



*Interview*

## **Cloud control: Climatologist Alan Robock on the effects of geoengineering and nuclear war**

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### **Abstract**

In this interview, Rutgers University climatologist Alan Robock talks with Elisabeth Eaves from the *Bulletin* about geoengineering and nuclear winter. He says that geoengineering is not the solution to global warming because of its many risks and unknowns. He notes that some of the technology that would be required to implement geoengineering has not been developed and that many socio-political questions would have to be resolved before it could be put into practice. The world would have to reach agreement on a target temperature and on what entity should do the implementing. Robock's biggest fear with regard to geoengineering is that disputes over these questions could escalate into nuclear war which in turn could cause nuclear winter, producing global famine among other effects. He goes on to describe his meeting with former Cuban President Fidel Castro and discuss the role of the arts in addressing existential threats.

**Keywords**

climate change, CIA, fossil fuels, geoengineering, greenhouse gas, meteorology, nuclear weapons, nuclear winter

**A**lan Robock's interest in climate science dates back to 1974, when his doctoral thesis advisor Edward Lorenz, the meteorologist known as the father of chaos theory, told him that "climate would be a good field to get into." Robock took the advice, and today he is a distinguished professor of climate science in the Department of Environmental Sciences at Rutgers University, where he also directs the undergraduate meteorology program. He served as a lead author for the Intergovernmental Panel on Climate Change's Fifth Assessment Report and is a vocal advocate for action on global warming.

Robock is an expert on the potential effects of geoengineering, those untried technologies aimed at manipulating the climate system in order to counter the effects of global warming. Interest in geoengineering has intensified since the National Academy of Sciences released a report (<http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=02102015>) in February recommending federal funding for more research, including into what it calls "albedo-modification techniques," which would prevent sunlight from reaching Earth's surface. Robock doesn't think geoengineering is the right solution to climate change though, as he explains in this interview.

Robock is also one of the foremost experts on the potential climatic impacts of nuclear explosions. By producing smoke that blocks the sun's rays, a nuclear war could cause a nuclear winter, cooling the planet catastrophically and causing global famine. He calls nuclear weapons

a more serious threat to humanity than global warming.

In this interview, conducted by contributing editor Elisabeth Eaves in January, Robock talks about geoengineering and nuclear winter, his encounters with the CIA and Fidel Castro, and what movie stars he thinks could best get his message across.

**BAS:** In the past, you've warned of geoengineering's potential dangers. Have any new techniques or studies led you to become more optimistic about it?

**Robock:** No. The solution to global warming is to stop putting out greenhouse gas. And we know how to do that. We have the technology. It's sun and wind. The problem is political, not technical.

If we try to compensate for warming with engineering projects on the only planet known to sustain intelligent life, it's still just too scary. If you could put a cloud in the stratosphere and maintain it there, it could cool the planet and counteract some of the negative aspects of global warming. But there are risks that haven't been addressed, such as how does the world decide what temperature it wants to be? What would happen if we started and then abruptly stopped, which could be catastrophic? Questions like these haven't been solved.

There's a new technique people are studying, which is to try to dissipate cirrus clouds to let heat escape. In theory, this doesn't come with some of the negative aspects of blocking out the sun. For example, it doesn't change precipitation patterns as drastically. But you would need fleets of airplanes to spray

chemicals into the upper atmosphere, which is an undeveloped technology. I don't know of anybody who has come up with an idea of how to do it safely.

The one thing called geoengineering that probably is a good idea is to take carbon dioxide out of the atmosphere. Unfortunately, it has the same name—geoengineering—as these other proposals, but it's a completely different issue in terms of the technology, costs, and risks. If we could do it cheaply enough and find a place to store the carbon dioxide, that would take away the cause of global warming.

An even better idea, of course, is to not put the carbon dioxide in the atmosphere in the first place. You can do that by using energy more efficiently but also, if you're going to burn fossil fuels, by capturing the carbon dioxide out of the smokestack. It has a much higher concentration right when it leaves a fixed source than it does once it's free in the atmosphere, so it's much cheaper to capture.

**BAS:** Is there anything you fear could happen that would make geoengineering inevitable despite all its problems?

**Robock:** I don't really fear geoengineering because I don't think it's ever going to happen. There was a conference at Asilomar five years ago where a bunch of people got together and discussed the ethics of geoengineering. Robert Socolow, who is a professor at Princeton, went around asking people their greatest fears, and at the end of the week he read them off.

The greatest fear, which is also mine, was global nuclear war. Because if countries can't agree on what the temperature should be, and somebody is mad at somebody else for controlling their climate, the situation could escalate into hostilities. And different countries have different interests. People at high latitudes,

like in Canada or Russia or maybe even the United States, might want to exploit the Arctic and send ships. So some people don't mind it a little bit warmer. But people in the Pacific, whose islands are sinking, want it to be cooler than it is today. They're already suffering. So there's a spectrum of different local impacts. I can't imagine how the world could agree on where to set the thermostat.

