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AGU: Geoengineering costs

How much would it cost to dim the sun a little with a dusty layer of aerosol particles in the stratosphere? The service comes for free if you can find an obliging volcano, like Mount Pinatubo, but they can hardly be relied on in the long term. Some schemes for doing it to order, though, could be pretty cheap, according to an analysis by Alan Robock and colleagues at Rutgers.

In the 1990s a National Research Council panel in the US estimated the costs of delivering dusty particles ito the stratosphere from big guns like those on old battleships. The panel came up with a figure of $30 billion a year: a lot cheaper than most proposals for carbon cutting, but still a fair chunk of change. Robock looked at the costs of getting into the stratosphere by the more orthodox means of aircraft. Near the poles, where the bottom of the stratosphere comes closest to the ground, big aircraft like Air Force tankers can get high enough to inject aerosols. Robock calculated that getting a billion tonnes of sulphur up to the stratosphere would take just three flights a day by each plane in a nine or fifteen plane squadron (nine if you use KC-10s, which are basically LD11 TriStars, fifteen if you use KC-135s, derived form the original design of the Boeing 707; plane spotting interlude ends here). That represents a purchase price of a billion or so and operational costs of well under $100 million.

If you want to take the sulphur higher, Robock says, think about F15-C Eagles (now we're talking...). With the smaller planes you need something more like a whole wing than a squadron -- 167 planes doing three flights a day. That's a purchase cost of about $6 billion, and an ops cost more like a billion a year.

As David Keith of the University of Calgary points out, though, no serious geoengineering scheme would really do this. Among the many hurdles such a scheme might face, designing planes optimised to its needs rather than buying them off the peg (or at the Air Force surplus store) is a no-brainer. For an example of the sort of thing you might go for, Keith points to the White Knight Two, a jet which will be put to use hauling Virgin Galactic's SpaceShip 2 up into the stratosphere before disengaging so that the spacecraft's rockets can take it up into space. White Knight Two is a lot less noisy and environmentally obnoxious than an Eagle, gets higher into the stratosphere and carries more cargo. If you want a sulphur deliverer, start from something like that and ask designer's like White Knight 2's Burt Rutan to optimise it for the task at hand.

Not all geoengineering requires aircraft. John Latham of NCAR has long touted a scheme for making the clouds over the ocean thicker and more reflective by kicking up particles of sea salt that will cause more droplets to form in them. He and his colleagues think that if you could build a specialist sea-salt-kicking-up ship

every week, for a cost of a maybe three million dollars, that would be enough to offset that week's carbon emissions. So you need a fleet that grows at a rate of about 50 ships a year.

But Daniel Rosenfeld of the Hebrew University, Jersualem, who has devoted his life to studying various forms, thinks that might be overkill. According to his analysis, if you pick the right places to seed the clouds (he didn't call them tipping points, and neither will I, but the idea is not dissimilar) you could create enough added reflection to counterbalance two degrees of global warming with just 50 specially designed fast hydrofoils. That would be cheaper than the cheapest aircraft option, for a far more powerful effect.

None of this, as Robock in particular is keen to point out, means that a schemes that made use of such techniques would work as advertised and be a good idea. There may well be all sorts of other reasons why such schemes are a bad idea. But there do seem to be some pretty low cost options around.

Posted by Oliver Morton on December 19, 2008 08:04 PM | Permalink

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Comments

Our management of water is very important. There is no reason why we should allow huge volumes of water to flop down and flow unimpeded across farms down stream, destroying them, while adjacent areas shrivel up by drought. There are huge pumps that can easily prevent this.
Increase in atmospheric carbon dioxide is undoubtedly increasing climate warmth. However I suspect that also an equally great affect on warmth is the baring of soil by increase in annual crop acreage, roads, buildings, grazing, and desertification currently, especially in the tropics. You may see an article that briefly discusses this in more detail in http://charles_w.tripod.com/climate.html .
I see no reason why many climate water problems can not be much ameliorated by intelligent management of water both before and after the water reaches the soil, including pumping it into water tables through clean gravel filled deep holes.

Posted by: Charles Weber | December 27, 2008 07:09 PM