PLAYING GOD WITH THE WEATHER—A DISASTROUS FORECAST

HEARING

BEFORE THE

SUBCOMMITTEE ON DELIVERING ON GOVERNMENT EFFICIENCY

OF THE

COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM

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These documents were submitted after the hearing, and may be available upon request.

PLAYING GOD WITH THE WEATHER—A DISASTROUS FORECAST

TUESDAY, SEPTEMBER 16, 2025

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM
SUBCOMMITTEE ON DELIVERING ON GOVERNMENT EFFICIENCY
Washington, D.C.

The Subcommittee met, pursuant to notice, at 10:02 a.m., Room HVC–210, U.S. Capitol Visitor Center, Hon. Marjorie Taylor Greene, [Chairwoman of the Subcommittee] presiding.

Present: Representatives Greene, Cloud, Fallon, Burchett, Burlison, Jack, Gill, Stansbury, Norton, and Crockett.

Also present: Representative Subramanyam.

Ms. GREENE. This hearing of the Subcommittee on Delivering on Government Efficiency will come to order.

Welcome, everyone. Without objection, the Chair may declare recess at any time.

I recognize myself for the purpose of making an opening statement.

OPENING STATEMENT OF CHAIRWOMAN MARJORIE TAYLOR GREENE REPRESENTATIVE FROM GEORGIA

Ms. GREENE. Good morning, and welcome to today's hearing. I would like to first ask for a moment of silence to pray for Charlie Kirk, his wife Erika, and their children.

[Moment of silence.]

Thank you.

Humans have been trying to control the weather for centuries. Native American tribes performed ceremonial dances to summon rain during droughts. The Mayans sacrificed humans to their rain god. Today, people are still trying to control the weather, but some things have changed. Modern attempts at weather control do not appeal to divinity. Instead, they use technology to put chemicals in the sky. Cloud seeding, for instance, uses silver or lead iodide to try to increase rainfall in a specific location.

What has also changed over time is the scale of ambition. Today's advocates of geoengineering do not just want to address droughts or improve conditions for agriculture. They want to control the Earth's climate to address the fake climate change hoax and head off global warming. That, of course, requires massive interventions. What methods do they use? One is to remove carbon

dioxide from the atmosphere. Yes, the same carbon dioxide that keeps plants alive and prevents mass starvation. Another method they want to use is to block the rays of the sun from hitting the Earth. You heard that right, yes, the same sun that makes all life possible on Earth.

Some scientists think they can predict and control the impact of geoengineering, but even the best scientific models will never be able to capture all of God's wonderful creation and nature's mysteries. So, we can predict the real impacts these global-scale interventions would have little better than the Native Americans could know the impact of their rain dances.

And we are not talking about experiments that take place within the four walls of a laboratory. Our world is the laboratory, and we happen to be the lab rats. Blocking the sun would have unknown consequences that no scientific climate model could ever reliably predict. This could include serious reductions in crop yields, significant changes in plant and animal life, disastrous ozone depletion, not to mention the damage done to human health.

The reality is that the Federal Government has a long history of experimenting with weather modification. That includes a 1947 attempt by the military and General Electric to intercept a hurricane off the coast of Jacksonville, Florida. It includes an event in the 1950s and 1960s where the U.S. Army admitted to spraying a mysterious chemical fog over a neighborhood in St. Louis, Missouri, which residents now claim it is giving them cancer. It includes Project Stormfury, a series of efforts in the 1960s and 1970s to weaken hurricanes by seeding clouds with silver iodide. And it includes Operation Popeye, an effort to create monsoons to aid our military efforts during the Vietnam War, literally weaponizing weather.

While these are different events scattered throughout history, a serious campaign to commercialize geoengineering to fight global warming would be a vastly larger enterprise and profitable. Hundreds of billions of taxpayer dollars could disappear into the coffers of research universities and the academic scientists who beat the drum of global warming alarmism. Venture capitalists are already trying to get rich backing companies like Make Sunsets, which inject aerosols into the atmosphere to reflect sunlight back into space.

It is worth asking, what if scientists could somehow manage to create a temperature dial that could be rotated to reliably set the global climate? Who would control the dial? After all, people in different regions prefer different weather conditions based on their local geography, economy, and way of life. The global climate impacts everyone and does not respect state or national borders. So, would we need a world government to make choices on how to turn the climate dial? Where does it end?

Despite the profound questions around geoengineering, the scientific community is pressing ahead, and they are getting financial support to do so from universities and left-leaning philanthropists like Bill Gates, who has funded geoengineering research. A June 2023 Biden White House Science Office report on solar engineering notes, academia, philanthropy, and the private sector have examined preliminary applications of climate intervention techniques

such as stratospheric aerosol injection and marine cloud brightening, which are techniques classified as solar radiation modification, or SRM, intended to rapidly limit temperature increases.

One thing we learned from COVID is that it is a mistake to allow the professional scientific community alone to determine Federal science policy, the same professional scientific community that closed ranks around the need to close schools and businesses due to COVID is of a single mind when it comes to global warming. They are convinced that global warming is such an immediate risk to mankind that it justifies the catastrophic risk of blocking out the sun. It is for the greater good, they say.

I do not think it is the job of the Federal Government to help these people play God with the weather. In fact, I think it is the job of Congress to protect our people and make sure that weather and climate-control experiments and activities do not create adverse, unintended consequences for the rest of us.

That is why I am grateful for the transparency the Trump Administration is shedding on this issue. Leading this effort is EPA Administrator Lee Zeldin. I am now going to play a video clip in which he recently addressed this issue personally and directly.

[Video shown.]

I look forward to hearing from our witnesses. But first, I yield to Ranking Member Stansbury for her opening statement.

OPENING STATEMENT OF RANKING MEMBER MELANIE STANSBURY, REPRESENTATIVE FROM NEW MEXICO

Ms. STANSBURY. Thank you, Madam Chairwoman.

Well, DOGE is back, and there is going to be a lot to unpack in this hearing. But I think first and foremost, we want to acknowledge that the purpose of this Subcommittee and why it was created in the first place by the Majority was to root out waste, fraud, and abuse. That is literally the mandate for the DOGE Subcommittee. And I want to emphasize that we remain focused on that mission. In fact, we are working on a report on the waste, fraud, and abuse that we are currently seeing in this Administration.

And I think it is important to also recognize that we are 14 days from a government shutdown, and so I am troubled to see that this Subcommittee, which is designed to address government spending, to streamline efficiency of government programs, has strayed so far from its mission, especially as there is such pressing matters facing our country, including a government shutdown, the passage of the big ugly bill, which not only drove up the Federal deficit by $4 trillion, but is kicking millions of Americans off their healthcare and about to make their healthcare premiums go up, tariffs that are causing inflation to go up and putting small family businesses out of business, an Administration that is flouting the rule of law every day, and a total lack of transparency in the Epstein case as the Administration has still refused to comply with the subpoena that this Committee issued.

So, there are a lot of important things that this Committee could tackle, and I would think that a topic involving environmental science would be more well-suited to a Committee that actually deals with science or environmental issues.

But I am happy to talk about climate change and weather modification. It is a topic that I have spent many years of my career working on. In fact, I worked more than 20 years as a water resources manager working on drought and water planning issues in the State of New Mexico, and I know how important addressing drought and water issues is for our farmers and ranchers out there. And personally and professionally, there is a lot to discuss with respect to weather modification. And so, if we are going to talk about it, let us talk about it.

Certainly, there are a lot of DOGE-related topics we could talk about with respect to climate change and weather programs, including the dismantling of climate natural resources emergency response programs, the firing of Federal officials, dismantling of EPA, the illegal freezing of Federal funding, removal of the United States from international climate agreements, dismantling clean energy programs, catastrophic response to natural disasters, including what we saw in Texas. And all of these topics would be ripe for an oversight hearing, so I hope that we can use this hearing to discuss some of those issues.

But with respect specifically to weather modification, whether it is cloud seeding or other technologies, I actually agree with many of the assertions about the need for further discussion, further science, and potentially further regulation of these particular technologies. But it is important that we distinguish between fact and fiction, between clickbait and real solutions.

So, let us talk about some facts. Weather modification and cloud seeding, as was mentioned, is a real thing. It exists. It has been practiced in varying forms since the 1940s. Increasingly, folks are looking at this as an opportunity to increase rain and precipitation. But the science is still out on many of these technologies, and we absolutely need to understand what are the implications for air quality, for precipitation, and the implications also for water rights in the West because this could have far-reaching implications.

But it is also important to understand that many of these technologies are in the R&D phase. They are in limited use in a number of states. And it is not actually technologies that the Federal Government even widely supports. This is largely in the private sector. So, in the world of science, it is widely acknowledged that more science is needed to understand use, efficacy, and impacts of these technologies. So, those are the facts. Those are the facts.

But it is hard to understand why we are discussing banning these practices outright in this Committee when the Oversight Committee in another Subcommittee, literally as we are sitting here right now, is having a hearing about dismantling the Environmental Protection Agency. And the actual bill under discussion in this Committee is trying to use the EPA to regulate these particular practices, so the inconsistency in governance is very confusing here.

But there is a more insidious issue here, which I think we have already heard in some of the comments, which is the using of the platform of Congress to proffer anti-science theories, to platform climate denialism, and to ultimately put our communities at risk by continuing to put out disinformation. So, I am grateful that we are joined today by Dr. MacCracken, who has spent his career very

distinguishedly [sic] at the national labs, helping to bring together scientists globally and across the United States to understand climate change, its impacts, and to help our communities really understand what is real here in terms of the science. And we hope to dig in to understand what we can do to help address drought, fire, and flooding, and how it is impacting our communities.

So, with that, I yield back, and I thank the gentlelady.

Ms. GREENE. Without objection, Representative Subramanyam of Virginia is waived onto the Subcommittee for the purpose of questioning the witnesses at today's Subcommittee hearing.

I am pleased to introduce our witnesses today. Dr. Roger Pielke, Jr. is a senior fellow at the American Enterprise Institute. He is an expert on science and technology policy, the politicization of science and energy and climate.

Mr. Christopher Martz is a meteorologist and policy analyst at the Committee for a Constructive Tomorrow. He is an expert on climate and weather.

Dr. Michael MacCracken is the Chief Scientist for Climate Change Programs at the Climate Institute.

Again, I want to thank all of you for being here to testify today.

Pursuant to Committee Rule 9(g), the witnesses will please stand and raise their right hand.

Do you solemnly swear or affirm that the testimony you are about to give is the truth, the whole truth, and nothing but the truth, so help you God?

[Chorus of ayes.]

Ms. GREENE. Let the record show that the witnesses have answered in the affirmative. Thank you, and you may take a seat.

