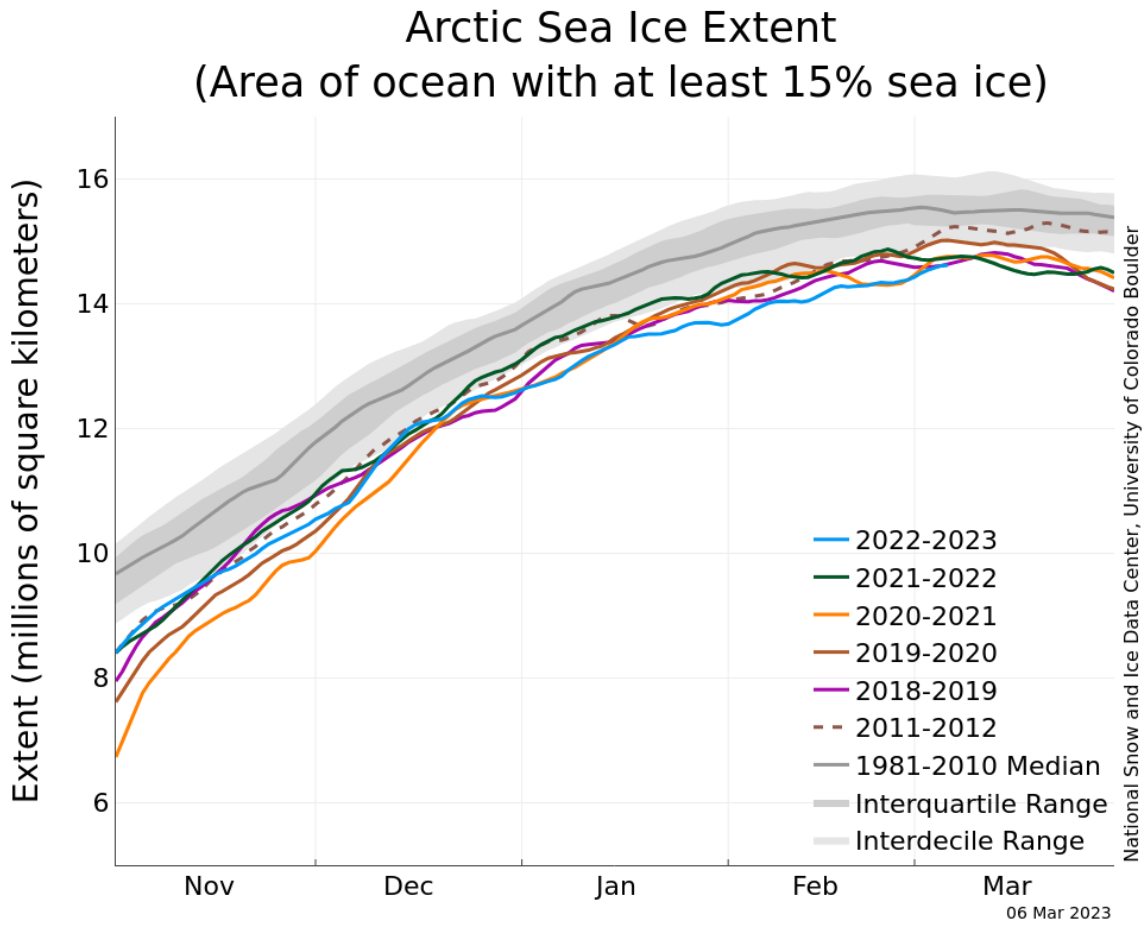
The two datasets are not directly comparable in that the tidal gauges do not measure sea levels *per se*; they measure the difference between sea levels and "fixed" points on land that in reality might not be fixed due to seismic activity, tectonic shifts, land settlement, precipitation, and other parameters. Accordingly, the data are unclear as to whether there is occurring an acceleration in sea level rise. It is reasonable to hypothesize that there has been such an acceleration simply because temperatures are rising due to both natural and anthropogenic influences, and such increases should result in more melting ice and the thermal expansion of seawater. But because rising temperatures are the result of both natural and anthropogenic causes, as discussed in section VII, we do not know the relative contributions of those causes to any such acceleration.[36]

The inconsistency of the northern and southern hemisphere sea ice changes add to the analytic complexity of anthropogenic climate change. The arctic sea ice has been declining, as shown in the following two charts.[37] For the second chart, however, note that the small number of years shown prevents a reliable derivation of inferences.

[36] See Frederikse *et. al.* at https://www.nature.com/articles/s41586-020-2591-3. As a crude approximation, the data suggest that about two-thirds of such sea level increases are due to ice melt, and one-third to thermal expansion of seawater. See Judith Curry, "Sea Level and Climate Change," Climate Forecast Applications Network, November 25, 2018, https://curryja.files.wordpress.com/2018/11/special-report-sea-level-rise3.pdf. Curry cites research from Xianyao Chen and colleagues, the central finding of which is that "global mean sea level rise increased from 2.2 ± 0.3 mm/year in 1993 to 3.3 ± 0.3 mm/year in 2014." See Xianyao Chen et al., "The Increasing Rate of Global Mean Sea-Level Rise During 1993–2014," *Nature Climate Change* 7 (June 26, 2017): 492–95, https://www.nature.com/articles/nclimate3325. Whether the trend from a 21-year period can yield important inferences is a premise problematic at a minimum. For a different empirical conclusion from the tidal gauge record, see J. R. Houston and R. G. Green, "Sea-Level Acceleration Based on U.S. Tide Gauges and Extensions of Previous Global-Gauge Analyses," *Journal of Coastal Research* 27, no. 3 (May 2011): 409–17, https://meridian.allenpress.com/jcr/article-abstract/27/3/409/28456/Sea-Level-Acceleration-Based-on-U-S-Tide-Gauges?redirectedFrom=fulltext. For an example of temporary rapid sea-level rise in the 18th century, see W. R. Gehrels et al., "A Preindustrial Sea-Level Rise Hotspot Along the Atlantic Coast of North America," *Geophysical Research Letters* 47 (2020), https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2019GL085814. For further reported evidence of an acceleration, see Hans-Otto Pörtner et al., *Special Report on the Ocean and Cryosphere in a Changing Climate*, Intergovernmental Panel on Climate Change, 2019, https://www.ipcc.ch/srocc/.

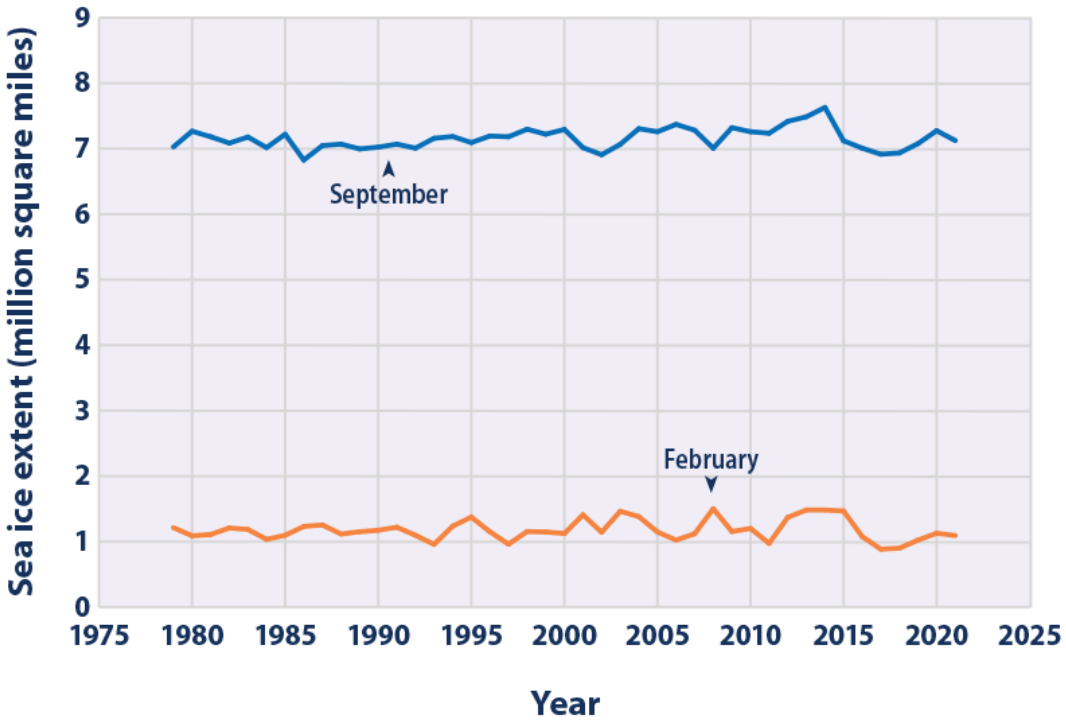
[37] See, respectively, https://www.epa.gov/climate-indicators/climate-change-indicators-arctic-sea-ice and https://nsidc.org/arcticseaicenews/.


Sea ice extent (million square miles)
7
6
5
4
3
2
1
0
March
September
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Year



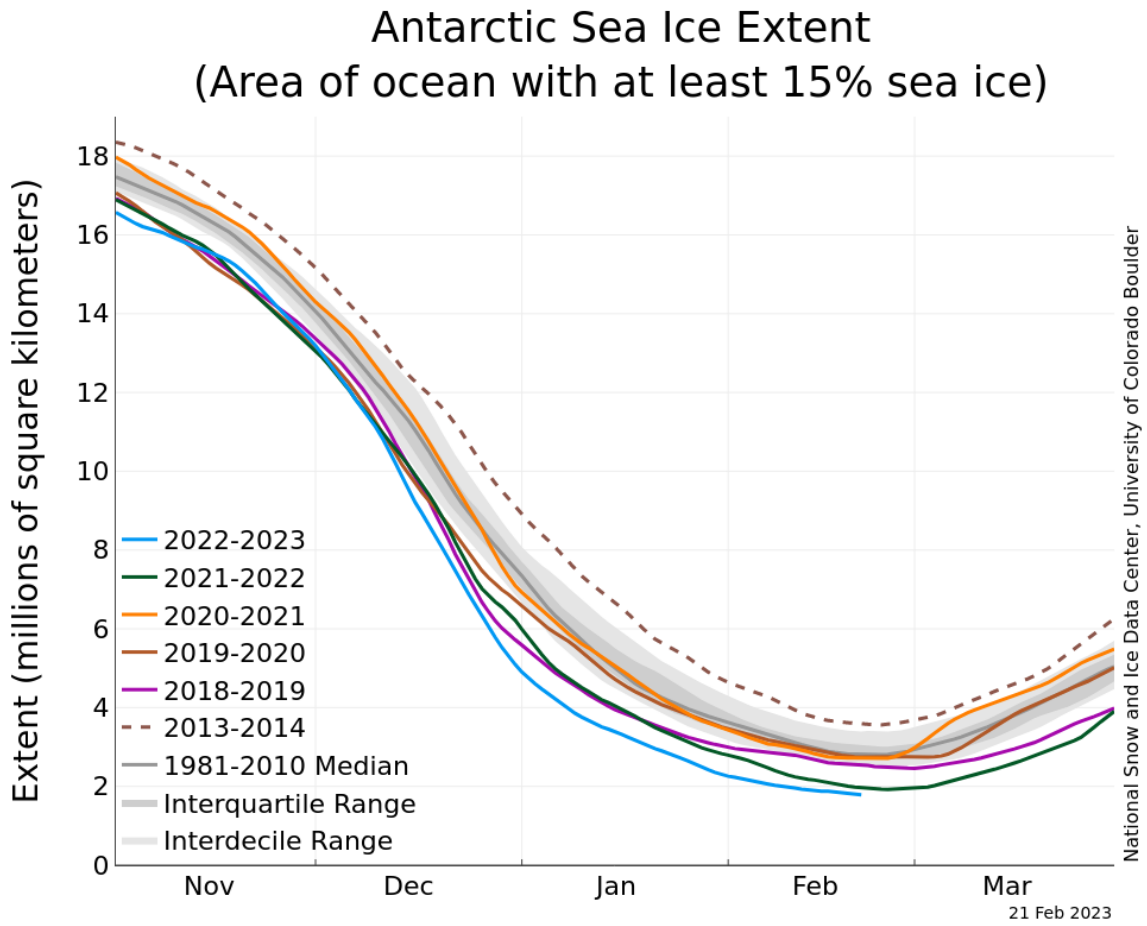
There is no long-term trend in the Antarctic sea ice extent, as shown in the following chart from the EPA.[38]

[38] See https://www.epa.gov/climate-indicators/climate-change-indicators-antarctic-sea-ice#ref5.



