

Issue Brief: Security Implications of Climate Change and Climate Interventions

Why the EU Needs a Comprehensive Climate Security Strategy

This issue brief examines how the impacts of climate change and climate interventions could affect the EU's security, and explores how timely governance and prudent research by the European Union can improve potential outcomes. To this end, the International Center for Future Generations (ICFG) recommends the EU develop and implement a comprehensive Climate Security Strategy, one that includes an analysis of solar radiation modification and its potential effects on the EU's security profile.

→ Climate interventions in a climate risk context

Climate change multiplies the risks across human and geopolitical security.¹ Extreme weather events exacerbate threats to food security and intensify economic and social pressures on farmers. Prolonged droughts already exacerbate water scarcity with far-reaching impacts. These conditions threaten human health, which is increasingly at risk from extreme heat and frequent wildfires, undermining the European economy and its overall security.

Climate interventions – a complex risk profile

Climate interventions are not a solution in themselves or a substitute for urgent efforts to phase out greenhouse gases, since climate interventions do not reduce emissions. At best, they might be a supplement to those efforts.

Scientific research consistently shows that climate interventions - most notably stratospheric aerosol injection, a type of solar radiation modification² - could in theory temporarily reduce global temperatures and limit climate risks. However, such interventions would also bring new risks, including geopolitical ones, especially if introduced without governance and international coordination. Large uncertainties, limited research and insufficient governance blocks responsible deployment today.

¹ See the Annex for an overview of statements by the EU, US, and various UN agencies.

² ICFG's [fact sheet](#) and [infographic](#) offer a more detailed explanation.

³ According to the [UNEP Emissions Gap Report 2023](#) policies currently in place point to a 2.8°C temperature rise by the end of the century.

⁴ See e.g. [Germanwatch \(2023\)](#) on climate tipping points implications for human security.

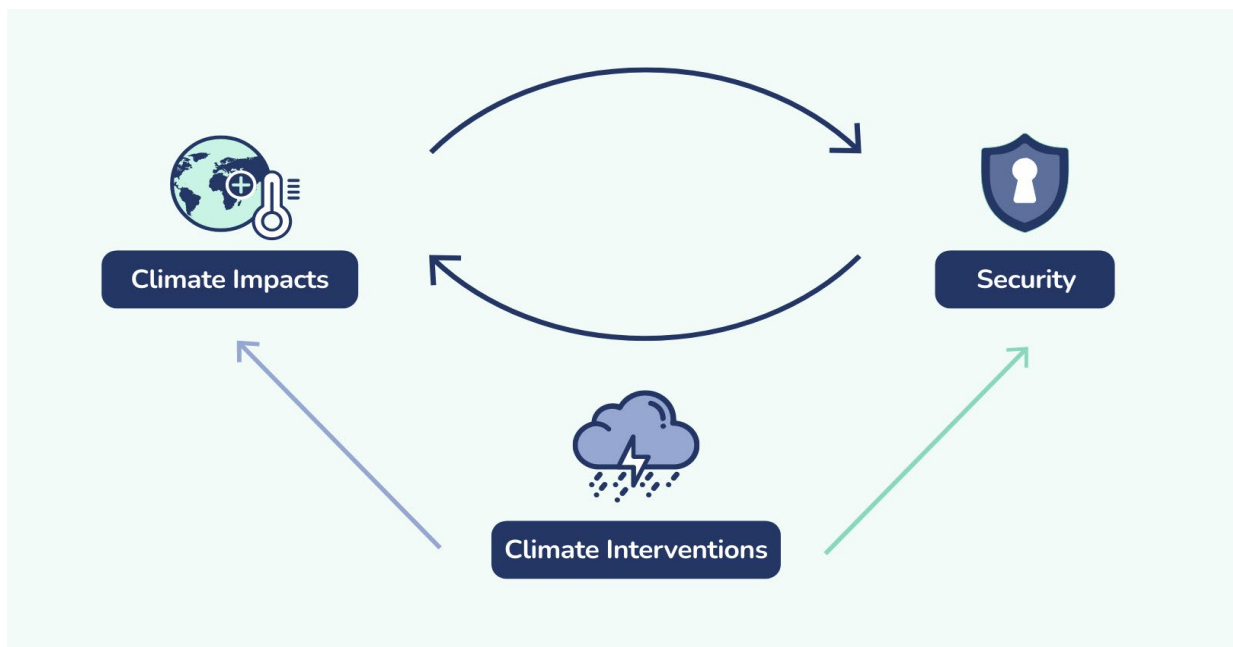
Climate interventions in a climate risk context

