Global Politics in a Changing World

A Reader

Fourth Edition

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minister until February 2007 and a staunch advocate of close transatlantic links, wrote in the *Washington Post* that the U.S. should not take Poland for granted, that Europe was a far greater contributor to the Polish economy than was the U.S., that Poland needed to be sure that its security interests would be protected and that Washington "should tell NATO how it intends to include the Central Europe base in the alliance's missile defence architecture." The U.S., Sikorski wrote, needed to "see the world through the eyes of its allies and offer them a partnership that enhanced the security of both."

The Consequences of a "Limited" Nuclear War

3.4 Climate Effects of Nuclear War

Alan Robock

While Americans have typically focused on the consequences of a nuclear, biological, or chemical attack *on the United States,* and on the measures that the United States might take to deter or defeat such an attack, in today's world a nuclear war between other nations that did not target America might well have huge consequences for America. In the following article written for this volume, Nobel Prize-winning meterologist Alan Robock analyzes some of the likely consequences for the global environment of a nuclear war between India and Pakistan.

The first nuclear war, in which the United States dropped two atomic bombs on innocent people in Hiroshima and Nagasaki, Japan, in 1945, so shocked the world that in spite of the massive buildup of these weapons since then, they have never been used in war again. These direct effects were startling enough, but in the mid-1980s research conducted jointly by Western and Soviet scientists discovered that if a third of the then-existing nuclear arsenal were used, a nuclear winter would result.

The direct effects of nuclear weapons, blast, radioactivity, fires, and extensive pollution, would kill hundreds of millions of people, but only those near the targets. However, the fires would have another effect. Cities and industrial targets would produce massive amounts of dark smoke. The fires themselves would loft the smoke into the upper troposphere, 5–15 km (3–9 miles) above the earth's surface, and then absorption of sunlight would further heat the smoke, lifting it into the stratosphere, a layer where the smoke would persist for years, with no rain to wash it out. Calculations with climate models showed that there would be so much smoke that

Robock, Alan, "Climate Effects of Nuclear War." Reprinted by permission of the author.

it would block out sunlight, plunging the world into cold and dark, killing crops and producing worldwide famine. This effect was named "nuclear winter" in the first paper on the subject in 1983 by Richard Turco and colleagues.

Recognition of these potentially catastrophic consequences, not only for the superpowers but also for distant uninvolved countries, was important in ending the arms race between the United States and the Soviet Union. The realization that more people could die in China or India from climatic effects of a superpower war than in the superpowers combined was a startling wake-up call. That the nuclear winter research was conducted jointly by Soviet and American scientists, with the same results, was a powerful message to the world that the science was valid, and not influenced by narrow political goals.

The overall size of the world's nuclear arsenals peaked in 1986, five years before the breakup of the Soviet Union. There still remain, however, tens of thousands of nuclear weapons in the world. And while the size of the American and Russian arsenals has declined, many additional countries have acquired nuclear weapons. Their ability to build nuclear weapons has stemmed in part from the availability of highly enriched uranium and plutonium, a consequence of the spread of nuclear reactors for power generation, which has been a result of a misguided international atomic energy policy. In addition to the original nuclear powers (the United States and the Soviet Union, now Russia), and the three earlier declared nuclear powers (Britain, France, and China), four other countries now have nuclear weapons: Israel, India, Pakistan, and North Korea. Furthermore, Iran is widely assumed to be seeking nuclear weapons, and other countries are considering acquiring them. It is not difficult to obtain the knowledge of how to construct nuclear weapons; all that is needed is the will and the nuclear material. Right now forty more countries possess enough enriched uranium and/or plutonium to quickly assemble nuclear weapons, and there is enough to make 100,000 nuclear weapons.

Given this proliferation and possible future proliferation of nuclear-armed states, colleagues and I have examined the probable effects of a regional nuclear war between new nuclear weapons states. Because the nuclear winter calculations conducted twenty years ago used much smaller computers and simpler climate models than available today, we also were curious to find out if using modern models would change our older results, by addressing some of the unknowns from then, and to find out if the current nuclear arsenal could still produce nuclear winter.[1]

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[1] For a fuller account of this research, see: Alan Robock, Luke Oman, Georgiy L. Stenchikov, Owen B. Toon, Charles Bardeen, and Richard P. Turco, "Climatic Consequences of Regional Nuclear Conflicts," *Atm. Chem. Phys.*, 7 (2007), 2003–2012; Alan Robock, Luke Oman, and Georgiy L. Stenchikov, "Nuclear Winter Revisited with a Modern Climate Model and Current Nuclear Arsenals: Still Catastrophic Consequences," *J. Geophys. Res.*, 112 (2007), D13107, doi:10.1029/2006JD008235; Alan Robock, Owen B. Toon, Richard P. Turco, Luke Oman, Georgiy L. Stenchikov, and Charles Bardeen, "The Continuing Environmental Threat of Nuclear Weapons: Integrated Policy Responses Needed," *EOS*, 88 (2007), 228, 231, doi:10.1029/2007ES001816; Alan Robock, "Climate Effects of a Regional Nuclear Conflict," *IPRC Climate*, 7 (2007), no. 1, 16–18; Owen B. Toon, Richard P. Turco, Alan Robock, Charles Bardeen, Luke Oman, and Georgiy L. Stenchikov, "Atmospheric Effects and Societal Consequences of Regional Scale Nuclear Conflicts and Acts of Individual Nuclear Terrorism," *Atm. Chem. Phys.*, 7 (2007),1973–2002; and Owen B. Toon, Alan Robock, Richard P. Turco, Charles Bardeen, Luke Oman, and Georgiy L. Stenchikov, "Consequences of Regional-Scale Nuclear Conflicts," *Science*, 315 (2007), 1224–1225.

