

Editor's note: this transcript is based on the webcast recording of the Symposium. I am grateful to Dr. Robock for sharing his slides with me. The super-set which these slides came from can be found at <http://climate.envsci.rutgers.edu/robock/talks/NuclearWinter67PublicLecture.pptx>. The original webcast recording can be found inside: <http://totalwebcasting.com/view/?id=hcf>. Left-mouse click the local file recording here at – <DPNE-AlanRobock022815.mp3> – to download the mp3 file to your machine. This presentation of Dr. Alan Robock was recorded on 28 February 2015 at The Dynamics of Possible Nuclear Extinction Symposium, presented by The Helen Caldicott Foundation, at The New York Academy of Medicine.



Alan Robock starts at 1:01:11 into the above film

The [Helen Caldicott Foundation](#) Presents

Dr. Alan Robock

Nuclear Famine and Nuclear Winter: Climatic Effects of Nuclear War, Catastrophic Threats to the Global Food Supply

[Symposium: The Dynamics of Possible Nuclear Extinction](#)

The New York Academy of Medicine, 28 February - 1 March 2015

Introduction by Dr. Helen Caldicott

The next speaker is [Alan Robock](#), Distinguished Professor of Climate Science in the Department of Environmental Sciences at Rutgers University. [Professor Robock](#) has published more 350 articles on his research in the area of climate change, including more than 200 peer-reviewed papers. His areas of expertise include geo-engineering, climatic effects of nuclear war, effects of volcanic eruptions on climate, regional atmosphere-hydrology modeling, and soil moisture variations. He serves as editor of [Reviews of Geophysics](#), the most highly cited journal in the U.S. sciences. His honors include being a Fellow of the [American Geophysical Union](#), the [American Meteorological Society](#), and the [American Association of the Advancement of Science](#), and recipient of the AMS Jule Charney Award. Professor Robock is a lead author of the 2013 Working Group 1 for the [Fifth Assessment Report](#) of the Intergovernmental Panel on Climate Change which was awarded the Nobel Peace in 2007. His title is "Nuclear Famine and Nuclear Winter: Climatic Effects of Nuclear War, Catastrophic Threats to the Global Food Supply."

Thanks very much Helen for inviting me.

This work was done in collaboration with a number of other people. Particularly, most recently, [Michael Mills](#) and [Brian Toon](#) and [Lili Xia](#).



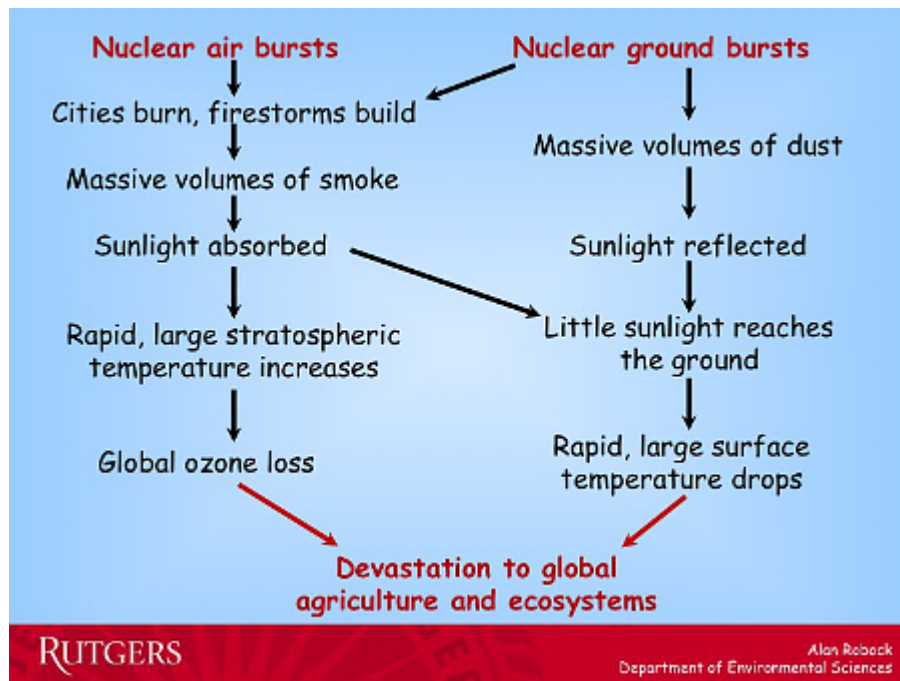
So here's our beautiful planet (stretched somehow by the computer here).



After a nuclear war it might look like this with a cloud of smoke covering the Earth, blocking out the Sun, and making it cold and dark at the Earth's surface.



And what could cause this—[Ted](#) showed you what [a blast over New York City](#) would do, but he didn't show the next step which is the fires that would result and put smoke in the atmosphere.

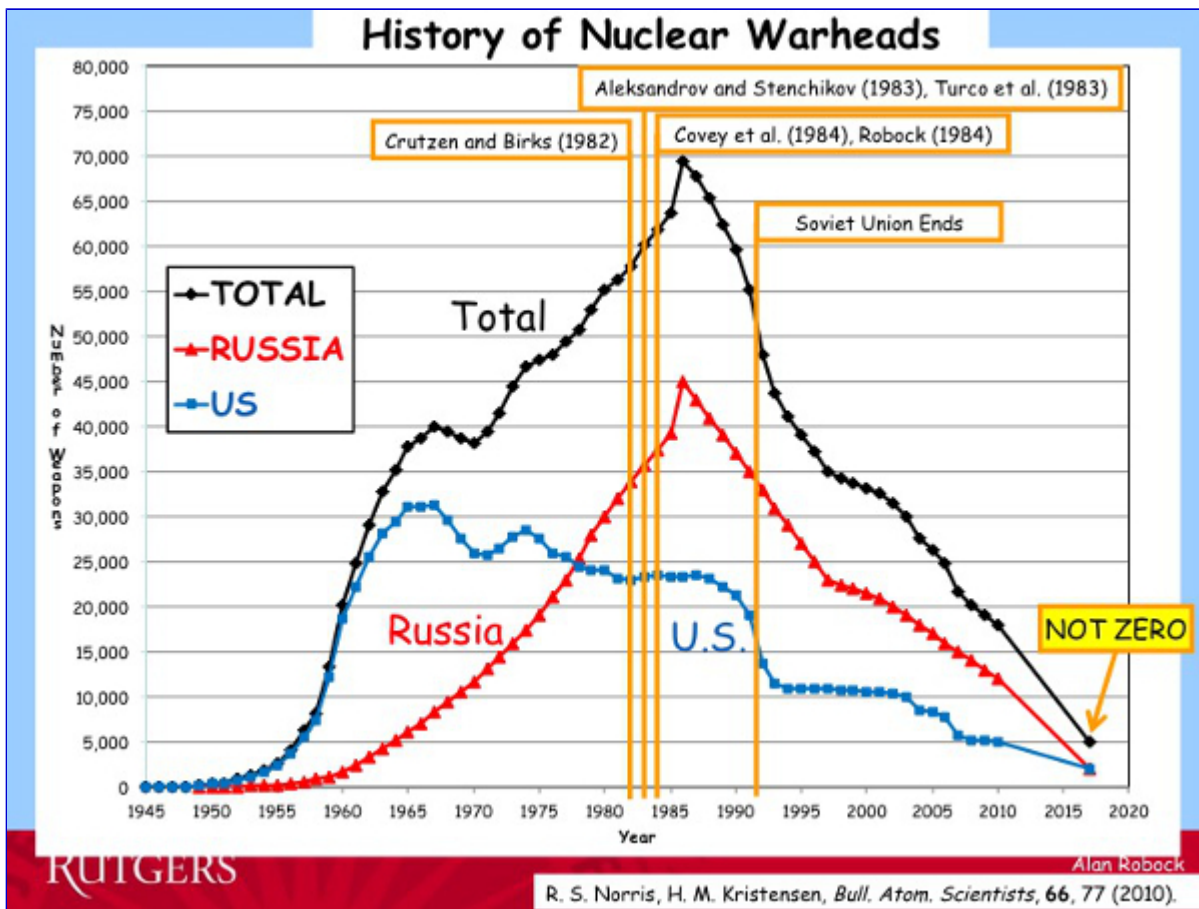


There are two types of targets: nuclear air bursts and ground bursts. The cities would burn and firestorms would build. Ground bursts also produce dust and in one case the sunlight gets absorbed and in another case it gets reflected. But that means very little sunlight would reach the ground. And that would cause rapid, large drops in surface temperature. This would be devastation to agriculture and natural ecosystems.

