Virginia and Climate Change

Separating Fact from Fiction

CO2 COALITION

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Updated March 2026

CO2 COALITION

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INTRODUCTION

This updated review of Virginia and Climate Change was commissioned to provide current information to policymakers after multiple climate change-related proposals were made in early 2026 by the newly installed governor and the state legislature. Predicated on the state's need to reduce greenhouse-gas emissions to forestall a purported climate crisis, the proposals would have huge economic impacts on the commonwealth's citizens and businesses.

Soon after taking office, newly elected Governor Abigail Spanberger announced that Virginia would rejoin the Regional Greenhouse Gas Initiative (RGGI). RGGI is a consortium of New England and Mid-Atlantic states that imposes a tax on fossil fuels to reduce their use and emissions of carbon dioxide (CO_2) from their combustion. The intended result of RGGI is to increase the costs of electricity from coal and natural gas-fired generation sources to make electricity generated from so-called "clean" renewable sources (wind and solar) more economically attractive.

Claims of rising temperatures, severe weather and dangerously rising sea level, along with dire predictions of more of the same—all purportedly driven by man-made emissions of carbon dioxide (CO_2)—have been used to justify the efforts of Virginia's government to control the uncontrollable: Earth's climate.

Within this report, we ask and answer the following questions:

- Is Virginia currently experiencing more extreme weather and negative environmental degradation due to increasing temperatures?
- Are the models used to predict future changes accurate enough for the Commonwealth of Virginia to take drastic, and likely economically harmful, measures?
- If the Commonwealth of Virginia did reduce its CO_2 emissions as envisioned, what effect would this have on global and local temperatures?
- Is the current warming, combined with increasing CO_2 levels, harmful or a net benefit?

To answer these questions, some of the world's top experts in various fields have compiled the data, science and facts. A summary of the specific findings is as follows:

Severe Weather: The frequency of natural disasters worldwide has not been increasing since about 2000, despite modestly rising temperatures and increasing atmospheric CO_2 concentration, countering claims of linkage with increasing natural calamities.

Temperature & CO_2: Worldwide average temperature records since 1850 show periods of both warming and cooling, demonstrating questionable direct correlation between temperature and CO_2 levels.

Heat Waves & Droughts: Both have declined in Virginia over the past century. In fact, the most severe heat waves and droughts occurred more than 80 years ago.

Virginia Temperature in Future Context: Computer models on which Virginia's climate programs are based have regularly overpredicted warming in recent decades. A methodology so flawed has no place in deliberating climate policies, as it provides no reliable forecast of future temperatures.

Climate Change & Agriculture: Consistent with worldwide trends, Virginia crop yields have been increasing for more than a century primarily due to increasing CO_2 levels, a longer growing season, judicious use of nitrogen fertilizer and improved farming practices.

Regional Sea-Level Rise: There is no acceleration in sea-level rise as recorded by tide gauges. However, local rises can have a strong geological component, as is the case in Virginia, where the rise is amplified by the well-documented isostatic rebound of land along the eastern seaboard.

Meaningless Climate Programs: Using the methodology of the United Nations' Intergovernmental Panel on Climate Change (IPCC), the amount of global warming "mitigated" by eliminating all of Virginia's CO_2 emissions from 2010 onward (assuming a climate sensitivity of 2.0 °C) amounted to 0.0021 °C (0.0038 °F) by 2100—a number too small to be measured or felt.

Conclusions: There is no correlation between CO_2 emissions and the safety of Virginians. In fact, the weather has been relatively benign in recent decades and agriculture in Virginia has benefited from modest warming and increasing CO_2 levels. Efforts to modify the climate are economically wasteful and meaningless in their effect.

ANALYSES

CLIMATE CHANGE AND VIRGINIA

Justifications for Virginia to impose increased regulations and taxation on fossil fuels and fossil fuel-generated electricity are based on dire warnings of existing and future CO_2-driven catastrophes. In this report, we will review and assess the claims of looming disasters that have been used by supporters of extensive deployment of expensive and unreliable "renewable" energy sources. We will show that stated claims of current and future harm from continuing emissions of CO_2 are unsupported by the facts.

Here, we will review various aspects of climate change in Virginia in the context of regional, national, and worldwide climate data. We conclude that Virginia's participation in the various attempts to reduce worldwide atmospheric temperature is climatically meaningless and based on flawed assumptions.

If it can be demonstrated that the clean energy plans are climatically inconsequential, then the governmental bodies tasked with the review of these programs should "follow the science" and reject the economically costly programs that have no utility.

The observed facts, as documented within this report, do not support any attempt to moderate the worldwide atmospheric temperature via reductions in GHG emissions in Virginia, the United States, or worldwide.

SEVERE WEATHER

Claims of increased severe weather related to increased man-made GHG emissions are one of the most frequently cited reasons to rein in production of alleged planet-warming emissions.

Governmental and scientific bodies agree that there is no connection between severe weather and human-caused changes in climate. For example, the Intergovernmental Panel on Climate Change in 2001 issued the following statement that has never been retracted or disputed, stating:

> *"The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible."*

The United Nations' World Meteorological Organization (2022) goes even further, stating:

> *"Thus, any single event, such as a severe tropical cyclone, cannot be attributed to human-induced climate change."*

A frequent misunderstanding concerning heat and extreme weather events (e.g., thunderstorms, tornadoes, and intense downpours) is the notion that GHG-related warming leads to more severe weather. The meteorological fact is that most extreme weather events are caused not by rising temperatures, but by an increase in temperature differentials, both in the vertical and the horizontal directions and increasing atmospheric temperature decreases those differentials.

As an example, it is well known (and has been for over a century) that GHG-related warming occurs more frequently at night than during the day, and more frequently in cold air than warm air. This means that: 1) It is more confined to winter than summer, and 2) the temperature gradient between the high latitude (polar) regions and the mid- and low latitude regions is lessened.

Elementary meteorology reveals that it is the strength of this gradient that supplies kinetic energy to the mid-latitude jet streams. This dynamic is, in large part, responsible for the development of strong weather fronts—an important component in the development of extremely destructive tornadoes. The weakening of this gradient may indeed be responsible for the decline in these tornadoes (Figure 1) that has occurred since the National Severe Storms Laboratory began using radar in 1973 "to observe the entire lifecycle of a tornado" (NOAA 2025d, 2025f).

Figure 1 indicates that there is no increase in the frequency of destructive tornadoes in the United States. If anything, Figure 1 suggests that the frequency of these tornadoes has been decreasing since the mid-1970s. These observations stand in contrast to claims made regarding an existing climate crisis.

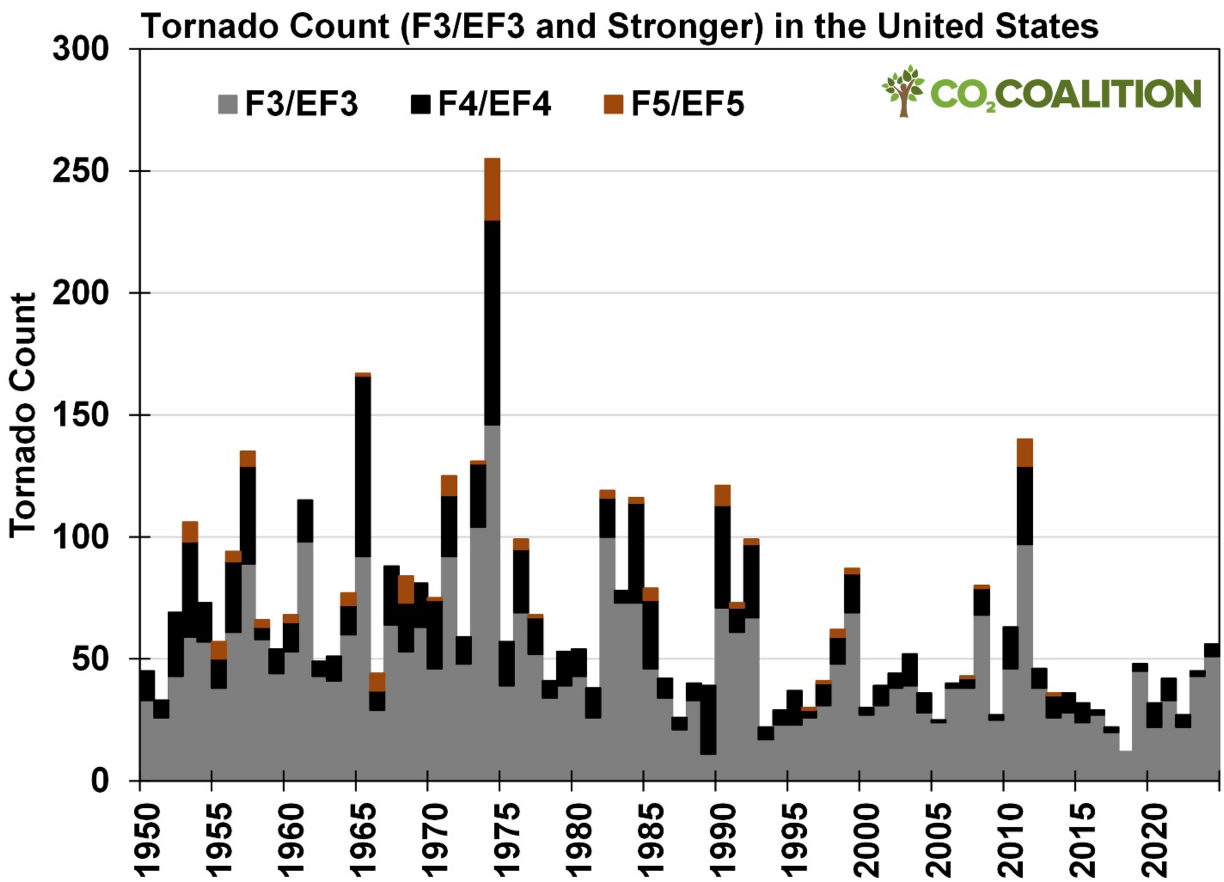

Figure 1: *Annual reported number of the most destructive tornadoes (Categories F3/EF3, F4/EF4, and F5/EF5) in the United States (NOAA 2025c) .*

The Centre for Research on the Epidemiology of Disasters (CRED) is the most reputable disaster reporting agency in the world. The worldwide natural disaster data from CRED, as gathered in their EM-DAT database, are shown below in Figure 2. While the data are available starting from 1900, we opted to show only those from 1970 onward, because the number of stations for reporting natural disasters began increasing around 1970 (Happer et al. 2023). Thus, from 1970 to about 2000, the world saw more thorough and increased reporting of these natural disasters, which is a major contributor to the increase in the reported number of natural disasters during this time period (Figure 2).

