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Fixing the Sky: The Checkered History of Weather and Climate Control

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In 1842, the American popular magazine writer Eliza Leslie wrote a story entitled ?The Rain King, or a Glance into the Next Century?, which was published in *Godey?s Lady?s Book* (p. 58). Looking forward to a fictional 1942, Leslie portrayed the so-called Rain King offering weather on demand to the residents of the Philadelphia area. Unfortunately for the Rain King, the people of southeastern Pennsylvania could not agree on the weather they wanted: washerwomen, for example, demanded fair weather, while umbrella makers wanted rain. Swayed by the demands of a high-society matron, the Rain King decided to make rain. But when the rain came it satisfied nobody: what had previously been a question of natural chance now aroused widespread suspicion. Finding himself increasingly unpopular, the Rain King fled on a steamboat to China, refusing to give up on his pathological ambition to control the climate.

James Rodger Fleming?s *Fixing the Sky* is a history of human folly on a grand scale, a Rain King writ large. Ranging widely, the book documents humanity?s varied attempts to control the climate from the classical era to the present. The book is replete with stories and anecdotes similar to Eliza Leslie?s prescient morality tale, as people at various times and in various places have sought to take up the reigns of Prometheus and fix the sky. Cannon are fired into clouds to prevent hail, chemical concoctions are used to attract rainclouds, 50,000 mirrors of 40 square miles each are launched into space to reflect incoming sunlight and cool the

earth. One of the book?s most powerful arguments for human folly is in its artful blurring of fact and fiction: schemes that appear well suited to the outer realms of science fiction turn out to be found in recent government policy documents (the idea for launching mirrors into space comes from a 1992 National Academy Report entitled *Policy Implications of Global Warming*) (p. 244). As yesterday?s fantasy becomes today?s reality, Fleming views this history as a mixture of comedy and tragedy (p. 9).

Fleming?s concerns about the viability of geo-engineering stem not from an anti-technology Luddism, but from a healthy respect for the complexity of the atmospheric system. In a succinct definition of ?climate? and ?weather? in the introduction, Fleming cites the meteorologist Harry Wexler in noting ?if you change the weather repeatedly on a large spatial scale, you are changing the climate, and vice versa? (p. 7). The history of atmospheric geo-engineering that this book presents is full of unintended consequences. Making rain in one place runs the risk of manufacturing drought in another, and there is often little sense of real control in human attempts to fix the sky. In August 1952, for example, a tragic flood in the town of Lynmouth in the southwest of England killed 35 people (p. 161). Although denied by authorities, there are suspicions that a British government cloud seeding project, variously known as Operation Cumulus or Operation Witch Doctor was partially responsible for the six-to-nine inches of torrential rain that caused the flood. William Studdard Franklin, a physics professor at MIT in the early 20th century believed that small actions taken in controlling the atmosphere could have significant consequences, and thought that this observation could be used to control the weather through ?small amounts of judiciously placed energy? (p. 84). Others might be less excited about causing what Franklin called ?atmospheric collapse? through the triggering of unstable equilibrium processes.

Another problem with climate engineering stressed by Fleming is its lack of viability. The reality of climate engineering in 1942 was not quite as Eliza Leslie had imagined one hundred years earlier, but the ambition to control the weather certainly existed. During the Second World War, British scientists developed a means of clearing fog from military airbases to permit take offs and landings during foggy weather. The somewhat primitive system, known as Fog Investigation and Disposal Operation (FIDO), simply burnt vast quantities of fuel around the edge of the runways to raise the temperature and lift the fog (p. 132). The system worked, and provided Allied airmen with safer takeoffs and landings in adverse weather conditions. But it worked at a cost. To land one plane using FIDO required 6,000 gallons of gasoline, at least 300 times more than the plane itself required to land. Over the course of the two and a half years in which FIDO was in operation, 30 million gallons of gasoline were burned around the edge of British runways at an estimated cost of £44,500 an hour. Such wastefulness could only be justified in a wartime situation and at the end of the war, the British abandoned FIDO. Within its very limited scale, FIDO could be described as a successful weather modification project, but the success was unsustainable: beyond the special circumstances of war, the ends simply could not justify the means. Such questions of feasibility hang over all climate-engineering projects. As yet, few, if any, have passed the test.

