DECLARATION OF ROY W. SPENCER

1. My name is Roy W. Spencer. I am over the age of 18 and am competent to make this declaration. The facts set forth in this declaration are based on my personal knowledge and are submitted solely in my individual capacity. They should not be attributed to the University of Alabama in Huntsville.

2. I am a Principal Research Scientist at the University of Alabama in Huntsville and received my Ph.D. in meteorology at the University of Wisconsin-Madison in 1981. Before becoming a Principal Research Scientist, I was a Senior Scientist for Climate Studies at NASA's Marshall Space Flight Center, where I and Dr. John Christy received NASA's Exceptional Scientific Achievement Medal for our global temperature monitoring work with satellites.

3. I have extensive knowledge of meteorology and climate science, beyond the above credentials. I have over 40 peer-reviewed publications and 6 books, all in those fields. Most notably our 2017 paper *UAH Version 6 global satellite temperature products: Methodology and results* describes our latest global temperature monitoring technique from satellite data

4. Most recently, I published *Global Warming Skepticism for Busy People*. The book discusses the evidence for limited warming from humanity's greenhouse gas emissions, and the evidence against warming-induced changes in storms or drought.

5. I am attaching a true and correct copy of my Curriculum Vitae to this affidavit.

6. In its recent request for information, the Department of Labor asks for information to protect life savings and pensions from "threats of climate related risks." The DOL stresses its belief in the mounting physical risks to business assets posed by climate change caused by greenhouse gas ("GHG") emissions.

7. The physical risks generally discussed include both acute and chronic risks.[1] Acute physical risks are defined as short-term, "event-driven," risks, such as those from the "increased severity of extreme weather events, such as cyclones,

[1] *See* Executive Order 14030

hurricanes, or floods."[2] Chronic physical risks refer to "longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves."[3]

8. In assessing the relevance of these risks, DOL asserts that "many" physical risks associated with climate change "already affecting"[4] Americans and points to the Financial Stability Oversight Council (FSOC) report that there is a "consensus" that in the long-term climate change "poses significant global risk."[5]

9. The FSOC Report appears to rely primarily on a single dataset to support its claim of increased acute climate-related financial risk.

10. This is unsurprising as the well-developed and rigorous body of scientific evidence on these issues points strongly in the opposite direction. While there are acute risks to businesses posed by the weather, there is significant evidence that the extreme weather events that cause these risks are *not* increasing and that the damage from natural disasters in lives lost and in economic cost relative to GDP are decreasing.

11. Further, while there is a scientific consensus that global temperatures have increased and are continuing to increase, there is great uncertainty in the magnitude and timescale of this temperature increase. There is even greater uncertainty about the risks that will (or will not) flow from these changes.

12. The FSOC Report suggests that there should be disclosure of GHG emissions because "reducing its GHG emissions by 50-52 percent by 2035" is "necessary . . . to limit the rise in average global temperatures to 1.5°C."[6]

13. While such reductions may be necessary, they are not sufficient. Even if U.S. GHG emissions are reduced to zero, global GHG emissions will remain largely unchanged because U.S. emissions make up only a small fraction of the world's total and the largest emitters are projected to increase emissions in the near term.

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[2] *See, e.g.*, TCFD, *Recommendations of the Task Force on Climate-related Financial Disclosure,* (June 2017) https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf (hereinafter "TCDF Report").

[3] *Id.*

[4] 87 Fed. Reg. 8,289.

[5] Financial Stability Oversight Committee, *Report on Climate-Related Financial Risk*, (2021) https://home.treasury.gov/system/files/261/FSOC-Climate-Report.pdf (hereinafter "FSOC Report").

[6] FSOC Report.

I. The assertion that acute physical risks have already impacted many businesses misrepresents the actual trends in natural disasters.

14. Contrary to the suggestion in the RFI "acute risks" from extreme weather events, such as hurricanes, floods, tornadoes, and wildfires are not increasing.

15. The frequency of hurricanes making landfall in the United States has declined slightly since 1900.[7] Further, the hurricanes that are occurring are not increasing in intensity. As Bjorn Lomborg explains, the "frequency of Category 3 and above hurricanes making landfall since 1900 is also trending slightly down."[8] While there has been some increase in strong hurricanes in recent decades, this is not a rise from pre-industrial baselines but "a recovery from a deep minimum in the 1960s–1980s."[9]

16. While absolute damage from hurricanes is increasing somewhat, this is almost entirely linked to increasing development along vulnerable coastlines. Today, hurricanes around the world cause damage worth 0.04% of global gross domestic product (GDP)[10]. Even if the proportion of strong hurricanes does increase, damage from hurricanes is still projected to drop to only 0.02% of global GDP by 2100 because as the world economy gets richer infrastructure tends to become more resilient.[11]