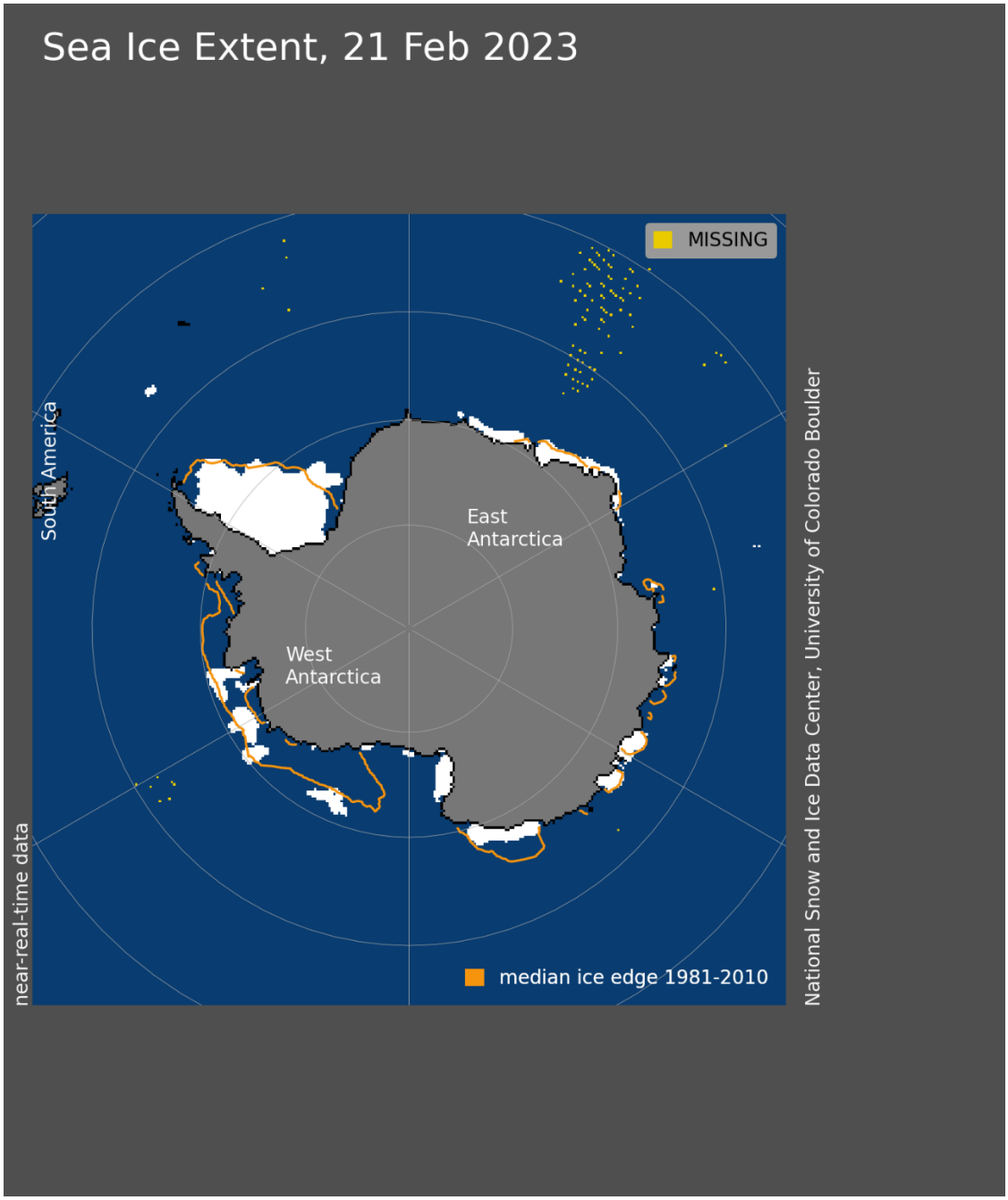
Even for the more recent years, the Antarctic sea ice appears to be stable as a matter of statistical significance, but, as noted above, it is inappropriate to derive inferences from a small number of year-to-year variations.[39]

[39] See https://nsidc.org/arcticseaicenews/2023/02/antarctic-sea-ice-minimum-settles-on-record-low-extent-again/. https://www.thegwpf.org/content/uploads/2021/12/Bates-Sea-Ice-Trends.pdf?mc_cid=dac7df538b&mc_eid=ad653edd6d; and https://www.thegwpf.org/content/uploads/2022/04/Humlum-State-of-Climate-2021-.pdf?mc_cid=dac7df538b&mc_eid=ad653edd6d. See also Patrick J. Michaels, "Spinning Global Sea Ice," Cato Institute, February 12, 2015, https://www.cato.org/blog/spinning-global-sea-ice.



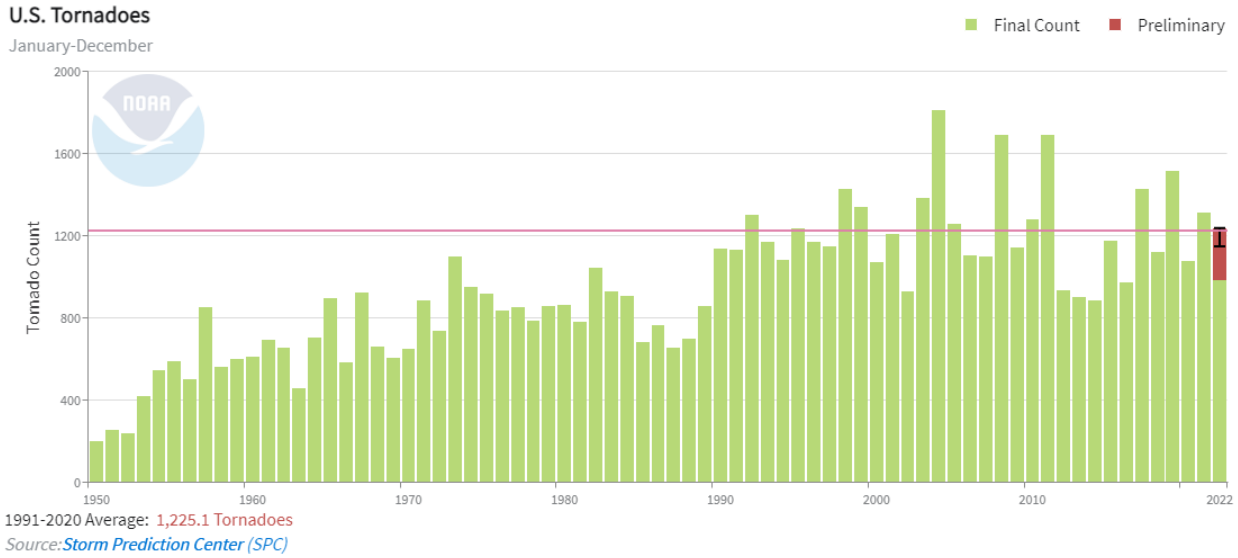
The data show that the Antarctic eastern ice sheet — about two-thirds of the continent — is growing, while the western ice sheet (and the peninsula) is shrinking, as shown in the following chart from the National Snow & Ice Data Center.[40] No agreed explanation for this phenomenon is reported in the literature.

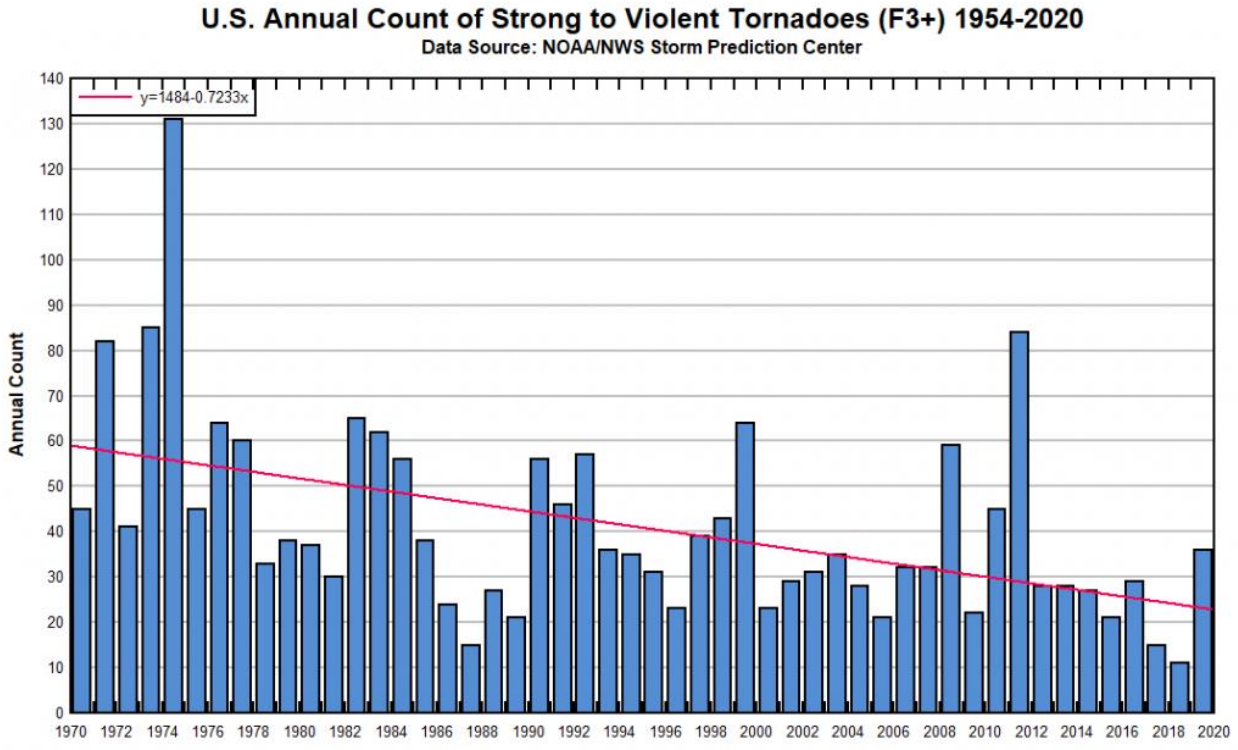
[40] See https://nsidc.org/arcticseaicenews/2023/02/antarctic-sea-ice-minimum-settles-on-record-low-extent-again/. On the eastern ice sheet, see https://www.nature.com/articles/s41561-022-00938-x. On the western ice sheet, see http://nsidc.org/greenland-today/. See also https://nsidc.org/arcticseaicenews/2023/02/antarctic-sea-ice-minimum-settles-on-record-low-extent-again/.



U.S. tornado activity for all EF ("Enhanced Fujita" scale) classes shows an upward trend since 1950, but, again, the issue of anthropogenic versus natural origins is unresolved.[41] The data for the period 1954 through 2014 for EF-3+ tornadoes show no trend or a downward trend. These trends are shown in the following two charts.[42]

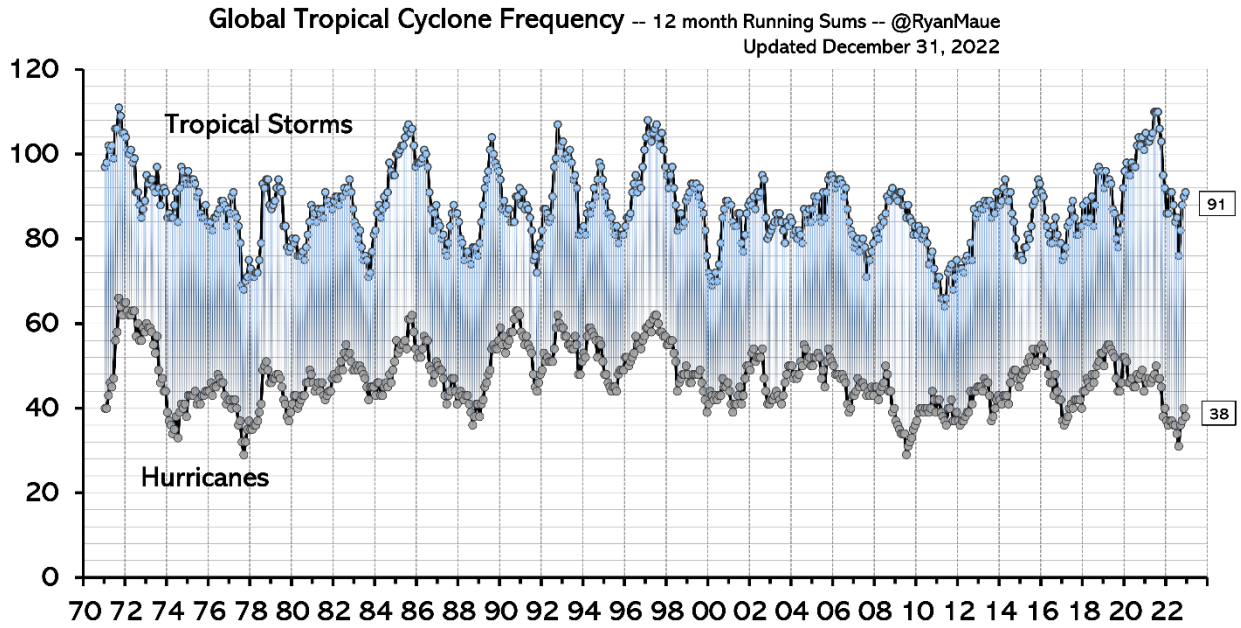
[41] See https://www.climate.gov/maps-data/dataset/monthly-and-annual-numbers-tornadoes-graphs-and-maps.
[42] See NOAA, "Historical Records and Trends," at https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/trends; and https://climateataglance.com/climate-at-a-glance-tornadoes/. Note that the