We appreciate you being here today and look forward to your testimony. Let me remind the witnesses that we have read your written statements, and they will appear in full in the hearing record. Please limit your oral statements to 5 minutes.

As a reminder, please press the button on the microphone in front of you so that it is on and the Members can hear you. When you begin to speak, the light in front of you will turn green. After 4 minutes, the light will turn yellow. When the red light comes on, your 5 minutes have expired, and we would ask that you please wrap it up.

I now recognize Dr. Pielke for his opening statement.

STATEMENT OF ROGER PIELKE JR., SENIOR FELLOW AMERICAN ENTERPRISE INSTITUTE

Dr. PIELKE. Chairwoman Greene, Ranking Member Stansbury, thank you for the opportunity to testify today. For the past 30 years, I have studied the connections of atmospheric science research and decisionmaking, first as a scientist at the National Center for Atmospheric Research, then as a professor at the University of Colorado, and most recently as a senior fellow at the American Enterprise Institute.

My written testimony discusses policy issues associated with weather modification and geoengineering. My prepared remarks begin with three recommendations, followed by ten take-home points, which those are discussed in depth in my written testimony.

So, first recommendation, Congress should enact legislation to improve oversight of weather modification activities, including first requesting an assessment from the National Academy of Sciences that precisely quantifies what is known and unknown about the effectiveness of weather modification projects to date and clarifying the prospects for ever being able to achieve certainty in quantifying that effectiveness. And second, improving the required reporting and communicating of weather modification activities under the 1972 law that defines weather modification in the United States.

Second recommendation, Congress should standardize U.S. Federal law governing weather modification, ensuring that all states are governed by identical legislative authority.

Third recommendation, the United States should lead diplomatic talks on an international solar engineering non-use agreement, with the ultimate goal of reaching broad agreement on a collective ban on outdoor experiments involving solar geoengineering and sufficient institutionalized capability to monitor the atmosphere to ensure compliance with the ban.

My ten take-home points, first, weather modification and geoengineering have various definitions in science and policy. Precision is necessary for effective discussion.

Number two, under the 1972 U.S. law, a "weather modification activity" is defined as "any activity performed with the intention of producing artificial changes in the composition, behavior, or dynamics of the atmosphere." According to the Intergovernmental Panel on Climate Change, geoengineering refers to "a broad set of methods and technologies that aim to deliberately alter the climate system in order to alleviate the impacts of climate change." Thus, most forms of geoengineering fall under the definition of weather modification activity. Arguably, the direct air capture of carbon dioxide would not fall under this definition, but other simple technologies, maybe painting roofs to change albedos to cool cities, or afforestation could fall under this definition.

Number four, weather modification activities have been widely implemented in the United States and around the world for 70 years. Many decades ago, weather modification was called weather control. Nobody calls it weather control anymore because scientists understand that controlling the weather is simply not possible.

Number five, despite the long track record of experience with operational weather modification activities, the effectiveness of weather modifying activities for actually modifying the weather is unknown. A hypothesis worth exploring systematically would be whether the precise quantification of the outcomes associated with weather modification is even possible, given the scientific record.

There is no record of geoengineering being implemented anywhere in the world. Some proposed projects, such as in Washington State and in Sweden, have been halted prior to implementation.

Number seven, due to the uncertain effects of weather modification and the fact that geoengineering has not occurred, there is no basis for occasional assertions that governments or others are actually altering the weather.

Number eight, supporters of geoengineering deployment experiments involve an interesting coalition of interest. It involves those who think we are in a climate emergency and have to act; those

who believe we are not in a climate emergency, but geoengineering would be better than emissions reductions; and finally, those who support who are involved in geoengineering research.

Number nine, the U.S. Congress has options for improving research understanding and oversight of weather-modifying activities. My written testimony summarizes many of these, drawing upon the excellent work of the Government Accountability Office and congressional Research Service, two crown jewels in this institution.

Number ten, finally, my written testimony goes into detail explaining my decision to join more than 500 other scientists and academics from around the world to call for a solar engineering non-use agreement. I will just briefly state, first, the understandings are not sufficiently developed to know what the outcomes would be, and unintended consequences are almost certain to happen.

Second, our 70-year history with weather modification should give us some humility in thinking that we can understand what the consequences might be. We have been trying to modify the weather for 70 years, and we do not know if we are modifying the weather.

And finally, we have one Earth, and experimenting on it carries considerable risks. I have likened geoengineering to risky gain-of-function research on viruses with uncertain benefits and catastrophic risks.

I look forward to your questions and our discussions. Thank you.

Ms. GREENE. Thank you.

I now recognize Mr. Martz for his opening statement.

STATEMENT OF CHRIS MARTZ
METEOROLOGIST/POLICY ANALYST
COMMITTEE FOR A CONSTRUCTIVE TOMORROW (CFACT)

Mr. MARTZ. I would like to thank the Chairwoman, Ranking Member, and Subcommittee for hosting this hearing on weather modification and geoengineering, and for giving me the opportunity to provide my perspective as a meteorologist on this highly contentious issue.

I am a meteorologist and policy analyst for the Committee for a Constructive Tomorrow, and I graduated from Millersville University of Pennsylvania with my bachelor of science degree in May. My testimony today will focus primarily on two things, and that is distinguishing airplane condensation trails from weather modification and geoengineering, which are three separate things, as well as why geoengineering, particularly solar radiation modification, the solar geoengineering should be prohibited, given the uncertainties about climate change itself, as well as the uncertainties that geoengineering could have on both the environment and life on Earth.

Now, in social media circles, people will often confuse weather modification with geoengineering, and to further complicate matters, you will see videos and pictures of these ominous-looking line-shaped clouds that are dashed across the sky. And a lot of people claim that these are evidence that the government is manipulating the weather, especially on a large scale, and that it can do things

such as steer hurricanes or generate hurricanes, which was a popular narrative after Hurricane Helene's remnants ravaged eastern Tennessee, northeast Georgia, and the Carolina backcountry last fall. And more recently, people have claimed that cloud seeding caused the Texas floods this summer, which killed, I think, over 100 people, unfortunately.

Now, contrails are line-shaped ice crystal clouds that form at altitudes above 20,000 feet behind the aircraft. The exhaust from aircraft is primarily composed of invisible water vapor, carbon dioxide (CO_2), and tiny particulates such as soot, which act as cloud condensation nuclei, which make it easier for water vapor in the air to condense onto those surfaces and form droplets, which then freeze and form these cirriform clouds that are artificial-type cirrus clouds that resemble the feather-like clouds you see in the sky ahead of a warm front.

Now, although contrails are definitely more common today than they were 30 years ago, that is largely because there is increased air traffic. And there is no compelling evidence that contrails are being deliberately created to alter weather patterns or block out the sun's energy, especially since contrails actually have a net warming effect on the planet. Now, in my written testimony, I attached a photograph of contrails over London in September 1940.

Now, weather modification, on the contrary, is a completely different issue, and it is very real, although its effects are uncertain. It is the deliberate attempts to alter local weather patterns, and the most common example of this is cloud seeding. And there are two different methods of cloud seeding. One is injecting clouds, especially mixed-phase convective clouds in the summertime with these agents, these hygroscopic water-attracting particles like salt to increase rainfall. The other option is, in the wintertime, especially in the Intermountain West, which has faced water storage problems for the last 25 years due to drought and also increased water demand from a growing population, they inject wintertime clouds with dry ice and silver iodide to increase snowpack.

Now, the Federal Government has been involved in cloud seeding since the 1940s. Examples of this include, as previously mentioned, Project Cirrus, Operation Popeye, and Project Stormfury, but the results of these in the long term have been inconclusive. Cloud seeding may affect rainfall locally from a cloud by up to 15 percent, but it is largely ineffective at large scales. Nine states actively facilitate cloud seeding programs, but they have strict regulations about when and where they can be implemented. Even—and there are two states, however, that have banned it, which is Florida and Tennessee.

Now, geoengineering is a different issue from that. It is a proposed attempt to counteract global warming by either removing CO_2 from the atmosphere or altering the amount of sunlight that reaches the Earth's surface, the latter of which is a very controversial topic. Stratospheric aerosol injection is the most widely researched SRM method, and it involves the addition of sulfur dioxide, mainly, into the stratosphere. And that chemical, SO2, then reacts and becomes highly reflective sulfate aerosols, which block out solar radiation. And this will be very similar to the cooling effects induced by major volcanic eruptions. The Intergovernmental Panel

on Climate Change (IPCC) says with high agreement that it could limit global warming to below 1.5 degrees Celsius above preindustrial levels.

Now, in regard to whether cloud seeding should be banned, I am of the view that we should minimize our interference with nature. I appreciate how cloud seeding has advanced our understanding of cloud physics as a meteorologist and I—but trying to manipulate the weather, even on a localized scale, can have unintended consequences downstream.

As far as the weather is concerned, the effects are uncertain, but there are some concerns with how it affects water tables in our soils because long-term injection of silver iodide into the atmosphere can precipitate down into our soil and water tables, and the long-term effects of that on marine life and aquatic life and terrestrial plant life and animals has not been studied definitively in the long term.

Now, as far as the geoengineering goes, using the planet as a test monkey for emerging technologies poses all sorts of risks. Among these that have been highlighted by the EPA are stratospheric ozone depletion, acid rain, and reduced crop yields. There is also the question of whether such large-scale climate intervention is even necessary, given the uncertainties regarding climate change. While the planet has gotten warmer over the last 100 years, there is uncertainty as to exactly how much influence humans have exerted on it. And this uncertainty arises from the fact that models, climate models, produce too much warming with known physics, which is why modelers have to artificially calibrate their models to the instrumental temperature record.

There is uncertainty in the magnitude of the natural energy flows as measured by satellites, which is six times larger than the estimated energy imbalance caused by CO_2, which means that warming could be mostly natural and we just do not know, or it could be mostly anthropogenic.

And finally, there is no fingerprint of anthropogenic or manmade global warming that distinguishes it from natural variability. These uncertainties need to be resolved in the peer-reviewed literature before world governments try to, much less consider, intentionally altering the radiation balance with novel technologies that have not been tested.

Thank you. This concludes my testimony.

Ms. GREENE. Thank you, Mr. Martz.

I now recognize Dr. MacCracken for his opening statements.

STATEMENT OF MICHAEL MACCRACKEN

(MINORITY WITNESS), CHIEF SCIENTIST FOR CLIMATE CHANGE PROGRAMS, CLIMATE INSTITUTE

Dr. MACCRACKEN. Thank you, Madam Chair Greene, Ranking Member——

Ms. STANSBURY. Dr. MacCracken, you need to turn your mic on.