17. A similar story can be told with flooding. Flooding costs as a share of GDP have declined nearly tenfold since the beginning of the 20th century, to 0.05% of GDP, while annual flood death risk in fatalities per million dropped nearly threefold.[12]

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[7] Philip Klotzbach, et al., *Continental U.S. Hurricane Landfall Frequency and Associated Damage: Observations and Future Risks*, Bulletin of the American Metorological Society (July 1, 2018), https://journals.ametsoc.org/bams/article/99/7/1359/70330/Continental-U-S-Hurricane-Landfall-Frequency-and

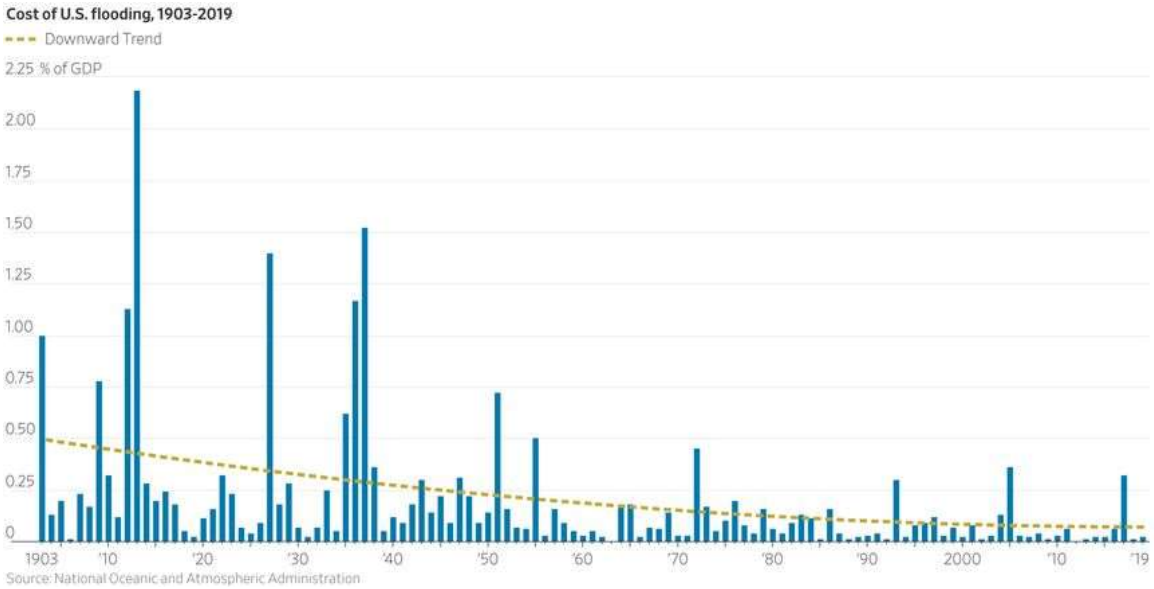
[8] Bjorn Lomborg, *Hurricane Ida Isn't the Whole Story on Climate*, Wall St. J. (Sep. 15, 2021), https://www.wsj.com/articles/hurricane-ida-henri-climate-change-united-nations-un-galsgow-conference-natural-disaster-infrastructure-carbon-emissions-11630704844.

[9] Gabriel A. Vecchi, et al., *Changes in Atlantic major hurricane frequency since the late-19th century*, 12 Nature Communications (July 13, 2021), https://www.nature.com/articles/s41467-021-24268-5

[10] Bjorn Lomborg, *Hurricane Ida Isn't the Whole Story on Climate*, Wall St. J. (Sep. 15, 2021), https://www.wsj.com/articles/hurricane-ida-henri-climate-change-united-nations-un-galsgow-conference-natural-disaster-infrastructure-carbon-emissions-11630704844.

[11] Robert Mendelsohn, et al., The impact of climate change on global tropical cyclone damage, Nature Climate Change (Jan. 15, 2012), https://www.nature.com/articles/nclimate1357.

[12] Bjorn Lomborg, The World Is Getting Safer From Floods, Wall St. J. (Sep. 8, 2021), https://www.wsj.com/articles/flood-climate-change-ipcc-united-nations-infrastructure-deaths-cost-severe-weather-11631134276.



Cost of U.S. Flooding, 1903-2019.[13]

18. Increases in absolute flood costs are more connected to growing development in floodplains. The number of homes exposed to floods in Atlanta, for example, increased 58% in the twenty years between 1990 and 2010.[14] Absolute damage increased because the number of homes impacted increased, not because the number or intensity of floods increased.