Yet another problem brought up by Fleming with historical attempts to ?fix the sky? is the prevalence of charlatans. In one of the most entertaining sections of the book, chapter three examines the history of the ?Rain Fakers? who, for a price, have offered their weather-making services to the public. The stories in this chapter are populated by fascinating characters, such as Charles Hatfield, described by Fleming as ?a charlatan?s charlatan.? In the first three decades of the 20th century Hatfield traveled around the United States, Mexico, and Canada with special towers full of chemicals which, he claimed, attracted moisture. Unsurprisingly, the period just before a rainy season seems to have been a popular time for most charlatans to sell the ability to make rain. Fleming is very good at exploring the motivations of the people paying for weather: there was a certain precariousness to agricultural life in the late 19th and early 20th centuries, for example, that led communities to take chances on the claims of weather-makers that a more secure society may have laughed at. On the other side of the story, Fleming could perhaps have made more of the question of whether or not the quacks and hucksters really believed what they were doing? Did it even matter what they believed? The material included in this chapter and the questions it raises could easily make a fascinating book in themselves.

A lesson that weather charlatans could have learned from medicine doctors of the Mandan Indians of the

Upper Missouri River is simply to keep trying until rain comes (and then if you are wise, bask in your success and don?t try again) (p. 22). This raises the interesting question of causation in the past, present, and future of atmospheric geo-engineering. If a rainmaker says it is going to rain, and then it rains, can it ever be said that the rainmaker caused the rain to happen? We would almost certainly answer no. But when it comes to more complex claims about fixing the sky ? claims that may involve science, technology, and mathematical modeling that potentially go beyond the ability of any single individual to comprehend fully ? we are perhaps more willing to accept claims for causation that may not be possible to substantiate. By including an extensive discussion of weather charlatans along with other more ?scientific? attempts to fix the sky, the result is that the whole enterprise seems to have a whiff of charlatanism about it. This would seem to be an intentional and legitimate criticism of geo-engineering projects that may make claims for effectiveness that go beyond their ability to prove.

As the book progresses it gets progressively darker as Fleming describes the connection between weather control and warfare. Chapter five, ?Pathological science,? examines Irving Langmuir?s work on weather control at the General Electric Corporation. In relation to Langmuir?s work on cloud seeding, Fleming accuses the Nobel laureate in chemistry of ignoring his own warnings about pathological science, ?the science of things that aren?t so? (p. 137). In the 1940s and 1950s, General Electric claimed that it could make snow and even control hurricanes. Between 1966 and 1972, attempts to modify the weather were infamously used by the United States in the Vietnam War (p. 179). The so-called Operation Popeye attempted to seed clouds to increase the rainfall over the Ho Chi Minh Trail, and make life more difficult for the Viet Cong. In 1972, the threat of repetitions of episodes such as this led to the United Nations developing a Convention on the Prohibition of Military or Any Hostile Use of Environmental Modification Techniques (ENMOD), which was opened for signature in May 1977, and which came into force in October 1978. Many environmentalists, however, saw ENMOD as a deeply flawed Convention since it did not prohibit research and development of weather modification. The US military liked the fact that it kept options open.

As Eliza Leslie realized as early as 1842, perhaps the one thing that can confidently predicted as a consequence of atmospheric geo-engineering is that it creates a sense of agency where previously there has only been chance. In the preface, Fleming describes an experience he had when working on cloud research flights with the National Center for Atmospheric Research near Leadville, Colorado (p. xii). One evening the local police informed the researchers that a Molotov Cocktail had been thrown into the hangar by locals who had mistaken their activities for cloud seeding, or ?stealing the sky water.? If people in Colorado became sufficiently upset by the prospect of weather modification to fire-bomb a research aircraft, the consequences of such sentiments on a global scale could be catastrophic. Of all the arguments advanced by Fleming about the folly of climate and weather control, this seems to be the strongest. The prospects for the global community deciding upon an ?ideal climate? that suits everyone would seem to be even more remote than the possibility for finding a workable mechanism for fixing the sky. The most likely scenario would seem to be that those countries with the necessary technological capabilities would decide for themselves where to set the thermostat. The unintended consequences of these decisions could be more devastating than the problems that they are intended to fix.