In other words, the increase in the reported number of natural disasters from 1970 to 2000 reflects the increasing number of nations and regions reporting these calamities, rather than an increase in the actual frequency of these events. In contrast, from 2000 onward, Figure 2 suggests that there is no increasing trend in the annual reported number of natural disasters.

Global mortality related to natural disasters has declined significantly over the past century (Figure 3). Much of this decrease can be attributed to better forecasting and improved infrastructure. However, the results refute the common claim of increasing global mortality attributed to natural disasters.

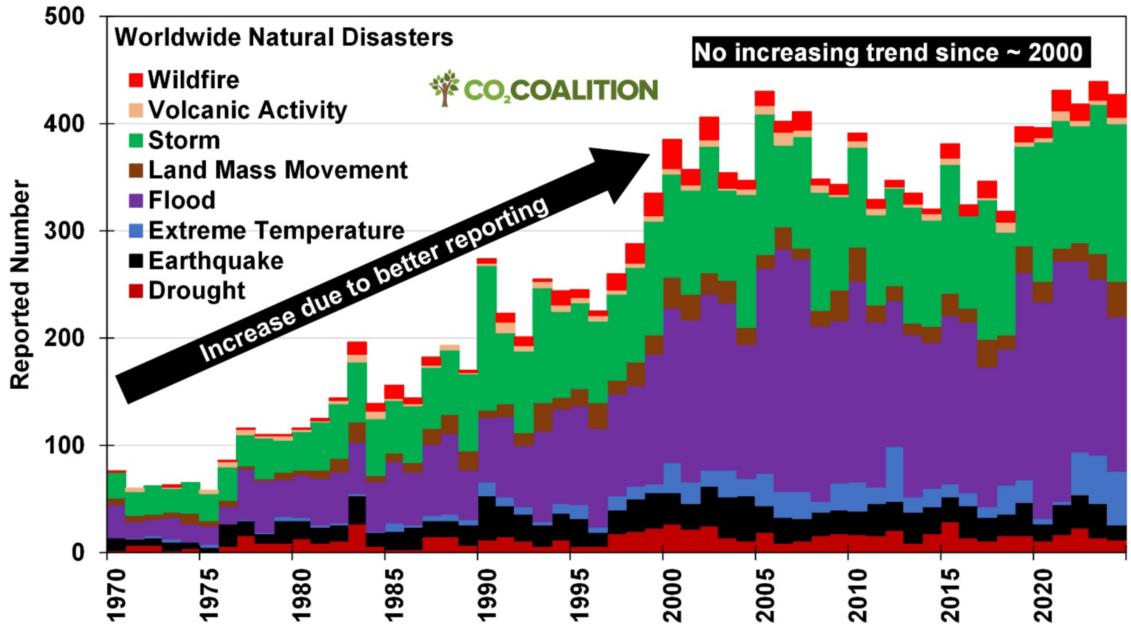

Figure 2: *Annual reported number of global natural disasters (Centre for Research on the Epidemiology of Disasters 2025).*

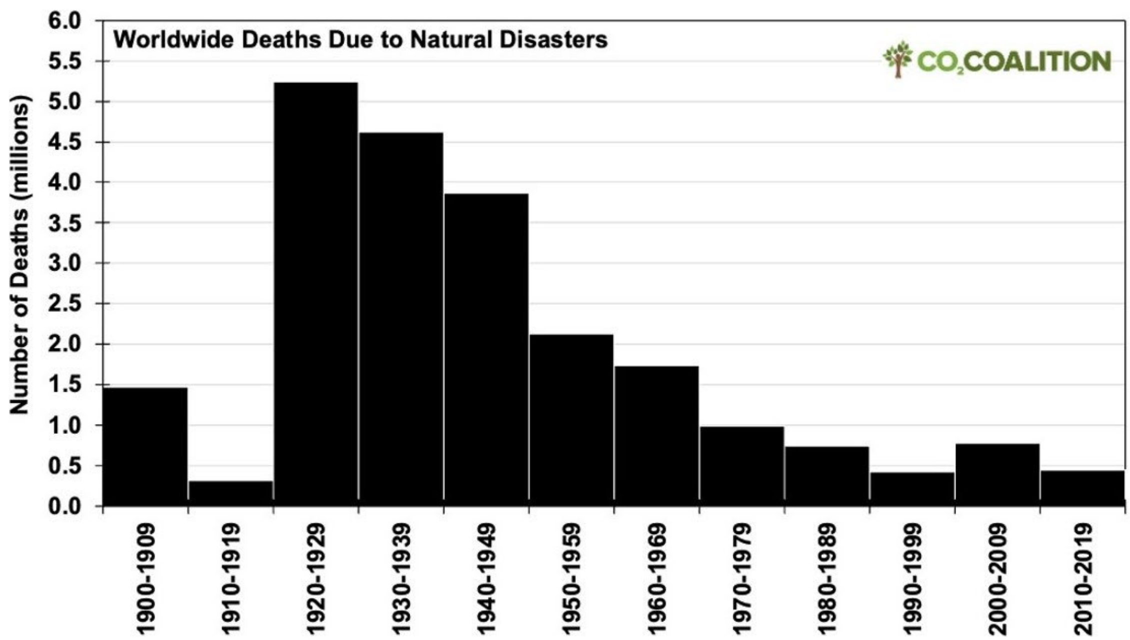

Figure 3: *Decadal reported number of worldwide deaths due to natural disasters (Centre for Research on the Epidemiology of Disasters 2025).*

Having established that deaths due to natural disasters have declined over the years, let us now turn to the next question: Are the costs of natural disasters increasing?

The simple answer to that is "yes, but." When expressed in terms of U.S. dollars, even when adjusted for inflation, the financial damage from natural disasters has increased dramatically from 1900 to 2011 (Centre for Research on the Epidemiology of Disasters 2025). However, this metric fails to take into account the increase in infrastructure, including those in high-risk areas (e.g., beach houses). To overcome this shortcoming, the percentage of GDP has been recommended as a more appropriate metric for quantifying the financial damage due to natural disasters. When this metric is used, the financial damage from natural disasters has declined over the years, as shown in Figure 4.

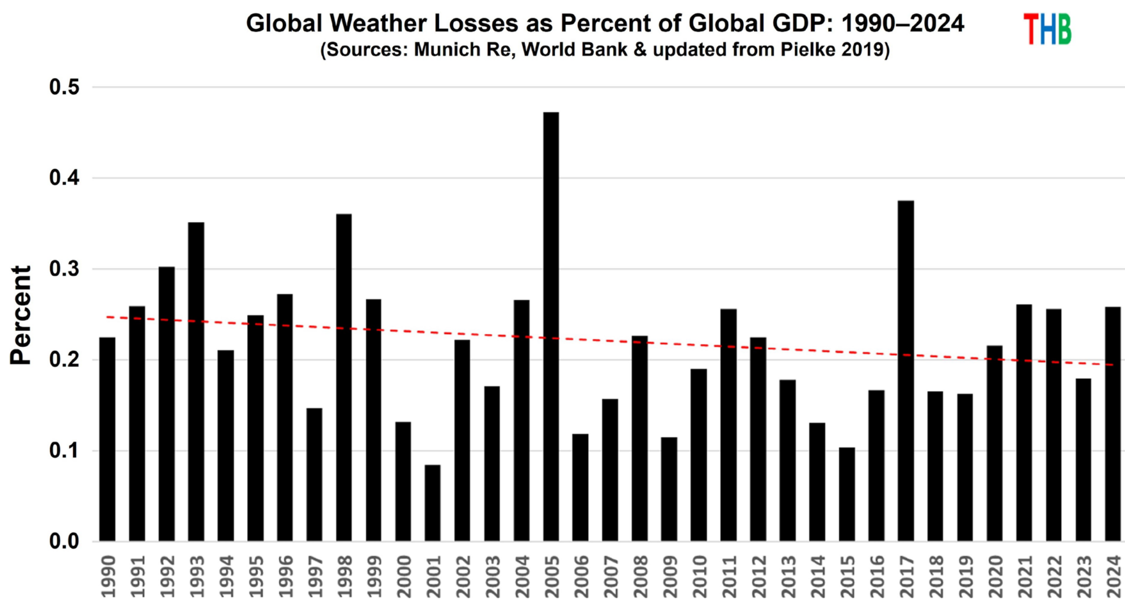

Figure 4: *Global annual financial damage due to natural disasters, as percentage of GDP. Image source: Pielke (2025)*

The frequency of worldwide natural disasters has not been increasing in recent decades, global deaths from natural disasters have significantly declined over the past century, and the worldwide financial damage (as percentage of GDP) from natural disasters has declined slightly since 1990.

Given these findings, there is no reason to believe that the experience of Virginia, or any other state, would be significantly different. Furthermore, these trends have occurred during a period of both rising temperature (discussed in the next section) and a growing concentration of atmospheric CO_2, countering claims of a linkage with natural calamities.

MODERN TEMPERATURE HISTORY VS. ATMOSPHERIC CARBON DIOXIDE

The dominant greenhouse gas is water vapor. Combined with clouds, the two are likely responsible for upwards of 90% of all greenhouse gas-driven warming (Lindzen and Happer 2025). Of the man-made greenhouse gases, the gas that has the potential to affect surface temperatures the most is CO_2. The source of this CO_2 is primarily from the combustion of fossil fuels (coal, natural gas, and liquid petroleum), which drive the world's economic engine (Engelbeen et al. 2024). The case for radically reducing CO_2 emissions and hence stifling economic development must be very strong indeed.

Earth's average surface temperature has increased by about 1.2 °C (2.2 °F) since 1850 (Figure 5). The "background" CO_2 concentration, prior to the Industrial Revolution, is a universally accepted value of about 280 parts per million (ppm) by volume. By 1850, when direct measurement with thermometers of global temperature began, it had risen to about 285 ppm (Keeling et al. 2025). The 2025 atmospheric CO_2 concentration was 427 ppm (Lan and Keeling 2025). This represents an approximate 50% increase since the beginning of the Industrial Revolution.

