

Can brightening clouds buy us time to fight climate change?



Brightening Earth's clouds so that they reflect more sunlight just might cool the planet – that is if we can figure out how to do it without causing any unintended harm. To test the theory out, a group of over 30 leading scientists have written up a research road map that was published in the journal *Science Advances* yesterday.

The paper focuses on how to approach attempts to artificially shade Earth's surface with marine clouds by spraying saltwater into the air from ships, a strategy called marine cloud brightening (MCB). They'll need to be really careful with any future experiments, which would fall into the controversial category of solar geoengineering. The idea is to counteract some of the effects of climate change by finding ways to reflect solar radiation.

Researchers still don't understand how fruitful those efforts would be, nor whether they might inadvertently create new problems by messing with the planet in this way. But with climate change whipping up worsening disasters and countries

falling behind on goals to reduce planet-heating pollution, some scientists see solar geoengineering as a possible contingency plan.

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Geoengineering – deploying new technologies to manipulate the environment in a way that might lower global temperatures – does nothing to stop the greenhouse gas emissions causing climate change, she added. It could have the potential to slow down worsening climate disasters while policymakers work to reduce emissions. But first, it’s important to know what the possible risks and benefits are.

There have already been tussles over what, if any, role solar geoengineering should play as a climate solution and how to regulate it. So far, the drama has mostly surrounded a different strategy called stratospheric aerosol injection (SAI), which involves catapulting particles up into Earth’s stratosphere to reflect sunlight back into space.

One startup caused a global uproar in 2022 when it forged ahead with its own makeshift SAI experiments despite a ban on large-scale geoengineering. You can watch the co-founders on YouTube in a parking lot to create sulfur dioxide gas they then launch. Even groups optimistic about solar geoengineering balked at the experiments, saying it undermined more serious research into how to mimic the way volcanoes have temporarily cooled the planet when spewing sulfur dioxide during eruptions.

Since then, there’s been a push within academia and

international institutions including the United Nations and European Union to craft stronger guidelines for solar geoengineering. Some environmental advocates oppose solar geoengineering altogether, saying the uncertainties are too great and that climate solutions need to focus on preventing greenhouse gas emissions causing climate change.

Scientists are even more unsure of the effects of marine cloud brightening than they are of stratospheric aerosol injection. So it's no surprise that the authors of the new MCB paper want to proceed with caution. The group of 31 scientists from around the world convened in 2022 to assess where the current scientific understanding of marine cloud brightening stands and what knowledge gaps need to be filled. The paper they published this week summarizes their findings and proposes a plan for advancing MCB research.

Marine cloud brightening mimics the effects of volcanic eruptions. But unlike SAI, it entails sending reflective particles into low-lying clouds instead of higher up into the stratosphere. Sulfur in pollution from ship stacks has also been shown to have a similar reflective effect, although recent research suggests this might have been overestimated in the past.

Clouds are a climate enigma, which makes them particularly tricky to manipulate. Some types of clouds block sunlight, while others can trap heat. The goal with marine cloud brightening, of course, is to have more of the former. Inadvertently causing clouds to thin out and rain might lead to more heating. The way a cloud forms or responds to human intervention will depend on a range of complex, shifting factors – from weather to how particles spread by humans interact with other aerosols already in the air.

“We would have to get the right-sized particles into receptive clouds at the right times of day and seasons, and over large-enough areas to shade large areas of ocean ... It's a major

challenge,” Graham Feingold, lead author and a researcher with NOAA’s Chemical Sciences Laboratory, said in a press release.

How viable marine cloud brightening is in the real world will depend on whether researchers see positive results in lab tests and modeling studies, the new paper says. They’ll also need to see if small field tests can be scaled up to have global impact. Satellite observations would be crucial for monitoring the outcomes of such experiments. Beyond the physical science feasibility addressed in this paper, there will also be societal and ethical implications to consider. How do you avoid any disparities when it comes to who benefits, or who bears any unforeseen burdens? Marine cloud brightening could trigger changes in rainfall from region to region, for example.

“Interest in MCB is growing, but policymakers currently don’t have the information they need to reach decisions about if and when MCB should be deployed,” Feingold said. “The question is whether we can design a MCB research program using our current modeling and observational tools to establish the feasibility of this approach on a global scale, and if not, what needs to be done to position ourselves to do so.”

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