Let's say we get to the point where the feared emission of methane from the Arctic occurs, and the ocean starts bubbling up really fast, or there's even more catastrophic melting in Antarctica and Greenland. There might then be calls to implement geoengineering until we get mitigation under control.

Once demand for geoengineering gets started, who's going to implement the process? Remember that whoever ends up doing it will have a huge financial interest in continuing to do it. Would you trust the planet to the BP Geoengineering Corporation, for example? I can't imagine the world agreeing.

**BAS:** So we might see calls for geoengineering, but then a fight about what to do?

**Robock:** Yes. People have said it's so cheap and easy that an individual could do it. Like, you know, Richard Branson is an environmentalist and he owns a lot of airplanes—how about him? But I find it hard to believe that any individual or country would do it. You could shoot their planes down once they started, so there's no way to do it without the agreement of the rest of the world. I guess a country could do it over its own territory.

Consultants for the CIA called me up four years ago and asked, "Could we detect somebody else trying to control our climate?" Well yeah, we could, because if somebody was creating a thin

cloud in the lower stratosphere we could detect that with our current satellite and ground-based observational system. We can see the effects of various small volcanic eruptions. If somebody were sailing ships around the ocean brightening clouds, we could see the lines in the clouds with satellite imagery. And we could see the airplanes or the ships that were doing it. So it would be impossible to do it in secret.

Of course, what they were also asking is, “Can we control somebody else’s climate?”

There’s a big report on geoengineering [<http://nas-sites.org/americasclimate-choices/public-release-event-climate-intervention-reports/>] by the National Academy of Sciences that is being released. It was funded mainly by the CIA. The CIA asked several other agencies, like NASA and NOAA, to help fund it, so that the report would look like a joint effort, but I was told it was almost all the CIA, which goes by the “US intelligence community” in the report. What’s wrong with this picture? The CIA wants to figure out how to control the globe’s weather.

**BAS:** So they’re taking it seriously.

**Robock:** I don’t know what their motivations are. But the panel that did the report is very good. It’s the top scientists, and I know a lot of them, and I reviewed part of the report. I don’t think the report is influenced by the CIA. It seems like it was done very responsibly.

**BAS:** Are there other ethical issues raised by geoengineering you’d like to talk about?

**Robock:** Some people say we shouldn’t do research because it’s a slippery slope to deployment, or because it takes resources away from something more productive. But in my opinion,

indoor geoengineering research—that is, studying data, studying past volcanic eruptions as analogues, doing climate modeling—is something we should do because we have to know what the possible impacts might be. If we are going to make policy decisions about this in the future, they should be informed, not emergency panic decisions.

Outdoor geoengineering research, such as actually spraying stuff into the atmosphere to brighten clouds or to create a cloud in the stratosphere, needs to be regulated. If the scientists can show that the amount of material they’re going to spray is not going to be dangerous, is going to be very small, and is going to be a particular amount over a particular time, then that should be fine as long as their environmental impact statement is independently evaluated and monitored and they are sanctioned if they break the rules. Otherwise they could say, “Well, we didn’t get a really strong signal, so let’s just do it twice as long or put twice as much in or over twice the area.” And there is no organization currently that can regulate outdoor geoengineering research. This infrastructure doesn’t exist today. If you want to go out in the atmosphere over national territories there are environmental rules, but if you get over the ocean there are no rules.

**BAS:** Let’s move on to talking about nuclear winter. How small a nuclear weapons exchange would be necessary to cause a climatic effect?

**Robock:** Well first of all I don’t like the jargon of “exchange.” It really sanitizes it. It sounds like you’re going to take a sweater you got for Christmas back to the store. Rather you could ask, “How much burning of people and villages and cities do we need?”

The United States and Russia have enough nuclear weapons to produce nuclear winter. That is, the effects of smoke from burning cities and industrial areas could cause the temperature to go below freezing in the middle of the continents.

We did a scenario in which we looked at 50 Hiroshima-size atomic bombs being dropped on India and 50 being dropped on Pakistan on the targets that would produce the largest amounts of smoke. That's much less than one percent of the current global nuclear arsenal. We found that these 100 bombs would produce enough smoke to block out the sun and cause temperatures to fall lower than any temperature in recorded human history, colder than the Little Ice Age of several centuries ago which produced famines and revolutions.

**BAS:** What else could result?

**Robock:** China and the United States are the two biggest grain-growing regions in the world. Weather disruptions caused by that small nuclear war could cause production to go down by 10 to 40 percent for five years and 20 percent for ten years. This would be a huge hit to the world food supply.

**BAS:** You recently wrote that nuclear weapons are a more serious threat than global warming. Why is that so?

**Robock:** Because nuclear weapons produce climate change too, and the climate change caused by nuclear weapons could be much more devastating. It could have a much larger immediate impact on our food supply, producing social disruptions as well as famine.