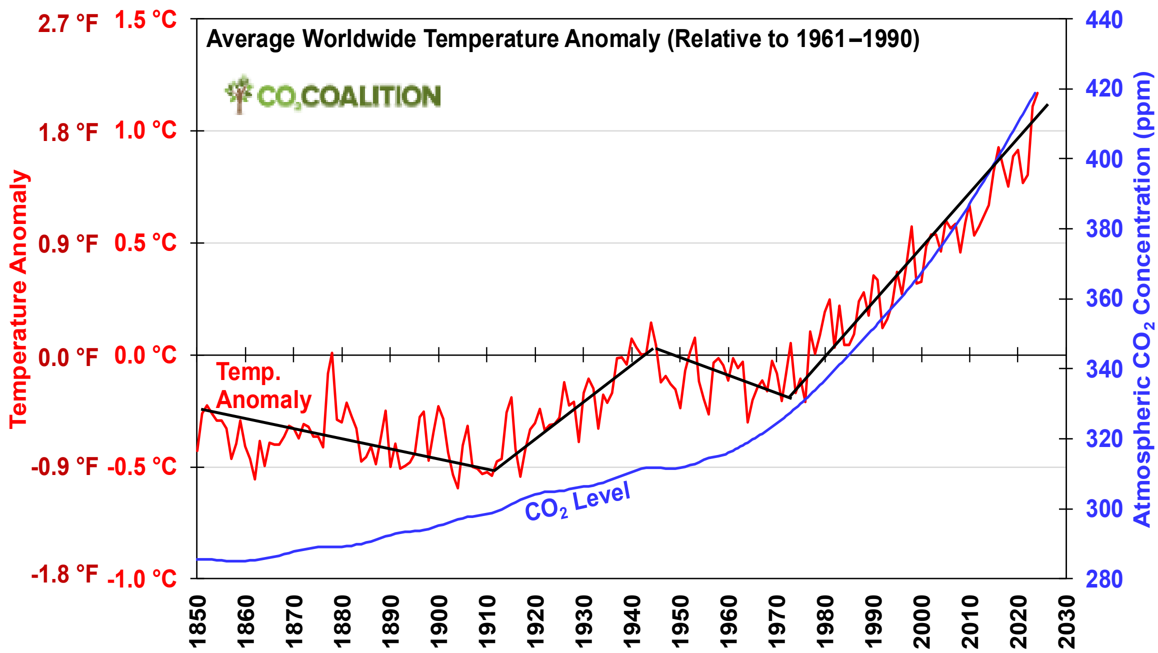

Figure 5: *Average global temperature anomaly (relative to 1961–1990) vs. atmospheric CO_2. Temperature: HadCRUT 5.1 (2025); CO_2: Keeling et al. (2025)*

As shown in Figure 5, there are two periods of warming since 1850. The first period of warming took place from 1910 to 1943, with a warming of about 0.6 °C (1.0 °F). During this time period, the atmospheric CO_2 concentration increased from about 299 ppm to about 312 ppm, or about 13 ppm (4%) (Keeling et al. 2025).

The second period of warming shown in Figure 5, began in 1978, is continuing, and has resulted in a warming of about 1.2 °C (2.2 °F) (warming of 0.03 °C per year), while the atmospheric CO_2 concentration increased from about 332 ppm in 1978 to about 425 ppm in 2024, or about 93 ppm (Lan and Keeling 2025).

The 13-ppm increase in atmospheric CO_2 concentration during the early warming trend coincided with a rate of warming of 0.02 °C per year. Since the beginning of our current warming trend, the atmospheric CO_2 concentration increased by 93 ppm (seven times more), yet the rate of temperature increase was only slightly larger than the earlier one that occurred at low levels of CO_2.

Another temperature anomaly (Figure 5) unexplained by the increase in atmospheric CO_2 concentration is the 33-year cooling trend that took place from 1945 to 1978. This temperature decline coincided with the post-World War II economic boom and the beginning of the introduction of the first significant increases in anthropogenic CO_2 emissions. If CO_2 were a primary driver of warming, it would be difficult to reconcile approximately three decades of cooling just as atmospheric CO_2 concentrations were increasing.

To assess historic temperatures in Virginia, data from the National Oceanic and Atmospheric Administration's (NOAA's) U.S. Historical Climatology Network (USHCN) was utilized. The USHCN consists of 1,218 stations located in the contiguous United States and is a subset of the NOAA Cooperative Observer Program. The sites for these USHCN stations were selected based on "spatial coverage, record length, data completeness, and historical stability" (Menne et al. 2009; NOAA 2025e).

Based on the USHCN temperature data (Figure 6), Virginia's average temperature history is only somewhat comparable to the worldwide average temperature history (Figure 5), despite experiencing the same changes in atmospheric CO_2 concentration.

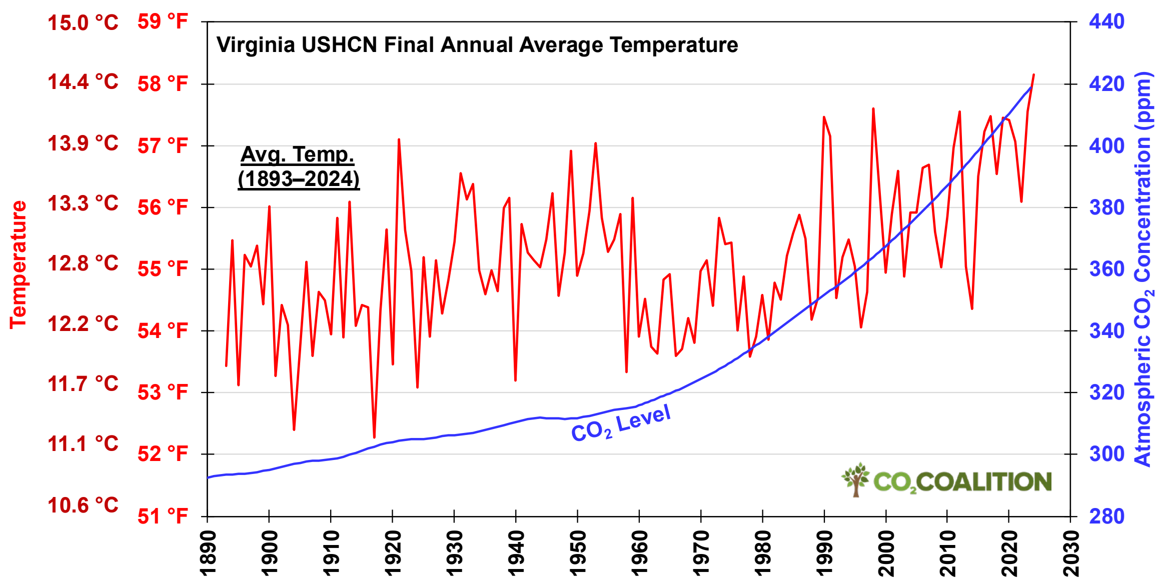

Figure 6: *Annual average temperature in Virginia vs. atmospheric CO_2. Temperature: NOAA (2025e); CO_2: Keeling et al. (2025)*

Similar to the worldwide average temperature history (Figure 5), Virginia's average temperature (Figure 6) shows two periods of warming, with the first beginning in 1917 and ending in 1953. This warming amounted to about 2.6 °C (4.8 °F). Unlike the worldwide average temperature record, this warming in Virginia was followed by a very sharp drop in temperature of about -2.1 °C (-3.7 °F) from 1953 to 1958. The magnitude of this cooling in Virginia is about seven times greater than the temperature drop of about -0.3 °C (-0.5 °F) from 1945 to 1976 in the global average temperature record (Figure 5).

In Virginia, warming resumes after 1958 but is very choppy and noisy. For example, there is no warming trend at all (although there is a lot of noise in the data) from 1990 to 2020). The current warming in Virginia since 1958 must be viewed in the context that temperatures *fell* about -2.1 °C (-3.7 °F) from 1953 to 1958. This means that this warming started from an anomalously cold base.

It must also be noted that the average temperature data shown above (Figure 6) have been altered to lower temperatures prior to 1994, and to increase the measured values in recent years. The overall effect of this manipulation is to amplify recent increases in temperature. For comparison, Figure 7 below shows the raw, unaltered average temperature data for Virginia. This raw data show that Virginia temperature of recent decades (high CO_2) is like that of the period from 1920 to 1950 (low CO_2).

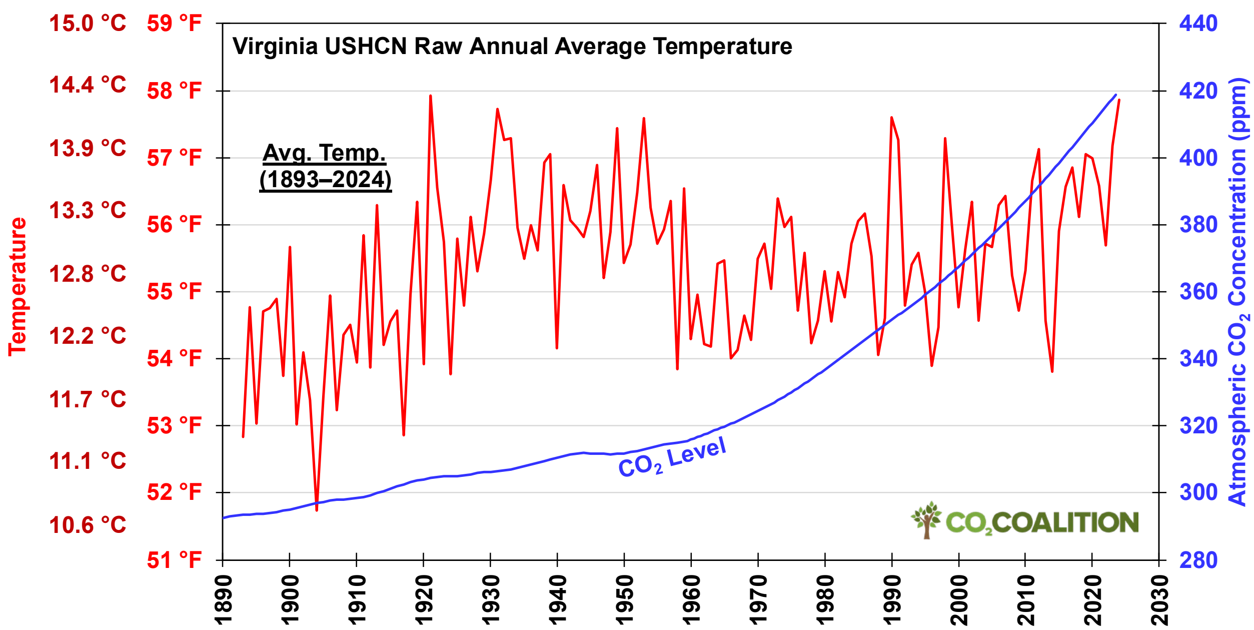

Figure 7: *"Raw" annual average temperature in Virginia vs. atmospheric CO_2. Temperature: NOAA (2025e); CO_2: Keeling et al. (2025)*

Note that the global data indicate that any temperature increases possibly driven by carbon dioxide-related warming are confined to the post-1976 period (there are also other causes), so much of the second warming *in Virginia* is more likely due to random natural factors compensating for the unusual cooling spike from 1950 to 1970.

