

The Geoengineering Conundrum: A SOCAN Perspective
Alan Journet, Co-facilitator, Southern Oregon Climate Action Now
alanjournet@gmail.com; 541-301-4107. Updated April 22nd, 2019

The specter of geoengineering as a response to the climate crisis has been raised in a number of contexts. There is much confusion regarding the multiple issues embedded in the reference to Geoengineering discussion in relation to Greenhouse Gas (GHG) emissions and atmospheric concentration. The goal of this discussion is to identify the issues briefly, and offer recommendations.

Geoengineering defined: consensus definition seems to be along the lines of - “a deliberate large-scale manipulation of an environmental process that affects the earth's climate, in an attempt to counteract the effects of global warming.” At its most benign and positive level, this would mean planting trees to capture and store carbon from the atmosphere but at its most alarming, it involves modifying (reducing) incoming solar radiation to reduce the warming effect. Prior to our awareness of global warming and its causes, humans have been engaged in many efforts that influenced local climate and regional habitability (the combination of deforestation and climate change probably influenced the residency of the Anasazi - the ancient ones - in the four corners region of the U.S. and may have contributed to diminution in the Fertile Crescent) to the creation of dams and huge reservoirs. Thus, in its broadest sense, geoengineering is nothing new.

1) The Chemtrails Concoction

For several years there has existed an active grassroots array of groups, including individuals of an array of backgrounds and political philosophies from left to right, who seem to have accepted an argument from the standard right wing anti-science, anti-government forces of the Tea Party, that someone (the culprit seems variably to be identified as ‘the illuminati,’ corporations, the military, or the gov’mint) has overtaken our fleet of commercial (and military) aircraft and fitted them with chemical spray capacity. What chemicals they are spraying seems to be variously identified and the purpose equally as varied. But the main evidence presented to support this claim is that occasionally we see (much photographed) extensive crisscrossing patterns of aircraft contrails in the sky.

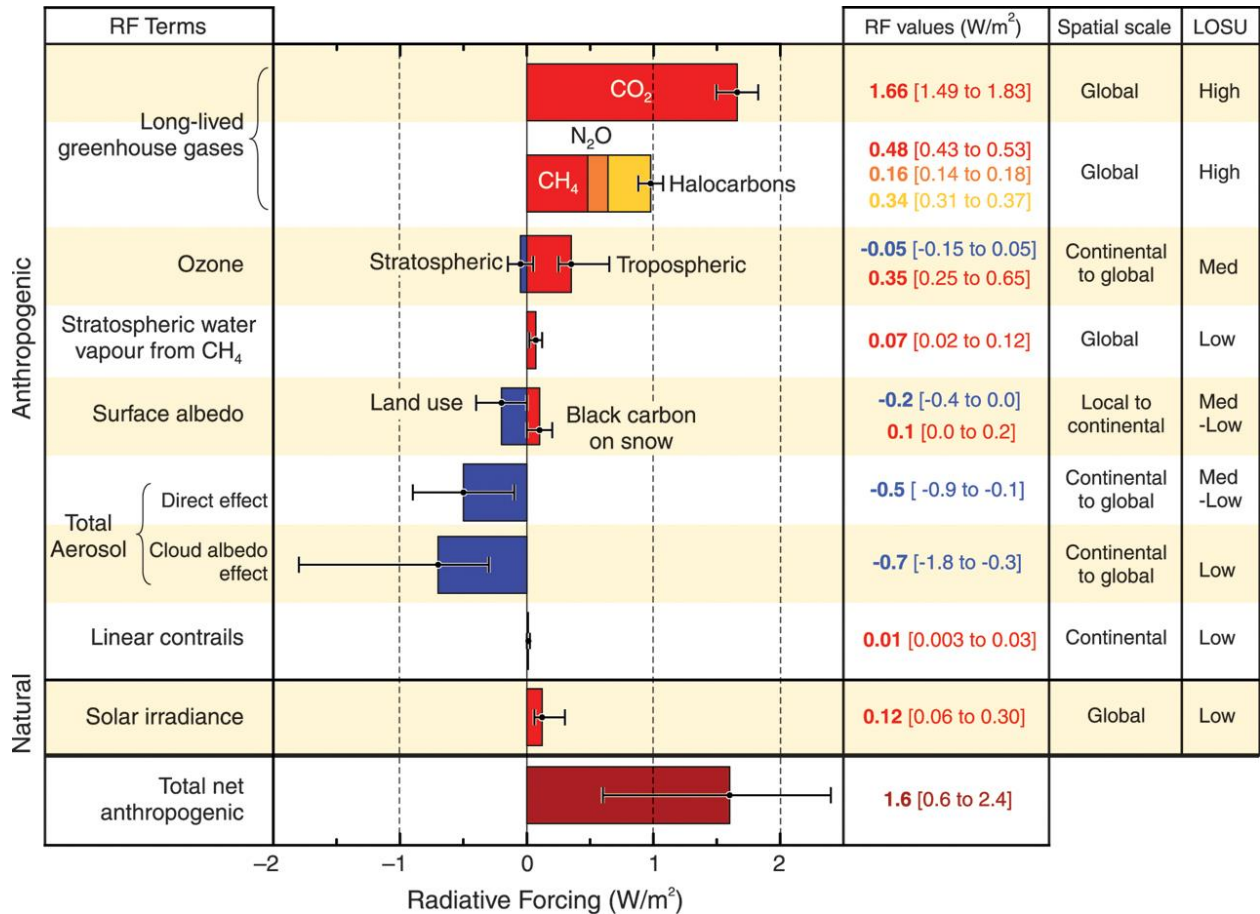
What proponents of this argument seem to ignore is the following: aircraft contrails are produced when jet aircraft fly at high altitude because the water vapor that is emitted from the engines crystallizes in the cold air upon expulsion - and thus we see the white contrails. When the upper atmosphere - where the aircraft are flying, is cold and moist, these contrails may persist for extended periods of time. When the upper atmosphere is relatively warmer and dryer, they dissipate rather quickly.