Ms. GREENE. Dr. MacCracken, can you turn on your microphone, please?

Dr. MACCRACKEN. I am sorry.

Ms. GREENE. That is okay. Thank you.

Dr. MACCRACKEN. So, thank you very much for inviting me here today. After earning my Ph.D., most of my career was spent at the Lawrence Livermore National Lab, mostly using computer models to analyze how natural and human-induced factors might affect the climate and what the risks might be of that.

My last nine years with Livermore were on assignment as a senior climate change scientist with the Interagency Office of the U.S. Global Change Program here in Washington, including four years heading the Coordination Office for preparing the first national assessment of the impacts of climate change, but also climate variability, which was an assessment called for in the Global Change Research Act of 1990.

Since retiring, I have served on a number of positions on a pro bono basis with the Climate Institute, president of the International Association of Meteorology and Atmospheric Sciences, and as a participant in various other national and international activities. I am currently on the steering circle of the Healthy Planet Action Coalition, which is a group that favors consideration of climate intervention or geoengineering, and on two groups that are seeking actually to address the issue, to make energy more affordable.

I want to say I am not a paid employee or a consultant of any organization. I am here speaking as a scientist, and the views are my own.

A primary lesson from the research career and from the scientific community is that climate change has changed in the past—climate has changed in the past, and so it can be expected to be changeable in the future. And what scientific research has shown quite clearly is that these changes are not random. It is not just climate doing something randomly. There are causes in the past that has been things like volcanic eruptions or changes in the Earth's orbit around the sun, changes in atmospheric composition, changes in land cover, and research is really indicating now that global warming over the last two centuries is primarily being due not to natural factors but to human-caused influences.

Let me say briefly, with respect to the Subcommittee's interest in weather modification, research has made clear that changing a major specific event, a hurricane or a drenching rain or a drought, is just beyond human capabilities. That is not what is happening. Nature has so much energy involved, that is not going to happen. As my fellow panelists have said, there is not really scientifically convincing evidence that it works, but there is not scientifically convincing evidence that it does not work, and so it can perhaps increase rainfall in some very dry places.

And this is—because it is so uncertain, that is exactly why there is so little weather modification actually going on. It is just not clear it is a worthwhile investment. And it certainly cannot cause massive floods or hurricanes.

With respect to the Subcommittee's interest in theoretical geoengineering, the notion is to explore if there are viable approaches to offsetting the increasing incidence of extreme weather and other impacts that are happening from climate change. My views sort of are—come from the broad scientific community. And on this issue, I disagree with these other panelists that thinking

that research on climate intervention is something that needs to be done.

The approaches that are used in doing it are all based on what has happened naturally. So volcanic eruptions put sulfur dioxide in the atmosphere. It turns to sulfate. It reflects maybe one percent of solar radiation. It is not like it blanks out the sun in any sense. And that can sort of exert a cooling influence. We had that after Mount Pinatubo. The climate went down. Then the aerosol sort of got mixed and naturally removed from the stratosphere, and the climate sort of recovered and kept going up.

So, are there approaches that we can use that, based on nature that we can optimize, maybe putting in a little bit on a constant basis and see what happens, try and learn about that? So, nature has really done the experiments on this, on whether these approaches will work. That is not something that science really has to go back and do. What we have to do is see if the tailoring and the optimizing and how that will work, will it be beneficial or not?

So, there are a host of questions for research to consider. What is happening due to global warming is quite exceptional, particularly not just the temperature, but the dew point is going up, and so places in low latitudes are having just almost intolerable situations and do not have the air-conditioned space that we have to go into. There is increased and accelerated melting and loss of mass from Greenland and the Antarctic ice sheets. Twenty thousand years ago, sea level was 400 feet lower than that, and then on over the next 12,000 years, 2/3 of the ice on land melted and it came up, so there is about another 200 feet of sea level equivalent in the Greenland and Antarctic ice sheets, and we really do not want to start those to get melting.

Ms. GREENE. Dr. MacCracken, we have——

Dr. MACCRACKEN. I'm sorry.

Ms. GREENE. Yes, if you could——

Dr. MACCRACKEN. Okay.

Ms. GREENE [continuing]. Just finish, please. Thank you.

Dr. MACCRACKEN. Okay. Well, thank you. I just say finally, if I could, that there is no geoengineering of any type going on at the global scale. There are a few localized efforts like to save the coral, to preserve the coral—Great Barrier Reef. Computer simulations sort of indicate that it would be beneficial.

Ms. GREENE. Dr. MacCracken——

Dr. MACCRACKEN. Okay.

Ms. GREENE [continuing]. Your time has expired. Yes. Thank you.

Dr. MACCRACKEN. Okay.

Ms. GREENE. I now recognize myself for 5 minutes of questioning. For years, anybody who questioned weather modification was labeled crazy or a conspiracy theorist. Now, we have learned that they have been doing it for decades. And not only is it a multibillion-dollar industry, the government has invested a lot of Americans' hard-earned tax dollars into it. They have been forced to spin it, and apparently it is now the only way we are going to save humanity.

However, let us look at the risk. According to GAO, injecting a cloud with silver iodide increases precipitation anywhere from zero

to 20 percent. It could be even more, but the truth is that we really do not know for certain. The questions that are asked is, can you control the exact amount of precipitation that a cloud will produce if it is injected with silver iodide or another cloud seeding agent? Can you control where the precipitation is going to land with 100 percent certainty? Can you say that it will not cause or enhance flooding with 100 percent certainty? Is there any way to measure with absolute certainty the effectiveness of seeding a cloud? Do we know with 100 percent certainty how much rain a cloud would have produced if it had not been seeded? And last, did the American people ever get to have a say in any of this?

The truth is that there is absolutely no way to measure the effectiveness of cloud seeding. But something else that needs to be known is the American people deserve to know that there is very little rules and regulations over this. These companies that perform cloud seeding and other types of geoengineering projects have to fill out forms from National Oceanic and Atmospheric Administration (NOAA), and they have to list what agents they are using. And there is a category that simply says "other," and they do not have to even fill out what "other" means, and I think that is extremely concerning.

But I would like to talk a little bit more about solar geoengineering. It is completely different, more consequential approach to human manipulation of the planet's climate. One geoengineering company called Make Sunsets injects aerosol into the atmosphere to reflect sunlight back into space. I want to show you their frequently asked questions page on their website.

Mr. Pielke, it says here, it says, "What are you doing?" It says, "We are using balloons to launch reflective clouds into the stratosphere." And then it says, "Why?" It says, "Unless we reflect sunlight, tens of millions of people will die, and 20 percent of species may go extinct. We are using the most effective way to reflect sunlight that we found and can afford to deploy." Mr. Pielke, is it true that tens of millions of people will die if they do not do this?

Dr. PIELKE. There is nothing you can find in the IPCC or other scientific literature to suggest that is a consequence. Sometimes those stark claims are made to try to scare people into other forms of action on climate change. So, if you do not change energy policy, we are going to mess up the stratosphere. And that is how I interpret that.

Ms. GREENE. Sounds like a major threat for their company to make money. They said, "How long do Make Sunsets clouds stay in the sky?" "Depending on the altitude and latitude at which we release them, anywhere between six months and three years." They also say, "Is it legal?" They say, "Yes, it falls under the Weather Modification Act." Then they have a question here, Mr. Martz, "I would like you to stop doing this." And they say, "And we would like an equitable future with breathable air and no wet bulb events for generations to come. Convince us there is a more feasible way to buy us time to get there, and we will stop. We will happily debate anyone on this."

Mr. Martz, they do not think that the rest of us have a say in this. What do you think about that?

Mr. MARTZ. Well, I think that the claim that the air is not going to be breathable is just patently ridiculous. Carbon dioxide, although it is a greenhouse gas, and yes, I do agree that some of the warming, at least, that we have seen the last 100 years is probably due to CO_2 emissions, there is no indication that the air is going to become unbreathable. It makes up 0.04 percent by dry air volume of Earth's atmosphere. And some submariners in the Navy are subject to the concentrations exceeding 5,000 parts per million and are just fine.

Ms. GREENE. Well, let me ask another question, Mr. Martz. You know, it is sulfur, right, that is put into the air. Is there health consequences for people, especially, like, after volcanic eruptions? Is there health consequences to that type of injection into the atmosphere?

Mr. MARTZ. Well, sulfur dioxide, if it is injected into the stratosphere, obviously, it blocks out solar radiation, and so that would potentially—that could, if it is implemented on a large enough scale over a long period of time, it could reduce crop yields because, obviously, plants need sunlight to grow. They need water and CO_2, just basic photosynthesis.

And there are also concerns that if it gets into the troposphere, it could create acid rain. And that is called acid deposition into the soil, and that makes it hard for plants to, obviously to grow, and that harms plant and animal life as well. Obviously——

Ms. GREENE. Mr. Martz, I am out of time. Thank you very much.

I now recognize Ms. Stansbury for 5 minutes.

Ms. STANSBURY. Thank you, Madam Chairwoman.

Well, I do believe we have actually discovered the purpose of the EPA. Literally, this is why the EPA exists, is to regulate, study, and understand how modifications to the environment impact human health and the environment. And in fact, that is the primary purpose of the Science Advisory Committee for the EPA. You do a regulatory process, you look at the science, you determine whether or not it is good for the environment and for human health. And then if it is not, then you come up with science-based solutions to regulate it. That is literally why the EPA exists. So, I am excited. We have discovered why the EPA exists today in this Committee hearing.

But arguably, the largest geoengineering experiment in human history is climate change. And Dr. MacCracken, I am really grateful that you are here to help us cut through the noise on all of this. You have had a distinguished career at our premier national labs, and you have also been intimately involved in helping to bring together consensus around climate change, including to understand both the global implications in carbon emissions and also what that looks like in terms of downscaling for specific places.

And so, I just want to—I had to print—this is a well-known graph for anybody who has studied and understands climate change, but the science is very, very, very, very clear. Since the beginning of the industrial revolution, you can see here that carbon emissions have gone up steadily, and global temperatures have also gone up. And the chemistry and the physics of that is that it creates energy in the atmosphere that affects the entire global distribution of weather events. So, you know, there is a lot of misin-

formation that gets put out there for folks that do not really understand the science of climate change. And its representation at the local scale is very different in different places, and it is always changing.

So, Dr. MacCracken, I hope that you can help us understand a little bit more. I mean, at the most basic level, we have the opportunity to educate the public here in this Committee today. What is the global scientific consensus about how we address this?