The modest warming seen over the last 100-plus years has resulted in a reduction of very cold nighttime temperatures (Figure 8), lessening Virginia citizens' needs for winter heating and energy demand while lengthening the commonwealth's growing season.

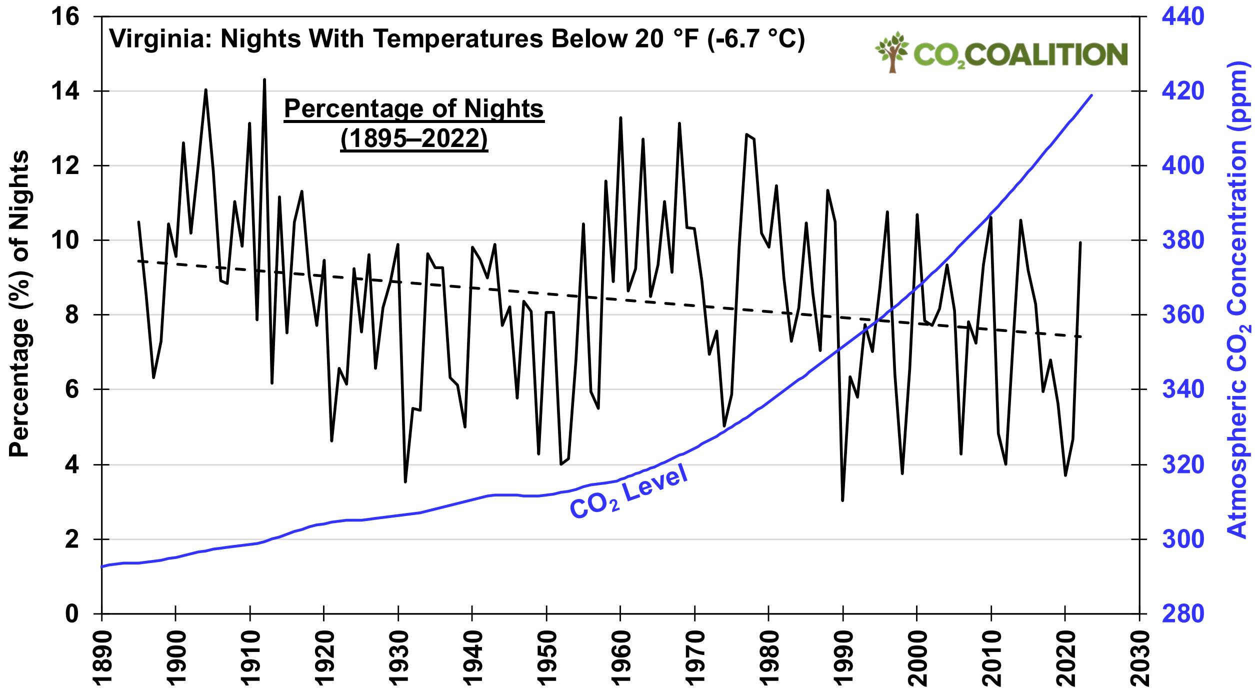

Figure 8: *Frequency of cold nights with temperatures below 20 °F in VA vs. atmospheric CO_2. Frequency of cold nights: NOAA (2025b, 2025e); CO_2: Keeling et al. (2025)*

HEAT WAVES

There is little dispute that the most severe heat waves in both the United States and Virginia occurred in the 1930s (EPA 2025a). In Virginia, the temperature record reveals that very hot days have not been increasing (Figure 9). It is worth noting that the data from the USHCN stations are of higher quality than those from many of the other NOAA stations.

In fact, the USHCN stations were selected in part because of minimal localized urban heat-island effect. For instance, the temperature station at Reagan National Airport (DCA) is not included among the USHCN stations because it experiences a large amount of spurious urban heat-island warming (amongst the largest in the world). Very hot temperatures at Reagan National Airport often generate headlines, but these heat waves are largely an artifact of the DCA/Washington, D.C. heat island.

Comparing the temperature data for Virginia to those for Mid-Atlantic States and the contiguous United States, Figure 10 shows the percentage of USHCN stations that recorded all-time high temperatures in these regions. Notice that most of the record all-time high temperatures were reported during the 1930s in Virginia, the Mid-Atlantic States, and the contiguous United States. On the other hand, since 2000, only few USHCN stations (less than 11% each year) in these regions reported all-time high temperatures. For instance, in Virginia, with the exceptions of the years 2003 and 2010, no USHCN stations reported any record all-time high temperatures from 2000 to 2022.

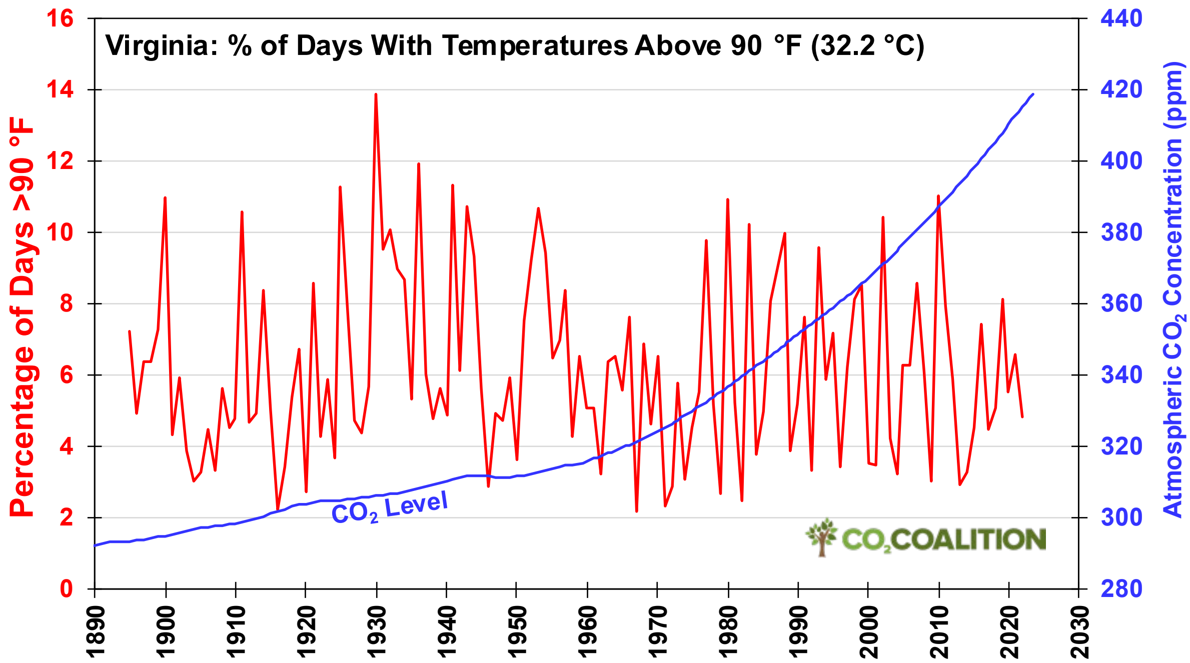

Figure 9: *Frequency of hot days with temperatures above 90 °F in Virginia vs. atmospheric CO_2. Frequency of hot days: NOAA (2025b, 2025e); CO_2: Keeling et al. (2025)*

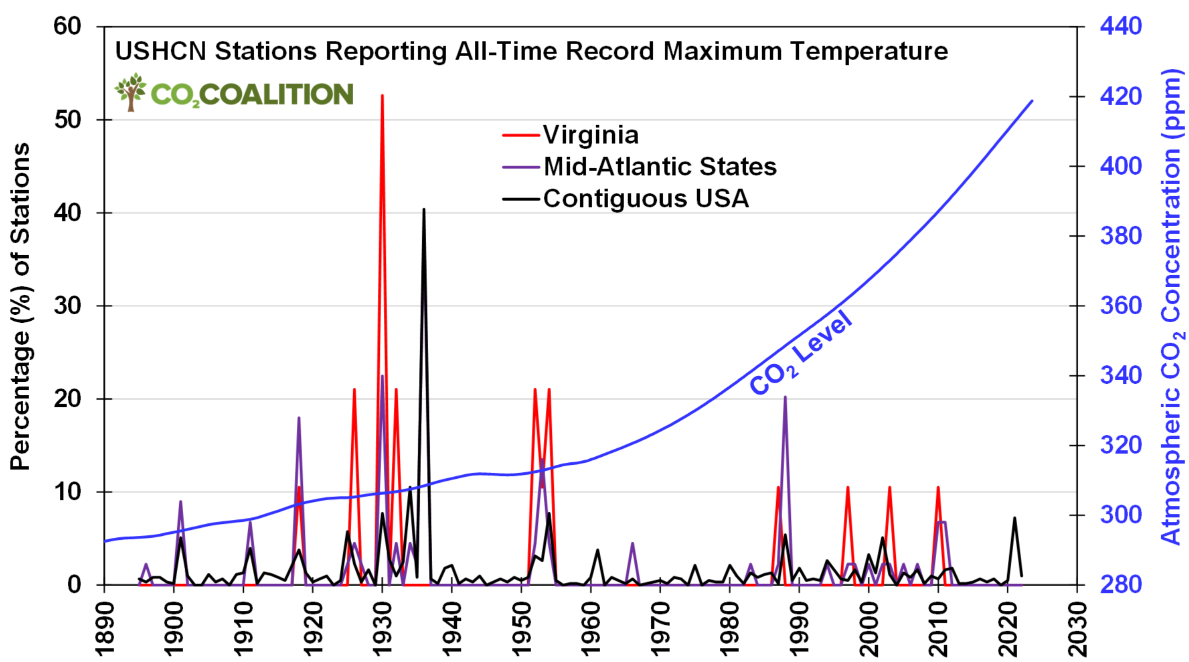

Figure 10: *The percentage of USHCN stations reporting all-time high temperatures vs. atmospheric CO_2. Number of stations: NOAA (2025b, 2025e); CO_2: Keeling et al. (2025)*

The percentage of all-time high temperature records in Virginia is inordinately confined to the year 1930, due to the extreme heat of the summer of 1930.