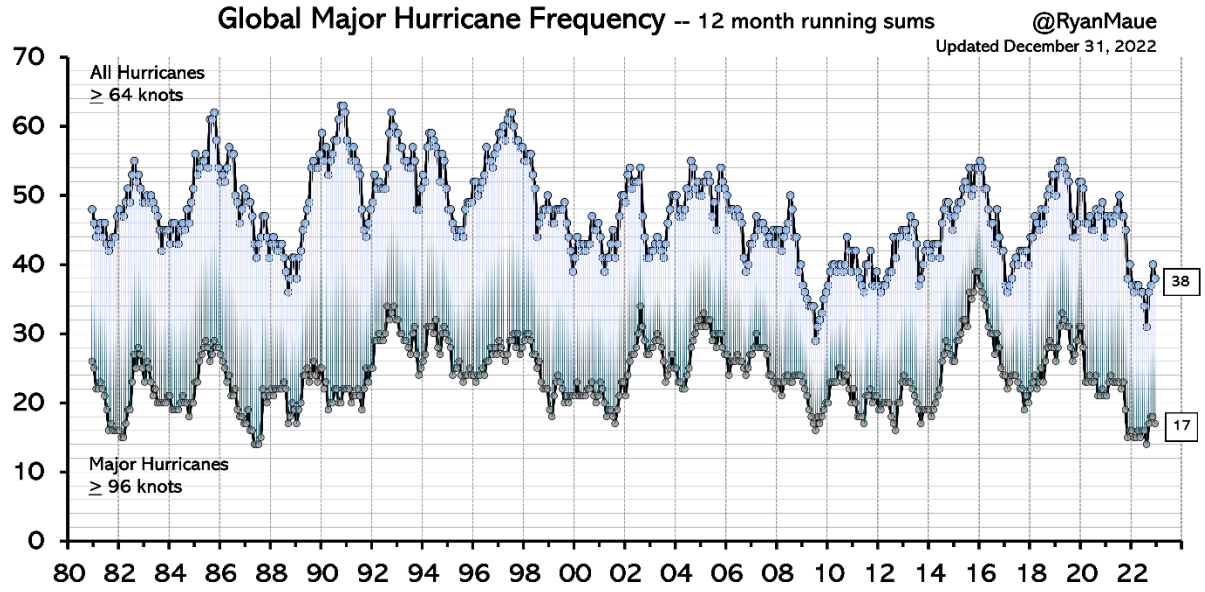




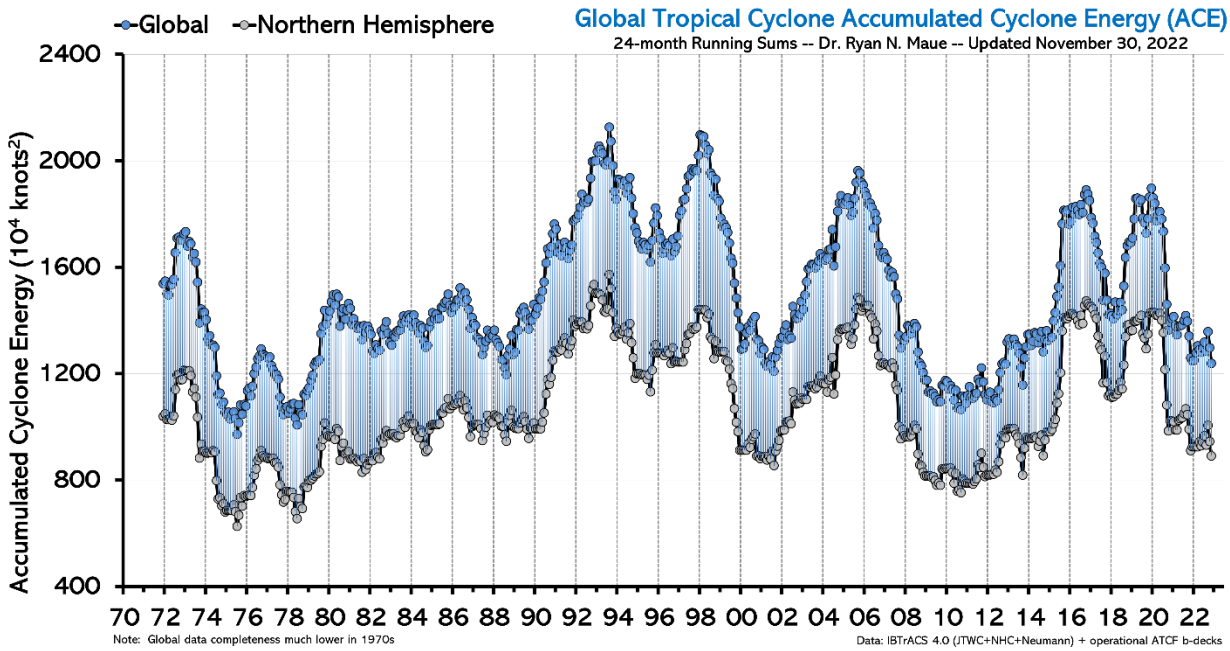
latter chart shows a heading of "1954-2020," but the bar chart begins in 1970. This discrepancy is unlikely to change the overall inference.

Tropical cyclones and accumulated cyclone energy show little trend since satellite measurements began in the early 1970s.[43]





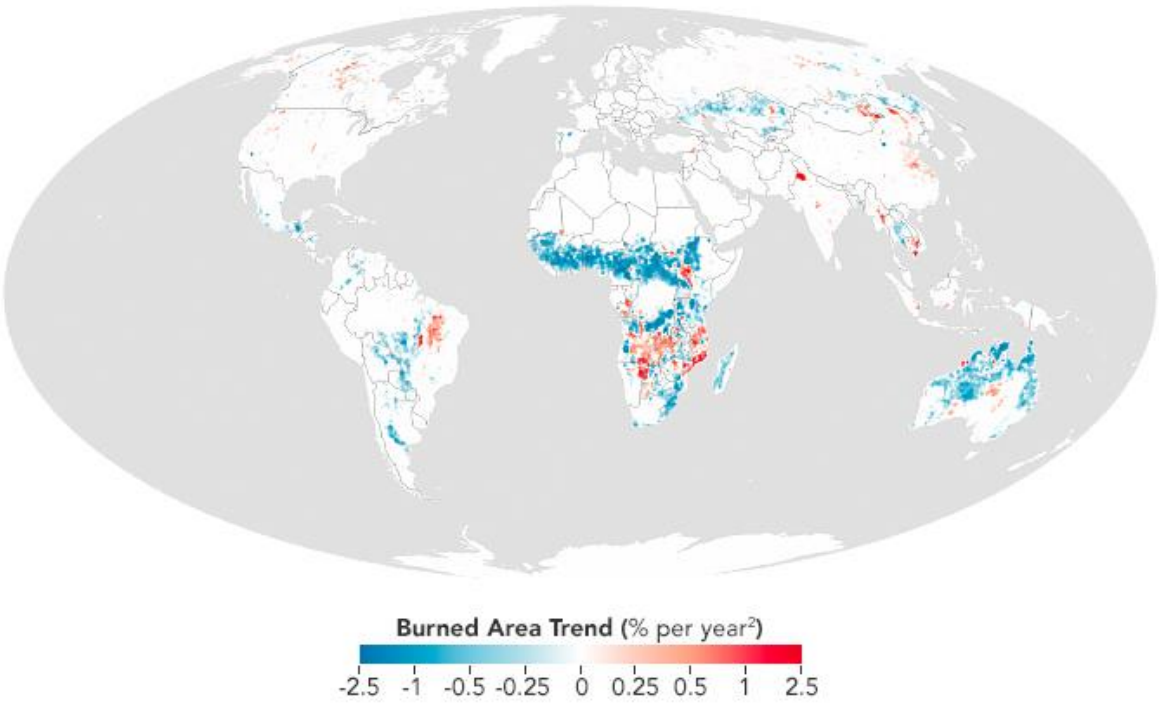
[43] For data on global tropical cyclone activity, see Ryan N. Maue, "Global Tropical Cyclone Activity, updated December 31, 2022, at http://climatlas.com/tropical/.



The number of U.S. wildfires shows no trend since 1985.[44] Global acreage burned declined sharply for 1998-2015, and by about 18 percent for the period 2003-2015 as reported by NASA, shown in the following figure.[45]

[44] For the reported U.S. wildfire data, see the EPA at https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires and the National Interagency Fire Center, "Total Wildland Fires and Acres (1926–2019)," https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html. Note that the recent U.S. wildfire phenomenon has been observed in government forests to a degree vastly disproportionate relative to private forests. See http://nwmapsco.com/ZybachB/Articles/Magazines/Oregon_Fish_&_Wildlife_Journal/20220401_Global_Warming/Zybach_20220401.pdf.

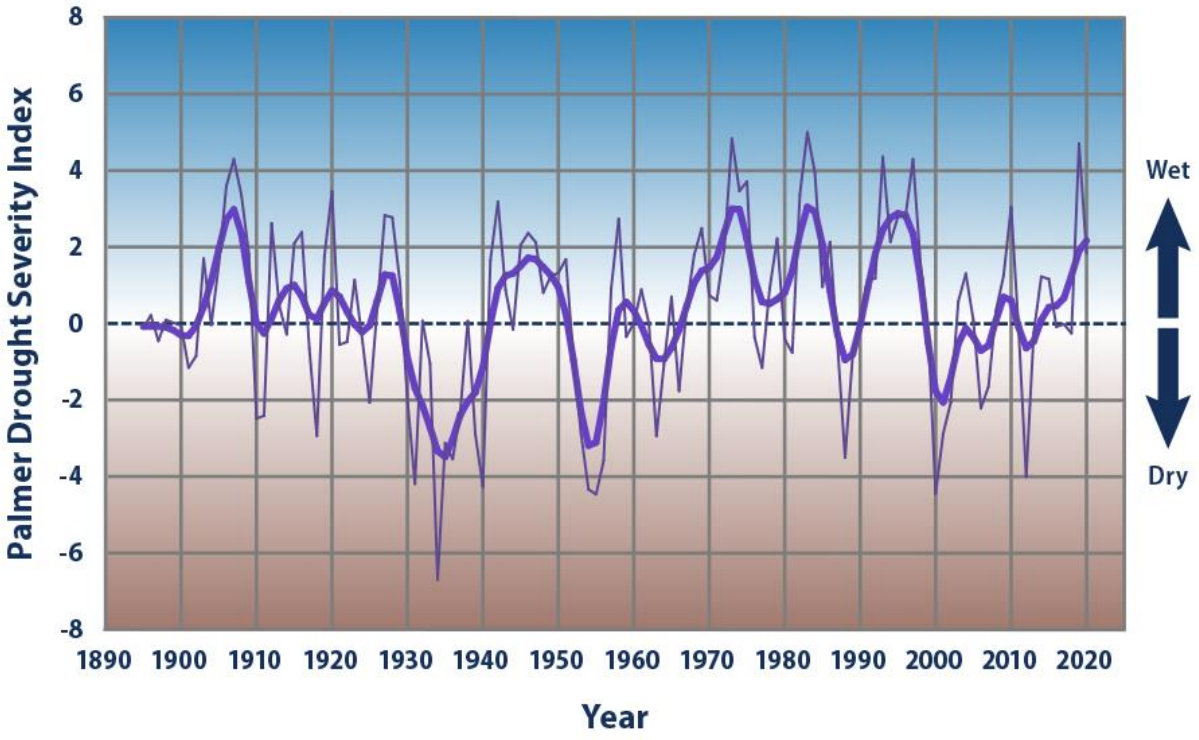
[45] On the decline in global area burned over past decades, see NASA at https://earthobservatory.nasa.gov/images/90493/researchers-detect-a-global-drop-in-fires; and Stefan H. Doerr and Cristina Santin, "Global Trends in Wildfire and Its Impacts: Perceptions Versus Realities in a Changing World," *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences* 371, no. 1696 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4874420/pdf/rstb20150345.pdf.