The smoke in the atmosphere also heats the upper atmosphere which then destroys ozone and that would mean a lot more ultraviolet radiation reaching the ground; also which would be devastating for life.



So this produces what we call Nuclear Winter with cold, dry, dark conditions at the surface, more ultraviolet-producing, crops dying, and global famine.



Max just showed a version of this graph showing the total number of nuclear warheads. The first idea of this was a paper by Paul Crutzen and John Birks [Crutzen, P.J.; Birks, J.W. (1982). "The atmosphere after a nuclear war: Twilight at noon". *Ambio* (Allen Press) 11 (2/3): 114-125]. Then climate model simulations of the response were done by both Russians—Aleksandrov and Stenchikov [Aleksandrov, V. V. and G. I. Stenchikov (1983): "On the modeling of the climatic consequences of the nuclear war," in *The Proceedings of Applied Mathematics, The Computing Center of the USSR Academy of Sciences, Moscow, 21 pp.*]—and Americans, Turco *et al* [R.P. Turco, O.B. Toon, T.P. Ackerman, J.B. Pollack, Carl Sagan: "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions," *Science* 23 December 1983: Vol. 222 no. 4630 pp. 1283-1292], and I published a paper the next year showing the long-term effects [Robock, Alan, 1984: "Snow and ice feedbacks prolong effects of nuclear winter." *Nature*, 310, 667-670].

The nuclear freeze movement was going on at the same time as Helen described. And then the nuclear arms race ended. And this science was part of the story of why the nuclear arms race ended.

The Soviet Union ended 5 years later so it wasn't the end of the Soviet Union that ended the arms race.

I'd also like to point out that the number by 2017 is not zero. We still will have 5,000 nuclear weapons on the planet and that's still enough to produce nuclear winter so the problem has not been solved.

Why do I think we scientists had a role? You can ask the people that made the decision: Ronald Reagan and Mikhail Gorbachev.

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 ..."

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

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Department of Environmental Sciences

Reagan 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 1800s, ... 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."

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."

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

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And Gorbachev said,

"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."

So both these men who made the decision had this information from both Russian and American scientists telling them the same story. That was a powerful message.

And in the United States people said, Why do we care about climate effects, we're all going to die anyway from a nuclear war. Wait, we're all going to die. And it made people really focus on the direct effects too and the craziness of the increase of the nuclear weapons.

That was 30 years ago. Why am I even telling you about it? I want to ask 2 questions. The Cold War and the arms race are over. Could the remaining nuclear arsenals still produce nuclear winter with temperatures below freezing? And now there are not just 2 nuclear nations, there are 9. What if a couple of the new nuclear nations, say India and Pakistan had war on the other side of the world, how would that effect us?

Thirty years after the threat of nuclear winter was discovered, we now ask:

1. Although the Cold War and its associated nuclear arms race are over, could remaining nuclear arsenals still produce nuclear winter? **YES, AND IT WOULD LAST LONGER THAN WE THOUGHT BEFORE.**
2. What would be the consequences of the use of a much smaller number of nuclear weapons in a regional nuclear conflict? **NOT NUCLEAR WINTER, BUT MILLIONS DEAD FROM BLAST, RADIOACTIVITY AND FIRES, AND SEVERE IMPACTS ON GLOBAL AGRICULTURE FOR MORE THAN A DECADE.**

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The answers to these questions are, Yes the current arsenal can still produce a nuclear winter and will last much longer than we thought—decades.

And a small nuclear war would not produce winter—that is the temperatures wouldn't get below freezing—but it would be terrible direct effects and there would be severe impacts on global agriculture for more than a decade.

THE STORY OF
AN
EYEWITNESS
By Jack London
Collier's, the
National Weekly
May 5, 1906



Within an hour after the earthquake shock the smoke of San Francisco's burning was a lurid tower visible a hundred miles away. And for three days and nights this lurid tower swayed in the sky, reddening the sun, darkening the day, and filling the land with smoke.

... I watched the vast conflagration from out on the bay. It was dead calm. Not a flicker of wind stirred. Yet from every side wind was pouring in upon the doomed city. East, west, north, and south, strong winds were blowing upon the doomed city. The heated air rising made an enormous suck. Thus did the fire of itself build its own colossal chimney through the atmosphere. Day and night this dead calm continued, and yet, near the flames, the wind was often half a gale, so mighty was the suck.

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Now unfortunately we know that cities can burn. There was an earthquake in San Francisco in 1906 and Jack London was out on San Francisco bay. He wrote,

Within an hour after the earthquake shock the smoke of San Francisco's burning was a lurid tower visible a hundred miles away. And for three days and nights this lurid tower swayed in the sky, reddening the sun, darkening the day, and filling the land with smoke.



Image from [Large-Format Damage Photos SF Museum 16 views powerpoint set](#)

And it produced a firestorm and pumped the smoke up into the upper atmosphere.



Image taken by George Lawrence, [courtesy of Harry Myers](#)

This is what San Francisco looked like afterwards. All of the buildings were gone except for some of the stone ones.



This is what one of the survivors of Hiroshima remembers which is the smoke and the fires.

Images presented on [Hiroshima: the first city destroyed by a nuclear weapon](#)
from [Nuclear Darkness, Global Climate Change & Nuclear Famine – The Deadly Consequences of Nuclear War](#)

CLICK AN IMAGE TO VIEW HI RES PANORAMA



[Hiroshima Peace Memorial Museum](#), Photo by Shigeo Hayashi - RA119-RA134



360 degree view span

[Hiroshima Peace Memorial Museum](#), Photo by H.J. Peterson - K-HJP001-K-HJP013

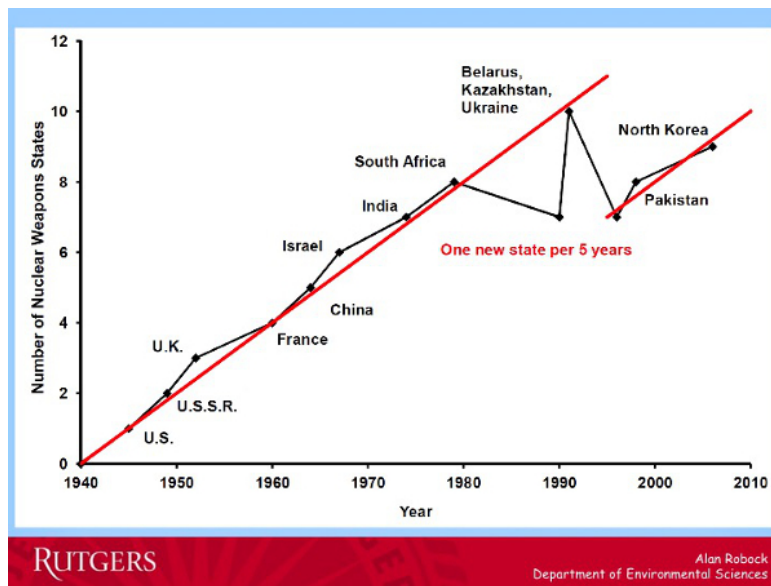


360 degree view span

[Hiroshima Peace Memorial Museum](#), Photo by Shigeo Hayashi A723-A742

And this is what Hiroshima looked like afterwards.

