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'Planetary sunshade' could strip ozone layer by 76%

19:00 24 April 2008 by [Catherine Brahic](#)

Planetary engineering projects to cool the planet could backfire quite spectacularly: a new model shows that a "sulphate sunshade" would punch huge holes through the ozone layer above the Arctic.

To make matters worse, it would also delay the full recovery of the Antarctic ozone hole by up to 70 years.

Pumping tiny sulphate particles into the atmosphere to create a sunshield that would keep the planet cool was first suggested as a solution to global warming by [Edward Teller](#), a physicist was best known for his involvement in the development of the hydrogen bomb.

[Simone Tilmes](#) of the National Center for Atmospheric Research in Colorado, US, used computer models to see how a sulphate sunshade would affect the ozone layer, which protects us from harmful UV rays. She says it could have "a drastic impact".

Tilmes modelled two different scenarios: one in which "large" particles measuring 0.43 microns in diameter are used, and one where the particles are two-and-a-half times smaller.

Cooling effect

Sulphate particles catalyse the breakdown of ozone molecules by chlorine atoms. Western economies have [almost entirely stopped using chlorine-based coolants](#) called CFCs, thanks to the [Montreal Protocol](#). However, such substances are [increasingly being used in Asia](#) and the atmosphere is still full of CFCs emitted during the 20th century.

In January 2008, researchers described how much of each type of sulphate particle would need to be injected into the stratosphere in order to compensate for a doubling in atmospheric carbon dioxide concentrations ([Geophysical Research Letters](#), DOI: [10.1029/2007GL032179](#)). Tilmes used these volumes in her computer models.

She found that injections of small particles over the next 20 years could thin the wintertime ozone layer over the Arctic by between 22 and 76%. Large particles, which would have less of a cooling effect, according to previous research, would still reduce Arctic ozone by 15 to 50% during the winter.

In the Antarctic, the injections would delay the recovery of the existing ozone hole by 30 to 70 years.

Cancer increase

A thinner ozone layer - popularly known as an ozone "hole" - lets more UV rays through, which can cause an increase in the incidence of various cancers. [According to NASA](#), a 1% decrease in the ozone layer can cause an estimated 2% increase in UV-B irradiation, leading to a 4% increase in basal carcinomas - the most common form of skin cancer.

In 2007, [Ken Caldeira](#) of the Carnegie Institution of Washington in the US found that if a sulphate sunshield were deployed and then removed - for instance because of a change in governments - [the effects of global warming after the removal would be far worse](#) than before the sunshield.



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Caldeira has also found that a sunshade could cause severe drought.

Journal reference: [Science](#) (DOI: 10.1126/science.1153966)

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Ozone Layer

Thu Apr 24 20:24:49 BST 2008 by Paul Emeny

Has anyone thought that the seeding of atmosphere by russians for matday parades has had an effect on ozone layer. Is there any way to extrapolate data to see if this has had an effect.

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Question About Atmospheric Co2

Thu Apr 24 21:18:15 BST 2008 by Rob

It has always seemed intuitive to me that there could be a way to sequester CO2 from the atmosphere. Is it feasible to send up molecules into the atmosphere that would either bind to or react to CO2, creating either a heavier molecule that would fall to the earth or perhaps 2 less harmful molecules. Can anyone speak to this idea/set me straight?

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Question About Atmospheric Co2

Thu Apr 24 22:28:28 BST 2008 by Gapthemind

The idea is that CO2 is a stable molecule, so it takes energy to separate it out into one carbon and 2 oxygen atoms. To summon that kind of energy, we'd need to burn fuel, which would inherently be less than 100% efficient, and therefore would release more CO2 into the atmosphere than it uses up.

An alternative is to use a non-fossil source of energy, like the sun, but nature already does that. Research into the energy efficiencies of various organisms makes me suppose that plants are about as efficient at turning the environment into plants as anything could ever get. Of course a plant's goals aren't our goals, so CO2 sequestration gains might be genetically engineered. That's in the future, though.

So the simple for-now answer is.. Plant some plants.

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Question About Atmospheric Co2

Fri Apr 25 14:14:14 BST 2008 by **Sam**

Two less harmful products? you mean Carbon and Oxygen? il give you oxygen but carbon is probably equally harmful. Only difference is carbon is more damagin to our health and CO2 is damaging to our environment.

I agree, best way so far is to decrease deforestation and increase aforestation by a large amount.

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Question About Atmospheric Co2

Tue Apr 29 08:43:29 BST 2008 by **Soylent**

"il give you oxygen but carbon is probably equally harmful."

Carbon or coal is safe in bulk quantities, it's breathing in the very fine particulates you have to worry about.

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Question About Atmospheric Co2

Tue Apr 29 08:40:46 BST 2008 by **Soylent**

6 billion tonnes of coal per year is ~20 billion tonnes of CO2. That's around 4 000 cubic miles of CO2 at standard temperature and pressure that you need to capture and shove into an hole somewhere and hope it doesn't come back up. And you need to do so at a handful of dollars per tonne and without using a whole lot of energy.

Leaving the coal in the ground and using nuclear fission for electricity might be a saner approach.

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Question About Atmospheric Co2

Thu Jul 03 23:11:19 BST 2008 by **Wawny**

I believe that Blue-Green algae is probably our best user/converter of CO2 to O2, and can also be harvested as a fuel

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Acid Rain

Thu Apr 24 21:44:11 BST 2008 by **Ugly American**

Sulphates precipitate out as acid rain.

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Acid Rain

Thu Apr 24 22:16:40 BST 2008 by **Ecoeng**

Most sulfates precipitate out as ammonium sulfate and are not acid.

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Acid Rain

Fri Apr 25 13:21:09 BST 2008 by **Toxophilomaniac**

Sorry, but you are slightly incorrect. Ammonium sulphate is the product of a weak base (ammonium hydroxide) and a strong acid (sulphuric acid), and as such will return a slightly acidic solution.

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Acid Rain

Mon Apr 28 09:01:39 BST 2008 by **Ugly American**

That's misleading. Ammonium sulfate decomposes to sulfuric acid in both soil and water. It's even used commercially acidify alkaline soil.

The problem is lowering the pH of lakes and even costal waterways has already caused severe disruption in the ecosystem. It's not that adult fish dissolve - it's that the things they eat never hatch.

PS - worldwide fish yield peaked in 1987 and we can see the dead zones from space

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