Dr. MACCRACKEN. Well, so, we have good indications that what is happening with CO—carbon dioxide, is it is coming from human activities, primarily from fossil fuels, some from deforestation. And we know also from history and physics and a number of other ways that that is going to lead to trapping of heat and making things warmer. If you want to stop getting warmer, and we have been going up significantly at a very rapid pace compared to geological times, you basically have to stop and phaseout CO_2 emissions.

Ms. STANSBURY. Exactly. And, you know, I want to just correct something that was discussed earlier, which is that the idea was put forward that somehow we want to eliminate carbon dioxide on planet Earth. Let us just be honest and clear about this. That is not possible by the laws of physics, okay? So, let us just say that. But really what we are talking about is reducing the amount of atmospheric carbon that is in the atmosphere so that we get back to something more approximating preindustrial revolution activities because it is driving the capture of heat on planet Earth, and heat creates energy. Anyone who has taken physics or chemistry, that is what climate change is. It is increasing energy on planet Earth. And that causes more extreme flooding, more extreme storms. That causes drought in some places. It changes the whole distribution of how the planet's energy functions. And that is really what climate change is.

So, in terms of reducing our carbon footprint, you know, we are headed in the coming months into the latest incarnation of the Conference of the Parties, COP, to prepare for international climate negotiations. The President has removed us from climate commitments, and the GOP has just taken away many of the tools we have to reduce carbon emissions through the big ugly bill. Tell us what the consensus is in the scientific community about addressing carbon pollution in the United States. What do we need to be doing here in the United States?

Dr. MACCRACKEN. Well, we have started by trying to use efficiency. We have started by trying to change our energy system. The key thing about our energy in the United States is most of the renewable energy, solar and wind, is out West and in the Midwest. And a lot of the demand is in the East Coast, and just as—which is unfortunate. So, what you do with natural gas, when you have a different place where the source is and where it is needed is you create pipelines. We need to do the equivalent of a pipeline for electricity across the United States It would be very beneficial to the country to do that and would—is necessary to get the cheapest energy for the future.

Ms. STANSBURY. Thank you.

Ms. GREENE. The gentlelady's time has expired.

I now recognize Mr. Cloud from Texas for 5 minutes of questioning.

Mr. CLOUD. Thank you. Thank you all for being here.

I think most people, you know, back home tuning into this would, first of all, be shocked to find out that maybe some of the suspicions—like weather modification is one of those things that has like not really been talked about, and people are like, is it happening? Is it not? I do not know. I see things online. And then come to find out like, okay, this has really been happening for decades. This is not conspiracy theory. This is, like, fact. There is businesses involved in doing this.

And that brings up all these questions about how is this happening? How is that permitted? Is any business just able to go out and, hey, I want to modify the weather in my area because I want rain. Well, what about these people who do not want rain? And where are those lines, and how does that work?

And then there comes the liability side of this. You know, recently—I am from Texas, and so, you know, I was there at Kerrville when the tragedy happened, and everybody was concerned did some cloud seeding happened a couple of days prior. I am not a meteorologist. You are, Mr. Martz. And I guess there is an understanding that that was too far away, I guess. But it does bring up the question about liability and if it was, would the business be liable then or not, and all these questions. I was wondering, Mr. Pielke, if you could touch on, kind of, those thoughts and what the current framework is and just kind of give us a 101 for the citizenry in a sense.

Dr. PIELKE. Yes, let me say, I mean, I have been aware of weather modification all my life. My dad was a meteorologist.

Mr. CLOUD. Yes, but you are involved in this, right?

Dr. PIELKE. And so, when I was preparing for this hearing, I looked at the NOVA data base. And I was, you know, shocked to find there was more than 1,100 reports in that data base covering the last ten years or so. So, weather modification is ongoing, and the reporting is not particularly good. Assessing the effectiveness is not good. And that leads people to ask questions.

So, if we go back to Project Cirrus back in 1947, I think it was Hurricane King, it started dissipating, and then it took a left turn, and then struck the United States. It is a natural question when someone intervenes in a system to say, did your intervention cause this bad thing to happen?

This is why I have recommended having a very public, a very authoritative study. We cannot have Republican science and Democrat science. We have to have science that is trusted by everyone to assess what weather modification has been done, what have been the effects. If we do not know what the effects are, what research can we do to know those effects? And if we cannot know the effects, maybe that would structure how we think about going forward with that technology.

Mr. CLOUD. Mr. Martz, do you want to speak to that?

Mr. MARTZ. Yes, I largely agree with that. I was actually going to bring up Project Cirrus, which obviously was a concern. There is also the concern, you know, in the case of like geoengineering—I know we are kind of going off topic from weather modification,

but it is a similar kind of issue here. If you were to—and, again, if it were to be—if they were to implement this and it were to be successful and it were to cause, you know, a few 10ths up to maybe a degree Celsius of global cooling, you know, over the course of three to five years, and of course, you would have to continue to do that every several years because the aerosols mix out.

But there is also the concern that say we did this, you know, and the instantaneous cooling occurred, and there was a, you know, a really cold winter, you know, that sent, you know, temperatures plunging below zero down into Louisiana. We saw this actually this past winter with the Gulf Coast winter storm and the Arctic outbreak. Say something like that happened, well, people will then probably, you know, blame that on the geoengineering. In fact, we know kind of through what natural variability, you know, obviously, the effects of this with volcanic eruptions.

In 1815, rather, Mount Tambora erupted and caused the year without a summer in 1816 when there were—there was two feet of snow in Vermont in June. And during that same period, there were frosts in Georgia, the Chairwoman's district. So, there are definitely concerns about that, and there is—there would be, you know, lawsuits filed. After Project Cirrus, there were lawsuits filed.

And obviously, the results were eventually inconclusive, and the U.S. Weather Bureau put together a team of scientists that showed that the hurricanes can make those kinds of turns all on their own——

Mr. CLOUD. Yes.

Mr. MARTZ [continuing]. And that kind of let the—that allowed the lawsuits to kind of subside. But there are definitely real concerns about that happening in the future. Again, we just saw this with the Texas floods, with I think it was Rainmaker Corporation if I am correct. And obviously, they—when they seeded, that was the days before, and it was, I think, 150 miles southeast of Houston, so it had no effect, but the people still asked the questions. And it also raises the concern of lawsuits being brought against these companies.

Mr. CLOUD. Well, and then I have a question. And Dr. MacCracken, you talked about this too. You said there is no scientific evidence that it works or that it does not. You mentioned that, too, Mr. Pielke. You know, we have had people, not on our Subcommittee that I am aware of, but on our general Oversight Committee, say, you know, the Earth is going to end—I think the countdown is down to six years now, you know, and there is this hysteria built around what we can and cannot do, yet there is no data for it.

And I would just say, like, our economy, we have spent trillions of dollars on this. And like are we actually moving that data out? Or, you know, I mean, what is the question on that? Anyway, I yield back.

Ms. GREENE. Thank you. I now recognize Ms. Norton from the District of Columbia.

Ms. NORTON. Thank you, Madam Chair.

The nonpartisan civil service is essential to our democracy. The Trump Administration's gutting of the Federal workforce is cruel, irresponsible, and dangerous. Federal workers keep the Federal

Government running. They do essential work every day that keeps Americans safe. Nonpartisan civil servants at the Federal Emergency Management Agency provide aid after storms, hurricanes, floods, tornadoes, and wildfires.

The agency's employees have warned Congress that the Federal Government is not ready to respond to hurricane season. More than 180 agency employees sent a letter on August 25 warning that the cuts to the agency have hurt its ability to respond to emergencies. Instead of taking preparedness seriously, the Trump Administration retaliated against the employees and put the public signers on leave.

Dr. MacCracken, what are the most important things we should be doing to ensure Federal agencies are prepared to respond to climate change, eliminating extreme weather?

Dr. MACCRACKEN. Well, the research they have been providing is information on what impacts will occur in particular places. So, we talk about global climate change, and people think about the science from the global scale, but impacts and what happens to people really depends on where you are.

And so, when we had the first national climate assessment, we did 20 regional workshops asking about what was happening in each region, what were their concerns, and it was fascinating that water resources was common among all of those kinds of areas and everything, but in a very different way. I mean, you would not think water would be a problem in Alaska. You might expect it to be a problem in the Rio Grande Valley. But it was a problem everywhere with different kinds of changes. And what we really wanted to do was try and provide each region access to the information so it could keep its economy strong, so it could keep doing things that make a difference.

I mean, in Washington, one of the very interesting things that has been done, it is known as one of the cities with the most trees. That is sort of a weather modification effort to provide shade and to provide moisture evaporation. One of the first weather modification assessments done in the United States was done by Thomas Jefferson. He basically noticed that clearing the coastal plain in the Atlantic of forests to have farms affected the sea breeze. And so, there are effects going on.

You want to think about what is going on in your region. You need to have information that is specific to your region. And that is a translation issue of getting from the global models down to what is happening locally. What is the statistics of the weather that is going to change? Warmer nights, hotter days, more frequent hot days, higher dew points. Those are the kinds of things that people really need to know about to help build their resilience and protect themselves.

Ms. NORTON. Dr. MacCracken, why is it so important that scientists follow the data and not presuppose their conclusions?

Dr. MACCRACKEN. Well, it is very—so what we try and do as scientists is reconcile multiple things. One is the data that comes in and the observations. Another is our theoretical understanding of how physics works about cold air being denser than warm air and how things move. Another is looking back over the history of the Earth to try and understand and figure out why those changes

were occurring that are shown in the geology. And so, what scientists are looking for is consistency across things, not just at any one. You cannot believe just one or the other. You have to look at consistency across all of those aspects.

Ms. NORTON. Thank you, and I yield any time remaining to the Ranking Member.

Ms. GREENE. The gentlewoman's time has expired.

I now recognize Mr. Burchett from Tennessee for 5 minutes of questioning.

Mr. BURCHETT. Thank you, Chairlady. Briefly, Mr. Martz, can you explain what cloud seeding is?

Mr. MARTZ. Yes, I can. I am happy to explain it. So, cloud seeding is the attempt to enhance rainfall or snowpack on a very localized scale. And obviously back——

Mr. BURCHETT. Localized meaning?

Mr. MARTZ. We are talking only like a couple kilometers, a few kilometers scale.

Mr. BURCHETT. Okay.

Mr. MARTZ. Yes. So——

Mr. BURCHETT. Are the materials used in cloud seeding safe?

Mr. MARTZ. There are some concerns with silver iodide and how that precipitates—when it precipitates out into the soil. There are concerns that it negatively can affect marine life, aquatic life, terrestrial life because of the release of silver at high concentrations.

As far as dry ice, the dry ice method of it, which is where those pellets sublimate into CO_2, that is a harmless method.

