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 modification[2] - 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.

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. [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.

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

[2] *CFG's factsheet and infographic offer a more detailed explanation.*

[3] *According to the UNEP Emissions Gap Report 2024, policies currently in place point to a 2.6–3.1°C temperature increase over the course of the century.*

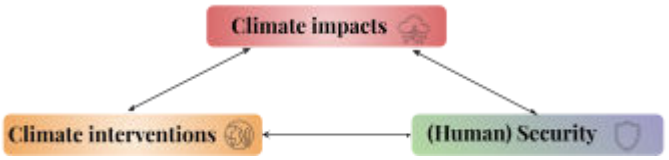
[4] *See e.g. European Commission's Joint Research Centre, 'Earth System Tipping Points are a threat to Europe' (2025) and Germany's federal intelligence service's National Interdisciplinary Climate Risk Assessment (2025).*

[5] *Climate change is likely to accelerate due to anthropogenic emissions and additional release of CO2 and methane from melting permafrost soils; according to the IPCC's Sixth Assessment Report (Working Group II).*

[6] *Studies, referenced by Germany's National Interdisciplinary Climate Risk Assessment, struggle in pointing probability and timing, but are clear on the possibility of a medium-term AMOC shutdown – with extreme impacts (see e.g. Rahmstorf, 2024).*

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

- ➔ Climate impacts severely exacerbates several threats to human and geopolitical security.
- ➔ Climate interventions could reduce some climate-related security threats.
- ➔ Climate interventions would introduce new threats, and uncertainties.



Positive	Negative	Unknown
• Computer models find that climate interventions could reduce climate change-related security threats under specific circumstances.[7] • The EU has an opportunity to advance strategic research and diplomacy efforts toward transparency, monitoring and foresight of possible impacts.	• Inadequate knowledge, bad decisions, or unexpected effects. • Termination shock - rapidly rising temperatures upon an abrupt stop of interventions • Slowing of the ozone layer recovery.	• Geopolitical tensions over the global thermostat • Competition or retaliation for impacts attributed to interventions - even if falsely attributed.[8] • Climate change and climate interventions related impacts. • Inadequate research efforts overlooking security dimensions.

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.

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[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 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).*

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.[9] Careful climate interventions may limit the change but regional changes may still happen, 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 are the only way to quickly reduce heat, but disease vectors may still be altered.
- ➔ **Economic security**: climate change threatens progress on economic development, including in vulnerable regions and puts sustainable development progress at risk.[10] Responsible climate interventions could theoretically improve economic indicators in most regions, but there are large uncertainties.

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 to 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

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[9] *The 2024 European State of the Climate report compiled by the Copernicus Climate Change Service and the World Meteorological Organization found that "Since the 1980s, Europe has warmed twice as fast as the global average, making it the fastest-warming continent. (...) Extreme rainfall is leading to catastrophic floods, and heatwaves are becoming more frequent and severe. Southern Europe is experiencing widespread droughts."*

[10] *See the 2024 UN Sustainable Development Goals Report - which indicates that climate change has severe impacts on the realization of sustainable development goals, including for poverty reduction. In addition, the European Environment Agency in its 2024 Climate Risk Assessment stated that although "The EU's Joint Research Centre (JRC) recently projected the economic fallout for the EU from the cross-border impacts of climate change via trade at EUR 10.32 billion per year in a 2°C warming scenario and EUR 27.38 billion in a 3°C scenario (...) these projections [were] likely to underestimate the cumulative impacts of supply chain disruptions (...)"*

Political security

- **Migration**: Disruptions of livelihoods and living conditions are contributing to the movement of populations, which is expected to rise dramatically in the 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 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
- ➔ **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-focussed 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.

Our take:

Based on the above, we recommend the EU develop 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 the Eur*opean* Union Institute for Security Studies (EUISS) and the European External Action Service (EEAS), along with the expertise of the European Space Agency (ESA), the European Research Council (ERC), the Joint Research Centre (JRC), the European Commission, and the European Defence Agency (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.

Authors

Matthias Honegger *Program director – Climate Interventions*

Cynthia Scharf *Senior Fellow – Climate Interventions*

Giulia Neri *Senior Policy Advisor – Climate Interventions*

Roxane Cordier *Researcher – Climate Interventions*

For questions or feedback write to us at
climateinterventions@cfg.eu

Annex 1: Key references to security implications of climate change and climate interventions

The following provides an overview of key statements by institutions in the US, EU, and UN pertinent to security implications of climate change and climate interventions; in order of recency. Highlights are ours.