So we have this example of cities burning and producing smoke.



The number of countries with nuclear weapons has increased about 1 every 5 years until the Soviet Union broke up and we have 2 more since then and now we have 9 nuclear nations.




Max showed another table like this. [So Many Exist Ready To Be Used - The World's Nuclear Warheads Count, August 2014.]

There are about 16,400 nuclear weapons in the world now as of August 2014. The graphs show the different [types]—the yellow are the ballistic missiles which are on hair trigger alert.

Russia has about 8,000. The US about 7,000. All these other countries have a couple of hundred. Why did they stop? Why do they only have a couple of hundred?

How many nuclear weapons do you have to put on your enemy to deter them from attacking you? One. Okay, maybe two if the first one doesn't work.

So why do we still have thousands? The US and Russia could *immediately* go down to 200 each and not lose any of their deterrent ability even if it were a deterrent.




Osama bin Laden, the founder and head of the Islamist militant group al-Qaeda, was killed in Pakistan on May 2, 2011, shortly after 1:00 am PKT (20:00 UTC, May 1) by U.S. Navy SEAL Team Six.

Did this raid risk the possibility of a Pakistan-India nuclear war?

RUTGERS <http://media.syracuse.com/news/photo/2011/05/nypost-bin-laden.jpg-0ebfa0e81ba7d1d2.jpg> Alan Robock
Department of Environmental Sciences


Max talked about—Ted also—about how close we've come several times. What about this time? Imagine you're Pakistani Air Defense and you see an attack coming in over the horizon. You're a nuclear nation. Who do you think would be attacking you? Would you guess it was the United States or maybe you'd think it was India. So did we almost start a nuclear war by going to get Osama bin Laden?



What if India and Pakistan had a nuclear war?
Imagine a skirmish in Kashmir escalating, due to poor communication, misunderstanding, panic, and fear.

RUTGERS http://upload.wikimedia.org/wikipedia/commons/0/0e/Kashmir_map.jpg Alan Robock
Department of Environmental Sciences

We didn't, fortunately. But along the Kashmiri border, there are always disputes between Indians and Pakistanis. Imagine a skirmish there escalating due to poor communication, misunderstanding, panic, problem with the computer.



Four killed in India-Pakistan border fire

Srinagar, India - Four people were killed when nuclear-armed rivals India and Pakistan traded heavy fire across their border early Saturday, with each country accusing the other of "unprovoked" military action.

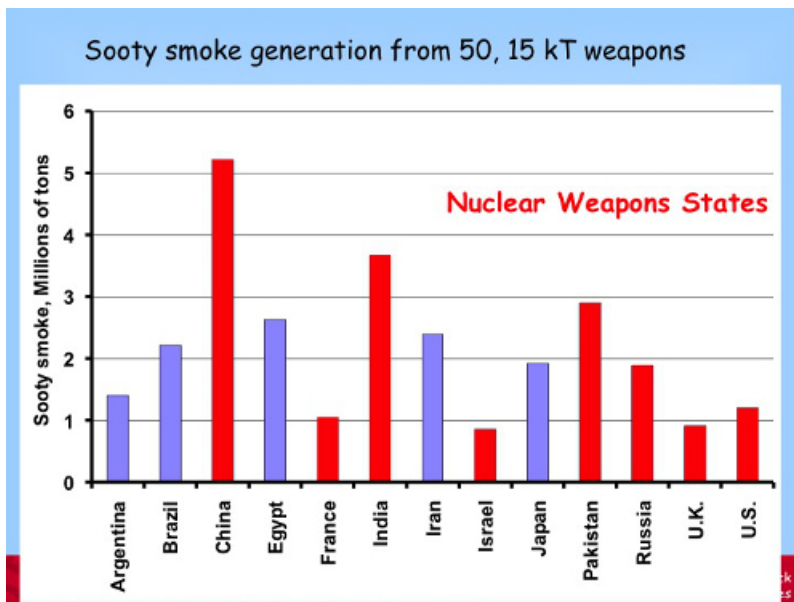
"Two civilians were killed" and four people injured, including a paramilitary soldier, on the Indian side of the international frontier when Pakistani forces opened fire, Indian police inspector-general Rajesh Kumar said.

On the other side of the frontier, two Pakistani civilians - a woman and a 60-year-old man - "were martyred" by Indian fire, a senior Pakistani military official said.

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In fact the last year I was at the IPPNW meeting in Kazakhstan, I picked up the newspaper that morning in the hotel: "Four people were killed when nuclear-armed rivals India and Pakistan traded heavy fire across their border early Saturday..."

This happens all the time. We've been really lucky that, again, this hasn't escalated into something worse.



So we decided to look at what the climatic effects of such a war would be. We took 50 Hiroshima-size weapons and put them on the 50 targets in each country that produce the largest amount of smoke. For India this would produce 3.5 million tons of smoke. For Pakistan, 3 million tons—6.5 million. We said, Let's be conservative; let's put 5 million tons of smoke into the upper atmosphere and see what the climate response would be.

What would be the consequences of a regional nuclear war using 100 15-kT (Hiroshima-size) weapons?

This would be only 0.03% of the current world arsenal.

Scenario: Weapons dropped on the 50 targets in each country that would produce the maximum smoke.

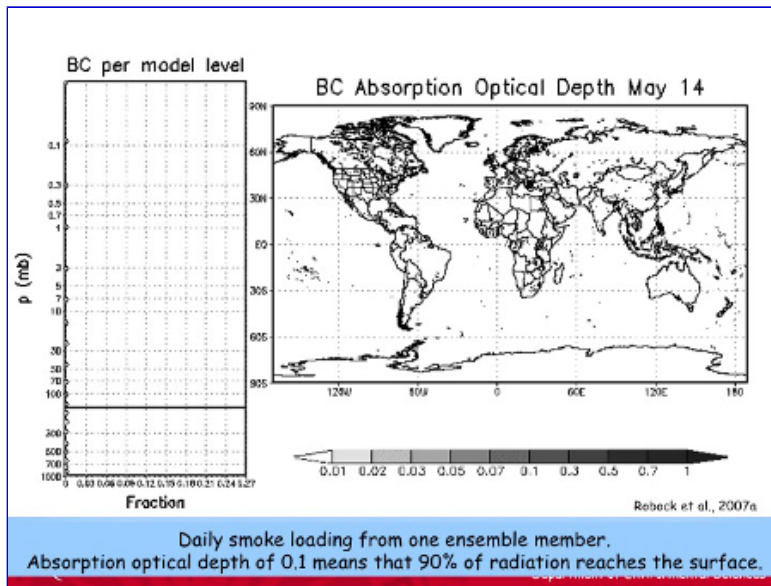
20,000,000 people would die from direct effects, half of the total fatalities from all of World War II.

Portions of megacities attacked with nuclear devices or exposed to fallout of long-lived isotopes would likely be abandoned indefinitely.