Mr. BURCHETT. Would you feel comfortable drinking a glass of water with several parts per million of silver iodide in it?

Mr. MARTZ. I probably would not want to do that, no.

Mr. BURCHETT. Okay. That is a good answer.

Are states seeing measurable successes in cloud seeding?

Mr. MARTZ. Not on a very large scale. We are talking not on a scale that is for 200 kilometers. But on a localized scale, there is some evidence that the statewide efforts, especially in the Intermountain West in Colorado, can increase like the snowpack or precipitation by up to 15 percent. But the range is zero to about 20 percent based on the peer-reviewed studies that I have read. But there is not a 100 percent success rate with that. That being said, I do not think that we should be trying to do that.

Mr. BURCHETT. Are you familiar with the process where they basically do it in a grid, and then they follow it on the satellite to see where the rain had fallen to verify, in fact, that it was effective or not effective?

Mr. MARTZ. Yes, I have seen that they do. There are obviously control areas and areas of experimentation, and their results are very inconclusive in the literature on that.

Mr. BURCHETT. Okay. And basically, the process is they put this stuff in the air, it gets in the clouds, moisture condenses on it, and it falls in the form of water droplets or snow, weather due to the temperature, correct?

Mr. MARTZ. Correct.

Mr. BURCHETT. Okay. Is it possible that there could be lawsuits in the future of people say they are being robbed of their rainfall, say if the winds were in a westerly position and the clouds were

to empty, say, in one county that was east of this area, and then they thought that the rain should have come to them, and yet it was literally stolen from them by the cloud seeding prior to that?

Mr. MARTZ. I think there could be concerns for lawsuits of stuff like that, for sure, and that is something that we probably almost saw or we might see from the Texas floods this year. Again, the results are going to be—and I think the court findings would find that there is really no evidence that it had any material effect because most of the studies show little effect, but again, the results are inconclusive, but that does not stop there being lawsuits being filed.

Mr. BURCHETT. They should have the companies that were selling this process to have to come back and say we are not effective.

Mr. MARTZ. Correct. Yes, they would have to——

Mr. BURCHETT. And so there would be——

Mr. MARTZ. Yes.

Mr. BURCHETT. That would be interesting to see.

Mr. Pielke, is the government engaging in any weather modification or geoengineering activities?

Dr. PIELKE. The Federal Government is not. State governments, the GAO reported there are nine states in the United States that support—and I will say effectiveness is measured not just in rainfall but also in marketing. I am from Colorado, and the state lets it be known that for ski season, there is cloud seeding going on, so.

Mr. BURCHETT. Have they been doing it in the past, though?

Dr. PIELKE. They have been doing it for several decades.

Mr. BURCHETT. The Federal Government has been doing it.

Dr. PIELKE. The Federal Government peaked its weather modification investments in the 1970s. If it was in this year's budget, it would be the equivalent of $500 million, so it was a substantial effort, but it did peak, and it has declined.

Mr. BURCHETT. Okay. What was the end result of that?

Dr. PIELKE. Uncertainty, as you heard, that there is not a lot of good science out there to say cloud seeding has this effect in this region. And I question whether it would even be possible because when you do an experiment, you have a control, and then you have the experiment, and you compare the two. We have one Earth, and so you cannot—you can use models and so on, but it is very difficult, I think, for weather modification to reach that bar of certainty that would be required to understand cause and effect.

Mr. BURCHETT. Okay. Yet, we keep investing in it. Could the weather modification activities of other countries have a harmful effect on Americans?

Dr. PIELKE. So, this is one where I think it necessarily has to be international. Wee have heard in the 1960s, the U.S. Government sought to employ weather modification techniques as a weapon of war, and it would be important for the community to get together, whether it is like nuclear nonproliferation, to disclose and set the ground rules for that type of research, just like you might do for gain-of-function research on viruses.

Mr. BURCHETT. Thank you.

Thank you, Chairlady.

Ms. GREENE. Thank you.

I now recognize Mr. Burlison from Missouri for 5 minutes of questioning.

Mr. BURLISON. Thank you, Madam Chair.

Dr. Pielke, just to begin with the basics, can you help us understand the difference between localized efforts and geo-forming efforts?

Dr. PIELKE. From a policy perspective, weather modification, as you heard from Mr. Martz, seeks to affect rainfall over, say, a drainage, a ski area, a small area. Geoengineering, as it is defined by the IPCC, seeks to counter the effects of global climate change, so at the much larger scale. And usually, the effects of climate change, for better or worse, are measured in global average surface temperature, so affecting that metric is the focus of geoengineering.

Mr. BURLISON. Mr. Martz, I saw in your notes that you referred to it that cloud seeding or a lot of these efforts really do not have—and you had a term for it; I am trying to get back to that—where the impact—it is hard to get beyond so many kilometers, right?

Mr. MARTZ. Correct, yes, above—let me find it here just so I get my terms right.

Mr. BURLISON. You had a word for it.

Mr. MARTZ. Mesoscale?

Mr. BURLISON. Yes.

Mr. MARTZ. Yes. And there are different levels of mesoscale. So, basically—so I said here—so all in all, cloud seeding is incapable of altering weather patterns on what Orlanski in 1975, it is a peer-reviewed paper, defines as the mesoscale level, particularly meso-alpha, which is greater than or equal to 200 kilometers. So, above that horizontal distance, 200 kilometers, there is really absolutely, like, no effect. That much we do know. But on much smaller scales than 200 kilometers, there is very much a lot of uncertainty as to the efficacy of cloud seeding from a rainfall precipitation standpoint, and the big reason for this is because natural variability is so large.

Mr. BURLISON. Yes. I hear you. So, I think if folks are listening or paying attention, you can definitively say—I mean, you are a Ph.D., you are a meteorologist, you can definitively say that these are—cloud seeding, while it may occur, it is probably not occurring as often as people think because its effects are unknown or not certain. And then, in addition, it only affects a small region. Would you both agree with that?

Dr. PIELKE. Yes. For all the effort that has been put into weather modification, if it is having effects, they are not large enough that we can really see them very clearly.

Mr. MARTZ. I would agree to that, yes.

Mr. BURLISON. Would you say that, in general, we kind of have a little bit of an arrogance about our impact on this planet?

Mr. MARTZ. Very much so. And I also find that it is a lot with climate change as well. Obviously, again, I am going to just put a disclaimer here before I am called a climate denier by people. I agree that CO_2 is a greenhouse gas, and yes, all else being equal, it does cause warming in the lower atmosphere. However, how that translates to changes in extreme weather is very much more complicated, and I find that there is a very stark parallel between people who claim that, you know, hurricanes are being caused—are

caused by cloud seeding, and that they are able to control hurricanes, as well as people who think that hurricanes are caused by, you know, a one part per 10,000 increase in atmospheric carbon dioxide.

And in fact, in my chart here that I show, it shows data that shows that neither hurricane frequency nor intensity, as measured by the accumulated cyclone energy index, have increased since 1990, and that is data from Colorado State University, actually, one of the schools that Dr. Pielke's father taught at, I believe.

And there is also no increase that—there is an increase in rapid intensification events globally. This is a chart. It went back to 1990. This was provided to me by Dr. Phil Klotzbach, also from CSU, and it shows that there is no increase since 1990 in the number of rapid intensification events, which is a measure of how fast hurricanes intensify, and it is defined as a 30-knot increase or greater in 24 hours.

So, there have been increases in heavy rainfall in some regions, and there have been decreases in other regions, and some of that could be tied to a warmer, you know, atmosphere in the Clausius-Clapeyron relation, but overall, the idea that we are able to control weather even through climate change is largely grossly overstated.

Mr. BURLISON. Thank you.

I yield back the rest of my time.

Ms. GREENE. The gentleman yields.

I now recognize Mr. Subramanyam from Virginia for 5 minutes of questioning.

Mr. SUBRAMANYAM. Thank you, Madam Chair.

I am very concerned about this Administration firing climate scientists and scientists generally and cutting off research for science. And we had a really good group of people outside NASA yesterday talking about the importance of science and climate science.

And Dr. MacCracken, I would just get your thoughts on what is going to be the implications of cutting off this kind of research and these types of firings? And what is that going to mean for our future when it comes to our climate, as well as science generally in our country?

Dr. MACCRACKEN. Well, without the information, it is hard to get projections of exactly what is going to happen, to get the best information so people can feel—can prepare themselves, can be resilient so society can design infrastructure that will withstand things.

When you increase the temperature—when you have the CO_2 concentration high, the 90 percent or so of the warming is going on in the ocean. What happens with, when the ocean warms, it keeps the air warm, but it also evaporates more moisture. And when that moisture-laden air comes over land and runs into a mountain range or a mesa or something, it forces out these drenching rains. And it is happening not just in Texas, which was really tragic, but there have also been tragic events in Pakistan and India and other locations that when the ocean warms, that heat just adds to the moisture. And if the ground is saturated in water already, all the additional moisture that comes out will run off, and that creates floods that are larger than the region is used to.

Mr. SUBRAMANYAM. And these weather events are costing us tens of billions of dollars, if not more. As a country, it is going to cost

us trillions eventually. You know, what can we do to prevent these weather events in the future?

Dr. MACCRACKEN. Well, if you want to stop ocean warming, you basically have to stop having carbon dioxide trapping infrared radiation and energy. That is hard to do to stop—get rid of all the CO_2 emissions. They provide a very valuable service, and so it is proving difficult. And that is why climate intervention is something we want to look at. It is an approach to trying to see if you can suppress the heating of the atmosphere as a whole, mainly of the ocean if you can, because the land will respond pretty quickly. But the ocean buildup of heat is something that will persist for very long times, and it just causes these atmospheric rivers that are occurring that hit California, that are hitting other countries. It is a very serious issue and can cause great harm, and it is very hard to withstand it as things happen.

Mr. SUBRAMANYAM. And do you think it is—are we too late, or is there things we can still do when it comes to curbing the negative effects of climate change?

Dr. MACCRACKEN. Well, there are some doomsayers out there, but there are certain things we can do. One thing is cutting methane emissions. Methane is natural gas. It leaks out from fossil fuel things. It comes from agriculture and other things. That has an atmospheric lifetime that is very short, whereas CO_2 has a long lifetime. So, if you can sharply cut CO_2 emissions, that really helps. And there is an international initiative to do that, and so that is one of the first things that people will urge as something to do.

Mr. SUBRAMANYAM. Great, thank you.

I yield back.

Ms. GREENE. The gentleman yields.

I request unanimous consent that the Subcommittee have a second round of questions for the witnesses. Without objection, so ordered.

I now recognize myself for 5 minutes of questioning.