19. This trend is noted in a peer-reviewed article cited by the U.N. Intergovernmental Panel on Climate Change (IPCC) report on flood damage, Inga J. Sauer et al., *Climate signals in river flood damages emerge under sound regional disaggregation,* 12 Nature Communications 2128 (2021), https://doi.org/10.1038/s41467-021-22153-9, which finds that increased exposure to flooding and increased resilience to flooding—and not climate-change induced changes in flooding—are the largest drivers of flood damage changes globally.

20. Additionally, there has been no observable increase in the frequency of major tornadoes over time.[15] While some research has suggested that increased global temperatures will create conditions more favorable to the formation of severe

[13] Bjorn Lomborg, The World Is Getting Safer From Floods, Wall St. J. (Sep. 8, 2021), https://www.wsj.com/articles/flood-climate-change-ipcc-united-nations-infrastructure-deaths-cost-severe-weather-11631134276.

[14] Alex P. Ferguson & Walker S. Ashley, *Spatiotemporal analysis of residential flood exposure in the Atlanta, Georgia metropolitan area*, 87 Natural Hazards 989 (Mar. 24, 2017), https://link.springer.com/article/10.1007/s11069-017-2806-6.

[15] Sarah Gibbens, Why we still don't fully understand the tornado-climate change relationship, Nat. Geo. (Dec.13, 2021), https://www.nationalgeographic.com/environment/article/why-we-do-not-understand-the-tornado-climate-change-relationship.

thunderstorms and tornadoes, such effects are not detectable in observations today.[16] As much as tornadoes are "exhibiting changes that may be related to climate change" the "scientific understanding is not yet detailed enough to confidently project the direction and magnitude of future change."[17]

21. There is not robust evidence that wildfires are increasing. As a meta-study in the Philosophical Transactions of the Royal Society explains, while there is a "widely held perception of increasing fire and fire impacts at the global and some regional scales" these perceptions are "not well supported by the realities that the available data show."[18]

22. Instead, there is increasing evidence suggesting that there is overall less fire in the landscape today than there was centuries ago.[19] What fires do occur seem to be more significantly influenced by non-climate related factors like forest management practices[20] and the growth of the wildland-urban interface.[21]

23. Further, over the past decades there is no clear trend of increasing direct losses from fire (such as losses of life or infrastructure) and the risk of death from fire is low compared with other natural hazards.[22] As a result, any increased risk from wildfire damage has far more to do with irresponsible development and an unwillingness for American policy makers to make "boring" infrastructure expenditures on things like bridges or forest management.

24. The natural disasters that do occur cause far fewer deaths than they did a century ago because the worst killers—droughts and floods—have been mitigated by technological improvements.[23] Most deaths from natural disasters in the 21st

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[16] Harold E. Brooks, et al.*, Increased variability of tornado occurrence in the United States*, 346 Science 349 (Oct. 17, 2014), https://www.science.org/doi/full/10.1126/science.1257460.

[17] K. Hayhoe, et al., Fourth National Climate Assessment, Ch. 2: Our Changing Climate (2018) https://nca2018.globalchange.gov/chapter/2/.

[18] Stefan H. Doerr & Cristina Santín, *Global trends in wildfire and its impacts: perceptions versus realities in a changing world,* 371 Phil. Trans. R. Soc. (June 5, 2016), http://doi.org/10.1098/rstb.2015.0345.

[19] *Id.*

[20] *See* Harold S. J. Zald,& Christopher J. Dunn, Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape, 28 Ecological Applications 1068 (Apr. 26, 2018), https://doi.org/10.1002/eap.1710.

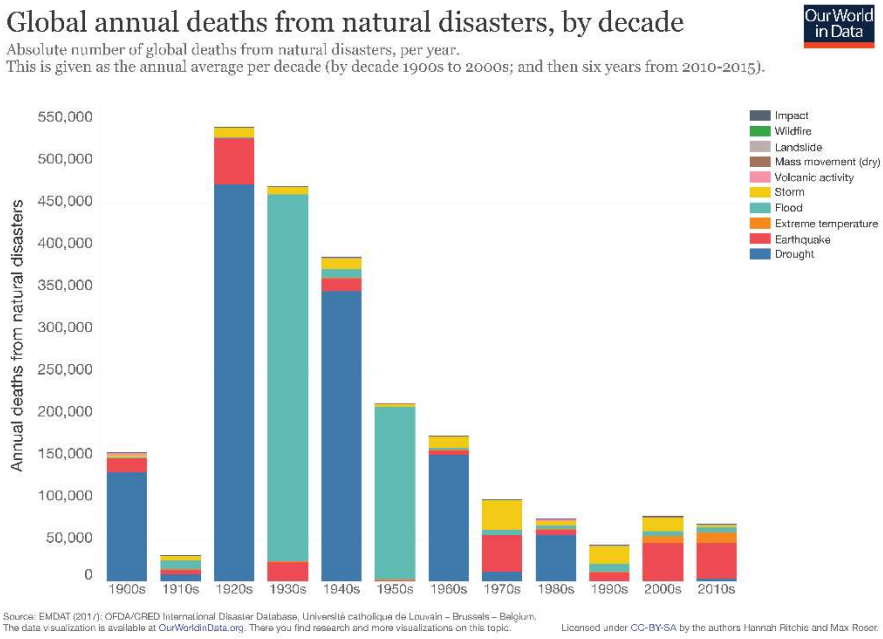
[21] *See,* Volker C. Radeloff et al., *Rapid growth of the US wildland-urban interface raises wildfire risk,* 115 PNAS 3314 (Mar. 12, 2018), https://doi.org/10.1073/pnas.1718850115.

