

Ethics of Nuclear Winter and Climate Intervention (Geoengineering) Research and of Making Policy Recommendations

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Abstract

There are many ethical issues that come up in geoscience research, and here I use my own experience to illustrate two of them. Ethics, unlike science, is based on values and not testable hypotheses. My values include justice and sustainability for all rather than increasing wealth for a few. One of the most important ethical issues is choosing what topics to research. In 1982 when I first heard about nuclear winter, I started work in that area. Soon thereafter, Presidents Reagan and Gorbachev ended the nuclear arms race, informed by matching scientific results from both US and Russian scientists. I continue to work in this area, because the greatest threat we pose to ourselves remains nuclear war, and the world still has enough weapons to produce nuclear winter. I think the second greatest threat is global warming. I do research on proposed interventions such as creating a cloud in the stratosphere to mimic large volcanic eruptions, which, if it proves to be technically feasible, could reduce some of the impacts of global warming. But this technique, sometimes called solar radiation management (SRM), would come with many risks. I have been working in this area for the past decade to try to better understand the potential benefits and risks, so that society, if it is tempted to consider SRM in the future, will be able to make an informed decision. I continue to work on the impacts of volcanic eruptions on climate, so we can better separate natural from anthropogenic impacts on climate, and so that we can have better seasonal forecasts after the next large eruption. I have stopped working on soil moisture, as I do not find it as ethically compelling, and I only have time for so many topics. Another ethical issue is whether to communicate policy recommendations. If you are seen to advocate a particular policy, will it tarnish your reputation as a scientist? I say, as long as you make your values clear, who better to make policy recommendations? You are the most knowledgeable on the subject. So I say that the US needs to sign the 2017 UN Treaty on the Prohibition of Nuclear Weapons, to save us and the world from nuclear annihilation. I say that the US needs to get back into the Paris Accords and increase our pledge to rapidly eliminate our greenhouse gas emissions, to save us and the world from environmental catastrophe. This is the behavior of an ethical scientist.

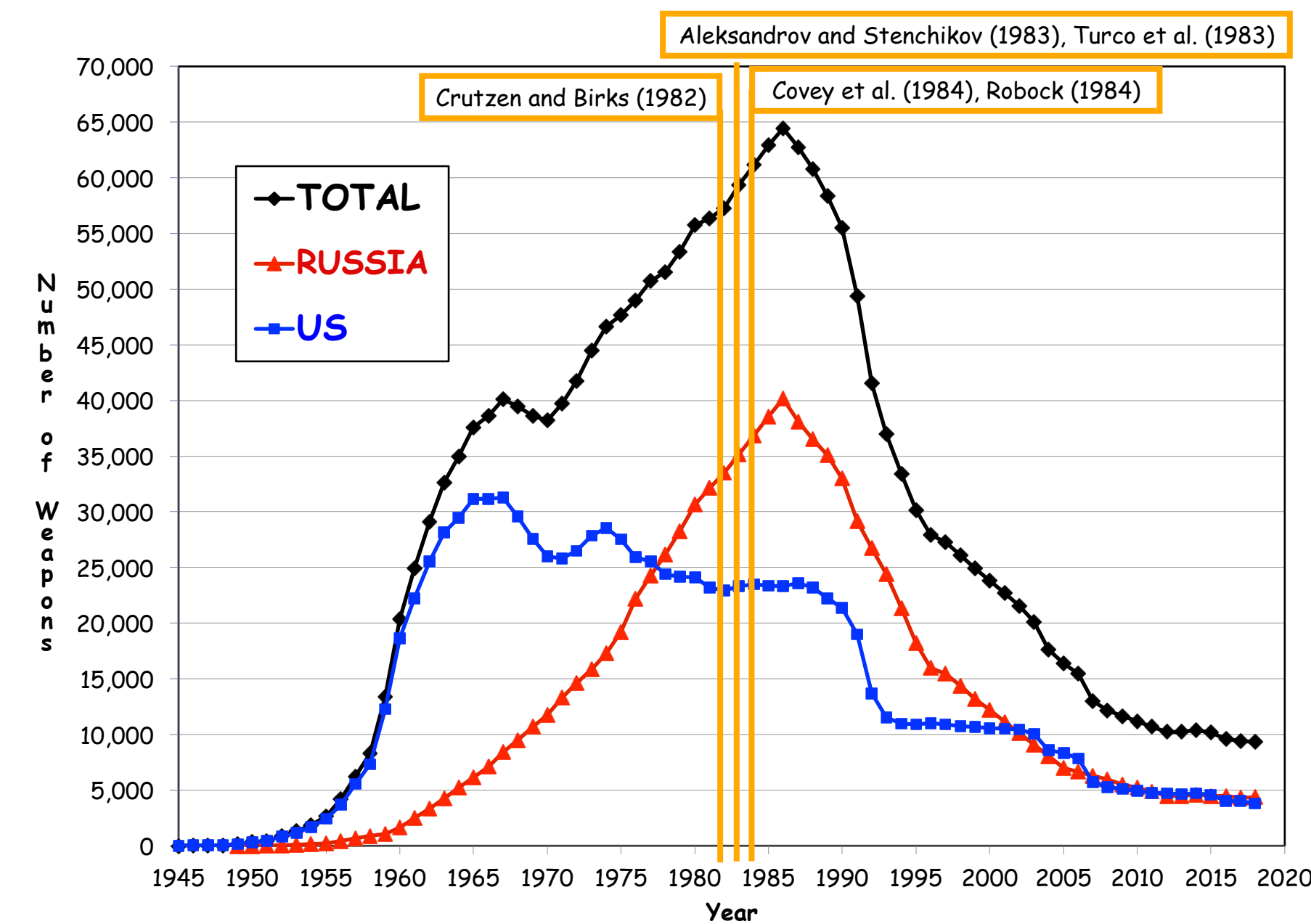
Ethics of Nuclear Winter and Climate Intervention (Geoengineering) Research and of Making Policy Recommendations