Nuclear weapons are also an easier problem to solve than global warming: just don't use them. To solve global warming, you have to stop burning fossil fuels, and to do that you have to

change the energy infrastructure of the planet and fight against very, very rich, well-funded multinational corporations that want to do business as usual.

**BAS:** You met with former Cuban President Fidel Castro in 2010 and 2011. How did that come about?

**Robock:** I had a student from Cuba, Juan Carlos Antuña, who got his PhD at Rutgers and then returned to Cuba, where he's a research meteorologist. He sent me an e-mail saying that the Cubans wanted me to come and talk about climate change. The next day, he sent me to a website where Castro was talking to the head of the Cuban weather service about nuclear winter.

As you know, Fidel fell down and broke his shoulder and his leg, and then he had these intestinal problems, and he was so sick he gave up power to his brother. But then he got better and he had free time on his hands that he never thought he would have. So somehow he discovered my work. He asked his son, Fidel Castro Diaz-Balart, to contact the head of the weather service, who contacted Juan Carlos, who contacted me and asked me to come.

**BAS:** What was it like to meet Castro?

**Robock:** Very surreal. I couldn't believe it was happening. But he's a really charismatic guy. The second time I met him, I sat across the table from him for more than three hours, and he went through his entire life history from his earliest childhood memories.

He talked about the Bay of Pigs invasion. He talked about Nixon and Kennedy and what movies you should see and said to read Anatoly Dobrynin's autobiography because that's the best record of what happened during the Cuban Missile Crisis.

Ten days after my first meeting with him, he said in his blog, "We've got to get

rid of all nuclear weapons.” And I was thinking, well, too bad he doesn’t have nuclear weapons to get rid of. On the other hand, it’s probably pretty good that he doesn’t have them. I just have to convince people who have them.

**BAS:** What do you think small countries, like Cuba, can do about climate change and nuclear weapons, given that the superpowers control so much of what happens?

**Robock:** In the 1980s, the non-superpowers of the world realized, based on nuclear winter theory, that they could experience huge suffering even if no bombs were dropped on their countries. There was a lot of pressure from these countries on the United States and Soviet Union to stop the arms race. Because, for example, more people could die in China than in the United States and Russia combined, even if no bombs were dropped there. That pressure from all the rest of the world helped to end the arms race. And so I think that these conferences on the humanitarian impacts of nuclear weapons can have an effect.

But unfortunately Putin is sort of ramping up the Russian nuclear establishment, building new submarines and ordering threatening flights. And in order to sign New START, Obama had to agree to this \$300 billion modernization of US nuclear weapons. And so those things have to be addressed.

**BAS:** You wrote a paper about weather imagery in Bob Dylan lyrics.

**Robock:** My best paper.

**BAS:** What role do you think artists can or should have in grappling with existential threats like nuclear weapons and climate change?

**Robock:** After my lecture in Cuba, they told me it would be broadcast on national television the next day at

prime time. So we walked into a hotel bar with a television. And I looked and there was a Julia Roberts movie on. It was a DVD because they only have two channels there. And I said to the bartender, “Could you change the channel and see if I’m on?” He changed it and sure enough there I was. But what it taught me is that if you want to change the way people think you need a movie with Julia Roberts, not a professor giving a lecture.

I’ve been working with a colleague to write a screenplay for a feature film where this Russian climate scientist falls in love with an American one, and they discover what the climate effects of nuclear war would be. Meanwhile, on the India-Pakistan border there’s an escalating conflict. I think you could write a screenplay with a little bit of sex. I’m not sure how to do the violence— whether to show the effects of what would happen in a dream, or let it really happen but not have a happy ending. I don’t know. But I think if we had some entertainment like that, that’s the way to educate people, not articles in the *Bulletin of the Atomic Scientists* or even TEDx talks.

Anybody who would be interested: If you know of any contacts who could write a movie about this, that would be great.

**BAS:** Do you envision any particular movie star in the role?

**Robock:** I’m old, so Julia Roberts would be fine for me, or Meryl Streep. But maybe some younger star so that it could appeal to young people too. Lizzy Caplan—she was in *Masters of Sex* and *The Interview*. She could be one of the scientists.

**BAS:** Is there anything you would like to add?

**Robock:** These are problems caused by humans. If we can cause them, we can

fix them. We have free will. People say it can't be done, but of course it can be done because we created the problems in the first place. We just need somebody with the vision and the courage to solve them.

We worry about tipping points in the climate system but there are also tipping points in human behavior. If you look

back at the United States 10 years ago, could you have imagined gay marriage or legalized pot or a black president?

These things have changed pretty rapidly, so I think it's possible we can get to the point of solving climate change and nuclear weapons too. I'm sort of optimistic, and that's why I keep working on them.