The security risks of climate interventions should be seen in the context of climate risks and an increasingly unstable world. We are currently on track for a temperature rise of 3°C by the end of the century,³ twice the Paris Agreement’s temperature goals. This will bring disproportionately greater climate impacts, as they are not linear. Climate risks to security can come abruptly due to climate tipping points.⁴ This includes the slowing and potential halt of the Atlantic Ocean’s circulation, disruptions of weather patterns, accelerating warming from permafrost methane releases,⁵ and knock-on effects on food security and critical infrastructures.^{1,6}

There is no comprehensive international governance for climate interventions technologies, which is in itself a serious risk. Additionally, the EU does not currently have a comprehensive Climate Security Strategy in place. This undermines its response capabilities, irrespective of whether the disruptions are caused by climate change or by climate interventions.

→ How might climate change - and climate interventions - affect security?

1. Climate change severely exacerbates threats across human and geopolitical security.
2. Reducing temperatures through climate interventions would help reduce numerous security threats.
3. Climate interventions would introduce new threats, and uncertainties.



⁵ Climate change is expected to accelerate due to additional release of CO₂ and methane from melting permafrost soils; the pace is [not fully understood](#).

⁶ [Studies](#) struggle pinpointing probability and timing, but are clear on the possibility of a medium-term AMOC shutdown – with extreme impacts (see e.g. [Rahmstorf, 2024](#)).

POSITIVE	NEGATIVE	UNKNOWN
<p>+ Computer models find that climate interventions could reduce climate change-related security threats under specific circumstances, though residual climate-threats would remain.⁷</p>	<p>- Deployment could go wrong due to inadequate knowledge, bad decisions, or unexpected effects especially if research, governance and international coordination are lacking.</p>	<p>? Geopolitical risks could include possible tensions over where to set the global thermostat, competition between countries, or retaliation for impacts attributed to interventions – even if impacts might not actually be due to the intervention.⁸</p>
<p>+ The EU has an opportunity to advance strategic research and diplomacy efforts toward transparency, monitoring and foresight of possible impacts.</p>	<p>- Key direct risks of climate interventions deployment include termination shock – rapidly rising temperatures when climate interventions are abruptly ended – and a slowing ozone layer recovery.</p>	<p>? Unknown impacts could be large from both climate change and climate interventions especially given the currently inadequate research efforts that do not systematically examine security dimensions.</p>

Insufficient knowledge of security relevant climate interventions risks and climate interventions benefits is an obstacle to responsible and informed decisions. Should such evaluations become necessary they would need to rely on responsible research having examined security dimensions across future scenarios of climate change with and without climate interventions.

→ Key security implications of climate change and climate interventions

Human security

- **Food:** Weather extremes can disrupt crop yields and undermine food security. Reasonable deployment of climate interventions lowers disruption risk, but residual changes and variations in weather patterns across regions may persist.
- **Water:** Climate change destabilizes the global water cycle, exacerbates drought and flood risks and alters regional precipitation patterns. Careful climate interventions may limit the change but regional water systems may still be impacted – including the South Asian monsoon serving over a billion people.
- **Health:** Climate change causes health stress and increases mortality including through heatwaves and disease. Climate interventions is the only way to quickly reduce heat, but disease vectors may still be altered.
- **Economic security:** climate change threatens progress on economic development in vulnerable regions and puts sustainable development progress at risk.⁹ Responsible climate interventions may improve economic indicators in most regions, but quantitative research is insufficient.

⁷ Studies have e.g. examined limiting warming to 1.5°C, (from a 3°C by 2100 trajectory, through well-coordinated SAI (MacMartin et al., 2018; Jones et al., 2018; Irvine et al., 2019; Irvine and Keith 2020). Evidence relies strongly on computer modelling; natural analogues from volcano eruptions are scarce and do not exactly mirror deliberate SAI.

⁸ A recent study identifies climate interventions security dimensions regarding negotiating tools, military capacities, targets of conflict, causes of conflict, or weaponization (Sovacool et al. 2023), another study finds conflictual views of potential security dimensions of climate interventions in the Arctic (Kornbech et al. 2024)

⁹ Studies show climate impacts severely on the sustainable development goals

Earth and ecosystem stability

- **Biodiversity:** Climate change is increasing biodiversity loss and shifting animal migration patterns undermining human livelihoods. Climate interventions could limit changes, but unequally, and introduce some additional changes (e.g. due a higher ratio of scattered light).
- **Security and earth systems stability:** Climate change increases the risk of catastrophic, irreversible shifts in key systems, such as the Arctic or the Atlantic Ocean currents that warm Europe (AMOC). Climate interventions deployed early might reduce risks, but deployed too late would add a layer of complexity. In all cases it would come with uncertainties and governance challenges.