The Palmer Drought Severity index shows no trend since 1895, as shown in the following chart.[46] Vicente-Serrano, *et. al.* report that "Meteorological droughts do not show any substantial changes at the global scale in at least the last 120 years."[47]

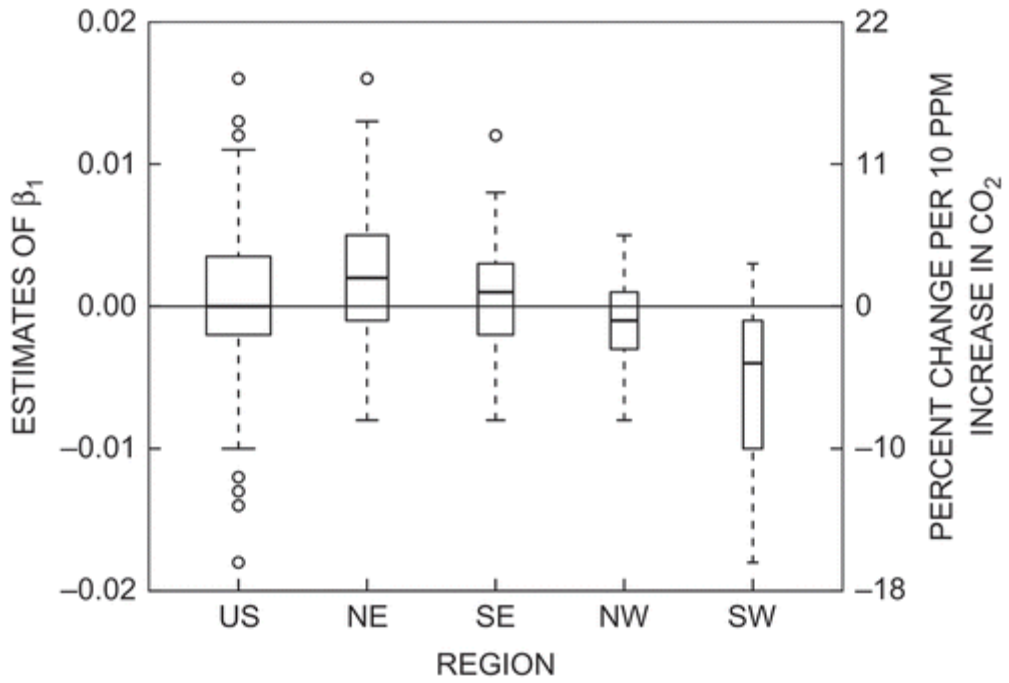
[46] See US Environmental Protection Agency, "Climate Change Indicators: Drought," https://www.epa.gov/climate-indicators/climate-change-indicators-drought; and US Department of Commerce, National Climatic Data Center, "Divisional Data Select," https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp.

[47] See Sergio M. Vicente-Serrano, *et. al.*, "Global Drought Trends and Future Projections," *Philosophical Transactions of the Royal Society*, October 2022, at https://www.researchgate.net/publication/364672519_Global_drought_trends_and_future_projections.



U.S. flooding over the past century is uncorrelated with increasing GHG concentrations.[48]

[48] See R. M. Hirsch and K. R. Ryberg, "Has the Magnitude of Floods Across the USA Changed with Global CO_2 Levels?," *Hydrological Sciences Journal* 57, no. 1 (2012): 1–9, https://www.tandfonline.com/doi/full/10.1080/02626667.2011.621895?scroll=top&needAccess=true&.



The IPCC in the AR6 reports that "The SREX (Seneviratne et al., 2012) assessed low confidence for observed changes in the magnitude or frequency of floods at the global scale. This assessment was confirmed by AR5 (Hartmann et al., 2013)."[49]

The available data do not support the ubiquitous assertions about the dire impacts of declining pH levels in the oceans.[50] Goklany reports as follows.[51]

> There is no likelihood of the ocean's average pH getting anywhere near as low as 7 (neutral) because of elevated carbon dioxide concentrations during the next three centuries. Ocean pH currently averages about 8 and is forecast to fall by 0.2 pH units or so during the present century. This change is considerably smaller than the difference in pH between different parts of the ocean, different days in the same part of the ocean, and even different times of day in coral reef lagoons. An examination of upper-ocean pH for a wide variety of ecosystems ranging from polar to tropical, open-ocean to coastal, kelp forest to coral reefs, indicates that variations in month-long pH spanned a range of 0.024 –1.430 pH units, and found that many organisms 'are already experiencing pH regimes that are not predicted until 2100.

The IPCC in the *Fifth Assessment Report* was deeply dubious about the various severe

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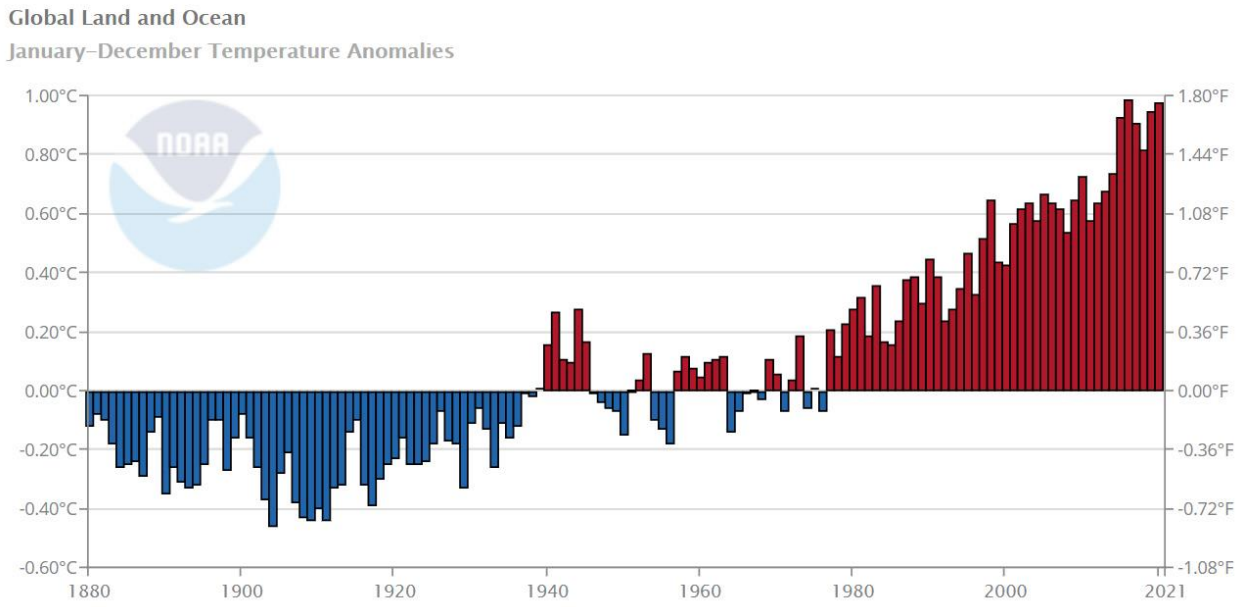
[49] See https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter11.pdf at p. 1568.
[50] For a summary discussion, see https://www.mattridley.co.uk/blog/thousands-of-results-on-ocean-acidification/. A comprehensive database is at CO_2 Science, "Ocean Acidification Database," http://www.co2science.org/data/acidification/results.php. See also Alan Longhurst, *Doubt and Certainty in Climate Science*, pp. 214–25, https://curryja.files.wordpress.com/2015/09/longhurst-print.pdf.
[51] See https://www.thegwpf.org/content/uploads/2015/10/benefits1.pdf at p. 16.

effects often asserted to be looming as impacts of anthropogenic warming; an example is a collapse of the Antarctic western and Greenland ice sheets. The IPCC analysis in the *Sixth Assessment Report* is almost identical.[52]

VII. Shifts in Climate Phenomena Result from Both Anthropogenic and Natural Phenomena

The draft NCA5 makes an argument implicit or explicit in much of the public discussion: "Human-driven greenhouse gas emissions have caused nearly all global warming observed since the late 1800s, with only very small effects from natural sources."[53] This cannot be correct. The NOAA data on global temperature anomalies since 1880 are shown in the following chart.[54]



Consider the period from 1910 through 1945: Temperatures increased by at least 0.4°C. The data published by the Climate Research Unit at East Anglia University are virtually identical, as illustrated in the following figure.[55]

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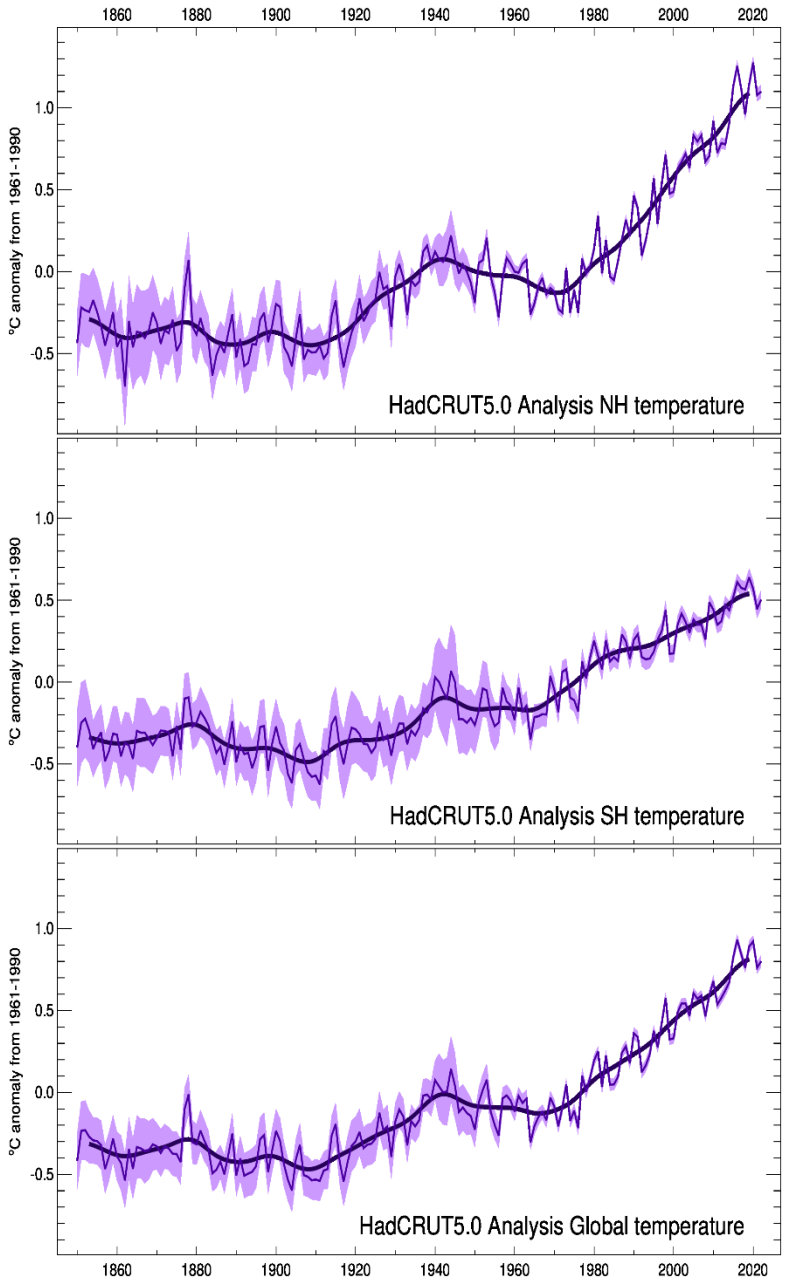
[52] For the AR5, see Julie M. Arblaster et al., "Long-Term Climate Change: Projections, Commitments and Irreversibility—Final Draft Underlying Scientific-Technical Assessment," in *Working Group I Contribution to the IPCC Fifth Assessment Report (AR5), Climate Change 2013: The Physical Science Basis*, September 23–26, 2013, p. 12–78, at http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter12.pdf. See the analogous analysis in the AR6 at p. 12-115 at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf.

[53] See the draft NCA5 at p. 1-33.

[54] See https://www.climate.gov/maps-data/dataset/global-temperature-anomalies-graphing-tool.

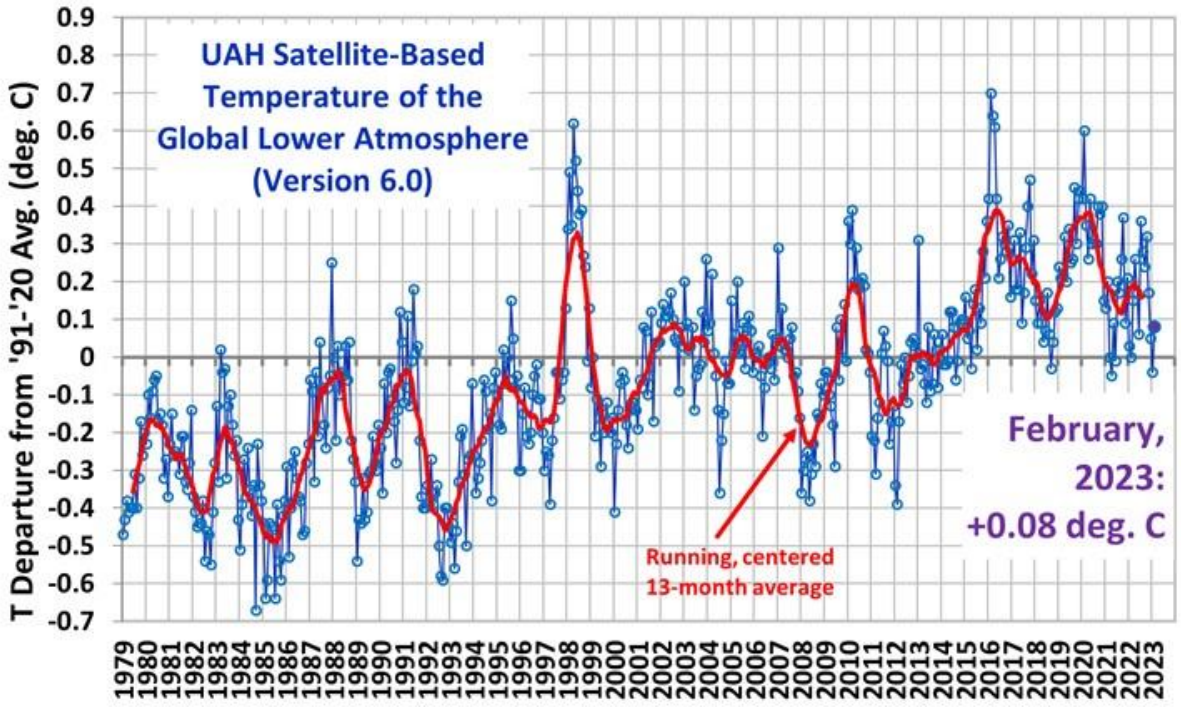
[55] See https://crudata.uea.ac.uk/cru/data/temperature/.