[22] Stefan H. Doerr & Cristina Santín, *Global trends in wildfire and its impacts: perceptions versus realities in a changing world,* 371 Phil. Trans. R. Soc. (June 5, 2016), http://doi.org/10.1098/rstb.2015.0345.

[23] C. Boyden Gray, Fossil Fuels and a Positive Vision for American Energy, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

century have resulted from earthquakes, which are not directly associated with climate change.

25. Further, data and evidence show that the overall economic damages associated with extreme weather have in fact decreased when measured in the context of global GDP.[24]



Global annual deaths from natural disasters by decade.[25]

26. The data referred to in the FSOC Report[26] which reference an increase in "billion dollar" events based on a National Oceanic and Atmospheric Administration (NOAA) dataset are also misleading. "What the dataset actually shows is a combination of poor methodology and the consequences of a growing society, with more people and property in locations exposed to loss from extreme weather. It is not an indicator of climate change. Climate data, not economic data, should be used for that purpose."[27] By ignoring the change in growth, the

[24] Roger Pielke Jr., *Statement of Dr. Roger Pielke Jr. to the Committee on Banking, Housing, and Urban Affairs of the United States Senate,* (July 20, 2021), https://www.banking.senate.gov/imo/media/doc/Pielke%20Testimony%207-20-21.pdf.

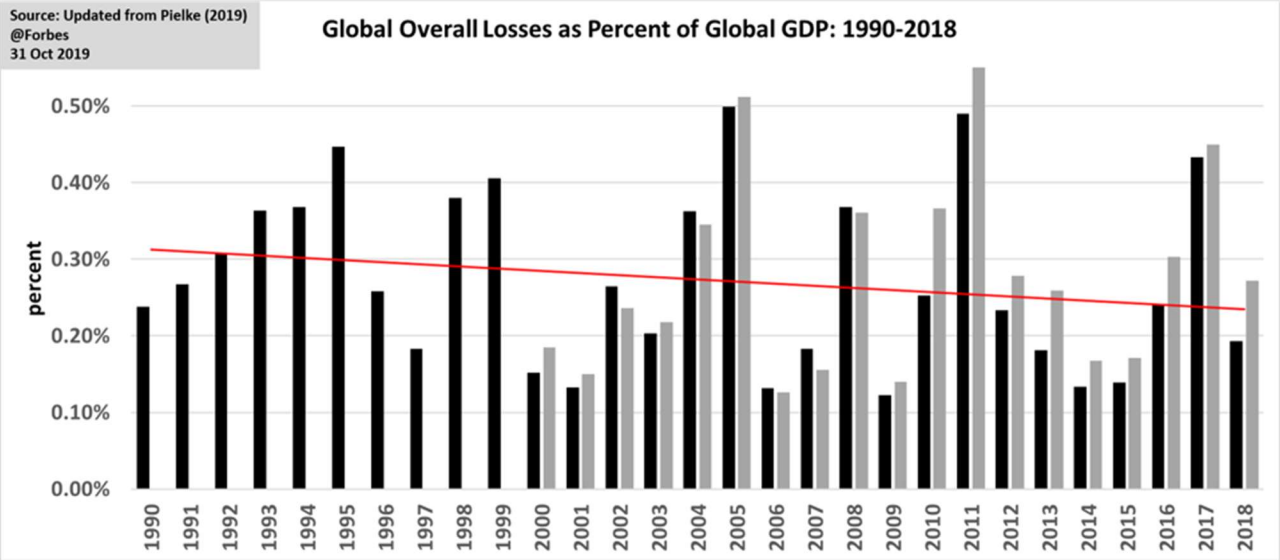
[25] *Id.*

[26] FSOC Report 12.