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Abstract. There are many ethical issues that come up in geoscience research, and here I use my own experience to illustrate two of them. Ethics, unlike science, is based on values and not testable hypotheses. My values include justice and sustainability for all rather than increasing wealth for a few. One of the most important ethical issues is choosing what topics to research. In 1982 when I first heard about nuclear winter, I started work in that area. Soon thereafter, Presidents Reagan and Gorbachev ended the nuclear arms race, informed by matching scientific results from both US and Russian scientists. I continue to work in this area, because the greatest threat we pose to ourselves remains nuclear war, and the world still has enough weapons to produce nuclear winter. I think the second greatest threat is global warming. I do research on proposed interventions such as creating a cloud in the stratosphere to mimic large volcanic eruptions, which, if it proves to be technically feasible, could reduce some of the impacts of global warming. But this technique, sometimes called solar radiation management (SRM), would come with many risks. I have been working in this area for the past decade to try to better understand the potential benefits and risks, so that society, if it is tempted to consider SRM in the future, will be able to make an informed decision. I continue to work on the impacts of volcanic eruptions on climate, so we can better separate natural from anthropogenic impacts on climate, and so that we can have better seasonal forecasts after the next large eruption. I have stopped working on soil moisture, as I do not find it as ethically compelling, and I only have time for so many topics.

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History of Nuclear Warheads



The nuclear arms race ended because U.S. and Russian scientists agreed that there would be nuclear winter if their countries had a nuclear war, and informed their leaders.

Ronald Reagan:



When asked about the effects of nuclear war in a February 12, 1985 interview in the *New York Times* said,

"A great many reputable scientists are telling us that such a war could just end up in no victory for anyone because we would wipe out the earth as we know it. And if you think back to ... natural calamities - back in the last century, in the 1800's, ... volcanoes - we saw the weather so changed that there was snow in July in many temperate countries. And they called it the year in which there was no summer. Now if one volcano can do that, what are we talking about with the whole nuclear exchange, the nuclear winter that scientists have been talking about? It's possible ..."

<http://www.nytimes.com/1985/02/12/world/transcript-of-interview-with-president-on-a-range-of-issues.html?pagewanted=all>

Mikhail Gorbachev:



"Mikhail Gorbachev explains what's rotten in Russia" by Mark Hertsgaard, *Salon.com*, Sept. 7, 2000

"Models made by Russian and American scientists showed that a nuclear war would result in a nuclear winter that would be extremely destructive to all life on Earth; the knowledge of that was a great stimulus to us, to people of honor and morality, to act in that situation."