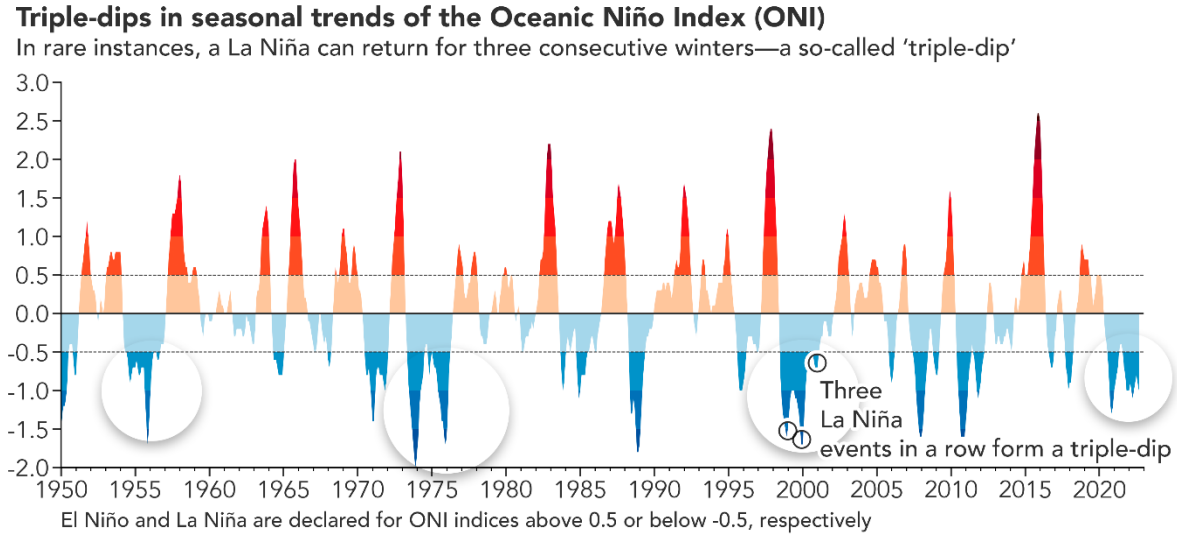


But atmospheric concentrations of carbon dioxide over that time period increased only from about 300 parts per million to about 310 ppm.[56] If that change in CO_2 concentrations yielded an increase in global temperatures of 0.4°C, the earth now would be uninhabitable, as current CO_2 concentrations are about 420 ppm.[57] Accordingly, given that natural influences affected climate phenomena before, say, 1970, it is reasonable to assume that they have affected them in more recent years. Can anyone actually argue that natural climate influences are irrelevant?

[56] See https://gml.noaa.gov/aggi/aggi.html.
[57] See https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_annmean_mlo.txt.

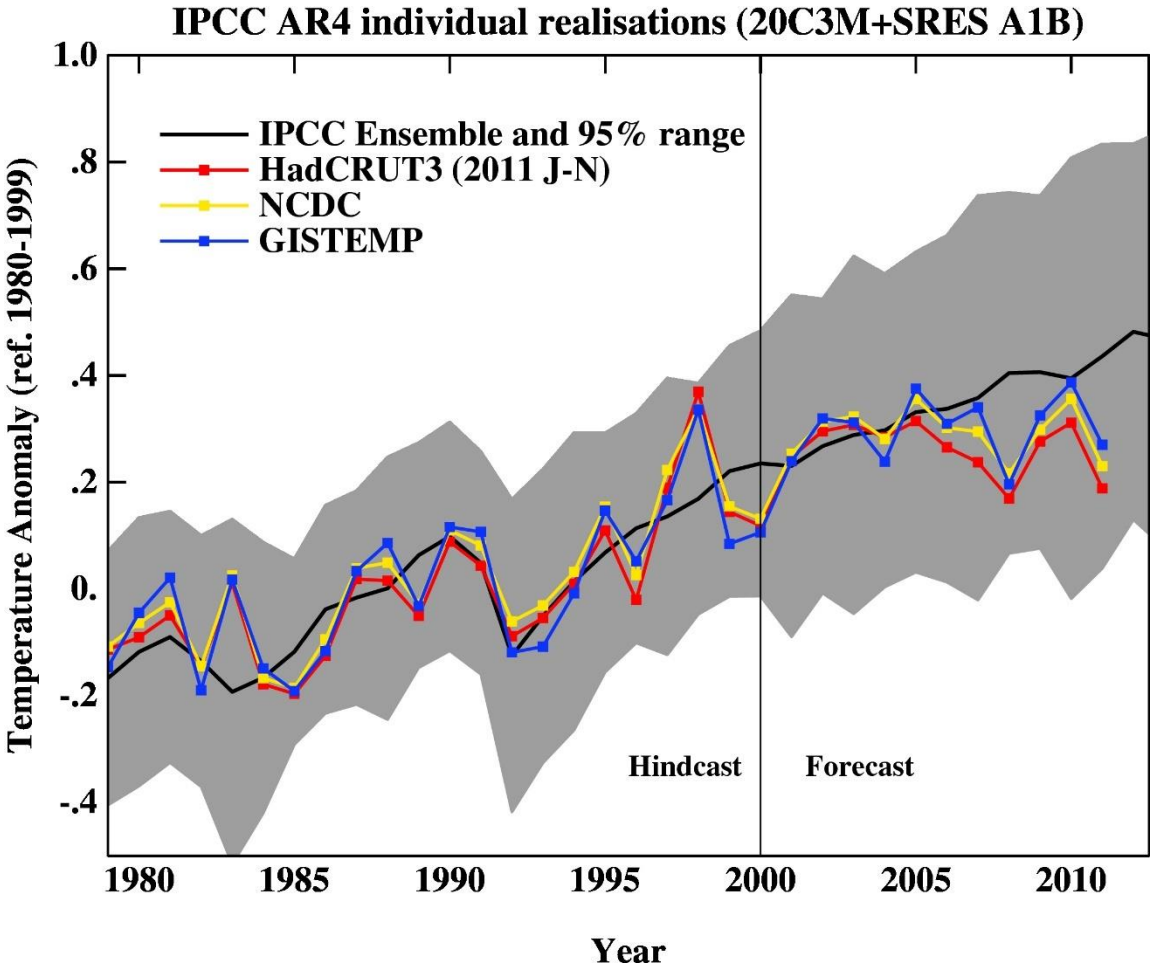
Consider the monthly satellite data for 1979 through February 2023 on temperature anomalies for four atmospheric layers, as reported by Spencer in the following chart.[58] What is clear is that the monthly and smoothed 13-month averages are influenced substantially by the El Niño/Southern Oscillation (ENSO) — alternating El Niño and La Niña conditions — as shown in the subsequent chart from NASA, in addition other important natural parameters and anthropogenic effects.[59]





[58] See the data reported by Professor Roy Spencer at https://www.drroyspencer.com/latest-global-temperatures/.
[59] See the NASA discussion at https://earthobservatory.nasa.gov/images/150691/la-nina-times-three.

Much of the climate science community has been driven to discount or ignore natural influences on climate phenomena because of its deeply problematic modeling methodology. In brief, the modelers adjust various assumptions in the models until the models predict the existing observations or a figure (say, for future temperature changes) that they deem acceptable or preferred.[60] Once the chosen parameters yield model predictions consistent with the historical record, there is no perceived need to incorporate the effects of natural phenomena, and so the "consensus" among the climate modelers is that all or most observed changes in climate phenomena are anthropogenic in origin. That this methodology is invalid should be obvious. Consider this chart, virtually identical to many available in the literature, purporting to show that the average IPCC climate model has predicted the past temperature record accurately.[61]



The models predict the past ("hindcast") accurately precisely because the models were "tuned" — internal parameters were chosen — to predict those observations. This is utterly invalid methodologically, and should not be viewed as credible.[62]

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[60] Private written communication with Professor John R. Christy, March 23, 2023, available from the author upon request.

[61] See https://skepticalscience.com/christy-exaggerates-model-data-discrepancy.html.

[62] Section VIII discusses the weak ability of the climate models on average to predict the actual temperature record.

Mainstream climate scientists have been driven to this "nearly all" assertion about anthropogenic influences for the obvious reason that once the importance of natural influences on warming are introduced (or conceded), the difficulty of separating anthropogenic and natural warming would become manifest, and the task of justifying the ensuing policy arguments would become vastly more difficult. The latest research in the peer-reviewed literature suggests that mankind is responsible for very roughly half of the approximate temperature increase of 1.1 degrees C since 1880.[63]

VIII. The Climate "Crisis"/"Risk"/"Stranded Assets" Framework Is Wholly an Artifact of Climate Models That Cannot Predict the Actual Data Record

McKitrick and Christy summarize the contrast between the model predictions and the actual satellite record as follows:

> The tendency of climate models to overstate warming in the tropical troposphere has long been noted. Here we examine individual runs from 38 newly released Coupled Model Intercomparison Project Version 6 (CMIP6) models and show that the warm bias is now observable globally as well. We compare CMIP6 runs against observational series drawn from satellites, weather balloons, and reanalysis products. We focus on the 1979–2014 interval, the maximum span for which all observational products are available and for which models were run using historically observed forcings. For lower-troposphere and midtroposphere layers both globally and in the tropics, all 38 models overpredict warming in every target observational analog, in most cases significantly so, and the average differences between models and observations are statistically significant. We present evidence that consistency with observed warming would require lower model Equilibrium Climate Sensitivity (ECS) values.[64]

Christy has produced analytic comparisons of the model predictions of temperature changes in the mid-troposphere with the actual measurements from satellites and weather

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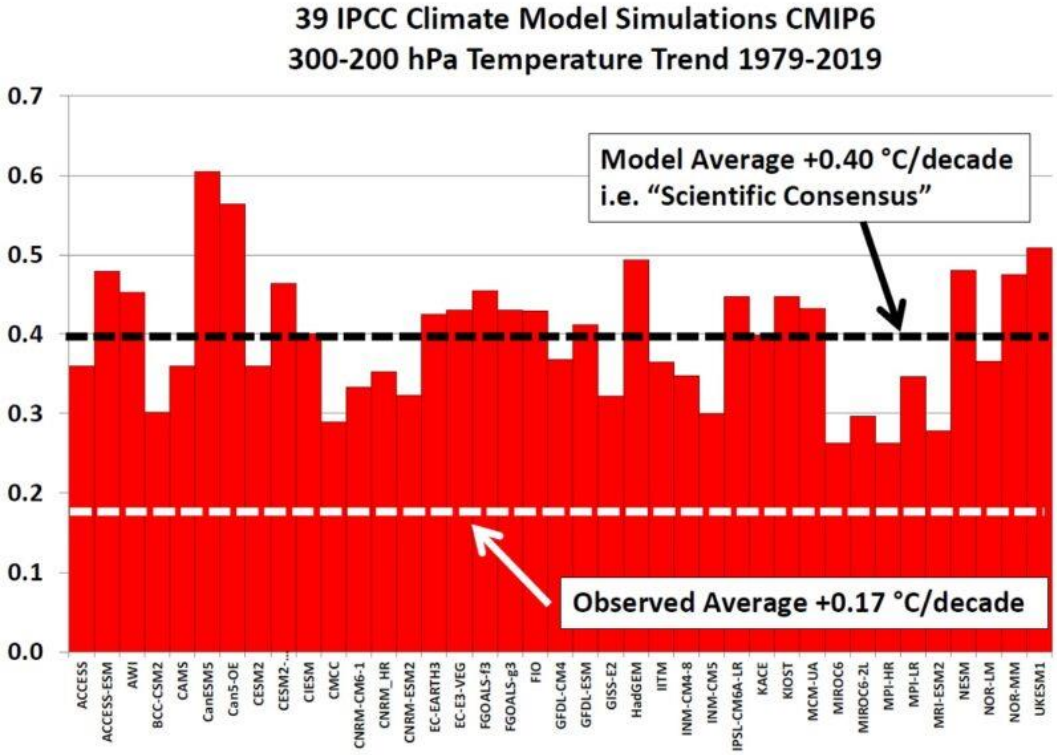
[63] See, e.g., Nicholas Lewis, "Objectively Combining Climate Sensitivity Evidence," *Climate Dynamics*, September 19, 2022, at https://link.springer.com/article/10.1007/s00382-022-06468-x; Ross McKitrick and John Christy, "A Test of the Tropical 200- to 300 hPa Warming Rate in Climate Models"; Nicholas Lewis and Judith Curry, "The Impact of Recent Forcing and Ocean Heat Uptake Data on Estimates of Climate Sensitivity," *Journal of Climate* 31 (August 2018): 6051–71, https://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-17-0667.1; and John R. Christy and Richard McNider, "Satellite Bulk Tropospheric Temperatures as a Metric for Climate Sensitivity," *Asia-Pacific Journal of Atmospheric Sciences* 53 (2017): 511–18, https://link.springer.com/article/10.1007/s13143-017-0070-z. For a chart summarizing the recent empirical estimates of equilibrium climate sensitivity as reported in the peer-reviewed literature, see Patrick J. Michaels and Paul C. Knappenberger, "The Collection of Evidence for a Low Climate Sensitivity Continues to Grow," Cato Institute, September 25, 2014, https://www.cato.org/blog/collection-evidence-low-climate-sensitivity-continues-grow.