[27] Roger Pielke Jr., *Statement of Dr. Roger Pielke Jr. to the Committee on Banking, Housing, and Urban Affairs of the United States Senate,* (July 20, 2021), https://www.banking.senate.gov/imo/media/doc/Pielke%20Testimony%207-20-21.pdf.

dataset excludes severe past events. As Rupert Darwall explains, "a $600 million hurricane in 1985 (Hurricane Kate) would have been about a $2 billion hurricane today, but that fact is not included in NOAA's dataset."[28]

27. This is why, in the 2006 Hohenkammer Consensus Statement, 32 leading climate experts declared: "Analyses of long-term records of disaster losses indicate that societal change and economic development are the principal factors responsible for the documented increasing losses to date."[29] A more accurate view of the data shows the opposite of what the NOAA dataset implies, that direct economic losses from disasters have declined over the past 30 years over 0.3% of global GDP to under 0.25% of global GDP.[30] Given no increasing severity of extreme weather events and large increases in the deployment of more resilient technology, these results are unsurprising.



Global disaster losses as a percent of global GDP, 1990 to 2019. Data from Munich Re (black), Aon (grey) and World Bank.[31]

[28] Rupert Darwall, *Climate-Risk Disclosure: A Flimsy Pretext for a Green Power Grab, Real Clear Briefings (Nov. 2021)*, https://assets.realclear.com/files/2021/11/1910_realclear-climateriskdisclosure-ruper-darwall-v6f.pdf

[29] Peter Höppe and Roger Pielke Jr., *Climate Change and Disaster Losses Workshop: Understanding and Attributing Trends and Projections* (2006), https://sciencepolicy.colorado.edu/research_areas/sparc/research/projects/extreme_events/munich_workshop/ccdl_workshop_brochure.pdf.

[30] Roger Pielke, Surprising Good News on the Economic Costs of Disasters, Forbes (Oct. 31, 2019), https://www.forbes.com/sites/rogerpielke/2019/10/31/surprising-good-news-on-the-economic-costs-of-disasters

[31] Roger Pielke, Surprising Good News on the Economic Costs of Disasters, Forbes (Oct. 31, 2019), https://www.forbes.com/sites/rogerpielke/2019/10/31/surprising-good-news-on-the-economic-costs-of-disasters

28. The most straightforward consequence of climate change, an average global warming, is largely borne out by the data. Since the 1970s, unusually hot summer days have become more common in the United States, but unusually cold winter temperatures have become less common, particularly very cold nights.[32]

29. But while both extreme hot and extreme cold can be fatal, extreme cold is far more deadly.[33] A 2015 meta-study in *Lancet* found that 17 times more deaths are attributable to low temperatures than to high.[34]

30. Some recent news stories have suggested that climate change is already causing 5 million deaths a year—but the research cited finds a different result.[35] As C. Boyden Gray explains,

> The referenced 2021 study did indeed find that 5 million deaths a year were linked to "non-optimal temperatures" of which 90% were cold-related and 10% heat-related.[36] But these are deaths associated with climate—not climate change. The authors also perform a time series analysis, examining the change in climate related deaths over 16 years, and find a net *decrease* in mortality over that period. While heat-related deaths increased somewhat this was more than offset by reductions in cold-related deaths, and the authors suggest that climate related mortality has decreased by about 166,000 deaths per year.[37]

31. While there are no doubt some physical risks posed by acute weather events, the scientific evidence shows that these are of decreasing—rather than increasing—significance.

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[32] *Climate Change Indicators: Weather and Climate*, EPA (last visited Apr. 29, 2022), https://www.epa.gov/climate-indicators/weather-climate.

[33] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

[34] Antonio Gasparini, et al., Mortality risk attributable to high and low ambient temperature: a multicountry observational study, 386 Lancet 369 (May 20, 2015), https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)62114-0/fulltext.

[35] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

[36] Qi Zhao et al., Global, regional, and national burden of mortality associated with non-optimal ambient temperatures from 2000 to 2019: a three-stage modelling study, 5 Lancet Planet Health (2021) https://doi.org/10.1016/S2542-5196(21)00081-4

[37] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

II. "Chronic risks" are far too speculative.

32. So called "chronic risks" as the result of changes in longer term weather patterns have been suggested as imminent: "sustained higher temperatures, sea level rise, drought, and increased wildfires, as well as related effects such as decreased arability of farmland, decreased habitability of land, and decreased availability of fresh water."[38] But there are deep challenges with quantifying these risks because of their "uncertainty and complexity" and the "multidimensional nature of the information" at issue.[39]

33. The first dimension of this uncertainty flows from the uncertainty of which warming model is most accurate. The IPCC Sixth Assessment report is good evidence of this uncertainty. The report gives several possible warming scenarios.