Figure 11 shows the Annual Heat Wave Index for the contiguous United States (EPA 2025a).

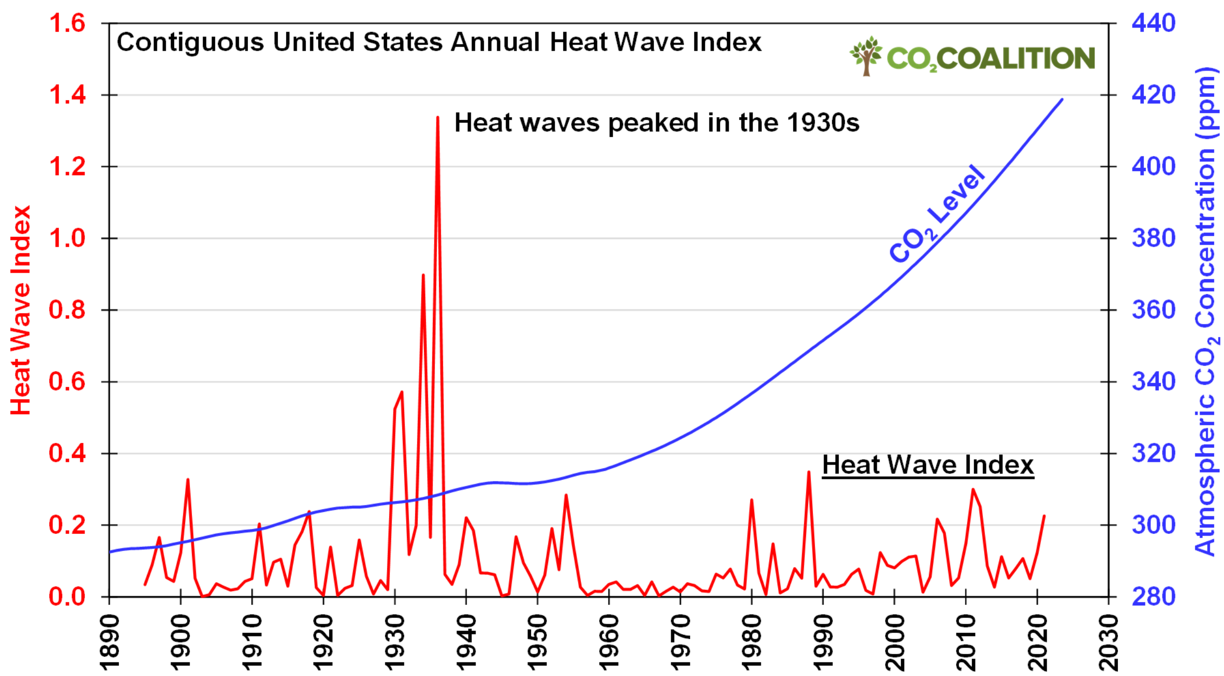

Figure 11: *Annual Heat Wave Index for the contiguous United States vs. atmospheric CO_2. Annual Heat Wave Index: EPA (2025a); CO_2: Keeling et al. (2025)*

Figure 11 indicates that the facts belie claims of increasing heat waves. For instance, the most severe heat waves occurred in the 1930s, long before the large increase in atmospheric CO_2 concentration. Claims that heatwaves in the United States are increasing in magnitude and frequency because of changes in atmospheric CO_2 concentration are simply not supported by the facts.

VIRGINIA TEMPERATURE IN FUTURE CONTEXT

The various "National Assessments" of climate change impacts on the U.S. include the Scientific Assessments of the United Nations' Intergovernmental Panel on Climate Change (IPCC) all rely upon models to estimate future climate. (Indeed, the EPA's 2009 "Endangerment Finding" from carbon dioxide and other greenhouse gases is also exclusively model-based, EPA 2009). The "clean energy" programs adopted and proposed by Virginia also rely on these climate models to predict a dangerous rise in temperature to justify increasing taxes and imposing new regulations.

Consequently, when weighing the advisability of Virginia's participation in these schemes, it is advisable to see how climate models compare against actual temperature data. Such a comparison is shown in Figure 12.

As shown in Figure 12, the predictions of the climate models, which are the rationale for Virginia's climate programs, have significantly overpredicted actual Virginia warming in recent decades. If the basis for implementing RGGI and other pending climate regulations is so systematically flawed, these climate models should have no place in formal debate on Virginia's

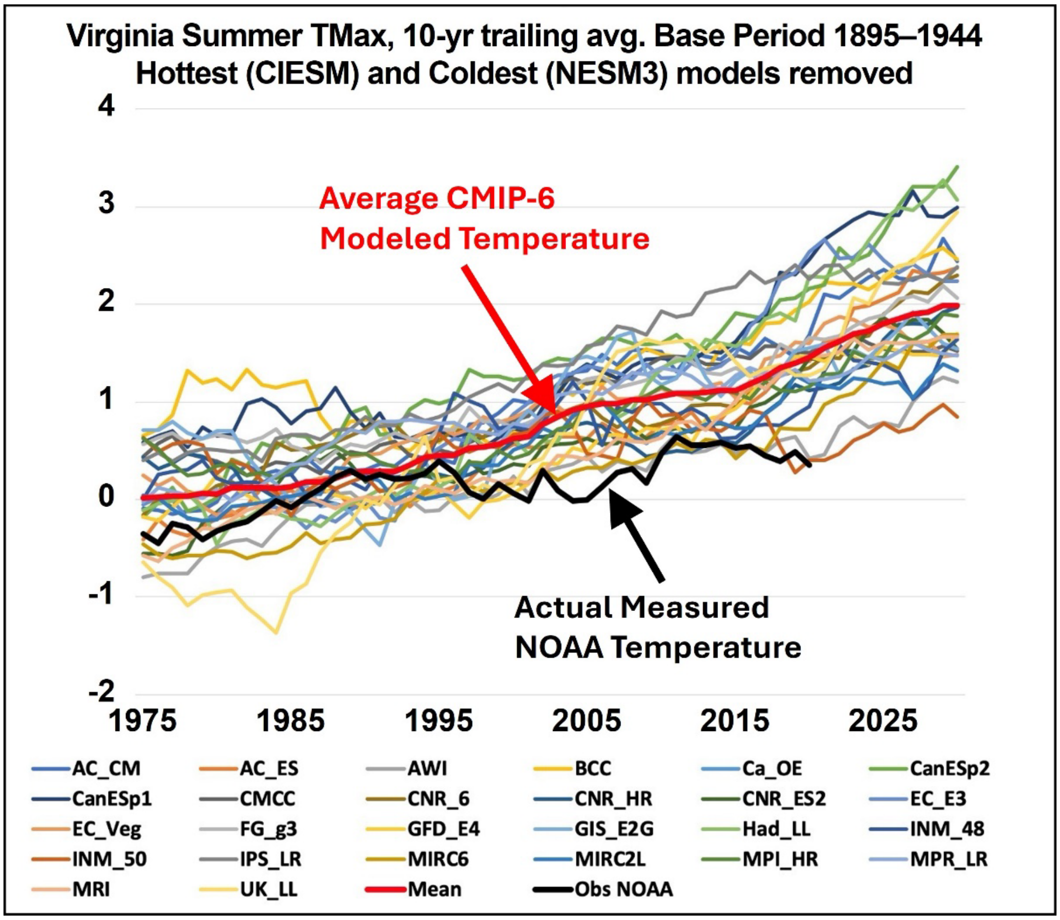

Figure 12: *Predicted (CMIP-6, colored lines) versus observed (USHCN) summer temperatures in Virginia. The solid black line is the Virginia mean, and the solid red line is the model mean. Figures are ten-year trailing means. It is clear that there is a continuing and increasing disparity between models that form the rationale for "clean energy" programs and the observed Virginia summer temperatures. Illustration from John Christy, State Climatologist for Alabama.*

climate policies. To put it simply, the latest (and presumably best) generation of climate models provides no reliable information regarding future temperatures in Virginia and globally. To "follow the science" is to admit that climate models provide no reliable clues for future temperatures in Virginia, or anywhere else in the world.

VIRGINIA PRECIPITATION AND DROUGHT

Drought is the single greatest threat to the agricultural sector in Virginia and around the world. According to the United Nations Food and Agriculture Organization (UNFAO 2021), "drought has been established as the single greatest culprit of agricultural production loss."

Drought is primarily driven by a regional decrease in precipitation and soil moisture. Drought is also made worse by high temperatures and heat waves, but as noted in the section above, high-temperature events are not increasing. Therefore, heat-driven drought in Virginia has been a non-factor.

The annual precipitation data for Virginia (Figure 13) is very noisy, as is most statewide annual precipitation data in the United States. Despite claims to the contrary, the Virginia precipitation data do not support claims of climate change-driven declining precipitation. In fact, there has been a slight increase in precipitation in recent decades.