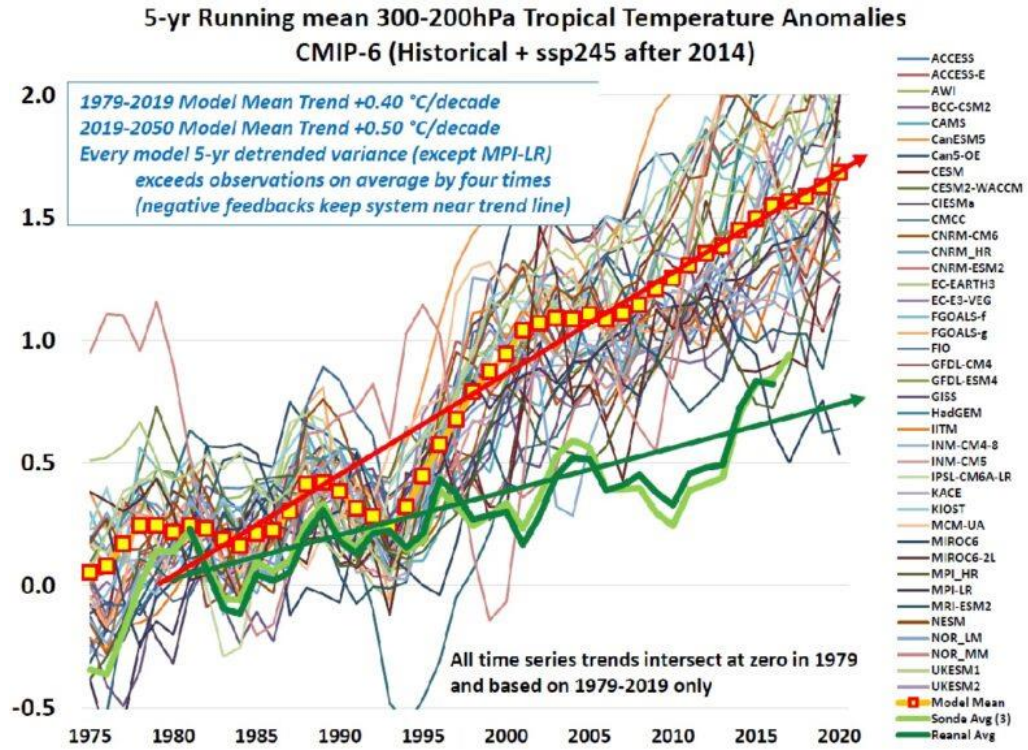
[64] See https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020EA001281.

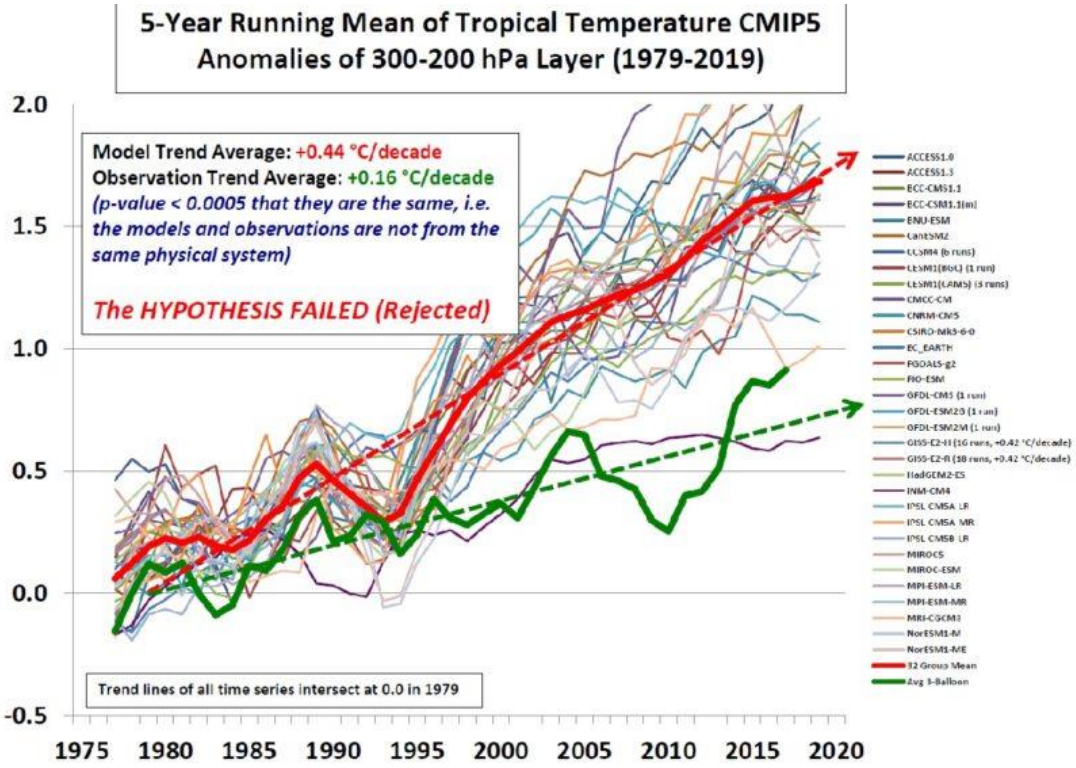
balloons.[65] For the AR6, the difference between the model predictions and the measurements is illustrated in the following chart.[66]



The performance of the CMIP-6 models in contrast with the data is illustrated in the following chart as well.[67] The upshot is that the models on average overstate the observations by a factor of over 2.3. Moreover, the CMIP-6 models on average essentially are no better than the earlier CMIP-5 models, the average of which predicted mid-troposphere temperature increases of 0.44°C per decade, while the actual measurements were 0.16°C per decade.[68]

[65] A good summary discussion is at https://clintel.org/new-presentation-by-john-christy-models-for-ar6-still-fail-to-reproduce-trends-in-tropical-troposphere/?mc_cid=1f85683f49&mc_eid=5965e22311.
[66] For the AR6, the suite of models is the Coupled Model Intercomparison Project Phase 6, at https://pcmdi.llnl.gov/CMIP6/. For the AR5, CMIP-5 is at https://esgf-node.llnl.gov/projects/cmip5/.
[67] See fn. 65.
[68] *Ibid.*


5-yr Running mean 300-200hPa Tropical Temperature Anomalies
CMIP-6 (Historical + ssp245 after 2014)
1979-2019 Model Mean Trend +0.40 °C/decade
2019-2050 Model Mean Trend +0.50 °C/decade
Every model 5-yr detrended variance (except MPI-LR)
exceeds observations on average by four times
(negative feedbacks keep system near trend line)
All time series trends intersect at zero in 1979
and based on 1979-2019 only
2.0
1.5
1.0
0.5
0.0
-0.5
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
ACCESS
ACCESS-E
AWI
BCC-CSM2
CAMS
CanESM5
Can5-OE
CESM
CESM2-WACCM
CIESMa
CMCC
CNRM-CM6
CNRM_HR
CNRM-ESM2
EC-EARTH3
EC-E3-VEG
FGOALS-f
FGOALS-g
FIO
GFDL-CM4
GFDL-ESM4
GISS
HadGEM
IITM
INM-CM4-8
INM-CM5
IPSL-CM6A-LR
KACE
KIOST
MCM-UA
MIROC6
MIROC6-2L
MPI_HR
MPI-LR
MRI-ESM2
NESM
NOR_LM
NOR_MM
UKESM1
UKESM2
Model Mean
Sonda Avg (3)
Reanal Avg


5-Year Running Mean of Tropical Temperature CMIP5
Anomalies of 300-200 hPa Layer (1979-2019)
Model Trend Average: +0.44 °C/decade
Observation Trend Average: +0.16 °C/decade
(p-value < 0.0005 that they are the same, i.e.
the models and observations are not from the
same physical system)
The HYPOTHESIS FAILED (Rejected)
Trend lines of all time series intersect at 0.0 in 1979
2.0
1.5
1.0
0.5
0.0
-0.5
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
ACCESS1.0
ACCESS1.3
BCC-CSM1.1
BCC-CSM1.1(m)
BNU-ESM
CanESM2
CCSM4 (6 runs)
CESM1(BGC) (1 run)
CESM1(CAM5) (3 runs)
CMCC-CM
CNRM-CM5
CSIRO-Mk3-6-0
EC_EARTH
FGOALS-g2
FIO-ESM
GFDL-CM3 (1 run)
GFDL-ESM2G (1 run)
GFDL-ESM2M (1 run)
GISS-E2-H (16 runs, +0.42 °C/decade)
GISS-E2-R (18 runs, +0.42 °C/decade)
HadGEM2-ES
INM-CM4
IPSL-CM5A-LR
IPSL-CM5A-MR
IPSL-CM5B-LR
MIROC5
MIROC-ESM
MPI-ESM-LR
MPI-ESM-MR
MRI-CGCM3
NorESM1-M
NorESM1-ME
32 Group Mean
Avg 3-Balloon

The question of why the models on average have not improved in any material sense is outside the scope of this statement prepared for the Committee.

IX. Government Policies Sharply Reducing Emissions of Greenhouse Gases Would Have Future Climate Effects Undetectable or Virtually Indistinguishable from Zero

It is important to examine, even in summary fashion, the future climate effects of public policies yielding an important "stranding" of large parts of the U.S. capital stock. Let us apply the Environmental Protection Agency climate model to various reductions in GHG emissions, both domestic and international, under an assumed equilibrium climate sensitivity of 4.5°C.[69]

Net-zero U.S. GHG emissions effective immediately would yield a reduction in global temperatures of 0.173°C by 2100. That effect would be barely detectable given the standard deviation (about 0.11°C) of the surface temperature record.[70] The entire Paris agreement: about 0.178°C. A 50 percent reduction in Chinese GHG emissions: 0.184°C. Net-zero emissions by the entire Organization for Economic Cooperation and Development: 0.352°C. A global 50 percent reduction in GHG emissions implemented immediately and maintained strictly would reduce global temperatures in 2100 by 0.687°C. Note that GHG emissions in 2020 fell by about 3.7 percent as a result of the COVID-19 economic downturn.[71] Can anyone believe that even larger GHG reductions — and the attendant economic costs — are plausible politically?

X. The Interagency Working Group Analysis of the "Social Cost of Carbon" As a Parameter Underlying Regulatory Policies Is Fundamentally Flawed

Precisely because the prospective climate effects of GHG emissions policies even barely plausible are so small, proponents have ignored those impacts in favor of a simple multiplication of the asserted reductions in GHG emissions by various estimates of the "social cost of carbon," that is, the present value of the stream of marginal economic damages caused by the emission of a metric ton of GHG, usually on a CO2e basis.

The Biden administration Interagency Working Group is in the process of updating the federal estimates of the SCC, but it is difficult to believe that they will differ substantially from the interim IWG estimates.[72] The interim estimates are fatally flawed, in that they (1) distort the actual economic growth predictions produced by the Integrated Assessment Models, (2) incorporate "co-benefits" in the form of a reduction in the emissions of other criteria and hazardous air pollutants already regulated under different provisions of the Clean Air Act, (3) incorporate the asserted benefits of GHG reductions on a global basis, and (4) employ discount rates that are artificially low, inconsistent, and inappropriate.[73]

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[69] Author computations. See the EPA climate model at https://magicc.org/. An assumed ECS of 4.5°C is the high point of the "likely" ECS range reported by the IPCC in the AR5, and higher than the high point of 4°C in the "likely" range in the IPCC AR6. See the AR5 at https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_TS_FINAL.pdf, at p. 81, and the AR6 at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf, at p. 46.

[70] See https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/1999JD900835.

[71] See https://www.nature.com/articles/d41586-021-00090-3.

[72] The interim estimates are at https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

[73] See Benjamin Zycher at https://scholarship.law.tamu.edu/cgi/viewcontent.cgi?article=1154&context=lawreview.