Political security

- **Migration:** Disruptions of livelihoods and living conditions is contributing to the movement of populations, which is expected to rise dramatically in coming decades. Climate interventions could reduce migratory pressures in some regions, but might not address those in other regions.
- **Technological competition:** World powers are racing to dominate new technologies with profound global impacts. Humanity has only one shared atmosphere which needs to be managed cooperatively rather than through competition.
- **Contested governance:** There is a risk that some powers gain early, outsize control over the governance and use of climate interventions. Disagreements on timing, form and inclusivity of (non-)deployment decisions appear likely. Climate interventions will require stable, continuous global governance over many decades to avoid termination shock (see below).
- **Winners and losers:** While well-designed deployment of some forms of climate interventions could benefit some of the global population and attenuate climate change's threat of inequality, hasty implementation or unexpected effects could also lead to outcomes in which inequality is exacerbated with climate interventions.
- **Risk of conflict due to demands for compensation:** Any residual climate impacts – whether attributable to climate interventions or not – could trigger demands for compensation or even lead to conflict.
- **Geopolitical conflict:** Climate change is currently exacerbating the causes of many conflicts. Successful climate interventions could reduce some of these, but introduce new risks, including disagreements over causality, governance and responsibility for trans-national impacts.
- **Political polarisation:** Many societies are already divided over policy questions on how to tackle climate change. The prospect of climate interventions is likely to be highly contested, and prone to rampant mis/disinformation, conspiracy theories and accusations
- **Abrupt popular demand for climate interventions:** Lethal heat waves, among other climate impacts, could rapidly lead to societal unrest, rapid migration flows, and demands for immediate action. Climate interventions could potentially ease pressure on this issue, but trigger others.
- **Entrenchment of conflicts over beliefs and values:** Many communities have fundamental moral, religious, and ethical objections to engineering the climate. Communities or countries with different positions could trigger or increase tensions. Science is unlikely to resolve those tensions.

Climate interventions research and uncertainty

- **Scientific uncertainty and insecurity:** Risks from a lack in monitoring capability, climate impact attribution, are currently very high due to the absence of coherent public research programs.¹⁰

¹⁰ The US DOD points to a need for an allied capability to detect climate interventions (see Annex).

- **Risk of misinformation:** The absence of a healthy research ecosystem across technical and social science domains and effective science-communication efforts accentuates the public information gap and fuels misinformation risks.
- **Lack of policy-facing scientific synthesis:** The lack of comprehensive international science coordination exacerbates insecurity associated with risks of badly informed policy choices.
- **Lack of trusted international assessments:** The lack of assessments by a trusted international body such as the IPCC or UNEP undermines trust for international cooperation due to vast information deficits among many governments especially in the global south.

Climate interventions deployment specific implications

- **Termination shock:** Were certain climate interventions to be suddenly stopped, they could lead to a rapid rise in temperatures to previous levels and cause massive harm to people and ecosystems. Effective governance and safeguards could reduce that risk, but would need to be in place over decades, if not a century or more.
- **Weaponization or diplomatic threat:** Climate interventions are an easily detected, blunt instrument that is unlikely to be suitable as a targeted weapon. The threat of deploying climate interventions - or doing so in a particular manner - may provide first or dominant movers with geopolitical and security advantages.
- **Counter-geoengineering:** If countries disagree over deployment, there is a risk that some may threaten – or take – measures to counter climate interventions. Experts indicate this would not be effective, but the mere threat may be problematic enough.

Insecurity from poor governance

The IPCC, UNEP and several security-focused organisations (see annex) describe the lack of governance of climate interventions as a risk in itself. Effective, anticipatory governance could minimise the chances of hasty, rogue or ill-considered activities.

- The security risks rise with delays in developing regional and global governance.
- Short-sighted governance that fails to ensure responsible research, trust-building, transparent monitoring, and international cooperation can, however, exacerbate security threats.
- Multilateral governance can take years to develop, requiring action now.

Based on the above we recommend that the EU develops a comprehensive Climate Security Strategy, outlining response options for major disruptions such as a halt of Atlantic meridional circulation, atmospheric destabilisation from polar ice melt, or unilateral climate interventions with regional or global impacts. This strategy should utilise the foresight capabilities of EUISS and EEAS, along with the expertise of ESA, ERC, JRC, EC, and EDA, and leverage European research through Horizon Europe to reflect the full risk-management landscape for climate and potential interventions. It should inform defence, infrastructure, adaptation, trade, and migration policies, enhancing the EU's strategic capabilities to anticipate and respond to developments that can arise within years.



For questions or feedback you may send us an email at climate_interventions@icfg.eu