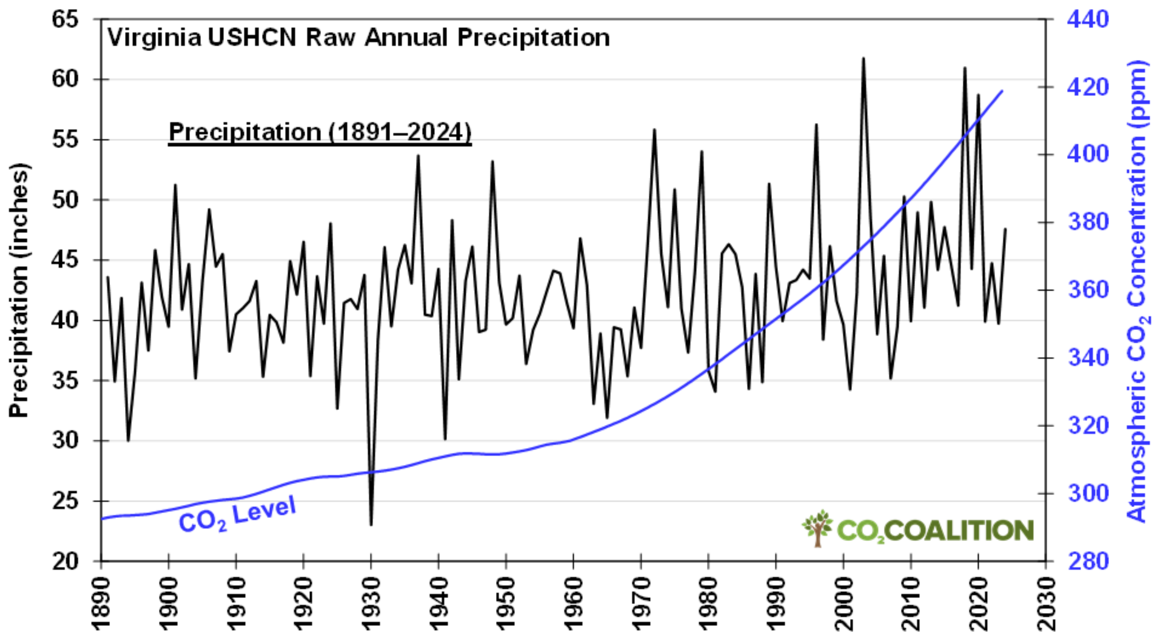

Figure 13: *Annual precipitation in Virginia vs. atmospheric CO_2. Precipitation: NOAA (2025e); CO_2: Keeling et al. (2025)*

There are multiple ways to quantify drought, but the most reliable are the various versions of the integrated Palmer Drought Indices, developed in the mid-20th century, and extensively used by state and federal agencies tasked with monitoring moisture conditions (NOAA 2025a; NOAA National Integrated Drought Information System 2025).

The extreme droughts of the 1930s are evident in Figure 14, but what is more interesting is the propensity for moisture surplus, indicated by the blue bars, beginning in the late 1960s and continuing until today. *In other words, the warming of the Virginia record correlates with an improvement in moisture level statewide.* This is especially beneficial for Virginia's heavily forested landscapes and large agricultural industry.

In the following section, we discuss the positive effect of increasing CO_2 on plant growth via CO_2 fertilization. However, another benefit of more carbon dioxide is that plants require less water to thrive and survive. More CO_2 means that plants require less transpiration to draw in CO_2, leading to less water loss by way of evaporation through leaves. Since plants draw less water from the ground, soil moisture remains higher.

The persistent tendency towards a moisture surplus remains a propitious feature of Virginia's recent climate.

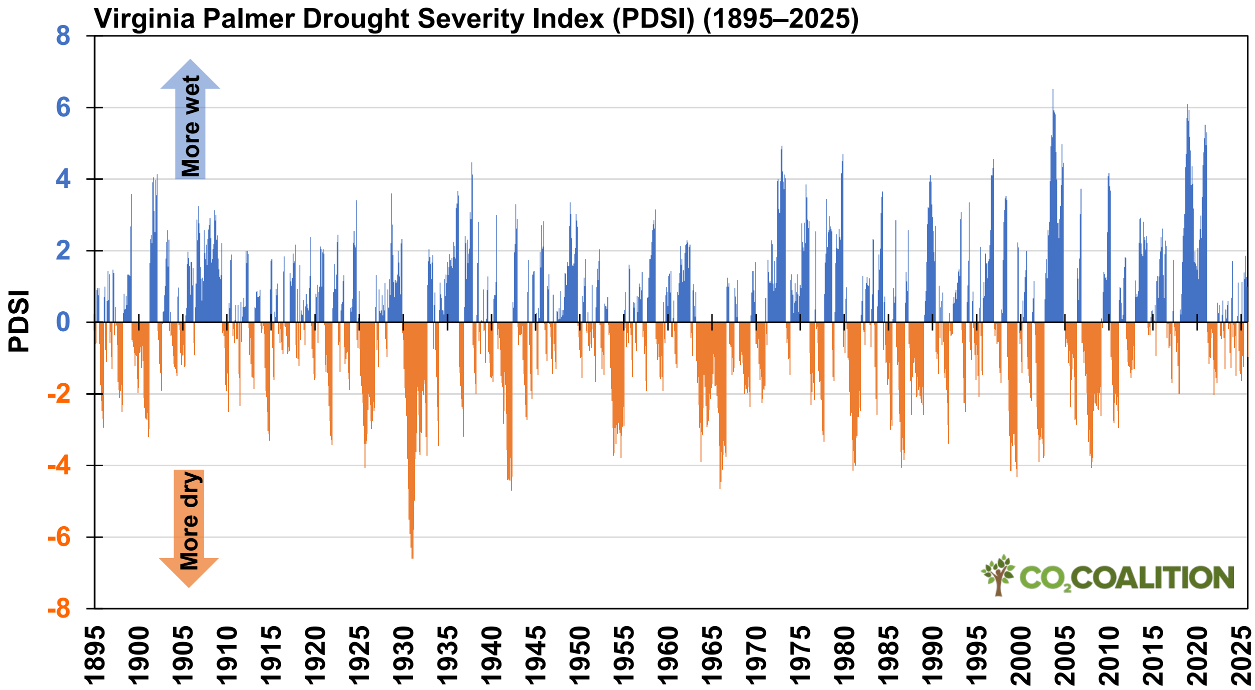

Figure 14: *Monthly Palmer Drought Severity Index (PDSI) for Virginia (NOAA 2025a).*

CLIMATE CHANGE AND AGRICULTURE

Linkage between agricultural decline and supposed CO_2-induced climate change is used as another justification for Virginia's proposed climate regulations. The specter of crop failure and hunger is used to create fear of looming food shortages and rationalize these programs.

If a CO_2-fueled rise in temperature were leading to degradation of our food supply, it should be easily recognized in crop-growth records. The facts provide ample evidence that just the opposite is occurring. The combination of modest warming, increasing CO_2 fertilization effect and technological innovation is fueling crop growth both worldwide and in Virginia.

A summary of 270 laboratory studies by Idso (2013) for 83 food crops showed that increasing atmospheric CO_2 concentrations by 300 ppm would increase plant growth by an average of 46% across all the crops studied.

This is over and above the remarkable trend in Virginia crop yields, shown in Figure 15, for the top four crops in Virginia in terms of value of production: hay, soybeans, corn and cotton (USDA 2025a, 2025b). The significant increase in crop yields shown in Figure 15 began in the 1930s with the widespread adoption of hybrid corn, increasing fertilizer application and more efficient farming techniques. These technical adaptations were turbocharged by increasing "fertilization" effect of growing atmospheric CO_2 concentration and longer growing seasons due to modestly warming temperature (Wrightstone 2023).

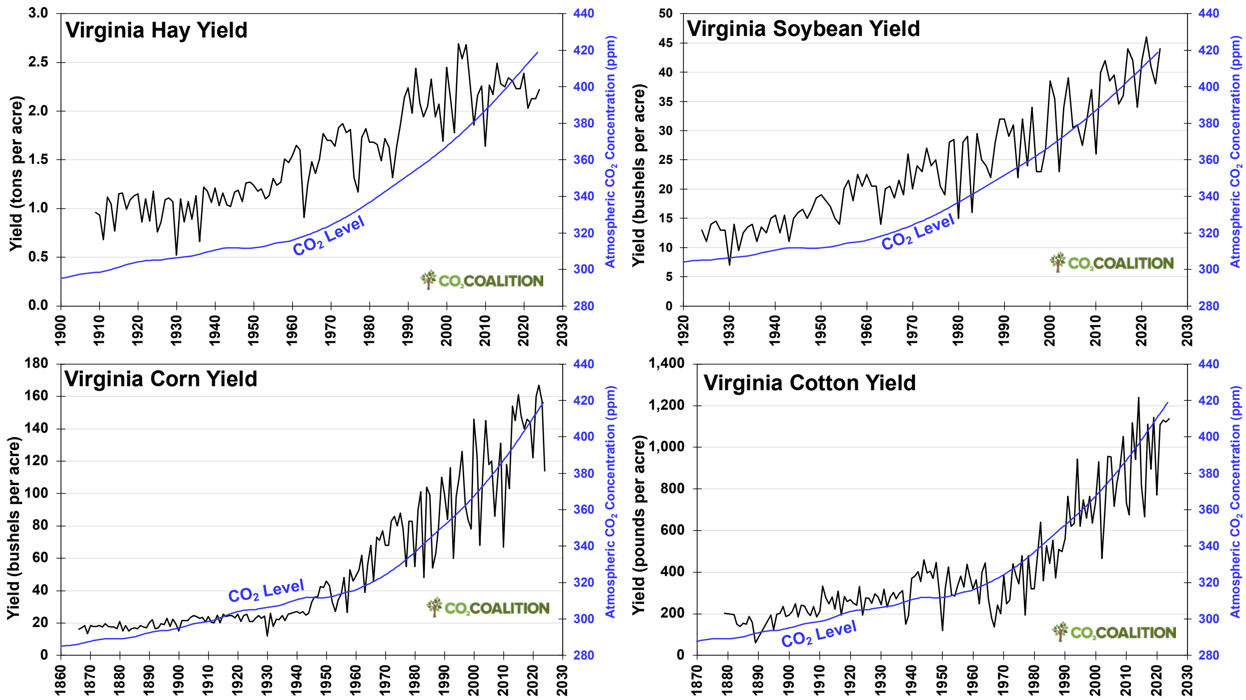

Figure 15: *Agricultural yield of the top four crops in Virginia vs. atmospheric CO_2. Agricultural yield: USDA (2025b); CO_2: Keeling et al. (2025)*

The sharp increase in the yield of crops shown in Figure 15 is characteristic for most crops grown in the United States. Extraordinary and persistent crop growth increase is not limited to the United States, but extends worldwide as well, as shown in Figure 16 for the four crops that make up about half of the worldwide primary crop production: sugar cane, corn, wheat and rice (UNFAO 2024, 2025). Like the increase in the yield of the major crops in Virginia (Figure 15), the increase in the global yield of major primary crops (Figure 16) coincide with the rise in atmospheric CO_2 concentration.