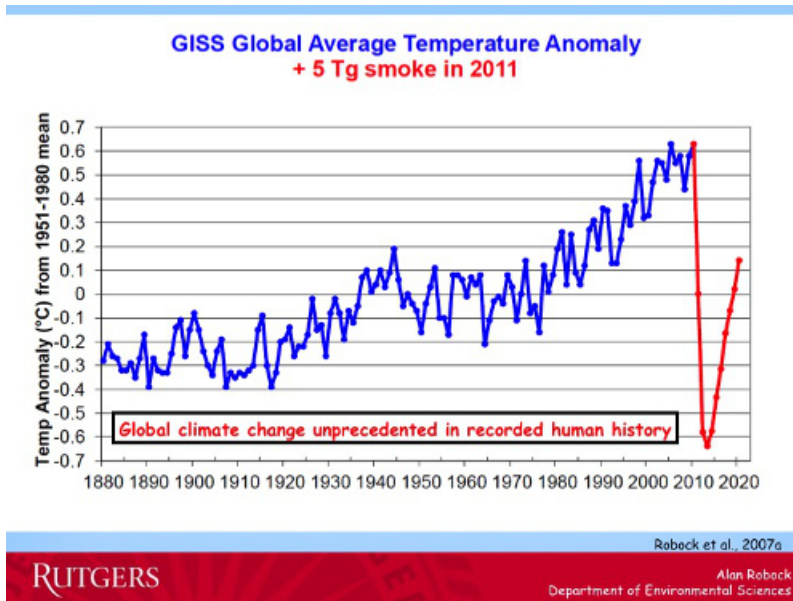
5 million tons of smoke injected into the upper atmosphere, accounting for fuel loading, emission factors and rainout.

Robock, Alan, Luke Oman, Georgiy L. Stenchikov, Owen B. Toon, Charles Bardeen, and Richard P. Turco, 2007: Climatic consequences of regional nuclear conflicts. *Atm. Chem. Phys.*, 7, 2003-2012.

This is much less than even 1 percent of our current global nuclear arsenal; 0.3 percent. Of course it would be a terrible direct effect. 20 million people would die directly.



Here's a movie of where the smoke would go. It would be heated—this is the tropopause. Most of it would be heated and go up into the stratosphere, the region above where there is weather so there wouldn't be any rain to wash it out and it would last for more than a decade, and it would cover the whole world.



If you graph the climate response on a graph of global average temperature: blue is the global warming we all know and love which I spent a lot of time working on; the red would be the global temperature change. So it would be a couple of degrees colder. It wouldn't be winter temperatures. But this would be the climate change unprecedented in recorded human history. Colder than the little ice age.

Two other climate models have now simulated the impacts of 5 million tons of smoke injected into the upper atmosphere from fires from nuclear attacks.

Stenke, Andrea, et al., 2013: Climate and chemistry effects of a regional scale nuclear conflict, *Atmos. Chem. Phys.*, **13**, 9713-9729, doi:10.5194/acp-13-9713-2013.

Mills, Michael J., Owen B. Toon, Julia Lee-Taylor, and Alan Robock, 2014: Multi-decadal global cooling and unprecedented ozone loss following a regional nuclear conflict. *Earth's Future*, **2**, 161-176, doi: 10.1002/2013EF000205.

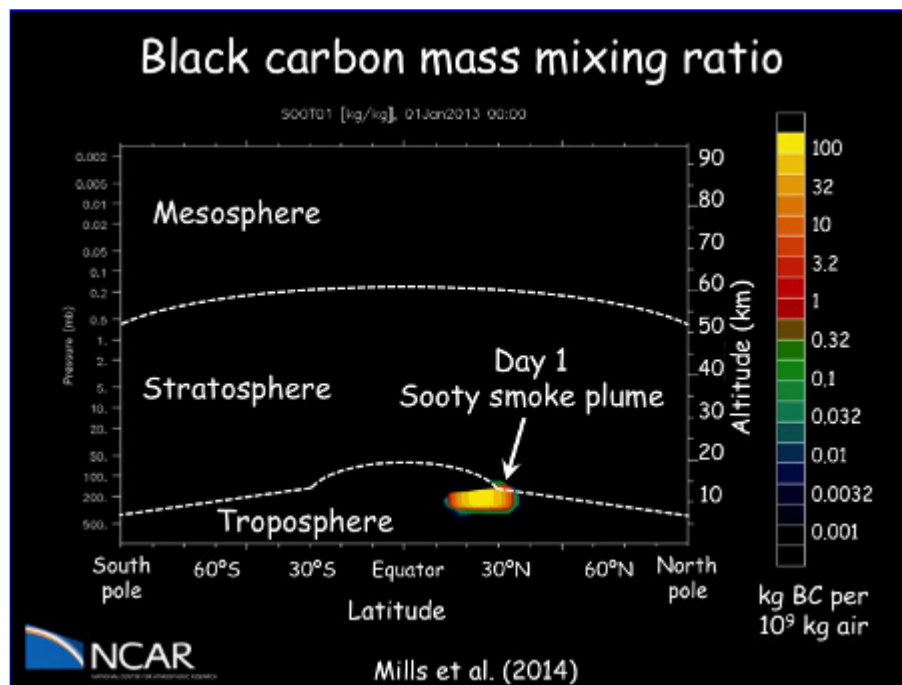
All three find global cooling for more than a decade, unprecedented in recorded human history.

(This is from "only" 100 15-kt bombs, much less than 1% of the global nuclear arsenal.)

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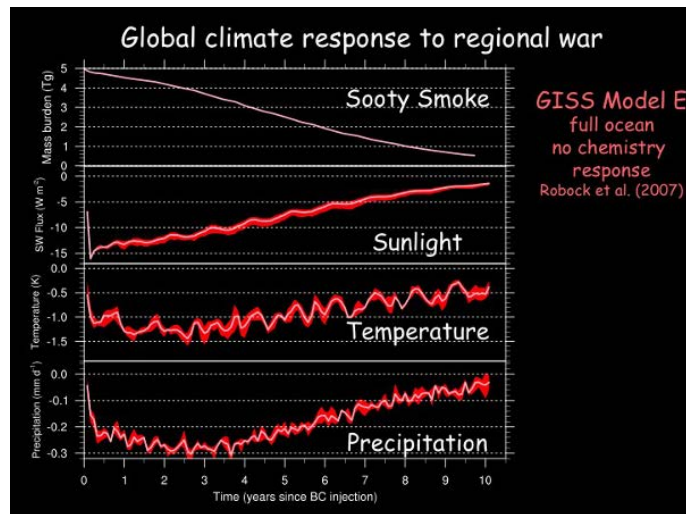
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Two other climate models have recently done a similar calculation to make sure this is not dependent on one climate model. All three found basically the same result.

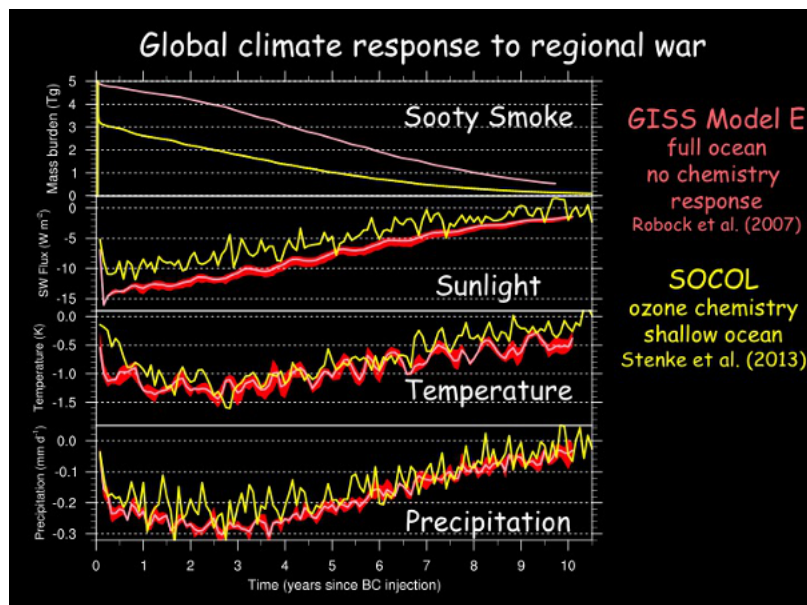


This is the climate model at the National Center for Atmospheric Research (NCAR) which is much more detailed and also includes the effects of ozone. [Here are two additional movies made by Michael Mills. Alan Robock had asked him to make another version with a white background and progressive shades of grey leading to black for the highest concentrations so it looks like smoke. The first animation is in greyscale and runs at 10 frames per second. The second animation version runs 5 frames per second.] The smoke goes up, it gets heated and goes up into the upper stratosphere and it stays there for years.