34. The worst-case scenario, RCP8.5, projects a 5ºC global surface temperature rise. But the scientific consensus is that this scenario is incredibly unlikely.[40] RCP8.5 was originally intended to explore an unlikely and high-risk future. To achieve this scenario, the world would require virtually no emissions reductions and an unprecedented fivefold increase in coal use by 2100.[41]

35. But, some climatologists believe that "global coal use peaked in 2013, and while increases are still possible, many energy forecasts expect it to flatline over the next few decades."[42] While worst-case scenarios can be a useful thought exercise, they cannot be the main driver of risk assessment.

36. Instead of 5ºC, a 2 to 3ºC temperature rise is far more likely. This smaller temperature rise will be far more manageable.[43] The IPCC's sixth assessment report states that with warming of 2 to 3º C we are likely to see the most catastrophic effects of climate change, like the melting of the Greenland or West Antarctic Ice Sheets, only "over multiple millennia."[44] This is far slower than the impending and extreme and catastrophic risks generally associated with the 5º C warming.

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[38] 87 Fed. Reg. 21,350.

[39] 87 Fed. Reg. 21,427

[40] Zeke Hausfather & Glen P. Peters, Emissions – the 'business as usual' story is misleading, Nature Comment (Jan. 29, 2020), https://www.nature.com/articles/d41586-020-00177-3.

[41] *Id.*

[42] *Id.*

[43] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

[44] IPCC, Climate Change 2021: The Physical Science Basis. Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Box TS9.

37. There are other uncertainties associated with the model. The projections of climate models depend in large part on projections of future GHG emissions. As Roger Pielke explains, these emissions scenarios are thus "a key input for the climate models that aim to project the future behavior of the climate. But emissions scenarios are themselves dependent on variables such as population growth, economic growth, technological change, land use change, and so on."[45] Each of these variables themselves interact in complex ways as people adapt to the various changes.

38. Beyond emissions uncertainty, there is also uncertainty in how these emissions will change global temperatures. The Earth's climate is a complex system, involving interconnected physical processes.

> Projecting global temperature changes requires modeling the mechanisms of countless physical process—processes often chaotic or stochastic and spanning different length scales. Lower-level mechanisms, like the absorption of CO_2 into seawater, are tightly coupled to higher level mechanisms, like large-scale ocean circulation. The mechanisms interact in complicated reinforcing and balancing feedback loops and often rely on scarce data or extrapolations beyond current conditions.[46]

39. Uncertainty about how changing climate will feedback into other climate forcing mechanisms provides more uncertainty. Increases in atmospheric temperature may cause global icesheets to melt, which would likely in turn reduce albedo and increase the absorption of solar radiation, creating positive feedback and raising global temperatures.[47] Or the same temperature increase may cause greater water vaporization, increasing cloud coverage, and increasing albedo, which would reduce solar radiation and lower global temperatures.[48] Predictions of the primary effects are possible—though by no means straight forward—but predictions of aggregate secondary effects are not much more than speculation.

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[45] Roger Pielke & Justin Ritchie, *How Climate Scenarios Lost Touch With Reality,* 37 Issues in Science and Technology 74 (2021), https://issues.org/climate-change-scenarios-lost-touch-reality-pielke-ritchie/.

[46] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

[47] Kristina Pistone et al., *Radiative Heating of an Ice-Free Arctic Ocean,* 46 Geophysical Research Letters 7474–7480 (2019).

[48] https://www.science.org/doi/10.1126/science.296.5568.727

40. Similarly, variability associated with ocean circulations could contribute to atmospheric cooling, or releases of GHGs frozen deep within the oceans could lead to increased atmospheric GHG production and increased warming.[49]

41. Some of the largest contributors to uncertainty in climate modeling are physical mechanisms that are not caused by anthropogenic activities or predictable with atmospheric temperature rise. For example, solar and volcanic variability are some of the largest drivers of temperature change in climate models.[50] If there is an increase in major volcanic eruptions, the increase in atmospheric particulate matter could have a global cooling effect, as could the decrease in solar radiation after the Grand Modern Maximum, the peak in observed solar activity and radiation that occurred in the late 20th century.[51]

42. An inspection of climate models, including consensus models like those used by the IPCC, bear out this uncertainty. While long term trends suggest overall warming, the magnitude and speed of the warming have been predicted far less accurately. Initial warming trends predicted by early models were falsified during the global warming hiatus, when from 1998 to 2012 global surface temperatures remained nearly constant.[52]

43. Climate models have also historically overpredicted temperature rise. In a study applying existing models to predict past temperature trends, economist Ross McKitrick and climatologist John Christy found that,