Over the decades, the number of aircraft flying has increased and the elevation at which they fly has risen. The result, inevitably, is that we see more of these contrails than was evident years/decades ago. While they are not spraying toxic chemicals, these aircraft contrails are not totally benign. As we can frequently see, they sometimes expand, dissipate, and form a thin cirrus cloud layer.

The cloud layer (albedo) so-formed has a dual effect on global warming. On one hand - it reflects in coming visible light back out into space, thus reducing the amount of incoming visible light energy that reaches the earth’s surfaces and radiates back outwards as longer wavelength

heat energy. This has a cooling effect. On the other hand, the cloud layer also has the effect of trapping outgoing heat radiation thus causing warming. We can personally verify this principle since winter days with clear skies are generally cooler than those with cloudy skies.

Figure 1. Positive (red) and negative (blue) temperature effects of various factors. From 2007 IPCC Report.



The overall impact of aircraft contrails, as assessed by the Intergovernmental Panel on Climate Change, is depicted in Figure 1 from the 2007 IPCC report (IPCC AR4 2007 Synthesis Report; Fig 2-4): The category 'Linear contrails' identifies the net effect as one of a slight (but very slight) warming, but the extent of the effect is almost inconsequential compared to the effect of greenhouse gas emissions (some of which, admittedly, come from aircraft combustion of fossil fuel).

Another problem with aircraft combustion is lead. "Most commercial airplanes use unleaded jet fuel. But piston-driven aircraft – generally small propeller planes – use aviation gasoline ("avgas"), which contains lead to prevent a chance of sudden engine failure."

(<https://journalistsresource.org/studies/environment/pollution-environment/plane-lead-fuel-emissions-economic-impact/>). These, however, are probably not the high-altitude aircraft that produce contrails.

