Would you swap climate change for acid rain?

John Abbot

'Climate change is happening so quickly that mankind may need to pump sulfur into the atmosphere to survive', argued Tim Flannery, 2007 Australian of the Year, in May. Flannery has suggested the sulfur be dispersed by jet fuel as a last barrier against climate collapse and that this would change the colour of the sky purple.

He conceded, however, there were risks.

But following Flannery's predictions would be reckless—his 'purple sky' strategy to tackle climate change would be a dangerous and highly expensive solution to an uncertain problem.

Deliberately introducing sulfur into the stratosphere would be an example of geo-engineering to mitigate global warming. Geo-engineering describes 'technological efforts to stabilise the climate system by direct intervention with the energy balance of the earth'.

The recent report on climate change from Ross Garnaut referred to a range of other geo-engineering proposals, including cloud seeding, and fertilisation of the ocean with iron and nitrogen to increase carbon sequestration.

The idea of artificially cooling the

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planet by introducing sulfur compounds into the stratosphere is not new. It dates back several decades, and was developed by Nobel laureate Paul Crutzen, and others, including Edward Teller, who originated the concept behind the hydrogen bomb.

There are reasonable scientific grounds to believe that a cooling effect could result from pumping sulfur into the air—introducing an artificial sulfate aerosol layer in the lower stratosphere would reflect solar radiation. Indeed, it has occurred a number of times in recent history from natural forces.

It has been estimated that eruption of Mount Pinatubo June 1991 injected some 10 Tg (teragrams) of sulfur into the tropical stratosphere. The enhanced reflection of solar radiation caused by the sulfur particles cooled the earth's surface on average by 0.5 degrees Celsius in the year after the eruption.

According to a 2006 paper in the journal *Climate Change*, the annual cost of deploying an effective amount of sulfur (about 1 Tg) into the stratosphere to achieve cooling would be in the range of $US25–50 billion.

But even that estimate could be low. In line with some other bulk commodities, the price of sulfur has in fact soared from $US50 per tonne a year ago, to $US800-900 per tonne now. So, it might now cost in excess of $US50 billion annually to cool the planet with sulfur—about 5 per cent of the current annual global military expenditure, and this is only if the current price of sulfur remains stable.

Increased demand for sulfur would further exacerbate price rises, particularly for sulfuric acid, which is already used for the manufacture of fertilisers, such as superphosphate.

And it is uncertain how long any cooling effect from the injected sulfur would last. Estimates based on studies of clouds of radioactive debris from atmospheric testing of nuclear weapons in the 1950s and 1960s suggest residence times of between 10 and 16 months for the aerosol particles.

Indeed the sulfur must eventually come down. It will be as droplets of sulfuric acid—like a dilute acid rain.

Over recent decades the developed world has gone to great lengths to get rid of the acid rain problem—petroleum refiners like Caltex in Australia have been forced to spend ten of millions to get sulfur out of our petrol and diesel. New Australian regulations limit the maximum amount of sulfur in diesel to 50 parts per million, down from 500 parts per million.

AAPimage | Greg Wood

Tim Flannery, 2007 Australian of the Year.

Flannery's idea of purple skies should definitely remain just that—an idea.

But still each year globally, 70 Tg of sulfur comes from fossil fuel (coal and oil) combustion and industry.

Other potential risks from Flannery's sulfur proposal include depletion of ozone and a decline in global rainfall while having no effect on ocean acidification because the atmosphere would still have high concentrations of atmospheric carbon dioxide.

Destruction of the ozone layer was of major environmental concern in the 1980s. The ozone layer is important because it blocks dangerous ultraviolet radiation from the Sun and sulfur can destroy ozone. The El Chich´on volcanic eruption in 1982 injected 3–5 Tg sulfur, destroying about 16 per cent of local ozone at 20 km altitude. After the Mount Pinatubo eruption the loss of global ozone was about 2.5 per cent.

There is good evidence that global temperatures have increased since the beginning of the last century, but there remain uncertainties in defining the contribution of man-made emissions to this warming and its impact on the planet. Given the dollar cost, transient nature and real potential risks of injecting sulfur into the stratosphere, Flannery's idea has rightly not been developed in detail by the government's climate change advisor, Ross Garnaut.

The album *Purple Rain* is ranked amongst the best in rock and roll history—a real musical experience—but Flannery's idea of purple skies should definitely remain just an idea.

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