United States Department of Defense, Climate change and global security, 2024:
"Since weather extremes may alter the defence posture of both Allies and potential adversaries, weather manipulation could be weaponized. The threat of state-sponsored large-scale weather manipulation using geoengineering techniques warrants an Allied ability to detect such actions.
While large-scale deployment of SAI is observable, many have called for research to be conducted into SAI to facilitate informed policy debates. In particular, The White House Office of Science and Technology Policy (OSTP) states, "Outdoor experiments would be valuable in combination with model and laboratory studies for understanding processes involved with potential SRM (Solar Radiation Modification) deployment." A report by the National Academies of Sciences, Engineering, and Medicine proposes a small-scale research, typically smaller than 100X, that would result in an observable impact on climate and be conducted under an international regime of governance founded on transparency. While international collaboration in SAI research could be beneficial in creating sound policy decisions regarding issues associated with climate intervention, one must also address the concern of state actors who may conduct this type of research without transparency and then may leverage knowledge gained to produce a unilateral breakout capability. […]

A program to measure stratospheric aerosols and particulates is also needed to **improve atmospheric modelling and prevent strategic surprise**. This program should provide a capability for the widespread measurement of atmospheric aerosols and particulates to ensure that an adversary cannot be positioned for **strategic surprise in executing unilateral climate interaction** (sic) action. Further, possessing the capability to deny that stratospheric tampering occurred is a valuable message to counteract potential histrionics used in psychological operations. […]

Finally, there is a need to leverage remote sensing for large-scale monitoring, given the global implications of climate intervention technologies. A partnership between the Office of the Director of National Intelligence (ODNI) and the DoD could address the challenge of collecting all available information, including the measurement data recommended above, to provide an assessment of adversary plans for large-scale climate intervention activities. […]

For the DoD, the implications of climate intervention include not only the effect of such approaches on its military operations but also the **possibility that it will have to**

respond to state sponsored climate intervention activities. The DoD will have to **develop the capability to monitor** such activities, which includes deploying the appropriate sensing capability. Measuring stratospheric aerosols and particulates to avoid strategic surprise will be key. The DoD must also **partner with other government agencies** developing these modeling and sensor capabilities."

European Environment Agency, European Climate Risk Assessment, 2024:
"The first European Climate Risk Assessment (EUCRA) is a comprehensive assessment of the major climate risks facing Europe today and in the future. It identifies 36 climate risks that threaten our energy and food security, ecosystems, infrastructure, water resources, financial systems, and people's health. Many of these risks have already reached critical levels and can become catastrophic without urgent and decisive action.

(Extreme) events, combined with environmental and social risk drivers, pose major challenges throughout Europe. Specifically, they compromise food and water security, energy security and financial stability, and the health of the general population and of outdoor workers; in turn, this affects social cohesion and stability."

UN Security Council 9547th meeting, Press Release, 2024:
"The Security Council today concluded its open debate on climate change and food insecurity, with speakers calling for urgent action to address the profound impact of these escalating crises particularly on vulnerable and conflict-affected nations."

US National Aeronautics and Space Administration (NASA), Slowdown of the Motion of the Ocean, 2023:
"…the movement of water north and south throughout the Atlantic might be weakening due to climate change," with potentially severe consequences for weather patterns in Europe."

European Commission and High Representative on Foreign Affairs and Security Policy, Joint Communication on the Climate-Security Nexus, 2023:
"In the context of accelerated global warming, deliberate large-scale intervention in the Earth's natural systems (referred to as "geoengineering"), such as solar radiation modification, is attracting more attention. However, the risks, impacts and unintended consequences that these technologies pose are poorly understood, and necessary rules, procedures and institutions have not been developed. These technologies introduce new risks to people and ecosystems, while they could also increase power imbalances between nations, spark conflicts and raise a myriad of ethical, legal, governance and political issues. Guided by the precautionary principle, the EU will support international efforts to assess comprehensively the risks and uncertainties of climate interventions, including solar radiation modification and promote discussions

on a potential international framework for its governance, including research related aspects. […]

Climate change and environmental degradation pose increasing risks to international peace and security. Extreme weather events, rising temperatures and sea levels, desertification, water scarcity, threats to biodiversity, environmental pollution and contamination and loss of livelihoods threaten the health and well-being of humanity, and can create the potential for greater migratory movements and displacement, pandemics, social unrest, instability and insecurity."

