A Response to "Carbon Majors and the Scientific Case for Climate Liability"

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Climate activists insist that (1) the narrative of catastrophic warming is rigorously formulated and beyond refutation and (2) oil and gas companies are global villains that should be brought to account for their sins. The recently published *Nature* article "Carbon Majors and the Scientific Case for Climate Liability" by Christopher W. Callahan and Justin S. Mankin, both at Dartmouth College at the time this article was prepared, makes no effort to demonstrate the validity of the catastrophic climate hypothesis but offers instead a blueprint for plaintiffs to sue oil companies over climate damage. Their proposal is essentially a rehash of all the major climate fallacies.

Before analyzing the article's proposal in detail, a key point is needed for context. The words "science" and "scientific" appear 44 times in this report, but as is often the case with climate activists, the term is misused. Science is one thing and one thing only – the testing of hypotheses against empirical evidence. Climate activists often try to substitute the concept of "consensus" for "science". Consensus means only that a self-selected group of people hold a certain opinion. Consensus does not become science by the holding of meetings or the publishing of reports.

A similar problem occurs with the term "peer reviewed." Peer review was originally a process by which scientific articles were evaluated by disinterested parties to determine if the authors' methodology and data management were rigorous. Today, articles on climate are reviewed only by other climate activists who screen for ideological purity. The term "peer-reviewed" appears eight times in the article. Neither "consensus" nor "peer review" establishes scientific rigor.

The authors claim that they can establish the liability of oil and gas companies for climate damage through a four-step process.

The first step is to evaluate changes in Global Mean Surface Temperature (GMST) using General Circulation Models (GCM). Although climate activists insist that these models are accurate and provide a precise tool for evaluating the impacts of CO_2 on global temperatures, the limitations and problems of these models have been demonstrated extensively in the literature. (For a complete discussion of these problems, see "An Assessment of the Conventional Global Warming Narrative" by Professor Richard Lindzen at https://www.thegwpf.org/content/uploads/2022/09/Lindzen-global-warming-narrative.pdf.)

Professor Lindzen offers detailed technical arguments about the difficulties of modeling a complex system like climate. For the general reader, suffice it to say that many parameters (changes in the Earth's orbit, fluctuations in solar energy, volcanoes, changes in ocean currents, cloud formation and others) affect climate and that these factors and their interactions with each other are not well enough understood to construct a model that makes useful predictions. (For a statistical analysis of GCM performance, see "U.S.A. Temperature Trends, 1979-2023: Models versus Observations " by Roy Spencer at https://www.drroyspencer.com/2024/02/u-s-a-temperature-trends-1979-2023-models-vs-observations/.)

The Dartmouth authors claim not only that these models can predict global temperature changes as a function of CO_2 but that simplified versions, so-called Reduced Complexity Climate Models or RCMs, can distinguish alternative scenarios with only tiny variations in CO_2 emissions. They further claim that running the model 1,000 times improves the result – a questionable assertion.

Since 1920, the world has emitted roughly 1.8 trillion metric tons of CO_2 (500 billion tons of carbon equivalent) from fossil fuels.[1] According to the article, Chevron emitted 16.6 billion tons of carbon or roughly 3.3% of the total. The authors contend that they can isolate the impact of Chevron's contribution by running the RCM simulation with actual carbon emissions, running the model a second time with 3.3% less carbon and then subtracting one from the other. The current mean surface temperature of the Earth is about 15° C or roughly 288° Kelvin. The authors claim that Chevron is responsible for a 0.025° warming – less than 0.01%. Attributing this level of precision to these crude models makes no sense.

The second step is the attribution of specific weather events, in this case heat waves. The process is referred to as "attribution science", but it's really just the opinions of climate activists. The essential problem with attribution is that we have no baseline. To claim, for example, that heat waves are becoming stronger and more frequent requires that we know the pattern of heat waves without the addition of CO_2 from fossil fuels. The Holocene Period is the time span of modern climate beginning with the end of the last great ice age about 11,700 years ago. We have good satellite data for only the last 50 years or so. We have scattered temperature readings of varying quality for about 150 years. Before that we have anecdotal evidence and some proxies, such as chemical and isotopic data from ocean sediments, isotopic data from Antarctic ice cores and tree rings. What we don't have is any sense of the pattern of heat waves over this entire period, if there is any such pattern.