> Comparing observed trends to those predicted by models over the past years reveals a clear and significant tendency on the part of models to overstate warming. All 102 [models from the Climate Model Intercomparison Project Number 5] warm faster than observations, in most individual cases the discrepancy is significant, and on average the discrepancy is significant. . . . While the observed analogue exhibits a warming trend over the test interval it is significantly smaller than that shown in models, and the difference is large enough to reject the null

[49] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

[50] John Fyfe et al., Significant impact of forcing uncertainty in a large ensemble of climate model simulations, 118 Proceedings of the National Academy of Sciences (2021) https://doi.org/10.1073/pnas.2016549118

[51] C. Boyden Gray, *Fossil Fuels and a Positive Vision for American Energy*, 21 Geo. J. L. & Pub. Pol. (forthcoming 2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4088564.

[52] Xiao-Hai Yan, et al., The global warming hiatus: Slowdown or redistribution?, 4 Earth's Future 472 (Nov. 22, 2016), https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1002/2016EF000417.

hypothesis that models represent it correctly, within the bounds of random uncertainty.[53]

44. This discrepancy across all models, as the authors note, suggests a "warming bias at a sufficiently strong rate" to reject the notion that any of these climate models provides a "realistic" assessment of warming.[54]

45. But risks of future chronic warming are not, by themselves, the risks in question. Instead, the primary concerns are extrapolations from these projections of higher temperatures to predictions of the effect of long-term weather changes on business operations.

46. But each weather or climatological event has, "a host of possible natural and anthropogenic causes in addition to anthropogenic climate change."[55] As the National Academy of Science explains, confidence in the linkage between temperature rise and other effects is "greatest for those extreme events that are related to an aspect of temperature, such as the observed long-term warming of the regional or global climate . . . . There is little or no confidence in the attribution of severe convective storms and extratropical cyclones."[56]

47. The economic impact of "chronic risks" is far more dependent on non-climate-change-related mitigation measures taken than it is on the rise of global temperatures. For example, as noted above, wildfires are far more strongly correlated with forest management practices and increasing population density and hence need for fire suppression in the wildland–urban interface than with a rise in global temperatures.[57]

48. One study, applying climate models predicting an increase in flooding, found that with no adjustments sea-level rise would cause $55 trillion in flood damage annually, as much as 5% of projected world GDP.[58] But with moderate mitiga-

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[53] Ross McKitrick & John Christy, *A test of the tropical 200- to 300-hPa warming rate in climate models.* 5 Earth and Space Science 529 (Sep. 21, 2018), https://doi.org/10.1029/2018EA00040.

[54] *Id.*

[55] National Academies of Sciences, Engineering, and Medicine, *Attribution of Extreme Weather Events in the Context of Climate Change*, (2016), https://doi.org/10.17226/21852.

[56] *Id.*

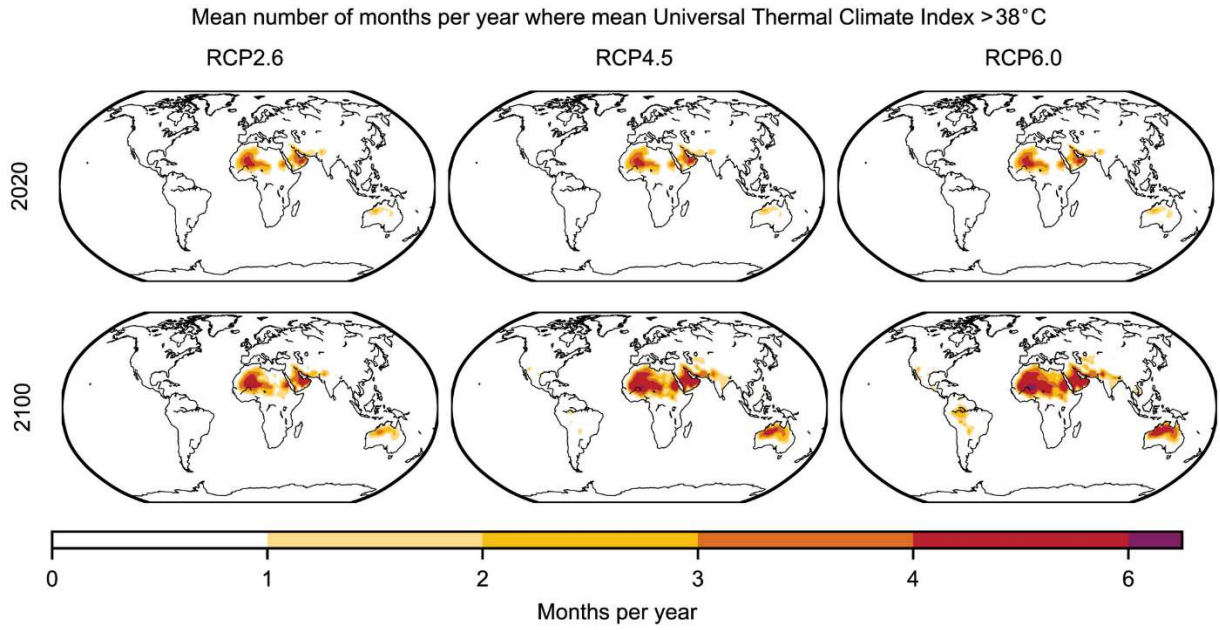
[57] Stefan H. Doerr & Cristina Santín, *Global trends in wildfire and its impacts: perceptions versus realities in a changing world,* 371 Phil. Trans. R. Soc. (June 5, 2016), http://doi.org/10.1098/rstb.2015.0345.