Conversely, a large number of studies show the adverse effects of a low-CO_2 environment. For instance, Overdieck (1988) indicated that, compared to today, plant growth was reduced by 8% in the period before the Industrial Revolution, with its low CO_2 concentration of 280 ppm.

While it is only common sense that plants thrive in response to higher atmospheric CO_2 concentrations, it is also relevant that the ancestors of the plants on which we rely first came into existence and prospered when CO_2 levels were up to five times today's levels. Therefore, the proposed attempts to reduce CO_2 concentrations would be bad for plants, bad for animals and bad for humankind.

Virginian agriculture has also benefited from the modest warming of about 2.8 °C (5.0 °F) that Virginia has experienced from 1893 to 2024 (a time span of 131 years) (Figure 7). Warming temperatures mean that growing seasons in the contiguous United States have lengthened by nearly two weeks (Kunkel et al. 2004), as killing frosts end earlier in the spring and arrive later in autumn, thus allowing additional harvests of various crops.

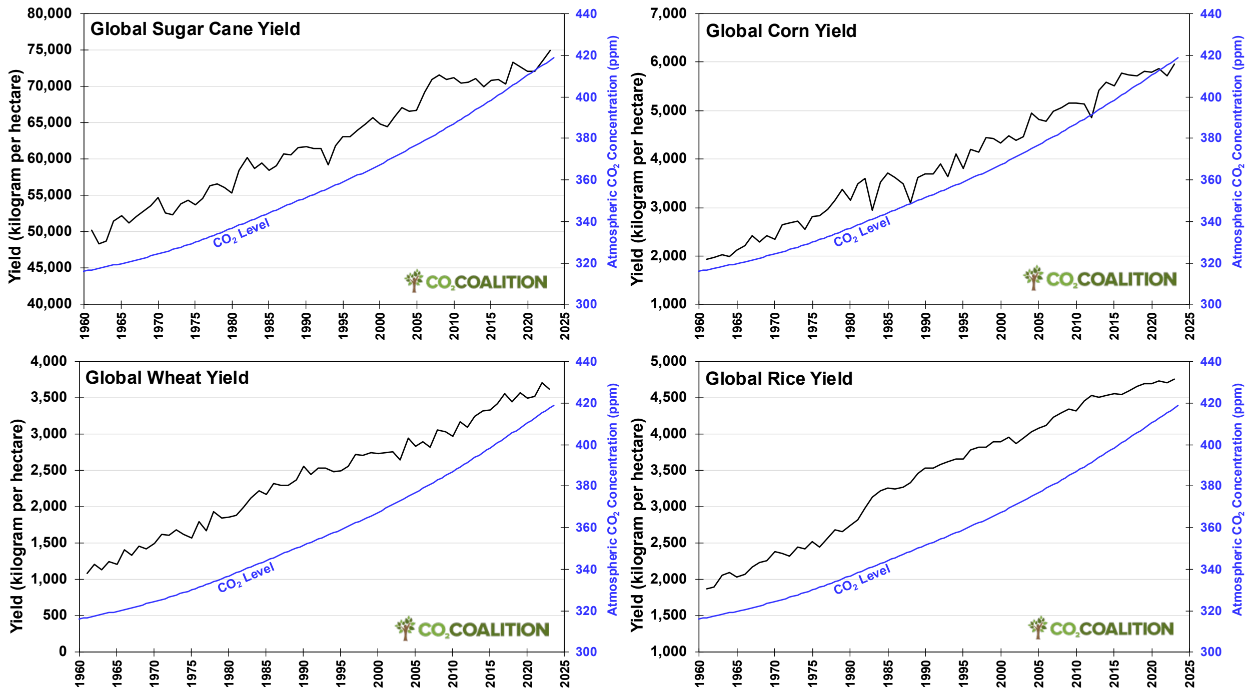

Figure 16: *Global agricultural yield of the four major primary crops vs. atmospheric CO_2. Agricultural yield: UNFAO (2025); CO_2: Keeling et al. (2025)*

GLOBAL TROPICAL CYCLONE ACTIVITY

With more than 7,200 miles of shoreline, Virginia has concerns about hurricanes and their potential for devastation. Figure 17 shows the accumulated cyclone energy (ACE) index for all tropical cyclones, since detection coverage became uniform with the advent of worldwide satellite coverage in 1970 (Maue 2025). The data show no increase in the intensity of these storms.

Records of landfalling hurricanes in the United States show a slight decline in these dangerous storms, rather than the increase that is claimed to be occurring (Figure 18).

As Figures 17 and 18 make obvious and despite claims to the contrary, there has been no increase in these dangerous storms.

REGIONAL SEA-LEVEL RISE

The longest and most consistent direct measurements of local sea level come from long-term tide gauges in onshore environments. Regionally, there are two tide gauge stations with data available dating to 1930 and earlier. These are at Sewells Point (tidewater Virginia) and Washington, D.C.

Global average sea-level rise is determined by a combination of the thermal expansion of water accompanying the approximately one-degree Celsius rise in surface temperature and ice-melt from land-based glaciers. Local sea-level rise can have a strong geological component, as is the

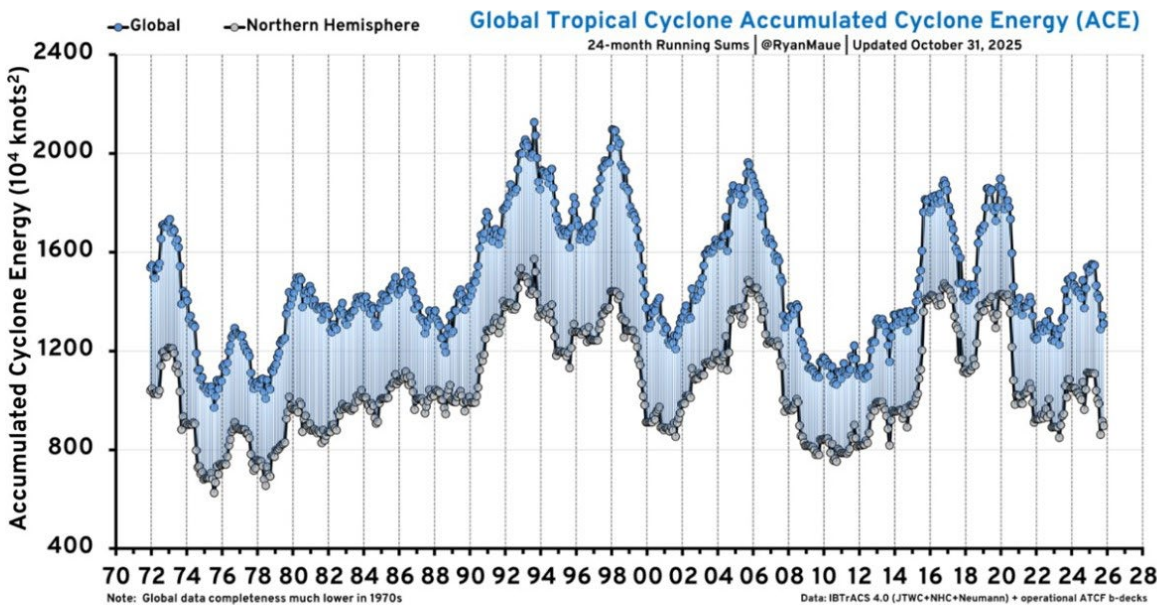

Figure 17: *Worldwide and Northern Hemispheric accumulated tropical cyclone energy (Maue (2025).*

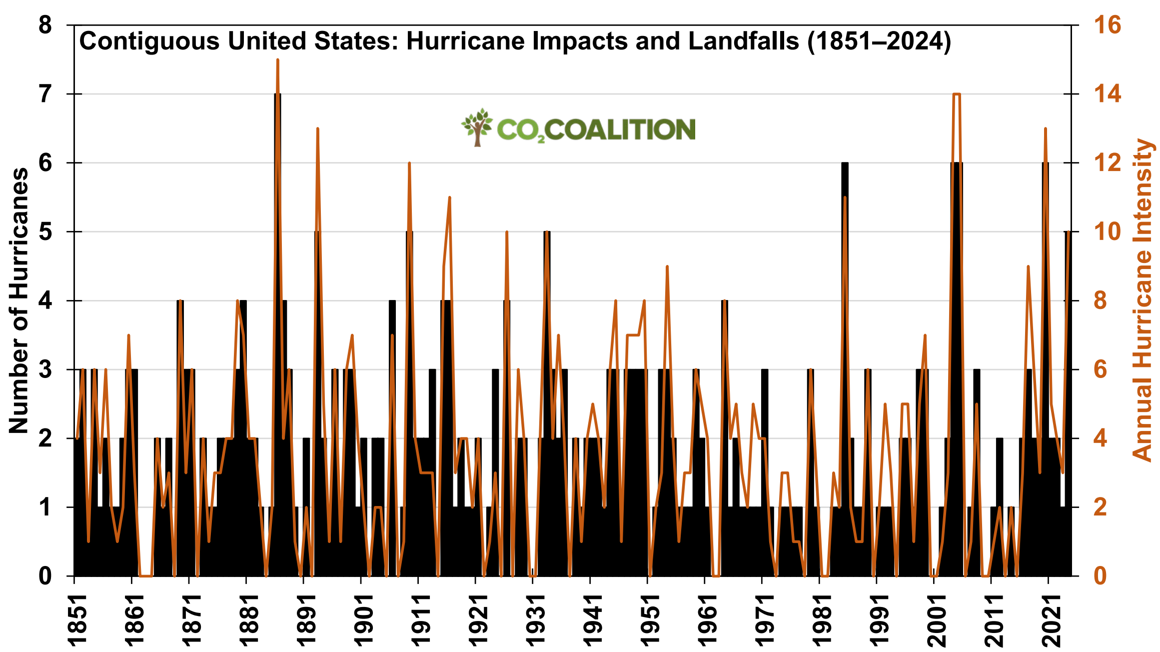

Figure 18: *Annual frequency and total intensity of hurricane impacts and landfalls in the contiguous United States (NOAA Atlantic Oceanographic & Meteorological Laboratory (2025).*

case in coastal Virginia, where the rise is amplified by the well-documented isostatic rebound along the eastern seaboard. This is a response to the melting of enormous North American glaciers at the end of the last ice advance more than 10,000 years ago. As interior land surfaces rise, some areas along coastlines subside. Land-subsidence rates in the mid- and northeast Atlantic coastal regions are between two and five mm/year, which yields 21st-century sea level rises of 7.8 to 19.7 inches *from non-climatic processes that cannot be arrested*.