[1] Source: Our World in Data at https://ourworldindata.org/grapher/cumulative-co-emissions?country=~OWID_WRL

The authors focus on recent heat waves such as those in India in 1998, France in 2003, Russia in 2010 and the U.S. in 2012. There have been many well-documented major heat waves before the advent of fossil fuels, including Europe in 1757, the U.S. in 1896, Beijing in 1743 and Argentina in 1900. There were undoubtedly many others over the Holocene that were simply unrecorded. The argument that heat waves are increasing is not supported by reliable data.

The authors acknowledge the major problems with this approach, noting that "the causal chain from emissions to impacts is nonlinear; and uncertainties compound from emissions, to warming, to hazards, to impacts." Yet they claim an ability to make precise judgements about these effects.

The third step is to take the calculated changes in global mean surface temperatures (GMST) and calculate the extreme heat effects at a regional level, for example, U.S. states. Extreme heat effects are defined as the five hottest days in each year. This step involves a process known as "pattern scaling." Pattern scaling simply takes the linear relationship between global trends and regional trends and assumes that that relationship is fixed. Again, the authors run their models at a regional level with actual CO_2, make a second run with the oil company's contribution removed, and then subtract one from the other. This is an assumption with no empirical support. The authors try to justify this pattern-scaling using 80 model runs. Eighty runs of a bad model, however, produce no more accuracy than a single run. Multiple runs simply produce the appearance of rigor to casual readers.

The final step is the least rigorous and most controversial. The authors claim that their work and other work in the literature allow them to estimate with precision the impact of unusually hot days on per capita income at the regional level. For hundreds of years, economists have tried to understand why per capita income varies from country to country, region to region, month to month and year to year. This is another example of a problem too complex to model. Both short- and long-term per capita income is influenced by culture, geography, demographics, normal weather variations, government policy, war, civil strife, crime, non-weather disasters, trade, influences from friendly or hostile neighbors, world commodity prices, exchange rates, interest rates and consumer sentiment, to name just some of the variables. The authors claim that they can isolate the effect of hot days by the use of regressions. Linear regressions assume (a) that all the variables are captured, (b) that we have an extensive time series on each one, (c) that their impacts on per capita income are linear and (d) that the interrelationships among the variables is understood. None of these conditions is met in this analysis, and any correlations are specious. Correlation is not causation.

Although the authors focus on the purported damages of heat waves, they claim that their methodology can be used for other types of damage, such as sea level rise, tropical cyclones or extreme rainfall.

The authors do admit that fossil fuels have major benefits, noting that "fossil fuels have also produced immense prosperity." They ignore, however, the direct benefits of CO_2, such as enhanced crop growth and drought resistance at a time when the world needs growing food supplies. (See, for example, the NASA study of carbon dioxide fertilization described at https://www.nasa.gov/centers-and-facilities/goddard/carbon-dioxide-fertilization-greening-earth-study-finds/.) This oversight – a major flaw in most "damage function" studies – constitutes an assumption that CO_2 impacts are always negative.

In summary, the Dartmouth authors assert that unvalidated GCMs plus opinions regarding attribution plus pattern-scaling assumptions plus specious economic correlations produce a tool sufficiently precise to confiscate large chunks of the retirement accounts of average Americans. The authors are not looking for a fine of some kind – they want the companies to disappear. Chevron's current market capitalization is $242 billion. The authors claim damages from Chevron of $1.98 trillion.

The authors are presenting a plaintiff's case that they assert is scientific. However, it is supported not by empirical evidence, the very definition of science, but by "consensus" and "peer review." They assert that "the scientific case for climate liability is closed" and recommend formation of "a standing scientific body that would be an essential resource for courts and citizens" – in essence a codification into law of an anti-scientific narrative.

This narrative rests on the hope that judges and juries will be easily swayed by poor analysis and that dissenting opinions can be kept out of the public square and out of the courtroom, creating an appearance of unanimity where none exists. The solution is to make sure that real science and meaningful analysis are brought to bear in the legal system and that our legal system is not distorted by this kind of spurious analysis.