

Climate geoengineering research should include developing countries

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Appeal on projects that could mask global warming is published in *Nature* by scientists from 12 countries, including Brazilian Paulo Artaxo. Credit: Pixabay

Placing giant mirrors in orbit to reflect sunlight before it reaches Earth and launching millions of tons of sulfur into the stratosphere to simulate the effects of a major volcanic eruption are among the mind-boggling climate geoengineering projects that are under consideration as ways to mitigate the global warming caused by greenhouse gases.

The impact of this kind of initiative on global ecosystems remains highly uncertain. According to a commentary published in the journal *Nature*, the only certainty is that developing countries will be the most affected

both by climate change and by any action taken to try to slow or stop the rise in global temperatures.

The text is signed by 12 scientists from Bangladesh, Ethiopia, India, Jamaica, Kenya and Thailand, among other countries. Brazil is represented by Paulo Artaxo, a Full Professor at the University of Sao Paulo's Physics Institute (IF-USP) who is also at the steering committee for one of Sao Paulo Research Foundation—FAPESP's Research Programs, namely the Global Climate Change Research Program (RPGCC).

The authors of the article argue that [solar geoengineering](#) cannot be an alternative to reducing [greenhouse gas emissions](#) and urge caution: "We recognize its potential physical risks and socio-political implications. And we oppose its deployment until research into its safety and effectiveness has been completed and international governance mechanisms established. But we are committed to the co-production of research and to well-informed debate."

According to Artaxo, projects that model the results of geoengineering strategies have been conducted in the United States, the United Kingdom and Germany, but so far, scientists from developing countries have not taken part.

Interest in geoengineering is burgeoning along with growing evidence that the Paris Accord signed by 195 countries in 2015 to contain greenhouse gas emissions will not be sufficient to limit [global warming](#) to 2 °C above pre-industrial levels.

"If emissions continue at the current pace, the average temperature rise could reach between 4 °C and 7 °C during this century," said Artaxo. "To prevent a collapse of the ecosystems that sustain our planet, it may be necessary to resort to geoengineering at some point. But without

serious research involving the entire world, we run a serious risk of doing even greater damage to the climate than we are now. An error in the use of any technique could cause the deaths of hundreds of millions of people from famine, thirst and other causes."

Research conducted to date shows that solar geoengineering techniques could temporarily cool Earth but would have significant side effects that might actually be worse than the harm they were intended to mitigate.

A strategy that has been tested on a small scale involved the casting of iron particles into the ocean to increase the absorption of carbon dioxide (CO₂) by marine biota.

"This could, indeed, be an effective way of removing CO₂ from the atmosphere," said the RPGCC-FAPESP member. "However, it would cause sharp and rapid acidification of the ocean. Simulations suggest large-scale use of this technique could lower ocean pH so far that practically all marine species would be wiped out."

If sulfur were launched into the atmosphere, the main impact would be felt by plants, most of which depend on direct sunlight to photosynthesize efficiently. "This technique could benefit species that photosynthesize with diffuse radiation. In other words, it would radically change the planet's biodiversity, and humanity would have no idea of the long-term impact," Artaxo said.

To Artaxo, the real concern is not the physical and chemical dimension but governance. Who would be responsible for deciding which techniques to use, when, where, and on what scale, especially since action taken by a single country could affect the entire planet? Who would pay for any damage done to specific countries? Above all, who could guarantee that the measures would continue to be taken for 100 or 200 years?

"Imagine we started to inject sulfur dioxide into the stratosphere and that after one or two decades, this became impossible owing to a severe international economic crisis or world war. The global temperature reduction obtained during the period could be reversed in no more than a year," Artaxo said.

Participation in the debate

No in-depth research on geoengineering to mitigate [climate change](#) has yet been done in Brazil. In Artaxo's view, it is vitally important to investigate the potential effects on the carbon balance, on the functioning of Amazonia and on rainfall in the Northeast, among others.

The article published in *Nature* also stresses the importance of studying the effects of [geoengineering](#) on hurricanes in the Caribbean, floods in Bangladesh and agriculture in East Africa, for example.

"Developing countries must be in a position to make up their own minds. Local scientists, in collaboration with others, need to conduct research that is sensitive to regional concerns and conditions. (...) Broader discussions among academics, policymakers, the public and public intellectuals are needed on climate risks and justice," the authors write.

More information: A. Atiq Rahman et al, Developing countries must lead on solar geoengineering research, *Nature* (2018). [DOI: 10.1038/d41586-018-03917-8](#)

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