All the tide-gauge data from the contiguous U.S. show strongly linear trends. In other words, despite increasing temperatures, *there is no acceleration in sea level rise in the tide-gauge records*. Satellite data showing an acceleration in sea-level rise are contaminated by sensor changes (different satellites) and challenged by the behavior of the very large number of independent direct measurements from tide gauges.

In Figure 19, we show the behavior of the two longest tide-gauge records in the Virginia region (Washington, D.C.: 1.16 ft/100 years; and Sewells Point, Va.: 1.59 ft/100 years).

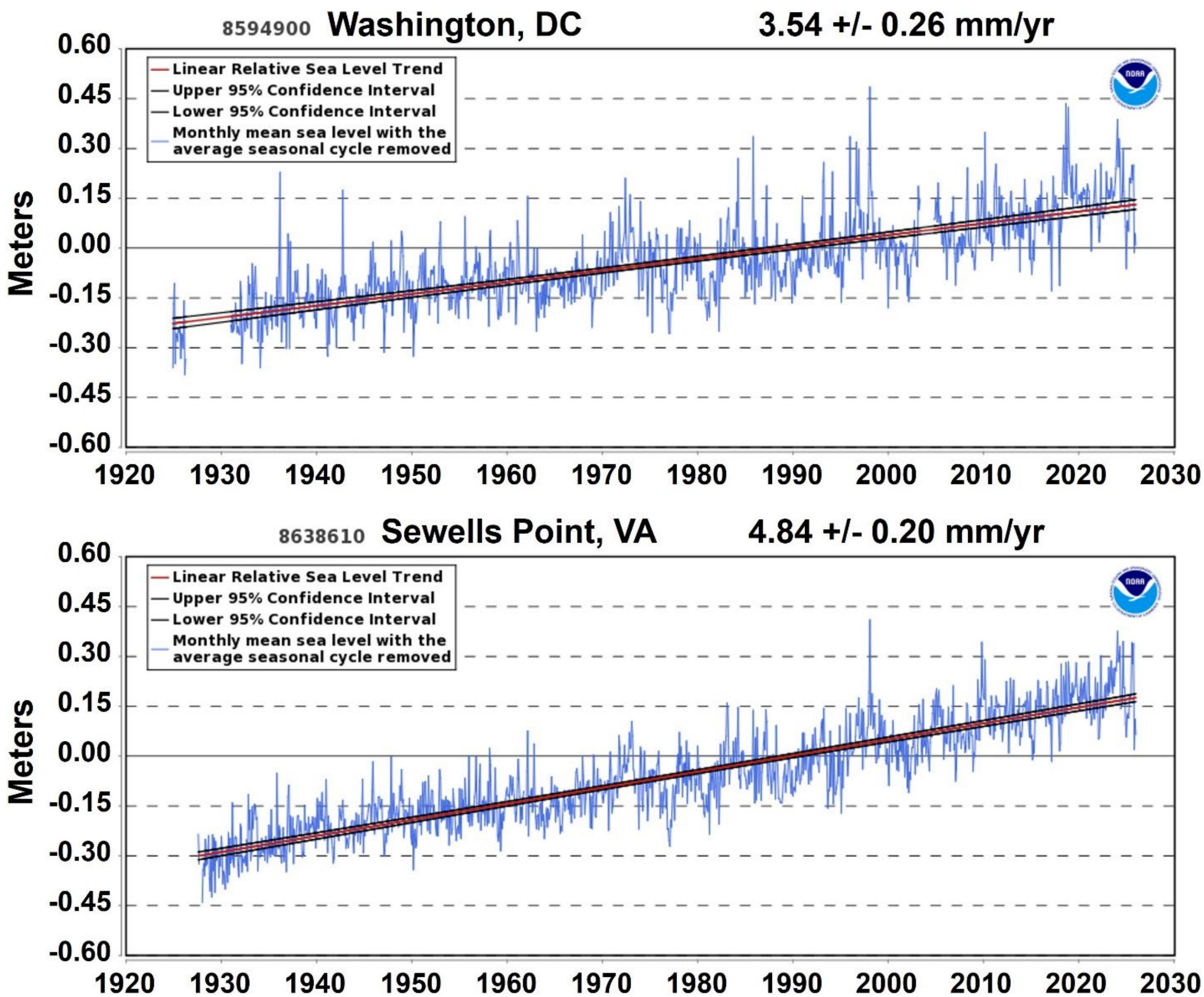

Figure 19: *Relative sea level at Washington, DC, and Sewells Point, VA.*
Sources of images: NOAA Tides & Currents (2026)

These two records, going back about 100 years, show that the rate of sea-level rise established at their beginning (the late 1920s) is the same as it is now, despite atmospheric concentrations of CO_2 in the 1920s being only 7% above the 1850 background and 45% today's. Virginians have easily adapted to and prospered with rises in sea level of up to two feet per century.

It should be noted that the most extreme projections of global sea-level rise this century (of 8.2 feet) are based upon a single reference (DeConto and Pollard 2016) that has been roundly criticized because its temperature model has Antarctica warming at several *times* its observed value.

Within this document, we examined several commonly cited reasons for stringent regulation of greenhouse gases in Virginia: (a) that "extreme" weather events are increasing and will continue to do; (b) that climate change is responsible for increases in severe events; and more specifically, (c) that heat waves are increasing in frequency; and (d) that hurricanes are increasing in power and frequency and that seas are rising at increasing rates.

None of these are supported by data or science. Virginian policies that claim a basis in these "realities" are in fact not scientifically founded and should be revisited.

THE CLIMATIC FUTILITY OF VIRGINIA'S PROPOSED CO_2 EMISSION REDUCTIONS

To estimate the amount of warming that would have been prevented if Virginia had managed to achieve net zero CO_2 emissions, we turn to the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC 2022), which has been used by the IPCC. MAGICC considers an equilibrium climate sensitivity (amount of warming from a doubling of the atmospheric CO_2 concentration) that could range from 1.5 to 4.5 °C (2.7 to 8.1 °F). Note that these models use multiple theoretical "feedbacks" to artificially increase predicted warming, a practice of doubtful validity.

Calculations without these positive feedbacks result in a very modest warming of less than 1.0 °C with a doubling of CO_2 (Lindzen and Happer 2025). So, the predicted warming used in MAGICC and in most climate modeling overpredicts warming greatly. Nonetheless, in our estimates shown in Figure 20, we assume a climate sensitivity of 2.0 °C (3.6 °F) for a doubling of atmospheric CO_2.

Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC)						
How much temperature rise would be averted by 100% reduction in net CO_2 emissions by 2010?						
Jurisdiction	**CO_2 emissions (2016) (million metric tons)**	**Percentage (%) of U.S. CO_2 emissions**	**Temperature rise averted by decreasing net CO_2 emissions by 100% by 2010 (Climate sensitivity of 2.0 °C)**			
			by 2050 (°C)	**by 2050 (°F)**	**by 2100 (°C)**	**by 2100 (°F)**
United States	5,161.00	100.0%	**0.041**	**0.0738**	**0.1040**	**0.1872**
Virginia	104.2	2.0%	**0.0008**	**0.0015**	**0.0021**	**0.0038**

Figure 20: *Estimated temperature rise that would have been prevented if the United States and Virginia were to have net zero CO_2 emissions starting in 2010 (MAGICC 2022).*

Based on the estimates from MAGICC, if *all* net CO_2 emissions from Virginia and the United States were kept to zero from 2010 onward, the amount of warming that would be averted would be 0.1040 °C (0.1872 °F) and 0.0021 °C (0.0038 °F), respectively, by the year 2100.

U.S. CO_2 emissions have been decreasing since 2007 (Global Carbon Budget 2025). In fact, in 2024, India's and China's CO_2 emissions amounted to 3.2 and 12.3 billion metric tons, respectively, while U.S. CO_2 emissions amounted to only 1.3 billion metric tons. The near-zero effect of Virginia's CO_2 emission reductions needs to be assessed in the context of the rapid expansion of global CO_2 emissions from developing regions, in particular India, China, Southeast Asia and Brazil.

Put simply, the United States is a minor player in worldwide CO_2 emissions.

The proposed reductions in GHG emissions in Virginia accomplish nothing to influence the climate, making Virginia's participation in RGGI and similar initiatives to alter global temperature meaningless. Looking only at Virginia's CO_2 emissions, MAGICC (using a 2.0 °C climate sensitivity) project that a complete elimination of the Commonwealth's CO_2 emissions would only avert an increase of 0.0021 °C (0.0038 °F) by the year 2100. This is far less than the difference in temperature that humans experience every few seconds in a "constant" environment, and far below our ability to even measure. In fact, this warming is scarcely different from zero. Therefore, according to the estimate from MAGICC, Virginia's attempts to reduce the planet's atmospheric temperature by reducing CO_2 emissions are climatically meaningless.

CONCLUSIONS

This detailed analysis of climate change and its alleged impact on Virginia finds the following to be true, and supported by various governmental and peer-reviewed studies concerning Virginia:

- There is no unusual or unprecedented warming.
- Heat waves have been declining.
- Severe weather is not increasing.
- Crop and forest growth are increasing.
- Droughts are in decline.
- There has been no increase in hurricanes.
- Complete elimination of CO_2 emissions within Virginia will have an impact on the temperature that is so close to zero that it is meaningless.

In short, there is no climate crisis and any attempts to eliminate CO_2 via regulation or taxation are "solutions in search of a problem."

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- **Gregory Wrightstone:** Geologist, CO_2 Coalition Executive Director and Expert Reviewer for the U.N. Intergovernmental Panel on Climate Change.
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* Note: Dr. Patrick J. Michaels, lead author of the original publication, passed away July 15, 2022.

About the CO_2 Coalition

The CO_2 Coalition was established in 2015 as a 501(c)(3) non-profit organization for the purpose of educating thought leaders, policymakers, and the public about the important contribution made by carbon dioxide (CO_2) to our lives and the economy. The CO_2 Coalition seeks to engage in an informed and dispassionate discussion of climate change, humans' role in the climate system, the limitations of climate models, and the consequences of mandated reductions in CO_2 emissions.

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