Economic growth predictions. The available analysis suggests that the prospective financial risks of anthropogenic climate change, at least in the aggregate, are much smaller than commonly asserted. Consider the predictions from the integrated assessment models, one central example of which is the Dynamic Integrated Climate and Economy Model, for which William D. Nordhaus won the Nobel Prize in Economics in 2018.[74] Under DICE, global gross domestic product (GDP) in 2100 varies by about 3 percent across policy scenarios, including no climate policies at all, a figure that is both very small and almost certainly not statistically significant given the vagaries of economic forecasting, the magnitude of annual changes in global economic growth, and the number of years remaining before the end of this century. (I exclude here Nordhaus' "Stern discounting" policy scenario, as it assumes a discount rate effectively equal to zero, a fundamental analytic error, as discussed below.[75]) Per capita consumption varies only by about 1.3 percent across policy scenarios, also a very small number and almost certain not to be statistically significant.

The IPCC — even in its most alarmist analyses — arrives at a conclusion very close to that reported in the DICE analysis. In its "1.5°C" report, it finds that the damage from anthropogenic climate change unmitigated by policy initiatives will reduce global GDP by 2.6 percent by 2100.[76] In other words, if we assume, conservatively, global GDP growth of, say, 2 percent per year, climate change unmitigated by policy initiatives would shift the global GDP growth path backward by about 15.6 months, an approximate reduction magnitude observed commonly during economic recessions.[77] By 2100, IPCC projects that individual incomes on average will be at least 400 percent greater than is the case today, so that climate change unmitigated by policy initiatives would make individuals in 2100 "only" 398 percent wealthier than individuals today.[78]

Incorporation of co-benefits. Because no policy to reduce GHG emissions can satisfy any

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[74] See William Nordhaus and Paul Sztorc, "DICE 2013R: Introduction and User's Manual," Yale University, Department of Economics, October 2013, Figure 4 and Table 1, http://www.econ.yale.edu/~nordhaus/homepage/homepage/documents/DICE_Manual_100413r1.pdf. See also Benjamin Zycher, "The Climate Left Attacks Nobel Laureate Willian D. Nordhaus," monograph, American Enterprise Institute, July 2020, at https://www.aei.org/wp-content/uploads/2020/07/The-Climate-Left-Attacks-Nobel-Laureate-William-D.-Nordhaus.pdf.

[75] See Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge, UK: Cambridge University Press, January 2007), https://www.cambridge.org/us/academic/subjects/earth-and-environmental-science/climatology-and-climate-change/economics-climate-change-stern-review?format=PB. On the contrast between the climate predictions made by the Stern model and the actual record, see https://rogerpielkejr.substack.com/p/off-target-an-evaluation-of-the-stern?utm_source=substack&publication_id=119454&post_id=104480671&utm_medium=email&utm_content=share&triggerShare=true&isFreemail=true. See also David Kreutzer, "Discounting Climate Costs," Heritage Foundation, June 16, 2016, at https://www.heritage.org/environment/report/discounting-climate-costs.

[76] See Marco Bindi, *et. al.*, "Impacts of 1.5°C of Global Warming on Natural and Human Systems," at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Chapter3_Low_Res.pdf, Chapter 3 of Valerie Masson-Delmotte, *et. al.*, eds., IPCC Special Report, *Global Warming of 1.5°C*, at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf.

[77] See the IMF discussion at https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/Recession#:~:text=In%20particular%2C%20a%20recession%20is,is%20close%20to%205%20percent.&text=The%20fall%20in%20consumption%20is,declines%20than%20that%20in%20GDP.

[78] The 400 percent figure implies average annual growth in per capita GDP of about 1.5 percent for the rest of this century. [15.6/12]*1.5=1.95. 400-1.95=398.05.

plausible benefit/cost test — their attendant future climate effects for the most part would approach zero, as discussed in section IX — the SCC interim estimates include purported "co-benefits," that is, the benefits of reductions in other pollutants, as factors to be considered in the evaluation of proposed regulations and projects. This is particularly the case for the asserted health benefits of reductions in the emissions of fine particulates (PM2.5).[79] Like many of the other pollutants included in the co-benefits methodology, fine particulates are a "criteria" pollutant,[80] as distinct from "hazardous air pollutants (HAP)." EPA already limits ambient levels of PM2.5 in a separate regulation, and is required under the CAA to determine every five years whether that standard "accurately reflects the latest scientific knowledge" on the health effects of exposure to particulates.[81]

The Clean Air Act explicitly requires the EPA, upon finding that a given criteria pollutant endangers the public health, to promulgate a "national ambient air quality standard" (NAAQS) that "protects the public health" with "an adequate margin of safety."[82] The CAA also empowers the EPA to regulate emissions of HAP. The law mandates that costs not be considered in the establishment of the NAAQS; this means that those standards are likely to be too stringent in a benefit/cost sense. Lowering the emissions of those pollutants even more through insertion of a co-benefits calculation in a new regulation aimed at an entirely different type of emission means that the excess net costs of the regulation are likely to be driven up even more.

Global benefits. OMB Circular A-4 directs federal agencies conducting benefit/cost analysis of regulatory measures as follows: "Your analysis should focus on benefits and costs that accrue to citizens and residents of the United States. Where you choose to evaluate a regulation that is likely to have effects beyond the borders of the United States, these effects should be reported separately."[83] The IWG analysis incorporates explicitly in its benefit/cost calculation the purported global climate benefits from reductions in U.S. GHG emissions, presumably on the grounds that the assumed GHG externality is global in nature.

This argument is fundamentally flawed, in substantial part because the global climate effect of *all* U.S. GHG emissions is very close to zero, as discussed above.[84] Accordingly, the global "benefits" in terms of the SCC would be effectively zero. The IWG cannot dispute this because it is the EPA climate model used directly or indirectly through the IAMs that is applied to the analysis

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[79] The EPA discussion of particulate matter regulatory actions is at https://www.epa.gov/pm-pollution/particulate-matter-pm-implementation-regulatory-actions. A severe critique of the EPA analysis of PM2.5 by the EPA Clean Air Scientific Advisory Committee in 2019 can be found at https://casac.epa.gov/ords/sab/f?p=113:12:3395659987569. A concise critique by James E. Enstrom is at http://scientificintegrityinstitute.org/PMPanel121021.pdf.

[80] See the EPA summary discussion at https://www.epa.gov/criteria-air-pollutants.

[81] See the EPA requirements for fine particulates at https://www.epa.gov/pm-pollution/implementation-national-ambient-air-quality-standards-naaqs-fine-particulate-matter. The CAA sections are at https://www.epa.gov/clean-air-act-overview/clean-air-act-title-i-air-pollution-prevention-and-control-parts-through-d#ia.

[82] See §7409 (b)(1), "National primary and secondary ambient air quality standards" at https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partA-sec7409.htm.

[83] See OMB Circular A-4, "Regulatory Analysis," September 17, 2003, at https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/.

[84] Again, this obviously is why CEQ substitutes the SCC estimates in place of actual predicted climate impacts.

of the SCC by the federal government. More generally, it is the EPA climate model that is used throughout the federal government for analysis of climate and energy policies.[85]

Furthermore, the inclusion of purported global benefits in the benefit/cost analysis of U.S. GHG policies would create a very large distortion in terms of an efficient international adoption of climate policies. An efficient promulgation of climate policies internationally would attempt to achieve both an equation of the global marginal benefits and costs of GHG emission reductions, *and* an allocation of emissions reductions that equates the marginal cost of such reductions across economies. If the U.S. is to promulgate domestic policies that equate domestic marginal costs with global marginal benefits, then other countries would have powerful incentives to obtain free rides on U.S. efforts. Given that the marginal cost function for reductions in GHG emissions almost certainly is upward sloping — the marginal cost of GHG reductions rises as such reductions increase — the outcome would be a global effort to reduce GHG emissions more costly than an international effort equating marginal costs across economies.[86] That is the central implication of the imperative incorporated in the IWG analysis of the SCC: Under any assumption about the global benefits of reduced GHG emissions, that cannot be an efficient outcome unless the U.S. is the low-cost source of *all reductions* in GHG emissions, an assumption that simply is not plausible.

Discount rates artificially low, inconsistent, and inappropriate. By definition "climate policy" is the allocation of resources away from current consumption and from productive activities that yield consumption goods during the current time period, in favor of a reduction in GHG emissions/concentrations that purportedly would increase the production of consumption goods during some series of future time periods. That is why the various policies proposed for reductions in GHG emissions assert in the respective regulatory impact analyses that there would result an increase in the present value of the long term consumption stream.[87] Accordingly, that use of resources during the current time period — again, by definition — is an investment, and it must be evaluated in comparison with the social return to alternative investments.

Therefore, it is the opportunity of cost of capital that is the appropriate discount rate to be applied to the estimation of the SCC, because the allocation — the investment — of resources toward reductions in GHG emissions imposes an opportunity cost in the form of other forgone investments. Because the use of scarce resources for reductions in GHG emissions is an investment, whether promising returns low or high, the appropriate discount rate is the opportunity cost of capital for the economy as a whole. For the period 1928-2020, the average annual before-tax return to investment in the Standard and Poor 500, in real (inflation-adjusted) terms was 8.5 percent.[88] For the period 1960-2020, the figure was 7.61 percent. Such long-run historical figures

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[85] See, e.g., Environmental Protection Agency and Department of Transportation, National Highway Traffic Safety Administration proposed rule, "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles — Phase 2," July 12, 2015, at https://www.regulations.gov/document/EPA-HQ-OAR-2014-0827-0002.

[86] This is true whether the marginal cost functions across economies are identical or differ.

[87] See, e.g., the EPA "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review," at https://www.regulations.gov/document/EPA-HQ-OAR-2021-0317-1460. See also Benjamin Zycher at https://www.aei.org/wp-content/uploads/2023/02/EPA-methane-emissions-climate-rev-EPA-HQ-OAR-2021-0317-1460-Zycher-comment-Feb-13-2023.pdf.

[88] The data on annual returns for several investment alternatives are reported by the Stern School of Management,

are consistent with the directive in OMB Circular A-4 that a discount rate of 7 percent be the baseline parameter applied to regulatory analysis by the federal government.[89]

The IWG has attempted to justify a "consumption rate of interest" defined alternatively at 2.5 percent, 3 percent, or 5 percent, by arguing that the use of the social rate of return on capital (7 percent under current OMB Circular A-4 guidance) to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC-GHG. The IWG argues instead that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context, and that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.[90]

That analytic argument is fundamentally flawed. First: The "consumption rate of interest" is not the correct conceptual discount rate for analysis of the SCC because the use of resources for purposes of reductions in GHG emissions is obviously an investment of resources in pursuit of an increase in the present value of the consumption stream, the opportunity cost of which is the marginal social return to investment. Even if we assume that the "consumption rate of interest" conceptually is the correct parameter for discounting purposes, the relevant metric is the real market rate of interest on intertemporal consumption shifts, one crude measure of which is the market rate of interest on unsecured consumer loans. Even given the recent years of low interest rates maintained by the Federal Reserve, that market rate appears to be over 7 percent in real terms.[91] For secured loans (new autos), the real interest rate appears to be at least 3 percent,[92] but that is not the correct parameter because there is no collateral insuring against the possibility that government policies mandating reductions in GHG emissions will prove uneconomic, that is, yield an aggregate economic return lower than the opportunity cost of capital. The discount rate argument presented in the interim IWG SCC analysis is fundamentally flawed analytically, and is inconsistent with the data for the U.S. credit market.

Note also that the use of a (low) "consumption rate of interest" for the evaluation of climate policy only would introduce an important bias in the allocation of resources among government policies and between government and private-sector resource use. The IWG does not argue that the "consumption rate of interest" should be applied to the benefit/cost analysis of all government investment and regulatory activity; only climate policies are to be so treated, on the grounds of "intergenerational equity," discussed below. Nor would the private sector choose to use an artificially-low discount rate for the evaluation of alternative resource uses. If it is only the climate dimension of investment and consumption choice dynamics that is to be shaped by the use of a low "consumption rate of interest," it is obvious that important distortions would be the central outcome, with a smaller capital stock resulting.

Second: The implicit premise in the IWG discussion of intergenerational analysis and the discount rate is straightforward: Future generations prefer to avoid the damages that they ostensibly will bear because of the climate effects of resource allocation decisions made by the

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New York University, at http://www.stern.nyu.edu/~adamodar/pc/datasets/histretSP.xls.

[89] See fn. 83 *supra*.

[90] See p. 3 at https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

[91] See the data reported by the Federal Reserve Bank of St. Louis at https://fred.stlouisfed.org/series/TERMCBPER24NS.

[92] See https://fred.stlouisfed.org/series/RIFLPBCIANM60NM.

current generation, and because future generations cannot vote during the current time period, it is equitable to force the current generation to bear the costs of anthropogenic climate change that otherwise would be inflicted upon future generations.

