Ashes in the wind:
The hidden cost of a regional nuclear war

Despite decades of relative stability, new research shows that the world remains at risk of nuclear conflict and the consequences could be globally devastating. From rising tensions to food system collapse, the threat is evolving, not disappearing, according to **Pavel Kiparisov** and **Christian Folberth**

About a decade ago, Pinker and Spagat came to the conclusion that a conflict comparable in scale to the wars of the 20th century is no longer probable today due to an observed decrease in human militancy. Cirillo and Taleb challenged these optimistic views by examining statistical properties and tail risks in a 2000-year dataset of violent conflicts.

Contrary to claims suggesting a decline in humanity's propensity for war, they found no evidence of a structural change in this behaviour. The inter-arrival time among conflicts causing at least ten million fatalities was, on average, 136 years (52 years for data rescaled to the current population) with a mean absolute deviation of 267 (61 years rescaled). Notably, these figures pertain to intervals between conflicts less severe than the world wars. The 'long peace' spanning eight decades since World War II is thus insufficient to conclude a lasting decrease in human militant nature. Consequently, the risk of another global conflict remains plausible, and the probability of it happening increases every year.

The contribution of nuclear winter research to the phase-out of the Cold War in the 1980s cannot be overstated. It made it clear to politicians on both sides of the Iron Curtain that there are no winners in a nuclear war and that an exchange of nuclear warheads could mean the end of humanity

Rising tensions among nuclear-armed countries and concerns that miscalculations or accidental escalation could lead to a catastrophe further add to this worrisome conclusion. Although disarmament efforts continue, and major countries demonstrate a discrete approach, the risk remains a significant global security challenge.

The Ukraine conflict has not come to an end yet. In September 2024, Russia revised its nuclear deterrence strategy, abandoning its previous doctrine of not striking first, including against a non-nuclear-armed country if it is backed by a nuclear state. In March 2025, France announced its readiness to extend the country's nuclear umbrella to European allies. Israel, an assumed nuclear-armed state, is in conflict with several neighbouring countries. In May 2025, tensions between India and Pakistan, both of which possess nuclear weapons, found new impetus.

As the international balance of power becomes more fragile after decades of relative stability, the need to understand the potential direct and indirect consequences of nuclear war increases. This brings us back to the research on nuclear winter, which sparked the most heated discussions throughout the 1980s.

In 1982, a notable paper was published by Crutzen and Birks. The paper's findings included that smoke from fires generated by major nuclear exchanges would block out the sun's rays in the Northern Hemisphere, dramatically changing the Earth's climate.

Subsequently, in 1983, a famous group of American scientists (known as TTAPS: Turco, Toon, Ackerman, Pollock, and Sagan) demonstrated that the repercussions would be even more dramatic. They posited that soot from cities would ascend into the stratosphere, causing temperature declines of more than 20 degrees Celsius and total recovery times of no less than a year. Meanwhile, Soviet scientists Alexandrov and Stenchikov, on the initiative of Moiseev, were studying the behaviour of the ocean and atmosphere in the aftermath of nuclear detonations. Their results aligned with findings from their American counterparts. Thus, the international scientific community, policymakers and the general public widely accepted the hypothesis of a nuclear winter, a global climatic effect that involves the cooling and drying of the Earth's atmosphere, causing large disruptions in all living systems.

Early nuclear war simulations assumed an all-out conflict between the USSR and the USA. The nuclear arsenals of these two countries were sufficient to ensure total mutual destruction. But what about conflicts between countries with smaller arsenals? Should scenarios involving them still be a concern for humanity? Recent nuclear winter research suggests that we should indeed be.

In 2020, Jägermeyr *et al*, including one of the authors of this article, analysed the indirect consequences of a nuclear conflict between India and Pakistan for food security. The scientists considered a scenario in which an exchange of

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nuclear warheads between the two countries would cause emissions of five teragrams (five million metric tonnes) of soot generated by fires into the stratosphere. The volume of particles would be sufficient to absorb sunlight, reducing the Earth's surface temperature and weakening the global hydrological cycle for at least a decade. In this scenario, the global mean surface air temperature would drop by 1.8 degrees Celsius, and precipitation would drop by 7.9 per cent in the first five years.

The problem, however, does not constitute only the environmental and climatic effects. A nuclear winter will cause other societal effects, including dramatic food shortages. Jägermeyr *et al* estimated that the India-Pakistan conflict would reduce global caloric production from maize, wheat, rice, and soybeans by 10.8 per cent in five years, reaching a maximum of 12.5 per cent in year four.

For context, the largest observed shock in food production recorded by Food and Agriculture Organization Statistics (FAOSTAT) since 1961 was a decrease of 4.6 per cent, which occurred in 2012. While domestic reserves could balance out the losses in the first year in the considered scenario, food availability was projected to fall by 13 per cent worldwide in subsequent years, with shortages of more than 20 per cent in many countries in the Global South. This is the potential cost of a regional conflict involving less than one per cent of the global nuclear arsenal.

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The authors of this article are building upon their research by studying the possible repercussions on the food system following a range of conflict-related disruption scenarios with a focus on food and fertiliser trade, the latter of which has been neglected so far. These scenarios include conflicts and trade disruptions between major military alliances and individual countries, the separation of countries into major political blocs, and the fragmentation of the trade network into the Global North and the Global South.

Preliminary results show that in all scenarios, countries not involved in the conflict suffer most from critical food shortages. In addition, inspired by works from the 1980s, we wanted to see if non-nuclear countries could exert pressure on nuclear states through trade limitations. It appears, however, that they are not in a position of power. If cut off from the food and fertiliser supply by nuclear states, they would be negatively affected by heightened risks of food insecurity. Meanwhile, countries possessing nuclear weapons could carry on with their operations as usual.

Finally, our research shows that in any tested configuration of conflicts, the world would see severe food shortages due to the intricacy of today's global agrifood trade network alone, which renders it highly vulnerable. Excluding key players – whether incidentally, voluntarily, or through enforcement – from the international supply chain can have far-reaching cascading consequences.

The contribution of nuclear winter research to the phase-out of the Cold War in the 1980s cannot be overstated. It showed politicians on both sides of the Iron Curtain that nuclear war has no victors and that a nuclear exchange could end humanity. This knowledge seems to have been forgotten or ignored recently, which is particularly concerning given the likelihood of a major conflict revealed by Cirillo and Taleb.

Although the theory of nuclear winter is scientifically sound, it remains a hypothesis that can only be proven through empirical testing. Its projections are devastating, with massive socioeconomic fallout for much of humanity, so we hope it never comes to that. Therefore, we must prioritise avoiding any type of nuclear conflict in the realm of international policy. CRJ

Sources

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