We conducted simulations with a state-of-the-art general circulation model of the climate. For the first time we were able to include a complete calculation of not only atmospheric but also oceanic circulation, and the entire atmosphere from the surface up through the troposphere, stratosphere, and mesosphere, to an elevation of 80km (50 miles). We cannot know how many nuclear weapons would be used in a conflict (hopefully none), so we considered three artificial, but possible, scenarios. One was a nuclear conflict between India and Pakistan, each using fifty Hiroshima-sized weapons (15 megatons explosive power), dropped on the targets in each country that would produce the largest amount of smoke. This would be only 0.3 percent of the current global nuclear arsenal, or 0.03 percent of the explosive power of the current nuclear arsenal. The second scenario was the entire current nuclear arsenal used in a conflict between the United States and Russia, and the third involved use of one third of the current nuclear arsenal, also targeted at the United States and Russia. The second scenario is the same as the baseline scenario we used twenty years ago.

Our results were startling. We found that the first scenario would produce climate change unprecedented in recorded human history, with global temperatures plummeting instantly to values colder than the Little Ice Age of the sixteenth to nineteenth centuries, with precipitation reductions and growing seasons shortened by several weeks in the midlatitudes of the northern hemisphere. One reason the climatic effects are so large is that the growth of megacities in the developing world has produced much more fuel for nuclear fires than realized previously. Whereas nuclear winter theory shows that the superpowers threaten the existence of the rest of the world, now newly emergent nuclear powers threaten the former superpowers, perhaps not with extinction, but with serious consequences, including drought and famine.

The second and third scenarios, of a nuclear war between the United States and Russia, would still produce a nuclear winter. But in contrast to earlier results, we found that the effects would last for longer than a decade for all three scenarios. For the first time we have computer power sufficient to conduct many ten-year simulations. Our climate model allows the response in the ocean to account correctly for heat storage and changes of ocean currents to give the proper time response. But most important, the vertical extent simulated in the model allows us to show that the smoke would be lofted into the stratosphere and stay there for years, much longer than realized before.

The United States and Russia are signatories to the Strategic Offensive Reductions Treaty, which commits both to a reduction to 1700–2200 deployed nuclear weapons by the end of 2012. This continuing reduction of nuclear weapons is to be commended, but our results show that even much more modest nuclear arsenals leave the possibility of a nuclear environmental catastrophe. In addition, serious additional attention is needed to the problem of nuclear proliferation. The story summarized here shows that the world has reached a crossroads. Having survived the threat of global nuclear war between the superpowers so far, the world is increasingly threatened by the prospects of regional nuclear war. The consequences of regional-scale nuclear conflicts are unexpectedly large, with the potential to become global catastrophes. The combination of nuclear proliferation, political instability, and urban demographics may constitute one of the greatest dangers to the stability of society since the dawn of humans.

Biological Weapons

3.5 With Custom-Built Pathogens Come New Fears

Joby Warrick

The world's attention has largely focused on the dangers of nuclear weapons. Biological weapons, however, may prove easier to manufacture, harder to defend against, and more deadly than nuclear weapons. Even more frightening, the danger is evolving and growing. In the next selection, *Washington Post* reporter Joby Warrick examines the threats that new biotechnology may make possible.

Eckard Wimmer knows of a shortcut terrorists could someday use to get their hands on the lethal viruses that cause Ebola and smallpox. He knows it exceptionally well, because he discovered it himself.

In 2002, the German-born molecular geneticist startled the scientific world by creating the first live, fully artificial virus in the lab. It was a variation of the bug that causes polio, yet different from any virus known to nature. And Wimmer built it from scratch.

The virus was made wholly from nonliving parts, using equipment and chemicals on hand in Wimmer's small laboratory at the State University of New York here on Long Island. The most crucial part, the genetic code, was picked up for free on the Internet. Hundreds of tiny bits of viral DNA were purchased online, with final assembly in the lab.

Wimmer intended to sound a warning, to show that science had crossed a threshold into an era in which genetically altered and made-from-scratch germ weapons were feasible. But in the four years since, other scientists have made advances faster than Wimmer imagined possible. Government officials, and scientists such as Wimmer, are only beginning to grasp the implications.

"The future," he says, "has already come."

Five years ago, deadly anthrax attacks forced Americans to confront the suddenly real prospect of bioterrorism. Since then the Bush administration has poured billions of dollars into building a defensive wall of drugs, vaccines and special sensors that can detect dangerous pathogens. But already, technology is hurtling