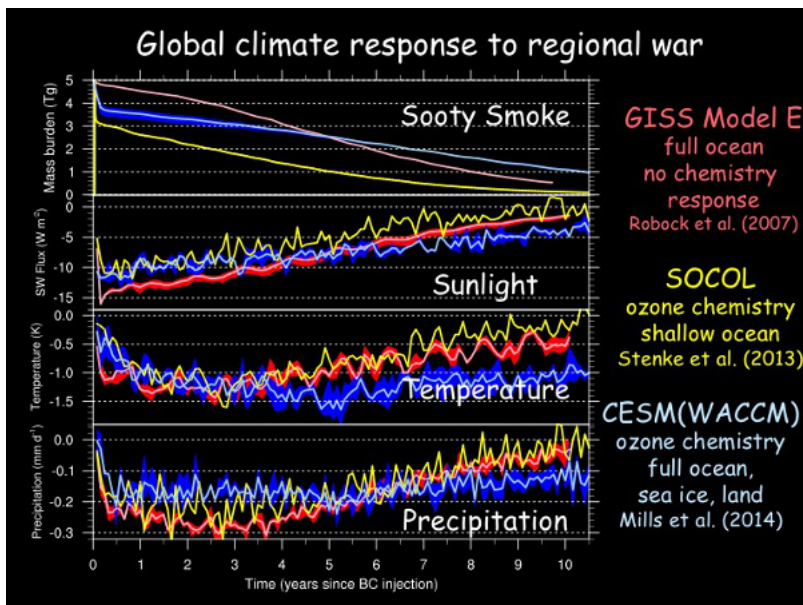
The sun heats it and this is in April. As you get to summer it goes to the northern hemisphere heated by the sun. And then it goes into the southern hemisphere when it turns winter and stays there for a long time. We can calculate how long it stays there.



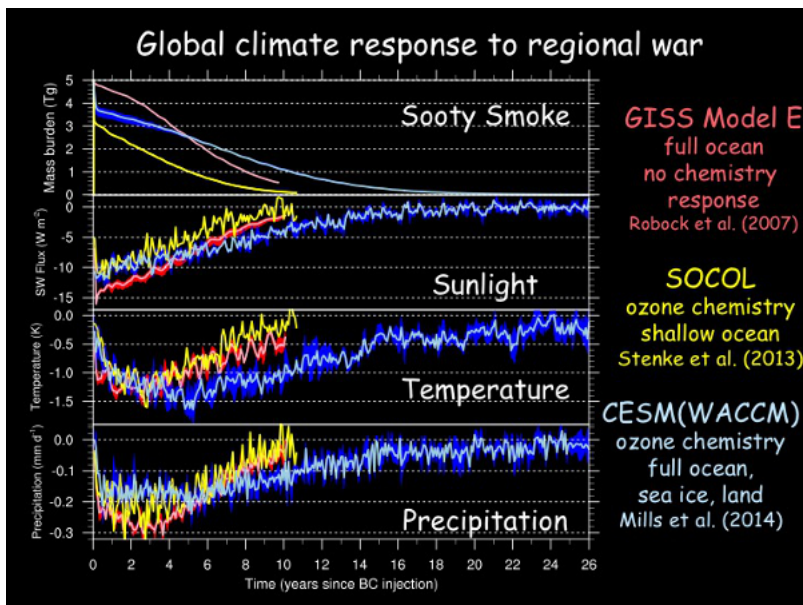
Our first calculation showed that the temperature would go down by 1.5 degrees Celsius, about 2 degrees Fahrenheit.



The Swiss model showed similar results.

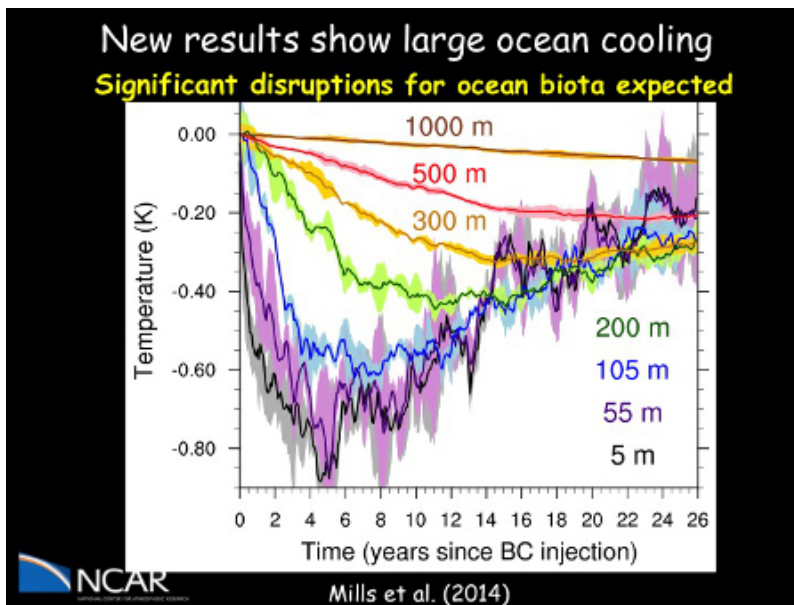


The NCAR model had the smoke last longer.

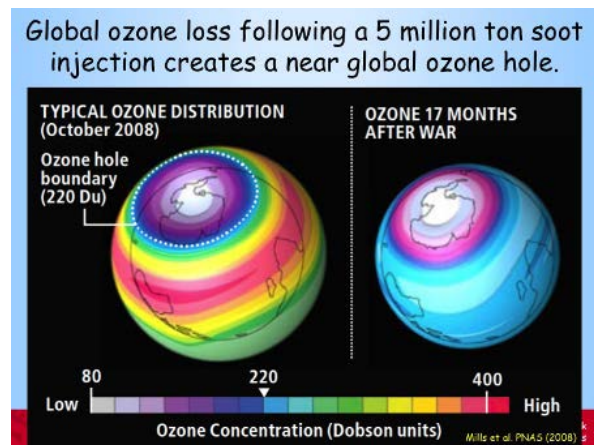


It calculated more detail in the stratosphere and actually it would last for a couple of decades.

Alright, so a couple of degrees. What does that mean? We said, Let's take this and let's go to places where they grow food and apply the change of temperature, the change of precipitation, the change of sunlight, and calculate how crops would grow.



There would also be cooling in the ocean.