<http://dir.salon.com/story/news/feature/2000/09/07/gorbachev/>



The Nobel Peace Prize 2017 was awarded to the International Campaign to Abolish Nuclear Weapons (ICAN) "for its work to draw attention to the catastrophic humanitarian consequences of any use of nuclear weapons* and for its ground-breaking efforts to achieve a treaty-based prohibition of such weapons."

* the science of nuclear winter (e.g., Robock and Toon, 2010)

Stratospheric Geoengineering

Benefits	Risks or Concerns
1. Reduce surface air temperatures, which could reduce or reverse negative impacts of global warming, including floods, droughts, stronger storms, sea ice melting, and sea level rise	<u>Physical and biological climate system</u>
2. Increase plant productivity	1. Drought in Africa and Asia
3. Increase terrestrial CO ₂ sink	2. Perturb ecology with more diffuse radiation
4. Beautiful red and yellow sunsets	3. Ozone depletion
5. Unexpected benefits	4. Continued ocean acidification
6. Prospect of implementation could increase drive for mitigation	5. May not stop ice sheets from melting
	6. Impacts on tropospheric chemistry
	7. Rapid warming if stopped
	<u>Human impacts</u>
	8. Less solar electricity generation
	9. Degrade passive solar heating
	10. Effects on airplanes flying in stratosphere
	11. Effects on electrical properties of atmosphere
	12. Affect satellite remote sensing
	13. Degrade terrestrial optical astronomy
	14. More sunburn
	15. Environmental impact of implementation
	<u>Esthetics</u>
	16. Whiter skies
	17. Affect stargazing
	<u>Unknowns</u>
	18. Human error during implementation
	19. Unexpected consequences
	<u>Governance</u>
	20. Cannot stop effects quickly
	21. Commercial control
	22. Whose hand on the thermostat?
	23. Societal disruption, conflict between countries
	24. Conflicts with current treaties
	25. Moral hazard - the prospect of it working could reduce drive for mitigation
	<u>Ethics</u>
	26. Military use of technology
	27. Moral authority - do we have the right to do this?

Each of these needs to be quantified so that society can make informed decisions.

Robock, A., 2008: 20 reasons why geoengineering may be a bad idea. *Bull. Atomic Scientists*, **64**, No. 2, 14-18, 59, doi: 10.2968/064002006.

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Geoengineering Research

The solution to the global warming problem is mitigation, leaving most of the rest of fossil fuels in the ground, and not using the atmosphere as a sewer for our carbon dioxide emissions. The world agreed in the 1992 Framework Convention on Climate Change to "prevent dangerous anthropogenic interference with the climate system." This can be accomplished with a gradually increasing carbon tax. But absent rapid global movement in this direction, for which there is no evidence now, the world may be tempted to use stratospheric sulfur geoengineering, to reduce global warming somewhat to reduce the worst impacts of climate change. But if this is done, will it make the world more dangerous?

Is it ethical to do research on geoengineering? Is it a slippery slope to implementation? Does it take resources away from other more productive research? I think we need to learn the potential benefits, risks, and concerns so that policy makers will be able to make informed choices. If we learn soon that geoengineering has insoluble risks, that will hasten the push toward mitigation.

IF YOU SEE SOMETHING,
SAY SOMETHING!

Results and Conclusions

- Ethics, unlike science, is based on values and not testable hypotheses.
- One of the most important ethical issues is choosing what topics to research. I choose to work on the climatic impacts of the use of nuclear weapons and on global warming, the two most important threats humans pose to humanity.
- As long as we make our values clear, who better than scientists to make policy recommendations in our area of research? We are better informed than anyone else (e.g., Mann 2014, Oreskes, 2015).
- I say that the US needs to sign the 2017 UN Treaty on the Prohibition of Nuclear Weapons, to save us and the world from nuclear annihilation.
- I say that the US needs to get back into the Paris Accords and increase our pledge to rapidly eliminate our greenhouse gas emissions, to save us and the world from environmental catastrophe.

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