It is an interesting observation to listen to the discussion between what I would call two sides in the belief on climate. And I would like to ask each of you, and I will start with you, Dr. Pielke, has Earth's climate and temperatures, has that been something that has changed historically since the creation of the world?

Dr. PIELKE. Yes, there is long time series that go back thousands, millions of years showing vast changes. However, the changes over the last century and a half have been judged to be largely driven by the accumulating greenhouse gases in the atmosphere, so that is not particularly controversial. What is controversial is what are the effects? When will we know them? I would disagree with Dr. MacCracken that we can control weather with carbon dioxide emissions. There is no knob that says more extreme weather, less extreme weather. There are a lot of great reasons for reducing carbon dioxide emissions, but I do not think anyone should think we are going to stop hurricanes or floods or atmospheric rivers using that knob.

Ms. GREENE. Mr. Martz?

Mr. MARTZ. I largely agree with Dr. Pielke about that assessment pretty much entirely. I do agree that obviously the planet has gone through all sorts of ebbs and flows throughout its 4.5 billion-

year history, and obviously, the Earth has gotten warmer over the last 100 years. And I do agree that some, most, I do not know how much of it is due to CO_2 emissions because CO_2 is a greenhouse gas. The laws of physics are very clear on that.

However, there are uncertainties, as I highlighted in my testimony here, and this is something that some of the scientists who work very closely on this, one of them is Dr. Roy Spencer at the University of Alabama in Huntsville. He is the science team leader on one of NASA's satellites that measures the radiation flows in and out of the atmosphere. I know him very well.

Ms. GREENE. Mr. Martz, I only have a short amount of time.

Mr. MARTZ. Okay. So, obviously, the natural energy flows in and out of the Earth's atmosphere.

Ms. GREENE. Right, but that is not controlled by man. I mean, did man——

Mr. MARTZ. No.

Ms. GREENE [continuing]. Create the Ice Age?

Mr. MARTZ. No.

Ms. GREENE. Yes, right.

Mr. MARTZ. Yes.

Ms. GREENE. So, none of us were alive back then to know for sure.

Dr. MacCracken, do you believe that the world has seen climate changes since the creation of the world?

Dr. MACCRACKEN. Well, I would say I am convinced by the evidence that that has happened, yes.

Ms. GREENE. Yes, thank you. I would also like to ask you all if you believe that people, regular people, the American people and people all over the world, do they have the God-given right to clean air, clean water, clean crops? Or should governments and for-profit businesses and then scientists be allowed to override ordinary people, citizens of the United States, and spray all types of chemicals into the air, whether it is from the ground or in the sky? Who has a God-given right over that? Dr. Pielke?

Dr. PIELKE. Yes, it is, in my testimony, that is why I called for enhanced oversight and regulation. I have this old-fashioned view—I am a political scientist by training—that the government is the people. And if we start talking about the government being separate from the people, then something is messed up out there. And so, I would much rather see people, normal people, feel like the government belongs to them and that they are one and the same.

Ms. GREENE. The government or clean air, clean skies, and clean land?

Dr. PIELKE. Well, the way we regulate and get clean air is we come together and work and call it government, call it, you know, whatever you want to call it. But there is no way to have clean air to regulate geoengineering unless people can come together and make decisions that this is in our common interest, so.

Ms. GREENE. Right. Mr. Martz?

Mr. MARTZ. I agree with that sentiment as well. I think that there obviously needs to be stricter oversight and regulation on some of these technologies and probably some more research into them. But I think that there should be, largely with Dr. Pielke, a

non-use agreement, especially in the solar geoengineering aspects of it. And as a final point, yes, people should have a right to, you know, free—or sorry, to clean air, clean water, and all of that.

Dr. MACCRACKEN. Dr. MacCracken.

Dr. MACCRACKEN. Yes, of course they should. And there is actually a lawsuit of the youth trying to ensure that is something that the government does to make sure that there is clean air, clean water, and a healthy climate.

Ms. GREENE. Yes, thank you. I agree with that. I just want to point back to a government-funded project that was in a government housing in St. Louis, Missouri, where the U.S. Army sprayed some sort of chemical fog over these people, basically making them lab rats in an experiment. And that is how people feel today about all types of weather modification and geoengineering. No one wants to be a lab rat. And I appreciate your comments where we only have one Earth, one Earth, and we really, honestly, should be taking care of that.

My time has expired. I now yield to Mr. Gill from Texas for 5 minutes of questioning.

Mr. GILL. Thank you, Madam Chairwoman.

Thank you all for being here.

Dr. Pielke, could you just briefly explain the difference between cloud seeding and geoengineering?

Dr. PIELKE. I will give you the broad brushes. But cloud seeding is an effort to modify precipitation over a small scale. Geoengineering is an effort to counter the effects of human-caused climate change at the planetary scale.

Mr. GILL. All right. And last July, as you know, there were catastrophic floods in Texas. Have you seen any evidence to suggest that cloud seeding contributed to those floods, exacerbated the problem, or had any impact on them?

Dr. PIELKE. I will defer to Chris, who has talked about that in his testimony.

Mr. GILL. Sure.

Mr. MARTZ. Hi, Congressman. There is no evidence that—well, there is—let me backtrack here. While there is evidence that cloud seeding can be effective, there is also evidence that it is not as effective. So, there are very inconclusive results and literature on it because natural variability is so large.

As far as the Texas floods go, in particular, I think the cloud seeding, the company that was accused of it was Rainmaker if I am correct on that. But when they seeded, when they did cloud seeding activities, they did it, I think, two days before the rain began. And it was 200—I think it was 150 miles southeast of Houston, Texas—or not Houston, San Antonio, if I am correct on that, which means that in terms of the Texas Hill Country, there was no way for that cloud seeding to have had any material effect on the floods.

Mr. GILL. Got it. And Mr. Martz, I will continue with you. Are you familiar with the butterfly effect?

Mr. MARTZ. Yes, I am.

Mr. GILL. Okay. Got it. You know, kind of the foundational principle of chaos theory, that small changes in initial conditions in a complex system can have second-, third-, or fourth-order consequences that are seemingly unpredictable. How do you think

about that concept being applied to weather seeding, you know, small changes in a complex system? And how can you understand or how can we get comfortable that there are not going to be third-, fourth-order impacts of potentially much larger magnitude?

Mr. MARTZ. Well, I think that there are, again, obviously, very much large uncertainties about it. And obviously, some more research into it needs to be done, probably on a modeling effort. But trying to, I think, that to do it—as far as the environmental impacts of it in particular need to be studied, especially with silver iodide and how it affects our water tables and our soil because there is definitely concerns about that. And I think there needs to be more laboratory studies on that and more research that is funded to do that kind of thing.

Mr. GILL. Given the complexity of the issue here and how large this problem is, how do you study something like that?

Mr. MARTZ. I think that you would employ a group of scientists and, you know, do some sort of bipartisan effort to look and see what we know about it and to do a comprehensive, thorough report that would be people from different perspectives that come together and discuss and mesh out the details and then conduct experiments on it. Because in science, you cannot just also, you cannot just use even modeling. You also have to test things and do it through a laboratory experiment to have observations because all science is numbers.

Mr. GILL. Got it. And Dr. Pielke, back to you. It has been reported that China spent $2 billion in the past decade on weather modification activities. How could an adversary use weather modification for nefarious purposes?

Dr. PIELKE. Yes, this is a great question and also gets to your last question as to why we want to understand effectiveness because if it is not effective, then they are not going to be able to do much with it. And so, this is why, as I said in my testimony, let us start with the questions that Chairwoman Greene had in her first 5 minutes of questioning, fantastic questions. You guys have the National Academy of Sciences at your disposal where you can ask exactly these questions. And a great question would be, given what we know about weather modification, what could our adversaries and enemies put it to use, and how would we know it?

I will also say, this is one reason why it is really important to make sure that the observations and monitoring of our atmosphere is fully funded, not just for scientists to do research, but so we——

Mr. GILL. What is your opinion on how an adversary could use weather modification?

Dr. PIELKE. So, my understanding is that weather modification is not particularly effective, and so based on that level of knowledge, not much. But it is certainly something that I would want a range of experts to weigh in on, given that we do not know what is going on in China and elsewhere.

Mr. GILL. Got it. Thank you.

Madam Chair, I yield back the remainder of my time.

Ms. GREENE. The gentleman yields.

I now recognize Ms. Stansbury for 5 minutes of questioning.

Ms. STANSBURY. Thank you, Madam Chairwoman.

Well, there is a lot going on in this hearing, so I want to kind of break it into pieces because I think it might help parse out some of the challenges I think the conversation is having.

So, let us talk about cloud seeding as a technology. As a technology, the idea of cloud seeding is based on the physics of clouds, which is that in order to have rain or precipitation, a water droplet has to be heavy enough to condense to fall out of a cloud. That is what cloud seeding is based on.

And so, there has been experimentation going back to the 1940s to introduce different particles into the atmosphere to see if dust or these other chemicals can create a precipitation moment. And, as has been identified by a number of our witnesses today, there is still a lot of research to be done about its efficacy. There are studies that have shown in certain instances it may have increased the probability of a specific incidence of precipitation, but there is also a lot of data needed, and there is a very robust analysis that GAO has engaged in and talked to experts. So, that is the science around cloud seeding. That is cloud seeding.

But climate change is a different situation. Let us talk about climate change. And I think every single witness here has identified that there is no dispute in the scientific community that global carbon emissions have gone up and that we know from observational data. This is not a theory. This is not like, oh, we are trying to figure out if this is true or not. The data are very clear. We have had an increase in global temperature.

It has manifest in regional temperature increases across different parts of the planet and in places like the American Southwest, like where I am from, it has manifest in an increase in temperature year after year, especially over the last 30 years, a decrease in precipitation year after year for the last 30 years, and the most intense drought we have seen in recorded history since there was a major geologic change in the planet. That is just facts. That is just observational data. That is just measuring what we see in the environment. So, there is no dispute over that.

And so, what scientists have consensus about is that carbon is a pollutant that is coming from industrial activity all around the planet. It is a challenge that involves the commons, which is our atmosphere. I agree wholeheartedly with the Chairwoman that we should be regulating spraying or putting things into the atmosphere, and that is exactly what the EPA does. That is why the EPA, on the consensus of scientists, not only across the United States, decided to regulate the emission of carbon because we know it is contributing to changes in the global atmosphere, that is increasing energy in the atmosphere, that is producing measurable effects on the ground.

Now, I agree that the incidence of individual weather events, the ability to change the trajectory of individual weather events, whether it is something as powerful as a hurricane or something as powerful as an atmospheric river, as was stated by Dr. MacCracken, those are events that are so massive in scale, we do not know that an individual entity or pollution in one place is culpable, if you will, for an incident happening.

