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## SURPRISING SCIENCE

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February 23, 2010  
[Riled up About Geoengineering](#)



Clouds form in shipping lanes because of emissions from ships' smokestacks. Image courtesy of NASA

One of the most contentious sessions at the [American Association for the Advancement of Science meeting](#) this past weekend in San Diego was on geoengineering, the study of ways to engineer the planet to manipulate climate. Intentional ways to do so, I should say—as many of the speakers pointed out, we've already pumped so much carbon dioxide into the atmosphere that the planet is warming and will continue to warm throughout this century, even if we started reducing emissions today. This isn't a political opinion, it's a fundamental property of the chemistry and longevity of carbon dioxide.

So, what is to be done? Every speaker endorsed reducing the amount of carbon dioxide we release into the atmosphere. As session chair [Alan Robock](#) said at the beginning, “just so we're clear, all of us strongly urge mitigation as the solution for global warming.”

But that's where the agreement ended.

The disagreements mainly concerned whether it's more dangerous to propose, test and deploy geoengineering strategies—or to do nothing.

The danger of doing nothing, [David Keith](#) pointed out, is that the full consequences of having so much carbon dioxide in the atmosphere are “deeply uncertain.” If there are massive droughts and at the end of the century due to climate change (“an unacceptably huge response” to carbon dioxide), we need to be ready to do something. And according to his research, “if we wanted to, we could do this.”

What could we do? Well, one cheap and easy way to bring down global temperatures would be to scatter sulfur particles in the stratosphere, mimicking the effects of volcanic eruptions and blocking some sunlight. The plume from the 1991 Mount Pinatubo eruption spread across the upper atmosphere and brought down global temperatures for a few years, and aircraft could deliver comparable amounts of sulfur compounds. Calculating the costs of engineering tweaks to existing technologies, Keith says, he found that the technology would be “so cheap it doesn't matter.”

Another approach is seeding clouds—the thicker and whiter they are, the more sunlight they reflect and the less heat they allow to accumulate in the lower atmosphere. We're already seeding clouds inadvertently—if

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you look at [satellite images](#) of the oceans, you can see clouds forming in shipping lanes. Emissions from the ships' smokestacks have particles that cause water vapor to condense as clouds. [Philip Rasch](#) calculated ways to manipulate these emissions to maximize clouds, at least in models.

Fiddling with the ocean works, too. [Kenneth Coale](#) has been conducting "ocean enrichment" experiments for years, in which he and his collaborators dump iron into the open ocean. Iron spurs more phytoplankton to grow, and phytoplankton take up carbon dioxide from the atmosphere. They eventually die and release carbon dioxide, but some of the carbon is tied up into solid particles (diatom shells and other detritus) that sink to the bottom of the ocean. There have been 15 iron enrichment experiments at many different latitudes, and it seems to work (although they haven't directly measured long-term carbon storage)—but there's a downside. (There always is.) The diatoms that dominate the phytoplankton blooms produce [domoic acid](#), a.k.a. the active ingredient in amnesic shellfish poisoning, which can cause neurological damage in people and marine mammals.

And it's the unintended consequences that make philosopher [Martin Bunzl](#) say that people shouldn't be experimenting with geoengineering at all. "My argument is that no amount of small-scale, limited experimentation will prepare for large-scale implementation." There's just no way to get enough data from small tests to tell what geoengineering will do across the planet, and the risks (of disrupting the Asian monsoon cycle, of causing more hurricanes, etc.) are [too great to accept](#).

One risk of even talking about geoengineering came up again and again: moral hazard. The idea is that if people know that there are cheap and easy ways to counter some of the effects of climate change, they won't bother to do the hard work of reducing what Rasch called "our carbon transgressions."

Historically, James Fleming pointed out, people have been fantasizing about manipulating the atmosphere for decades (a [PDF](#) of his recent Congressional testimony). They fall into two categories: "commercial charlatans and serious but deluded scientists."

It's hard to tell how much of an impact these discussions about the technology, risks and ethics of geoengineering will have in the public at large. The geoengineering sessions attracted their own protesters this year—usually it's the genetically modified crops people who get all the protesters' attention—but the protesters were less concerned about moral hazard or Asian tsunamis than they were about their [pet conspiracy theories](#).

Posted By: Laura Helmuth — [Climate Change](#), [Earth](#), [In the News](#), [Oceans](#), [Science 101](#), [Technology](#) | [Link](#) | [Comments \(1\)](#)

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1. Great post, Laura. I am researching an article on geoengineering and found this; it nicely sums up different angles. Must have been an intriguing session.

*Comment by DeLene — April 21, 2010 @ 8:02 pm*

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