Due to the nature of its subject, *Fixing the Sky* is more than just a fascinating work of history. As Fleming knows all too well, plans for geo-engineering the climate are being discussed at the highest levels of government as potential solutions to the ?problem? of global climate change.(1) In a world that appears increasingly resigned to continued and increasing greenhouse gas emissions (at least in the short to medium term), policy makers face stark choices. In comparison with the economic and political difficulties of reducing carbon dioxide emissions, and the uncertainty and expense of adaptation to climate change, geo-engineering appears to some to offer a ?quick fix? to cool the planet.(2) A few thousand mirrors in space (to reflect solar radiation), a handful of particulates pumped into the stratosphere (to reflect or intercept sunlight), and a little iron in the oceans (to encourage the growth of carbon sequestering phytoplankton), might seem to provide a neat recipe for ?business as usual?. But this is a recipe that is clearly not to Fleming?s taste.

Near the beginning of his introduction, Fleming notes that the book ?is an extended essay arguing for the

relevance of history?. The fact that this history deals with one of the most pressing issues facing humanity at the current time raises the question of how historians should engage with contemporary issues and debates. Such a question is as old as the discipline of history itself. Does Fleming?s hostility to ?fixing the sky? shape the way he writes history? Or does the history itself shape Fleming?s hostility? The more immediate the issues involved, the more pressing these questions become. In answer to the first question, the book is clearly influenced by the author?s antipathy towards weather and climate modification. As noted above, the inclusion of a chapter on ?Rain Fakers? has the consequence of giving the whole geo-engineering enterprise a quite appropriate sense of hucksterism. But there is no suggestion that Fleming lets his argument interfere with the evidence. The inclusion of rare examples of climate modification ?success stories?, such as the British wartime FIDO project, demonstrate a balanced and scholarly approach throughout the book.

The more interesting question is how the history of weather and climate modification can shape present discussions about geo-engineering fixes to climate change. The history of weather and climate modification ? with example after example of hubris, charlatanism, and unintended consequences ? has clearly shaped Fleming?s views, and will most likely influence the opinions of readers of this book. But will would-be climate engineers be swayed by a litany of past errors? One likely response is that the history of climate engineering will simply encourage climate fixers to try a little harder, think bigger and assert more control: simply because atmospheric geo-engineering has not always worked in the past, they might argue, does not mean that it cannot work in the future. As Fleming repeatedly shows, weather-makers are seldom known for their humility. Past failures may, in fact, serve as a provocative challenge for future endeavor.

The most powerful arguments that *Fixing the Sky* raises against atmospheric geo-engineering are in the questions it raises. What might the unintended consequences be? How do we know that weather or climate modification has been successful? Is it economically and environmentally feasible? What are the potential military applications of these technologies and the consequent geopolitical implications? And, perhaps most importantly, with which country, corporation, or organization does the responsibility for fixing the sky lie? These are questions that Fleming?s book bring to the fore, but which are not necessarily present in all the technocratic discussions about atmospheric geo-engineering that are taking place in response to climate change. These questions bring culture, politics, philosophy, theology, economics and other humanistic disciplines into the center of discussions of atmospheric geo-engineering. And these human dimensions may ultimately be impossible for even the most ambitious Rain King to control.

Fleming?s book opens the way for further historical studies of weather and climate modification. The history presented in *Fixing the Sky* is largely, although not entirely, a Western story. A wider range of examples, drawn perhaps from African, Asian, and Latin American histories of weather and climate modification, might add a new set of questions to the list raised by Fleming?s book. The global nature of climate engineering makes a global approach to the subject imperative. An acceptable practice for one culture in terms of tinkering with the weather and climate may not be acceptable to another. Such considerations can only add to the unintended human consequences of atmospheric geo-engineering, and ought to feed into policy debates. As Fleming?s work demonstrates, there is plenty of material for historians to deal with in relation to this subject. The history of human attempts to control the weather and climate not only make wonderful history, but also has a crucially important role to play in contemporary debates about fixing the sky.

Notes

1. For an excellent discussion of the ?problem? of climate change see M. Hulme, *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity* (Cambridge, 2009). Back to (1)
2. Recent works discussing geo-engineering include Jeff Goodell, *How to Cool the Planet: Geoengineering and the Audacious Quest to Fix Earth's Climate* (Boston, MA, 2010), Eli Kintisch, *Hack the Planet: Science's Best Hope ? or Worst Nightmare ? for Averting Climate Catastrophe* (Hoboken, NJ, 2010).Back to (2)

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