What we are talking about is a change in global chemistry and global atmospheric physics that is driving the distribution of

weather events all across the planet, and that is why it is a common pool problem. It is why we need international climate agreements. It is why tens of thousands of scientists around the world are urging countries to take climate action now. It is why the United States regulates carbon, or was, until Donald Trump took away those regulations just a couple of months ago. It is why we measure carbon emissions.

It is why we are prepared, as Democratic Members of Congress, to go show our faces and good faith on international forums, that the United States still stands strong with climate action because, as one of my colleagues just pointed out across the aisle, it is an international problem. It is an international problem. Pollution in one side of the planet affects the entire global commons, and that is why we need climate action in the United States and every single country on planet Earth because it affects all of us. So, that is what the science tells us, and I want to just be clear on that.

And with that, I yield back.

Ms. GREENE. The gentlelady yields.

I now recognize Mr. Fallon from Texas for 5 minutes of questioning.

Mr. FALLON. Thank you, Madam Chair, appreciate it. And I love the civil discourse. We need more of it in the country. That is for sure.

Dr. MacCracken, thank you for coming. And it is not often that I get to talk to and converse with somebody as learned as you, sir. You graduated from Princeton. Is that correct?

Dr. MACCRACKEN. Yes.

Mr. FALLON. In 1964?

Dr. MACCRACKEN. Excuse me?

Mr. FALLON. In 1964?

Dr. MACCRACKEN. 1964, yes.

Mr. FALLON. I do not know when that became 61 years ago. Isn't that something? So, you have been——

Dr. MACCRACKEN. It was a long time ago.

Mr. FALLON. Fair to say you have been a climate scientist for over half a century?

Dr. MACCRACKEN. Yes.

Mr. FALLON. Sir, do you think that there is a growing tendency for those in power, at least, I should say, for some of those in power to engage in climate alarmism?

Dr. MACCRACKEN. Scientists try, when they speak about it, to be very careful in how they talk to the science.

Mr. FALLON. But I am not talking about scientists. I am talking about politicians.

Dr. MACCRACKEN. No, but in the—yes, in the media and others, things get simplified and amplified and then that gets reported, so.

Mr. FALLON. So, in other words, like for instance——

Dr. MACCRACKEN. That happens, yes.

Mr. FALLON. Like making frightening, fear-mongering claims of doom and gloom and being more hyperbolic than serious about climate and the weather. Is that a fair statement?

Dr. MACCRACKEN. Well, I think the situation that we are facing is rather unprecedented in what is happening in society.

Mr. FALLON. And I apologize. Yes. Doctor, I just have limited time. So, kind of, yes or no, I suppose. Like, for instance, Al Gore, former Vice President of the United States, made a name for himself. Some would say famous, some would say notoriety with his activism within the climate realm. And in 2009, he said that he believed there was a 75 percent chance that the polar ice cap would be ice-free in the summer months. Did that ever happen since 2009?

Dr. MACCRACKEN. No, that did not happen.

Mr. FALLON. That has not happened. In fact, on the Southern Pole, Antarctica shelf grew a little bit, didn't it, from 2021 to 2023?

Dr. MACCRACKEN. Well, there are variations that occur with what——

Mr. FALLON. Yes, but it did not happen. He made a claim in 2009. It has been proven to be egregious. It never happened. In 2006, in his documentary "An Inconvenient Truth," he claimed that sea levels could rise up to 20 feet in the near future. Did that happen?

Dr. MACCRACKEN. It is starting to accelerate.

Mr. FALLON. Did it happen?

Dr. MACCRACKEN. It has not happened yet, no.

Mr. FALLON. Not 20 feet.

Dr. MACCRACKEN. No, but that is a possibility——

Mr. FALLON. But it did not happen in——

Mr. MACCRACKEN [continuing]. When the global average temperature——

Mr. FALLON [continuing]. The near future, 20 feet.

Mr. MACCRACKEN [continuing]. Is as high as we are headed.

Mr. FALLON. In fact, right now, we are at elevation 410 feet in D.C. You grew up in Schenectady, New York. I grew up in Pittsfield, Mass, very close to one another. We are at 1,039 feet in elevation. Princeton was at 203 feet. What is a beach house? What is the elevation of a beach house?

Dr. MACCRACKEN. They tend to be a few feet.

Mr. FALLON. Yes, zero, two, three, something like that.

Dr. MACCRACKEN. Sure, yes.

Mr. FALLON. It is interesting that Al Gore ran for President on the Democratic ticket in 2000, did not make it. But the next Democratic President did was Barack Obama. And he invested $12 million in a beach house in Martha's Vineyard. And Joe Biden, the next Democratic President, has invested nearly $4 million, at least its current value, in a beach house, sea level, pretty much two feet, not to 20 feet. And in fact, what really happened was sea levels rose, according to the National Oceanic Atmospheric Administration and from 1993 to 2021, 3.8 inches, not 20 feet. By that rate, it will take 1,136 years to reach 20 feet. I do not think we would define that as "in the near future."

Another Committee Member, a former Committee Member of the Oversight Committee in 2021 made some interesting claims. She claimed that crop yields are already projected to fail, and by 2028, famine will hit the world's most vulnerable populations. Do you agree with that statement, sir?

Dr. MACCRACKEN. I am sorry, I missed exactly what you——

Mr. FALLON. Oh, sure. No, no, that is okay. A former Member of this Committee, who is rather prominent in the political realm, said that by 2028, which is only 18 months from—well, less than that now—that crop yields are projected to fail, and famine would hit the world's most vulnerable populations.

Dr. MACCRACKEN. It is amazing how fast one can get into situations of drought and failures in particular regions.

Mr. FALLON. But has that happened?

Dr. MACCRACKEN. It has not.

Mr. FALLON. Okay.

Dr. MACCRACKEN. No.

Mr. FALLON. So, again, because I just have 30 seconds left, I just wanted to share some data and facts, which our friends like. The five poorest countries in the world, which would be the most vulnerable, Madagascar had a population in 2000 of 16 million. Today, it is 31 million. It has doubled. Liberia, three million, now six. Somalia, nine million, 19 million now. Democratic Republic of the Congo was 50 million. Now, it is 113 million. Mozambique, 18 million, 36 million. You see the trend. It has doubled. Famine has not occurred. It is hyperbolic. It is not serious.

Madam Chair, I yield back.

Ms. GREENE. The gentleman yields.

I now recognize Ms. Crockett from Texas for 5 minutes of questioning.

Ms. CROCKETT. Thank you so much, Madam Chair.

The Republicans have been so busy protecting pedophiles and rapists that they forgot what this Subcommittee is supposed to be about. We are supposed to be talking about improving government efficiency. We are supposed to be talking about protecting taxpayer dollars from corruption. But congressional Republicans have let the most corrupt Administration in American history run wild. Republicans have turned the U.S. Government into the world's largest Ponzi scheme. And it is not surprising that corruption is rampant in this administration because, well, we know who the President is.

It has actually been 84 days since our last hearing. The Chairwoman could have called a hearing about how this is the weakest hiring market since 2017, and we all know who the President was in 2017. We could have had a hearing on how Donald Trump's illegal tariffs are increasing the cost of living for their constituents. We could have had a hearing on why the Bureau of Prisons is accommodating human traffickers like Ghislaine Maxwell. We could have had a hearing on how the President is using the office to enrich himself and his family and friends. We could have had a hearing on how this Administration is illegally stealing more than $400 billion in congressionally directed funds. But they would rather distract you from the fact that their constituents are likely to die from their decision to cut healthcare and SNAP before some chemtrail conspiracy.

The Republicans do not care about their constituents suffering from anything. They have been railing against the American people for the last nine months. And they have been doubling down. Taking your healthcare was not enough. They have attacked Americans' housing, they have attacked Americans' food and childcare assistance, and they have attacked Americans' environmental protec-

tions. They are letting the oil companies and big data companies write their energy and environmental policies. These policies not only lead to sicker people, they also lead to dirtier water, more polluted air, and increased utility bills. And we know that these policies will disproportionately impact Black and Brown communities around the country.

So, Dr. MacCracken, the Trump Administration has dismantled agencies, fired scientists, defunded research, and is defunding universities. Do these actions disincentivize institutions from engaging in research and deter students wanting to work on climate science?

Dr. MACCRACKEN. I would think the answer to that would be yes.

Ms. CROCKETT. Thank you so much. And Dr. MacCracken, wouldn't you agree that eliminating environmental research can have devastating impacts on communities, particularly Black and Brown communities, which are often located in highly industrialized areas?

Dr. MACCRACKEN. Yes, I agree. And I might just say during the national assessment, that was one of the issues we tried to address by having some of the historically Black colleges be looking at the assessment of climate change and its significance in the Gulf Coast region.

Ms. CROCKETT. Thank you so much. I have a couple of UCs that I want to enter into the record really quickly at this moment. One is from September 11 of 2025. It says, "August 2025, Earth's third-hottest August on record. Four nations and territories set or tied their all-time heat record in August: Japan, Brunei, the UAE, and Martinique."

Ms. GREENE. Without objection, so ordered.

Ms. CROCKETT. The next one that I have is a UC that says, "State of the climate 2025 on track to be second or third warmest year on record."

Ms. GREENE. Without objection, so ordered.

Ms. CROCKETT. The third one is "Natural disasters have caused more than $131 billion in losses so far in 2025" from *CBS News*.

Ms. GREENE. Without objection, so ordered.

Ms. CROCKETT. The reason that I wanted to point these things out because I think that we cannot have a hearing like this unless we settle on some basics, one of those basics being that climate change is real. Whether or not any individual has accurately predicted exactly the day or how bad it is going to be and when is one thing. But the reality is that, as I was listening in, while I was not physically here, I was tuned into the hearing, I will say that even the Republican witnesses admitted that we are heating up.

So, the question is, what is it that we need to do to actually turn the heat down? Unfortunately, it seems like this Administration's decision has been to defund any and every one that actually could work on saving us because we do not know what will happen if this daggone planet—and yes, it is more than the United States—heats up to a ridiculous amount.

I can tell you that other countries acknowledge that climate change is real and that we have real work to do and it is within the science realm instead of the conspiracy realm.

And thank you. With that, I will yield.

Ms. GREENE. The gentlelady yields.

I now recognize Mr. Jack from Georgia for 5 minutes of questioning.

Mr. JACK. Well, thank you very much, Madam Chairwoman.

And I want to commend our witnesses for your testimony. I found it enlightening throughout today's hearing.

And if I could start with Mr. Martz, just to establish for this Subcommittee's record, could you briefly describe for us the history of weather modification within our country? When did it start? And how did we arrive to where we are today?

