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Climate 'technical fix' may yield warming, not cooling

By Richard Black
Environment correspondent, BBC News, Vienna

Whitening clouds by spraying them with seawater, proposed as a "technical fix" for climate change, could do more harm than good, according to research.

Whiter clouds reflect more solar energy back into space, cooling the Earth.

But a study presented at the European Geosciences Union meeting found that using water droplets of the wrong size would lead to warming, not cooling.

One of the theory's scientific fathers said it should be possible to make sure droplets were the correct size.

Cloud whitening was originally proposed back in 1990 by John Latham, now of the University Corporation for Atmospheric Research in Boulder, US.

It has since been developed by a number of other researchers including University of Edinburgh wave energy pioneer Stephen Salter, joining a number of other "geoengineering" techniques that would attempt either to reduce solar radiation reaching earth or absorb carbon dioxide from the air.

One version envisages specially designed ships, powered by wind, operating in areas of the ocean where reflective stratocumulus clouds are scarce.

The ships would continually spray fine jets of seawater droplets into the sky, where tiny salt crystals would act as nuclei around which water vapour would condense, producing clouds or thickening them where they already exist.

It has not yet been trialled in practice, although proponents say it ought to be.

Drop kick

But Kari Alterskjaer from the University of Oslo in Norway came to the European Geosciences Union (EGU) meeting in Vienna with a cautionary tale.

Her study, using observations of clouds and a computer model of the global climate, confirmed earlier findings that if cloud whitening were to be done, the best areas would be just to the west of North and South America, and to the west of Africa.

But it concluded that about 70 times more salt would have to be carried aloft than proponents have calculated.

And using droplets of the wrong size, she found, could reduce cloud cover rather than enhancing it - leading to a net warming, not the desired cooling.

"If the particles are too small, they will not brighten the clouds - instead they will influence particles that are already there, and there will be competition between them," she told BBC News.

"Obviously the particle size is of crucial importance, not only for whether you get a positive or negative effect, but also whether particles can actually reach the clouds - if they're too large, they just fall to the sea."

The possibility of this technique having a warming impact has been foreseen by cloud-whitening's developers.

In a 2002 scientific paper, Dr Latham wrote: "... the overall result could be a reduction in cloud droplet concentration, with concomitant reductions in albedo and cloud longevity, ie a warming effect".

But, he argued, this possibility could be eliminated by careful design of the spray system.

Contacted after the presentation in Vienna, Professor Salter took the same line.

"I agree that the drop size has to be correct and that the correct value may vary according to local conditions," he said.

"However, I am confident that we can control drop size by adjusting the frequency of an ultrasonic pressure wave which ejects drop from micro-nozzles etched in silicon.

"We can test this at very small scale in the lab."

Professor Salter is working with engineers in Edinburgh to produce extremely fine yet robust nozzles from semiconductor sheets.

Small cuts

In an era when many climate scientists are frustrated by slow progress in reducing greenhouse gas emissions, cloud whitening has sometimes been held up as an example of a technology that could make a real difference, at least to "buy time".

It has been calculated that a fairly modest increase in the reflectivity of these marine clouds could balance the warming from a doubling of carbon dioxide in the atmosphere - although even proponents admit it would do nothing to combat the other major consequence of carbon emissions, ocean acidification.

One scientist at Ms Alterskjaer's presentation, having heard her outline why it might not work, commented that it was the most depressing thing he had heard in a long time.

And Piers Forster from the UK's University of Leeds, who is leading a major UK project on geoengineering techniques, suggested more research would be needed before cloud whitening could be considered for "prime time" use.

"The trouble is that clouds are very complicated; as soon as you start manipulating them in one way, there are a lot of different interactions," he said.

"We need real-world data and we need modelling that tries to simulate clouds on more appropriate scales, and that means less than 100m or so, because if you look at a deck of stratocumulus it's not one big thing, it has pockets and cells and other features.

"Far more uncertain is the idea that you'd inject a particular drop size, because it won't stay that size for long - it will spread out, and that would be uncertain."

Professor Salter, too, believes more research needs to be done, including building a prototype injector ship and studying how it works in practice.

Interviewed by the BBC late last year, he said that such research was urgently needed because there was little sign of real cuts being made in the world's greenhouse gas emissions.

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