Like so many conspiracy hoaxes - which are based on the misinterpretation of a grain of truth, the above had spawned an entire passionate group of concerned citizens to become convinced that someone is using aircraft to spray toxic chemicals on us. The problem is that these claims

are based on anecdote and fraud. The anecdotes include the claim from pilots or fliers that they saw an aircraft spraying some brown chemicals as they approached an airport. What this claim misses is the likelihood that such aircraft are returning to an airfield due to a problem and have to discharge fuel before landing - since to do otherwise would produce a fire hazard. The fraudulent evidence includes images of USFS fire retardant sprayer aircraft with tanks and pipes for spraying their retardant that are displayed as evidence of the chemtrail sprayers. This fraud also includes images of prototype aircraft where the weight of passengers is replaced by tanks. Finally, and interestingly, what the proponents of chemtrails often provide as evidence is the analysis of western U.S. soils (CA and Siskiyou, for example) which have a high concentration of toxic chemicals. What they are missing is that these soils are derived from serpentine rock - which is inherently rich in toxic chemicals.

Unfortunately, governments have been demonstrated to engaged in a sufficient number of seriously questionable anti-social and anti-environmental activities over the years (many shrouded in secrecy) that it is tempting to accept claims of yet another instance of such behavior. The catch is that we have to apply logical analysis to the claims and research the supporting evidence before jumping on the band-wagon.

The point here is that when we consider the arena of geoengineering, we have to be careful about what the subject really is. This particular issue - the chemtrails issue - which has recently been sanitized under the heading 'geoengineering,' can be safely dismissed as the concoction of a force of anti-science, anti-government conspiracy hoax purveyors similar to the Barack Obama 'birthers.'

2) The Climate Intervention Discussion

It has been recognized for some years that public acceptance of the science of global warming and its climate change consequences, particularly in the United States, has been slow to develop. The U.S. has consequently not been the global leader in reducing emissions that it could have been. One broad result is that we are not, globally, making the strides towards reducing greenhouse gas emissions that we know are needed. The 2018 IPCC report that indicates the need for a 45% reduction on 2010 emissions by 2030, and the achievement of net zero emissions by 2050 if we are to limit warming to 1.5°C above pre-industrial revolution (late 18th C) levels underlines this collective failure.

One consequence of recognizing this failure has been discussion in many circles of the need and possibility to develop technological solutions to the problem - solutions that would either reduce warming or capture greenhouse gases from the atmosphere. The two main techniques that have been proposed are (a) Solar Radiation Management and (b) Carbon Dioxide Reduction. Among the entities exploring these solutions was the National Academy of Sciences that released evaluations of these in 2015 under the collective heading 'Climate Intervention.' They released a report on each of the above approaches and a summary (<https://nas-sites.org/americasclimatechoices/public-release-event-climate-intervention-reports/>). It should be noted that the last of these started with the statement: "Climate intervention is no substitute for reductions in carbon dioxide emissions and adaptation efforts aimed at reducing the negative consequences of climate change. However, as our planet enters a period of changing climate never before experienced in recorded human history, interest is growing in the potential

for deliberate intervention in the climate system to counter climate change.” Thus the discussion of these techniques is predicated on the view that reducing emissions is the best approach.

The Royal Society of London also engaged in an analysis of geoengineering producing a report in 2009 (<https://royalsociety.org/topics-policy/publications/2009/geoengineering-climate/>). The Royal Society concluded, among other items (note this comes from an earlier time when targets were less rigorous):

“Parties to the UNFCCC should make increased efforts towards mitigating and adapting to climate change and in particular to agreeing to global emissions reductions of at least 50% on 1990 levels by 2050 and more thereafter” , “CDR and SRM geoengineering methods should only be considered as part of a wider package of options for addressing climate change. CDR methods should be regarded as preferable to SRM methods” and “The Royal Society, in collaboration with international science partners, should develop a code of practice for geoengineering research and provide recommendations to the international scientific community for a voluntary research governance framework.”

2 a) Solar Radiation Management (SRM)- The Pinatubo Solution

Just as the albedo of clouds reflects back into space incoming solar radiation in the visible range (the prime driver of global warming), so can other materials in the upper atmosphere. For example, the main contribution of volcanoes to global temperature is that they emit aerosols (droplets and particles) into the upper atmosphere that reflect incoming visible wavelength radiation and cause cooling. Understanding of this principle has led some individuals to suggest that we could counter global warming by inserting such materials into the upper atmosphere and reflecting incoming radiation back into space. While theoretically, this is a reasonable argument, it has many drawbacks:

- 1) in order to be successful, we would have to have a good sense of exactly how much aerosol mix we'd need to deposit in the atmosphere to have given cooling response,
- 2) by stimulating cooling, it is likely that this technology would create the illusion that we can continue business as usual with ongoing fossil fuel use and GHG emissions,
- 3) while this approach might induce global cooling, it would do nothing to reduce the emissions of carbon dioxide into the atmosphere which is the primary cause of ocean acidification - so this problem would likely be exacerbated,
- 4) reducing incoming visible radiation may reduce photosynthetic productivity - undermining both natural ecosystems and agriculture,
- 5) reducing incoming radiation will also reduce the effectiveness of photovoltaic systems thus undermining our sane efforts to address global warming,
- 6) it is difficult to predict what other collateral damage might be caused by inserting aerosols into the upper atmosphere,
- 7) there is some evidence that substantial precipitation changes will occur, causing droughts and floods around the world; the location of these impacts seems to depend on where the aerosols are released,

- 8) if, at some stage, we stop the injection of aerosols into the upper atmosphere, we will suffer the sudden warming caused by the accumulated greenhouse gases emitted during the project.

Sensibly, the NAS report concluded: "Albedo modification at scales sufficient to alter climate should not be deployed at this time."

2 b) Carbon Dioxide Reduction (CDR)

As a result of the combination of its concentration in the atmosphere and its warming potential (mainly the former), the dominant greenhouse gas is certainly carbon dioxide. It is tempting, therefore, to consider promoting a technology that would capture CO₂ from the atmosphere and thus reduce its concentration and warming impact. This, of course, is exactly what we encourage when we promote forest growth and health and encourage regenerative agriculture that returns CO₂ from the atmosphere to the trees and the soil. Indeed, these are encouraged in the NAS analysis. Additional techniques include fertilizing oceans with iron to encourage plankton growth that will capture the through CO₂ photosynthesis. Regrettably, the plankton will also die, decay, and release the CO₂ back into the ocean and atmosphere. Other options include engineering techniques that can capture the CO₂ and store this in a solid form that could be stored (underground, for example). Unfortunately, no commercially viable mechanisms have yet been developed that could perform such extraction in high enough volume to have a meaningful impact.

This approach has few of the drawbacks associated with Solar Radiation Management, but still requires that we be careful about the energetic needs of any engineering approach - particularly considering from where that energy comes (renewable sources versus burning fossil fuels, for example).

Recent reports (https://www.washingtonpost.com/climate-environment/2019/04/19/climate-change-solution-slowly-gains-ground/?noredirect=on%26utm_term=.0d7050f2894a&utm_term=.320a9f4ff6e6) suggest that three companies (Carbon Engineering,, Climeworks, and Global Thermostat), think they can capture carbon dioxide profitably. The claim is that the cost has fallen from \$600 to \$100 a ton and could be lower with cheaper energy. With a new Federal credit (the 2018 federal budget) of \$50 a ton of CO₂ captured and stored underground, this is becoming viable. One downside is that the captured CO₂ may be used to assist the extraction of more fossil fuel, which garners an addition \$35 boost for enhanced oil recovery funds through what appears to be fracking.

Summary

In order to engage in a rational conversation about geoengineering, it is important to understand what the subject really is. If the subject is 'chemtrails' we can dismiss that as nonsense. However, if it's one of the Climate Intervention Techniques, we should consider the proposal carefully. Solar Radiation Management seems fraught with entirely too much hazard than it's worth, while Carbon Dioxide Reduction has, depending on the specifics, considerable promise as an assist. Indeed, almost all Global Warming solutions incorporate the notion of promoting forest and/or agricultural sequestration of CO₂.

Naomi Klein, in "This Changes Everything," expanded in "The Shock Doctrine" argues that proponents of free market capitalism exploit natural crises to push through and gain acceptance for controversial policies that would not be accepted in less tense times. In the former book, Klein discusses this doctrine in relation to geoengineering expressing the concern that when global warming and its climate change consequences present humanity with desperate enough a situation and our survival is clearly at risk, questionable programs such as the Pinatubo Solution might be broadly accepted by a frightened public.

It is evident from their analyses, that both the U.S. National Academy of Sciences and the Royal Society of London have doubts about the efficacy and ethics of geoengineering.