Consequences of severe ozone loss

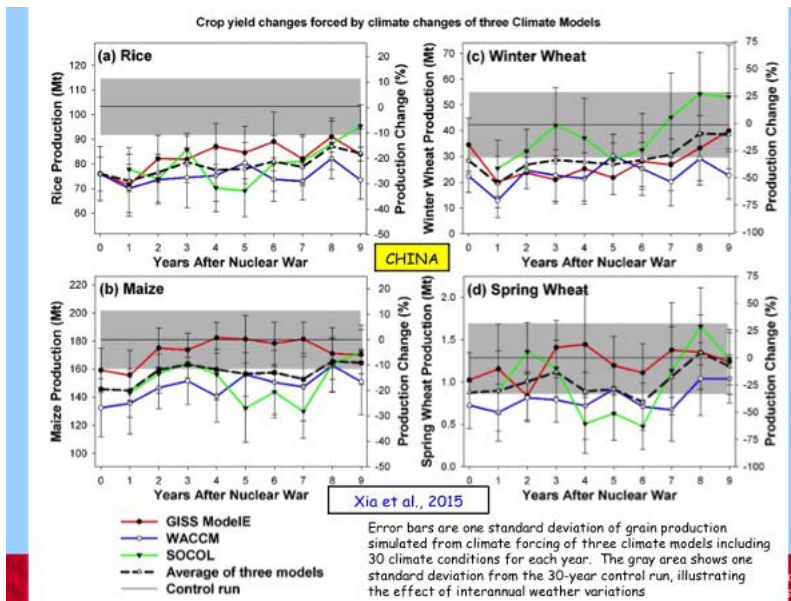
Human health
A fair-skinned North American would receive a painful, noticeable sunburn after 6 minutes in the sun at noon in June.
Increased skin cancer rates

Land crops and ecosystems
Plant height, shoot mass, and foliage area would be reduced.
Beneficial soil bacteria would be disrupted.
Genetic damage would accumulate over generations.
Plants would be more susceptible to attack by insects and pathogens.

Fisheries and ocean ecosystems
Phytoplankton activity in the upper layer of the ocean would be inhibited.
Decreased reproductive capacity and impaired larval development of marine animals

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First of all the ozone would be depleted. Now we worry about the ozone hole around Antarctica. This would be a *global* ozone hole with excess ultraviolet. We haven't even had time yet to look at the impacts of the UV.



This is a graph from our analysis using all of those three climate models looking at how the production of the main food crops in China, the country that grows the most food, would change.

This is for 10 years. For rice it would be down by 20 percent. For winter wheat, 40 percent. And this is only in the first decade.

How agricultural production would change in the 10 years following a nuclear war between India and Pakistan (not considering damage from excess UV yet)

Summary:

	<u>First 5 years</u>	<u>Second 5 years</u>
US maize	-20%	-10%
US soybeans	-15%	-10%
China maize	-15%	-10%
China middle season rice	-25%	-20%
China spring wheat	-25%	-20%
China winter wheat	-40%	-25%

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Let me summarize this in a table. In the US, corn would go down by 20 percent, soy beans 15 percent, rice would go down by 25 percent in China, wheat by 40 percent.

This means the same amount of food that was grown in China when they had several 100 million fewer people. And it would last for more than a decade.

You can imagine people hoarding food, world food trade collapsing. And now we're analyzing every crop in every country so we can go for the whole world and tell no more chocolate for you, no more wine for you. People can really have a gut feeling of how it's going to affect them. Not somewhere else in the world.

One U.S. Trident submarine has 96 nuclear weapons, each 100 or 475 kt, making each Trident more powerful than 1000 Hiroshimas.



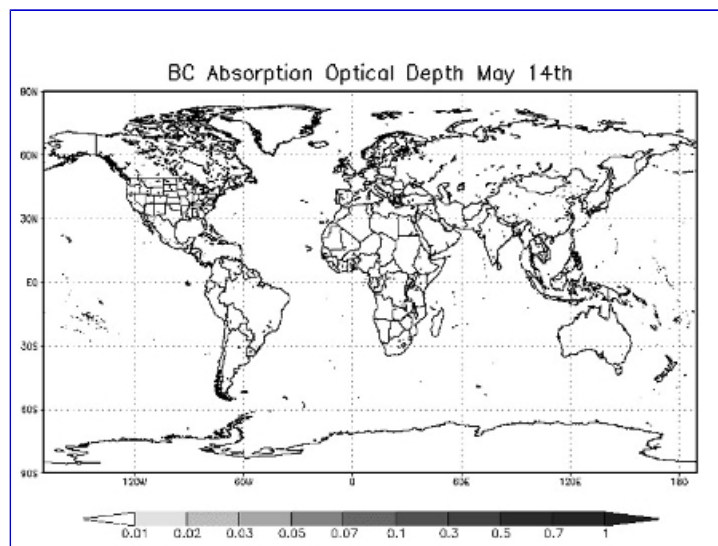
The U.S. has 14 Tridents, and that is less than half the U.S. nuclear arsenal.

RUTGERS http://www.rutgers.edu/cees/alan_robock/alan_robock_launching_trident_100kt_launch_concept.jpg

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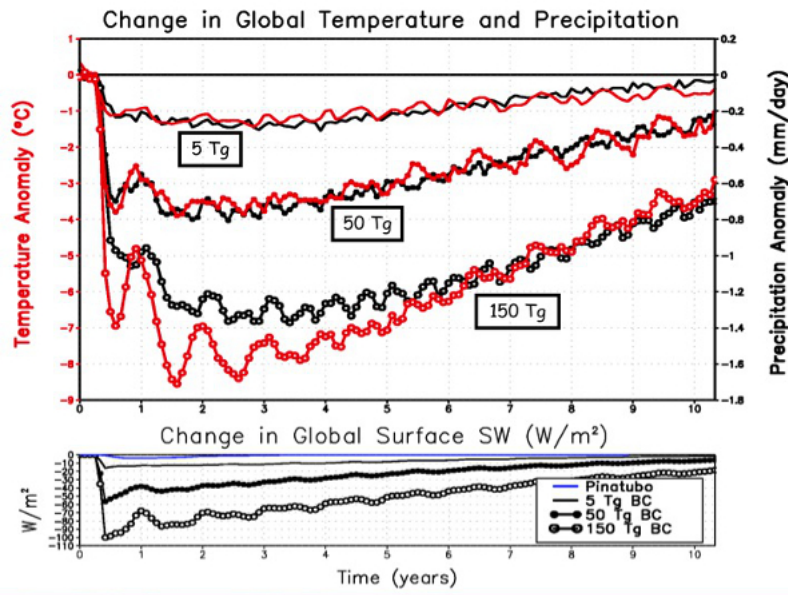
But the story—it's much worse than that. Forget about what I just—it's much worse than that. Because as Ted mentioned, every Trident has 100 nuclear weapons and they're much more powerful than the Hiroshima bomb. So each Trident submarine can produce about 1,000 Hiroshimas and the US has 14 of them. And that's only half of our arsenal. And Russia has got the same size arsenal.

So we could produce much, much, much more smoke if we used them.



So we did a simulation of what would happen if the US and Russia had a nuclear war. And [there would be] a *lot* more smoke. It would go up in the atmosphere and cause much more temperature

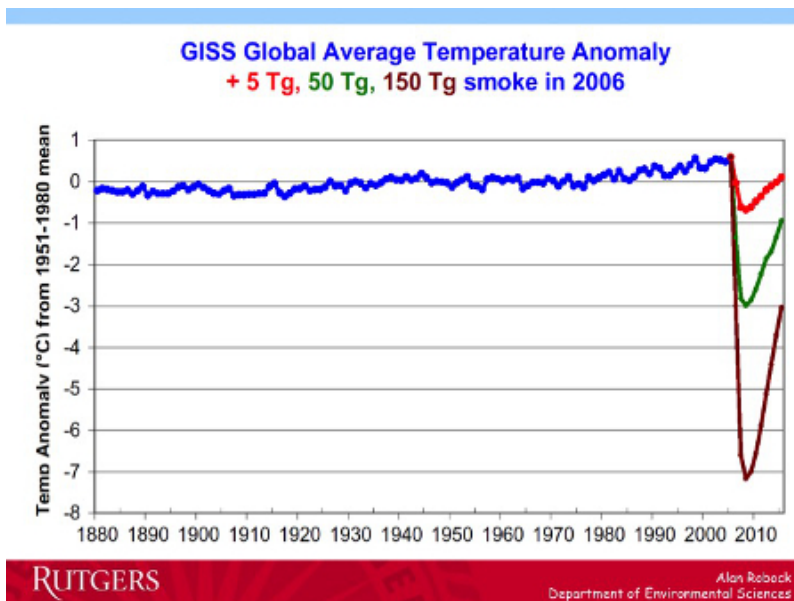
change.