However seemingly straightforward, that argument is not correct. Future generations prefer to receive a bequest of an aggregate capital stock more- rather than less valuable, an objective very different from a maximization of the value of one dimension — climate phenomena — of that aggregate capital stock. This requires efficient resource allocation by the current generation, and therefore the application of the correct discount rate. Consider a *homo sapiens* baby borne in a cave some 50,000 years ago. Despite the fact that at birth that child would have enjoyed environmental quality effectively unaffected by mankind, and *a fortiori* climate phenomena determined by natural processes only, the baby at birth would have had a life expectancy of only about ten years.[93]

Accordingly it is obvious that given the opportunity to choose, that child would opt for less environmental quality and (perhaps) greater climate risk in exchange for a longer life expectancy engendered by a more valuable aggregate capital stock yielding improved shelter, expanded food supplies, a cleaner water supply, better medical care, *ad infinitum*. Greater wealth is the central objective of any generation, a reality shunted aside by the focus in the IWG analysis upon only the climate dimension of the aggregate capital stock to be bequeathed to future generations.

The application of a 7 percent discount rate would reduce the SCC in the various IAMs to figures close to zero, or even below it.[94] That is why the proponents of climate policies insist upon the use of discount rates artificially low.

XI. Observations on Planetary Greening and Global Food Production

Increases in atmospheric concentrations of GHG might engender serious adverse effects, although there is no available evidence in support of that hypothesis, as discussed in section VI, but beneficial effects already are observable in the data. Satellite data from NASA show a significant greening effect of increases in atmospheric carbon dioxide, as displayed in the following NASA mapping.[95]

With respect to global food production, data from the United Nations Food and Agriculture Organization show that global per capita food production increased 46 percent between 1961 and 2020, and 20 percent for 2000-2020.[96] The global number of undernourished people declined from 796.2 million in 2000 to 590.6 million in 2018, even as the global population increased by 24.6 percent.[97] From 2018 to 2020, the number of undernourished increased from 590.6 million to 721.7

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[93] This life expectancy observation was provided by Professor Gail Kennedy, Department of Anthropology, University of California, Los Angeles, during a telephone interview conducted February 16, 2011.

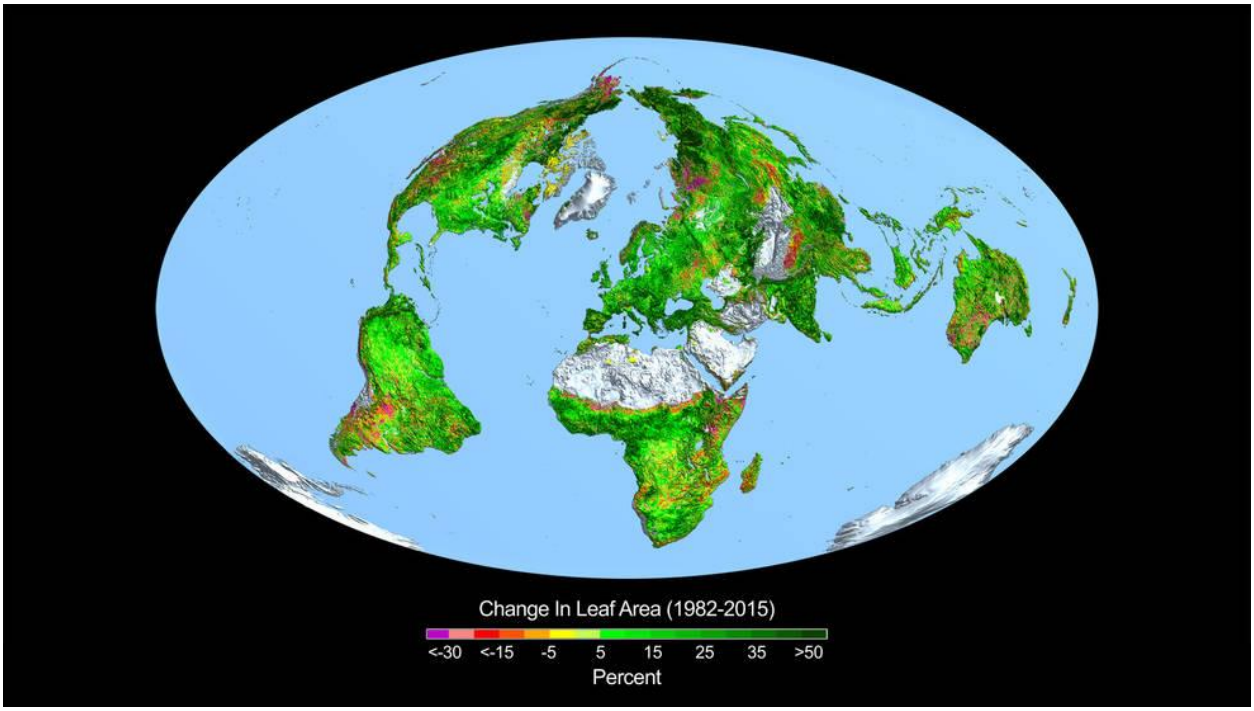
[94] See David Kreutzer at https://www.heritage.org/environment/report/discounting-climate-costs, and the references listed.

[95] See https://www.nasa.gov/feature/goddard/2016/carbon-dioxide-fertilization-greening-earth, Zhu *et. al.* at https://www.nature.com/articles/nclimate3004 and Chen *et. al.* at https://www.science.org/doi/10.1126/sciadv.abb1981.

[96] See the FAO data at https://www.fao.org/faostat/en/#data/QI.

[97] On undernourishment, see the FAO data at https://www.fao.org/faostat/en/#data/FS. On global population, see the data reported by the U.S. Bureau of the Census at https://www.census.gov/data-tools/demo/idb/#/country?COUNTRY_YEAR=2023&COUNTRY_YR_ANIM=2023.

million, but to attribute this to "climate change" is preposterous; obviously, COVID and various wars and supply chain problems were the problem. Even given those adverse conditions, the number of global undernourished fell by over 9 percent from 2000 to 2020 while the global population grew by 26.5 percent. FAO data show that global food prices in real terms declined about 4 percent from 1961-1972, increased about 30 percent through 1975, declined over 28 percent through 2018, and then increased about 49 percent through 2022.[98]



XII. Observations on the Meaning of Climate "Risk"

Projections of climate phenomena and resulting "risks" to the economy — far into the future — are very far from trivial methodologically. Which climate model(s) should be used? Which assumptions about future emissions, about the sensitivity of the climate system, about policies to be adopted internationally, about the climate effects of those policies, *ad infinitum*, should be incorporated into those analyses? What confidence should be attached to the predictions made by the models? Are government agencies and private business firms — even very large ones — in a position to do such analysis in a credible fashion? If not, whom should they retain to do that analysis for them, and how should they evaluate the differences among the available alternative providers of such analyses?

[98] See the FAO price data at https://www.fao.org/worldfoodsituation/foodpricesindex/en/#:~:text=In%202022%20as%20a%20whole%2C%20the%20FAO%20Meat%20Price%20Index,annual%20average%20registered%20since%201990.

The concept of "risk" by its very nature implies a range of possible outcomes delineated by a statistical distribution of likelihoods around some mean and with some standard deviation. "Uncertainty" clearly is a more accurate term than "risk" in this context, in that the mean and/or standard deviation of the relevant statistical distributions are very unlikely to be known. The reality is that the analysis of "climate risk" would be deeply speculative, and the level of detail and the scientific sophistication that would be needed to undertake it is staggering. The supporting analyses and documentation would take up thousands of pages, with references to thousands more, and the premise that this process would facilitate improved decision making by investors, government officials, and others is difficult to take seriously.

If climate "risks" are deemed sufficiently important for policy purposes, why not others that are potentially large but uncertain or speculative? All such risks are difficult to evaluate, and the list is long. Massive volcanic eruptions. Asteroid impacts. Powerful earthquakes. Tsunamis. The potential problem of mass contagion is one with which we are far more familiar now than was the case only a few years ago. Other "risks" are the use of bioweaponry by terrorists, nuclear war, gamma ray storms, and on and on. Is climate "risk" the most important? If that is the hypothesis, what is the basis for it? Why are those others, and many more, not worthy of a "stranded assets" analysis? What distortions would result from attention only to climate change and not others?

XIII. Conclusions

The "Low-Carbon World" assertion explicit in the title of this hearing assumes a structural economic shift away from conventional energy — fossil fuels — that is virtually certain not to be observed. Because fossil fuels are overwhelmingly the most efficient forms of energy available now or prospectively, market forces will not engender a massive shift away from them toward such unconventional forms of energy as wind and solar power. Such unconventional energy technologies are uncompetitive because they are far more costly and far less reliable than conventional energy. That is why they cannot survive a competitive market test, and it is only large subsidies, both direct and indirect, and other policy-driven subventions that allow them to survive. Accordingly, market forces will not yield a sharp decline in the market value of those significant parts of the capital stock complementary with the production, transport, and consumption of conventional energy, that is, a "stranding" of the relevant respective components of the capital stock. Moreover, any such market shift would take place over many years or decades as part of the long-term process of capital depreciation, investment, and changes in resource allocation. Accordingly, no market-driven "stranding" of capital assets will be observed.

Market-driven shifts in the values of capital assets are not an appropriate focus for government policies given the central principle of resource allocation driven by individual preferences reflected in market prices. Shifts in market conditions always have resulted in changing relative prices and wealth distributions, in particular as a result of technological advances, and there is no principle consistent with support for a market economy that would be imply a role for government in terms of accelerating or hindering such shifts.

Nor will government policies engender such a massive economic transformation, that is, a "stranding" of capital assets complementary with conventional energy. With the exception of the methane tax included in the Inflation Reduction Act, Congress has never enacted a statute

mandating direct reductions in greenhouse gas (GHG) emissions, for the obvious reason that large reductions in such emissions cannot be achieved without sharp declines in the consumption of fossil fuels, that is, a large increase in energy costs that would not be consistent with the political interests of elected public officials. The IPCC in a recent report argues that achievement of the purported 1.5°C "safe" limit on global temperature increases would require implicit taxes equivalent to over $35 per gallon of gasoline by 2030, in constant year 2022 dollars, and rising sharply thereafter. Congress will never enact such policies.

This is true as well at the international level. The Paris agreement, apart from the reality that the Nationally Determined Contributions are meaningless, necessarily contains no enforcement mechanism, and no such international agreement even conceptually consistent with the most basic tenets of national sovereignty could do so.

A regulatory regime sufficiently stringent to create a large-scale "stranding" of conventional energy assets would not survive legal challenges under the Major Questions doctrine.

There is no evidence of a climate "crisis" in terms of temperature trends, polar sea ice, tornadoes, tropical cyclones, wildfires, drought, flooding, or ocean alkalinity. The IPCC is deeply dubious about the various severe effects often asserted as prospective impacts of increasing atmospheric concentrations of GHG. Moreover, NASA reports significant planetary greening as a result of increasing atmospheric concentrations of carbon dioxide, and data from the United Nations Food and Agriculture Organization show that global per capita food production increased 46 percent between 1961 and 2020, and 20 percent for 2000-2020.

The "crisis" narrative is derived wholly from climate models that cannot predict the actual temperature record. In particular, the suite of climate models underlying the IPCC 5th and 6th Assessment Reports overstate the mid-troposphere temperature record by factors of about 2.5. Moreover, the models are fine-tuned in such a way as to deny the importance of natural influences on climate phenomena, but that is inconsistent with a large body of evidence, in particular the substantial warming observed from 1910 to 1945, and the close correlation between the satellite temperature record and the El Niño/Southern Oscillation.

Government policies to reduce GHG emissions would have future climate effects either trivial or indistinguishable from zero, as predicted by the EPA climate model under a set of assumptions that exaggerate the prospective impacts of such emissions reductions. Such policies, whether domestic or international, cannot satisfy any plausible benefit/cost test.

Because such policies cannot be asserted to yield nontrivial future climate impacts, the federal government has resorted to asserting benefits from reductions in GHG emissions driven by calculations of the "social cost of carbon," a deeply problematic analytic framework distorted by the misuse of economic growth projections, the inclusion of co-benefits in the form of reductions in pollutants already regulated under the Clean Air Act, the incorporation of asserted global benefits, and the use of discount rates artificially low, inconsistent with the interests of future generations, and certain to distort resource allocation within the government sector and between the government and private sectors.

The concept of "risk" implies a range of possible outcomes delineated by a statistical distribution of likelihoods around some mean and with some standard deviation. "Uncertainty" clearly is a more accurate term than "risk" in this context, in that the mean and standard deviation of the relevant statistical distributions are very unlikely to be known. The reality is that the analysis of "climate risk" is deeply speculative, the implication of which is that policymakers should exhibit far more modesty in terms of assumptions about conditions and outcomes. Moreover, the universe of "risks" both severe and low in probability is enormous. Massive volcanic eruptions, asteroid impacts, powerful earthquakes, tsunamis, mass contagion, the use of bioweaponry by terrorists, nuclear war, and gamma ray storms are only a few of the many horrors entirely plausible. Why is climate "risk" the most important? What distortions would result from vastly disproportionate attention to climate change relative to the others?

That this hearing is driven by a question poorly formulated — one that assumes the answer to the underlying economic question — suggests strongly that any forthcoming conclusions will interfere with policymaking consistent with sound economic, environmental, and social outcomes. The Committee would be wise to reorient its focus and assumptions, and begin anew.