[58] Jochen Hinkel, et al., *Coastal flood damage and adaptation costs under 21st century sea-level rise*, 111 PNAS (Feb. 3, 2014), https://doi.org/10.1073/pnas.1222469111.

tion (the construction and maintenance of dikes, at a maximum cost of $31 billion under RCP2.6, or about 0.00002% of world GDP) the total costs of flooding would *decrease* from today's levels to only 0.008% of world GDP.[59]

49. Finally, some of these chronic risks that have been suggested are simply incorrect. For example, the SEC recently suggested that businesses must account for risks such as the "decreased arability of farmland." But global warming will most likely increase the total arable land in the United States, possibly by more than 15%.[60]

50. Further, over the next 80 years, all climate change scenarios predict virtually no change in habitability throughout North America.[61]



There is virtually no change in inhabitable land by 2100 in North America.[62]

[59] *Id.*

[60] *See, e.g.*, Xiao Zhang & Ximing Cai, Climate change impacts on global agricultural land availability, 6 Env. Research Letters (Mar. 18, 2011), https://doi.org/10.1088/1748-9326/6/1/014014;

[61] Christopher Lyon, et al., *Climate change research and action must look beyond 2100*, 28 Global Change Biology 349 (Sep. 24, 2021), https://doi.org/10.1111/gcb.15871.

[62] Extract from Figure 3 of Christopher Lyon, et al., *Climate change research and action must look beyond 2100*, 28 Global Change Biology 349 (Sep. 24, 2021), https://doi.org/10.1111/gcb.15871.

51. In fact, the most likely change will come in regions are those currently considered too cold to be regularly habitable (like most of Canada and Alaska) as warming will slightly increase the habitability of these areas.[63]

III. Even if the U.S. GHG emissions were eliminated it would not substantially alter the world's climate trajectory.

52. The United States is responsible for about 15% of global GHG emissions, about half of those emitted by China.[64] China produced nearly 13 billion tons in 2019, as much as the United States, India, Russia, and Japan combined.[65]

53. By substituting natural gas for coal in much of its electricity production, the United States power sector has stopped being the largest contributor to its GHG emissions. Overall United States GHG emissions have fallen from a peak of over 6 billion tons of CO2e in 2007 to just 5.1 billion in 2019—roughly equivalent to emissions in 1980.[66]

54. In contrast, emissions in much of the developing world—including China—are growing.[67]

55. Even if the United States takes dramatic steps to reduce GHG emissions, this is unlikely on its own to make any significant difference in global GHG emissions. Because climate change has global consequences and is dependent on global levels of GHG emissions, the risks associated with the U.S. failing to reach emissions reductions of "50 percent by 2035" or "net-zero emissions" by 2050 are essentially zero.[68] As a result, an individual company's GHG emissions do not correlate with these global risks.

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[63] Climate Change 2021: The Physical Science Basis. Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Box TS9.

[64] EPA, *Global Greenhouse Gas Emissions Data*, https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data (last updated Feb. 25, 2022).

[65] The Chinese Companies Polluting the World More Than Entire Nations, Bloomberg News (Oct. 24, 2021), https://www.bloomberg.com/graphics/2021-china-climate-change-biggest-carbon-polluters/.

[66] U.S. Energy Information Administration, Environment, https://www.eia.gov/totalenergy/data/browser/xls.php?tbl=T11.01&freq=m

[67] Lauri Myllyvirta, *Analysis: China's carbon emissions grow at fastest rate for more than a decade*, Carbon Brief (May 20, 2021), https://www.carbonbrief.org/analysis-chinas-carbon-emissions-grow-at-fastest-rate-for-more-than-a-decade.

[68] 87 Fed. Reg. 21,406 (presenting examples of target GHG emissions).

56. I declare that the foregoing is a true and correct statement of my expert opinion and judgment.

Executed on: May 16, 2022

Roy W Spencer

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