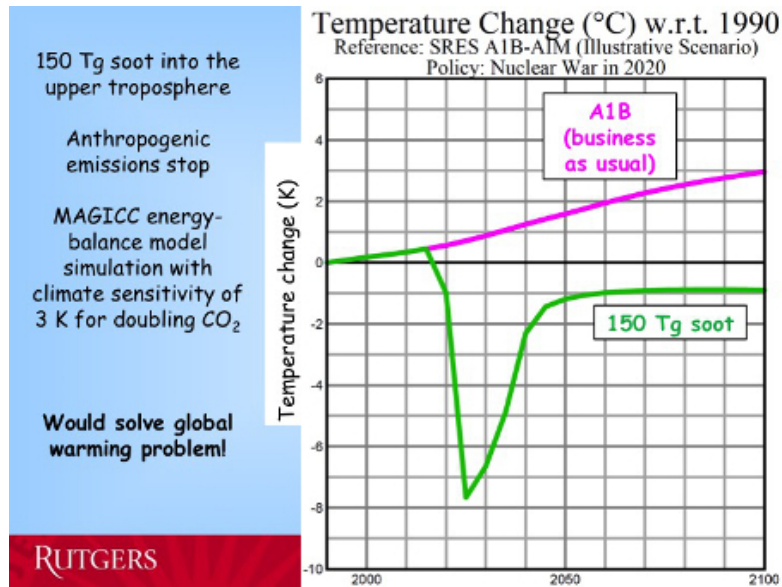
Now I'm going to graph the global temperature change. In the 5 terragram case I first showed you is up at the top here. I've had to re-scale the graph. Now for 150 million tons of smoke, 7 or 8 degrees Celsius colder. Colder than the Little Ice Age.

This is the same amount of smoke that we put in the atmosphere when we were studying nuclear winter in the 1980s using a third of the-then much larger arsenals. We were trying to figure out, How can you still get so much smoke? It turns out, with a third of the arsenal, every possible target in Russia and the US had 9 nuclear bombs targeted on it. Because they put one on. Okay, let's put two on in case it doesn't work. So we have this huge pile of weapons, Okay let's bounce the rubble.

Now if we just put one on each target we can still produce the same amount smoke even after the new START agreement is in effect.



If you look at global warming then, [laughs], this huge impact.



Before you ask the question, Yes, this would solve the global warming problem. I did a calculation. If you put that much smoke in and you stop producing CO₂, global warming is gone. I'm writing an article about that called: "A Modest Proposal: A Solution to Global Warming." [laughter]

What's New?

- A nuclear war between any nuclear states, using much less than 1% of the current nuclear arsenal, would produce climate change unprecedented in human history.
- Such a "small" nuclear war could reduce food production by 20% to 40% for a decade.
- Nuclear winter theory was correct.
- The current arsenal can still produce nuclear winter.
- The effects of regional or global nuclear war would last for more than a decade.

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Department of Environmental Sciences

What's new in this work? A nuclear war between any nuclear states using much less than 1 percent of the current nuclear arsenal could produce climate change unprecedented in recorded human history.

Such a "small" nuclear war could reduce food production by 20 to 40 percent for a decade. And we've repeated the nuclear winter calculations done in the 1980s about which there was some doubt about well do you really get temperatures below freezing? It turns out nuclear winter theory was

correct. In the current arsenal, the Russian and American one can still produce temperatures below freezing and the effects would last for more than a decade.

Now we have modern models that can heat the smoke, take in the upper atmosphere and calculate how long it would stay there. In the 1980s the climate model simulations were done on a Cray-1 Computer which is much less powerful than your iPhone in terms of its computing capability and storage. Now we have modern computers that can do this much better.

Nuclear Winter Analogs

- **Seasonal cycle**
- **Diurnal cycle (day and night)**
- **Firestorm: 1906 San Francisco earthquake**
- **Fires: World War II firestorms**
 - Dresden, Hamburg, Darmstadt, Tokyo ("conventional" bombs)
 - Hiroshima, Nagasaki (nuclear bombs)
- **Smoke and dust transport, Surface temperature effects**
 - Martian dust storms
 - Asteroid impact → dinosaur extinction
 - Forest fires
 - Saharan dust
 - Volcanic eruptions

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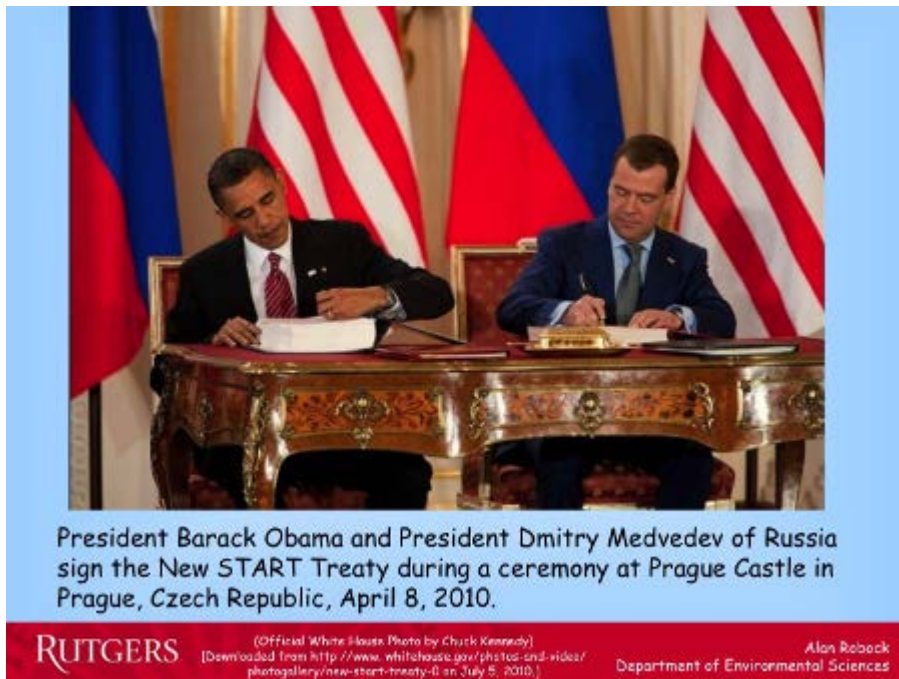
Everything I've told you so far is theory. It's based on models. The same models we use to do weather prediction and climate model simulations.

How do we test this theory? We don't really want to do it in the real world so we use analogs. We use things that inform us about parts of the story.

We know it gets cold in the winter. Why is it cold? Less light, less energy—the days are shorter, the sun is not as intense. So we have a feeling for how cold it can get. If you turn off the sun we know it gets cold at night time.

Unfortunately we have examples of cities burning both in San Francisco and during World War II with so-called *conventional bombs*, which makes it sound like it's okay.

And we have examples from Volcanoes and Martian dust storms of this dust and smoke being transported around the world and causing cooling.