Mr. MARTZ. I mean, weather modification has been proposed at least since the 1890s to my knowledge, probably before that. And back in the 1940s is really when it got started. Obviously, there was Project Cirrus, and then it really started to peak about the 1960s and 1970s is when it peaked. And starting in the 1980s, it started to significantly decrease on a Federal level. There is still a lot that is being done at a state level and a local level, but the Federal Government, as Dr. Pielke had mentioned, does not largely—is not largely involved in such activities.

Mr. JACK. And to understand the science behind this, as I understand, the 1940s and 1950s scientists started experimenting by using, if I am not mistaken, silver iodide and dry ice to——

Mr. MARTZ. Correct. Correct.

Mr. JACK [continuing]. Simulate precipitation. And I am glad you did mention Project Cirrus. This matters to both the Chairwoman and I because we represent the incredible State of Georgia. But if you could brief this Committee on what happened with Project Cirrus. And, as I understand it, Savannah, the third largest city in our state, was struck by a hurricane because of some of the activities therein.

Mr. MARTZ. Yes, so Project Cirrus—so an atmospheric scientist by the name of Vincent Schaefer, he worked for General Electric Laboratories. And he discovered in 1946, he discovered that by putting dry ice into an environment with supercooled liquid water droplets that he could get it to freeze. And this could be done—he extrapolated this to the atmosphere where it could spur microphysical reactions in clouds to alter precipitation. NOAA has a great article on this. So, they partnered with the Naval Research Laboratory and the Army Signal Corps to experiment in hurricanes.

So, in October 1947—I think it was October 13, 1947, they flew two B–17s and a B–29, and they dumped huge chunks of dry ice. And specifically in their first round, which was half an hour, they dumped 80—hold on, where is it at? They dumped a whole lot of dry ice. It was 80 pounds, rather, over a 100-mile course. And they wanted to see what the cloud changes were in the hurricane. And then they did two more mass droppings with 50 pounds each.

And obviously, the next day, the hurricane eye was 50 miles east—or 50 miles west, rather, of where it was supposed to be, and the hurricane made 135 degree turn and hit Georgia. And so, this obviously was—generated a bunch of lawsuits, and they were thrown around. And one of the, actually the head of General Electric at the time said he was 99 percent sure that it changed course due to cloud seeding. However, the U.S. Weather Bureau, which is now the National Weather Service, put together a team of sci-

entists, and they found that really there is no evidence that the cloud seeding had that kind of effect because hurricanes can do those kinds of turns naturally on their own. And there have been similar tracks to that in the past.

Mr. JACK. I am grateful for that explanation. And again, Madam Chairwoman, just want to submit for the record that our own state was impacted by weather modification and a hurricane that was not meant to strike our state naturally did strike our state in 1947.

In closing, I am curious, one of my constituents, a really smart guy from Coweta County, has raised the threat of SAIs, stratospheric aerosol injections, to myself and would love for you to comment, Mr. Martz, on how SAIs are potentially going to be developed over the years to come and what this Committee can do to combat the threat thereof.

Mr. MARTZ. Yes, to my knowledge, there is not really any sort of solar geoengineering that is being done worldwide to my knowledge. There have been some attempts that have been shut down, such as the University of Washington project, which I think got 20 minutes in before it was halted. But there—it is the proposed attempt, and it is a very real proposal, to inject primarily sulfur dioxide into the stratosphere, which is the layer above the troposphere where we live, and the sulfur dioxide reacts with other gases in the atmosphere, and it forms sulfate aerosols, which are highly reflective because their width in terms of the microns—the tenths of microns, is about the width of the radiation of sunlight coming in. They are very highly reflective particles, and so it could cause—if it was successfully implemented, if it were to be implemented, it could cause significant global cooling that would counteract, you know, the warming that we have seen over the last 100 years.

But we know what the climate was like during the Middle Ice Age. We know what the winters were like in 1850. It was not a very pleasant time. So, the claims that, you know, today's climate is not ideal compared to then are just false.

Mr. JACK. Well, I appreciate, in closing, you acknowledging the threat of SAIs. I want to thank my constituent for briefing me on that threat.

And Madam Chair, I want to commend you for holding this hearing. I think this is a hearing people will study for years to come, and I appreciate the testimony that our witnesses provided today.

And with that, I yield back.

Ms. GREENE. Thank you, Mr. Jack.

In closing, I want to thank our witnesses once again for their testimony today.

I now yield to Ranking Member Stansbury for closing remarks.

Ms. STANSBURY. Thank you, Madam Chairwoman.

I will just note, you can put anything in a hearing record whether or not it is true or not, so I will just say that for the record.

But I am grateful that we had this hearing today because, as I said earlier, we finally discovered the purpose of the Environmental Protection Agency, which is to study and use science to inform the regulation of pollution.

And I have heard a lot of statements from my colleagues across the aisle today identifying that, yes, indeed, we do want to study and regulate pollution in the atmosphere, that we want to make

sure it is not adversely affecting communities, which is the foundation of environmental justice, which is something that we care deeply about. And we understand that we can have cross-border impacts, which is why we need international agreements and action on climate change.

All of these are the reason why the Environmental Protection Agency exists. All of these are the reasons why the Federal Government funds science. All of these are the reasons why we have Federal scientists who help to vet science, as was noted about the National Academies. All of this is why we need to take climate action.

Now, I want to just address some comments I heard about urgency. Now, one of the things that we did not have the opportunity to get into today in our discussion, even though we did, of course, establish that the science is real, the observational data is real about the increase of carbon dioxide emissions and how that is driving temperature and precipitation changes around the world. But the reason why there is a global consensus about the need and urgency of action right now is because there is an overwhelming consensus in the scientific community that we could reach a tipping point. And this is really about trying to address the global risks of reaching a tipping point because we know from physics and chemistry that if there is too much energy in the atmosphere, it could continue to ratchet up the impacts of these extreme events.

And we are already seeing these impacts. We are already seeing it. In my home state of New Mexico, we have had the largest, most catastrophic fires ever in recorded history, including back before humans were recording on paper what happened. We have seen the largest-scale floods that we have ever seen in specific locations because of extreme weather events. We are seeing temperature changes and snowpack changes that are impacting food production, that are impacting farmers. It is already happening. We cannot deny our eyeballs. It is happening in front of us. The data are there.

And so, the reason why there is an urgency to act on a global scale right now is because we want to make sure that the Earth does not cross a tipping point because of the things we are putting into the atmosphere. Now, the way that we do that is we have to take an all-of-the-above approach because carbon emissions are coming from all different sources. There are some sources that are putting more in the atmosphere, and there are some less.

And that is why we passed the largest, all-of-the-above climate strategy in American history three years ago in the Inflation Reduction Act. That is exactly what that bill was designed to do. It was designed to address utility sector scale changes, transportation changes, manufacturing changes, to help people make that transition so we can reduce carbon emissions and we can prevent our planet from crossing a tipping point. That is all it is. It is not alarmism. Like, that is literally all we are trying to accomplish by climate action is to keep our planet in some sort of balance because, yes, we have one Earth. We have one Earth. This is our home. And so that is why we need climate action.

That is why the firing of Federal employees, the defunding of science, the firing of EPA's science panel, the deregulation of carbon emissions, and the whole-scale attack that we are seeing on

the Federal science enterprise is not only problematic for many countless reasons in terms of continuing this enterprise, but because it is dangerous for the planet and for our communities.

And so, I hope that my colleagues who seem to care about emissions, who seem to care about environmental justice, as I have heard in this hearing, who seem to care about the localized impacts of putting things in the atmosphere, can understand why we need climate action now.

And with that, I yield back.

Ms. GREENE. I now recognize myself for closing remarks.

What we have learned here today has been fascinating. I hope the people watching it at home have been able to see the radicalized positions on the other side of the aisle. Remember, if you even questioned that someone could control the weather, you were labeled a conspiracy theorist or crazy. Then they changed the message to, well, it is not hurting anyone and it is to provide water for people.

And now they have come full circle around to the point that modifying the weather is how they save the planet from the global warming hoax, whether you agree or not. The people clearly disagreed with the climate hoax and disagreed with my Democrat colleagues, so much so that they made a big change last year. They elected President Trump, and they elected Republicans to control the House and the Senate.

These climate activists have come so far that they are actively trying to inject chemicals into the air to block the rays of the sun from hitting the Earth. And they want to take away our God-given rights, our God-given rights over the Earth in order to satisfy their godless climate cult beliefs.

Imagine these geoengineering projects were implemented at large scale across the globe because that is what they want to do. These lifegiving rays of the sun provide essential functions to the human body, including the strengthening of the immune system, inflammation reduction, strengthening of bone health, and so much more. The effects of the human body of a lack of sun exposure include irregular circadian rhythm, depression and mental illness, deficiency in bone strength, which can lead to a form of tuberculosis, and many more health problems, not to mention the potential damage done to the plant and animal life, as well as the possible ozone depletion. And as mentioned here with one of our witnesses, potentially cooling the earth could also cause people to freeze to death, crops to die, and could literally lead to killing millions and millions of people.

Radical climate alarmists worship the climate as if it is a religion. They are so radical, they glue themselves to the road, blocking traffic, and destroy artwork in museums. They scream global warming is going to kill us all and that U.S. cities are going to vanish underwater.

One other interesting hypocrisy of the left is that if they truly believed their global warming hoax and the rising sea levels, the cost of all of us will be underwater in a few short years, why are they investing millions of dollars into beachfront properties across the same coast they claim will be underwater? Bill and Melinda Gates own a $43 million beachfront home in California. The

Obamas own a $12 million waterfront compound in Martha's Vineyard. Mark Zuckerberg is building a $270 million beachfront compound in Hawaii. Mark Cuban owns a $19 million beachfront mansion on the coast of California.

What this whole debate comes down to is who controls the skies. Do we believe in God and that He has dominion over His perfect creation of planet Earth? Do we believe that He has given us everything we need to survive as a civilization since the beginning of time? Or do you believe in man's claim of authority over the weather based on scientists that have only been alive for decades and were not here to witness the climate changes since the beginning of time?

This is why I have introduced my bill, the Clear Skies Act, to end weather modification and geoengineering because I do not believe planet Earth is a lab, and I do not believe people are lab rats. I believe that people have the right and they have the God-given right to have clean air, clean skies, clean water, and clean food.

And with that, and without objection, all Members have five legislative days within which to submit materials and additional written questions for the witnesses which will be forwarded to the witnesses.

If there is no further business, without objection, the Subcommittee stands adjourned.

[Whereupon, at 11:53 a.m., the Subcommittee was adjourned.]