Now, what should we do about it? President Obama and President Medvedev signed the new START Treaty in 2010.

New START requires each side, within 7 years of the treaty coming into force, to reduce warheads to a maximum of 1550 per side, but each long-range bomber counts as one warhead no matter how many it has.

4000 nuclear warheads (which could be in the arsenals of Russia and the US for the next decade) are enough to produce nuclear winter.

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And that pledged that within 7 years each side would bring their nuclear warheads down to 1550 per side. But strangely each nuclear bomber counted as one nuclear weapon because they couldn't tell how many bombs there were inside of them.

So maybe that means each country will still have about 2,000 nuclear weapons. So that's 4,000 nuclear warheads altogether, and maybe another 1,000 in the rest of the world.

Policy Implications

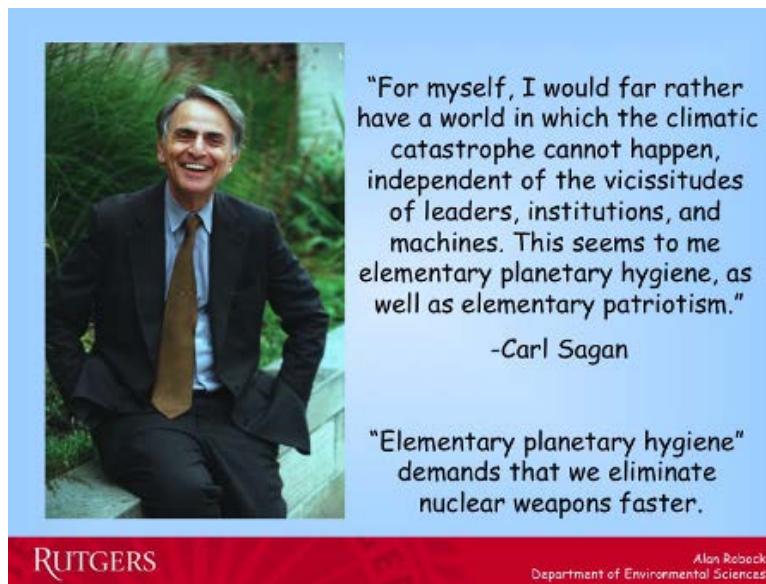
1. **Immediate American and Russian reductions** to the same arsenal sizes of the other nuclear nations, about 200 weapons each, would maintain the nuclear deterrence of each and **prevent nuclear winter.**
2. **Nuclear abolition** will **prevent nuclear famine.**

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What are the policy implications then? Immediate American and Russian reductions to the same arsenals of the other nuclear nations—about 200 each—would prevent nuclear winter. We wouldn't be able to produce enough smoke to actually cause temperatures to go below freezing and sentence the entire world to famine.

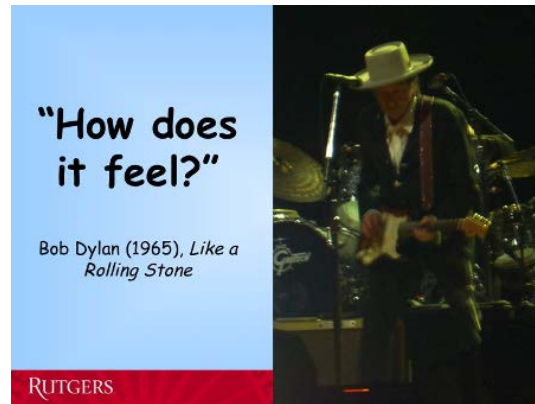
But if we want to prevent the famine that will result, maybe a *billion people* would die from a war between India and Pakistan because of cutting the food supply then we have to get rid of all the nuclear weapons.



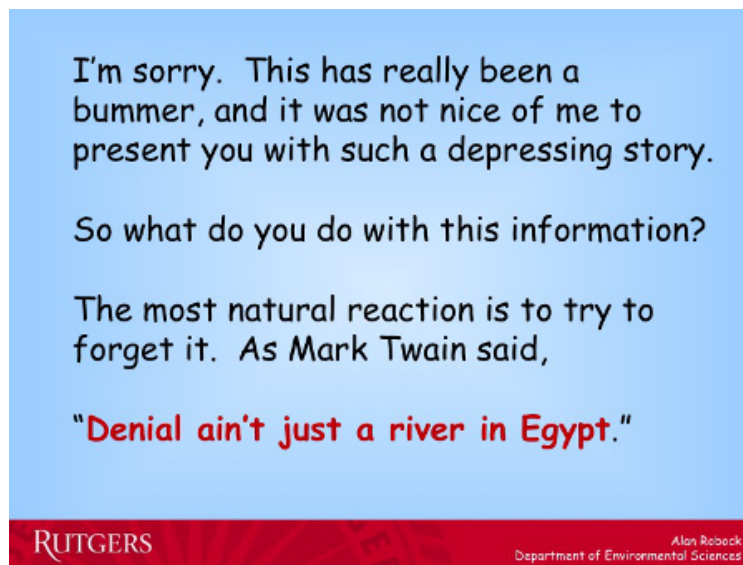
Carl Sagan, who was one of the leaders about talking about this in the 1980s, said,

“For myself, I would far rather have a world in which the climatic catastrophe cannot happen, independent of the vicissitudes of leaders, institutions, and machines. This seems to me to be elementary planetary hygiene, as well as elementary patriotism.”

So “elementary planetary hygiene” demands that we eliminate the nuclear weapons much faster than they are being eliminated now.



So how do you feel? I’m really sorry to bum you out about this. To tell you about all this. I guess you paid to listen, though.



So, what can you do about it? Mark Twain said, “Denial ain’t just a river in Egypt.” It feels good psychologically to pretend you didn’t hear what I just said and go home and pretend it doesn’t exist. And most of the world does that. Helen calls that psychic numbing.

But another action is to try and do something about it to get rid of the weapons.

WEAPONS ALREADY BANNED

There are already international conventions prohibiting biological weapons, chemical weapons, land mines and cluster munitions, but no comparable treaty – as yet – for nuclear weapons. The international community must address this legal anomaly. As with the negotiating processes that resulted in treaties banning land mines and cluster munitions, threatened governments should work in close partnership with civil society to bring about a nuclear weapons ban regardless of resistance from states possessing the weapons.

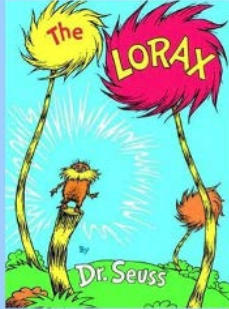
				
X BIOLOGICAL WEAPONS	X CHEMICAL WEAPONS	X LAND MINES	X CLUSTER MUNITIONS	
Banned under the Biological Weapons Convention	Banned under the Chemical Weapons Convention	Banned under the Anti-Personnel Mine Ban Treaty	Banned under the Convention on Cluster Munitions	
1972	1993	1997	2008	

NUCLEAR WEAPONS
NOT YET BANNED BY TREATY

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We've already banned biological weapons in the world, chemical weapons, land mines, and cluster munitions. But the worst weapons of mass destruction of all—nuclear weapons—have not been banned. So the ICAN is the **International Campaign Against Nuclear Weapons**, is working to actually ban nuclear weapons.

Max mentioned Dr. Seuss. I'll just end with another quote from Dr. Seuss.



"Unless someone like you cares a whole awful lot, nothing is going to get better. It's not."

Dr. Seuss, *The Lorax* (1971)

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“Unless someone like you cares a whole awful lot, nothing is going to get better. It’s not.”

Thanks.

For more about this work, go to climate.envsci.rutgers.edu/nuclear/