European Commission, Communication on Managing climate risks – protecting people and prosperity, 2023:
"Climate resilience is a matter of maintaining societal functions, but also of competitiveness for economies and companies, and thus jobs. Managing climate risks is a necessary condition for improving living standards, fighting inequality and protecting people. It is a matter of economic survival for rural and coastal areas, farmers, foresters and fishers. For businesses, climate risks are already well recognised and are seen as the top four risks in a decade."

Council of the EU, Council conclusions on Climate and Energy Diplomacy, 2023:
"EU climate and energy diplomacy is a core component of the EU's foreign policy."

UN Environment Program, One Atmosphere, 2023:
"SRM could create societal risks including the potential for international conflicts (because of transboundary effects), unilateral SRM ('rogue' parties may opt for SRM deployment) and counter and countervailing SRM deployments. SRM deployment would therefore raise ethical, moral, legal, equity and justice questions.
The lower cost estimate of an SRM deployment (about 20 billion USD per year per 1°C of cooling) puts the cost of an SRM deployment within the reach of many states and perhaps non-state actors, raising concern over how a 'rogue deployment' might be avoided or responded to. […]

There are also concerns that differences of opinion over whether, what kind or how much SRM to deploy could generate political and possibly even military conflict. Critically, integrated assessments of many impacts, both positive and negative, remain limited in scientific literature; for example, mortality and morbidity from heat stress, water resources, flood risk, storm damage, vector-borne diseases, biodiversity, food security, ocean ecosystems and fisheries."

UN Security Council, Climate Crisis Generating Growing Threats to Global Peace, 2023:
"With the climate crisis generating an increasing threat to global peace and security, the Security Council must ramp up its efforts to protect the Organization's peace operations around the world and lessen the risk of conflicts emanating from rising sea

levels, droughts, floods and other climate-related events, briefers, ministers and delegates told the 15–nation organ."

European Parliament Research Services, Briefing: Climate change considerations for EU security and defence policy, 2022:
"Among the sectors affected, security and defence is not spared: climate change not only acts as a threat multiplier, but also impacts capabilities and operational considerations."

UN Environment Program, Addressing Climate-Related Security Risks, 2019 and revised in 2022:
"Residents of urban and peri-urban areas in climate-exposed regions face growing risks of displacement (and possibly secondary displacement), especially in vulnerable coastal regions. The effect of environmental and climatic changes on migration is best understood within the context of existing migration patterns. Conflicts can force people in high-risk areas to flee to less dangerous places within their own country or across borders. In cases where environmental risks and violent conflicts occur at the same time, this pressure can even be intensified, and in receiving areas, an influx of migrants can put pressure on local resources or public services, exacerbating the likelihood of political tensions or outbreaks of violence. However, migration can also be an effective adaptation strategy. Migration can improve living conditions and provide economic perspectives. Temporary or seasonal migration from severely affected regions to less affected areas, such as during seasonal rainfalls or heat waves, can help cope with a crisis."

UN Development Program, A typology and analysis of climate-related security risks, 2022:
"The analysis shows that climate change is recognized by many countries as a matter of national security, but also as a factor that exacerbates the drivers of different types of conflict and security risks. Conflict and insecurity are also described in the NDCs as increasing vulnerability to climate change and/or as being potentially disruptive to climate action and to the achievement of NDC targets, including in post-conflict situations."

United States National Intelligence Council, Climate Change and International Responses Increasing Challenges to US National Security Through 2040, 2021:
"Risk of Unilateral Geoengineering Increasing: We assess there is a growing risk that a country would unilaterally test and possibly deploy large-scale solar geoengineering technologies as a way to counter intensifying climate effects if it perceived other efforts to limit warming to 1.5˚C had failed. Without an international agreement on these technologies, we assess that such a unilateral effort probably would cause blowback."

And, “We assess that the lack of any country level dialogue or governance body to set regulations and enforce transparency over research increases the possibility that state or nonstate actors will independently develop or deploy the technology— possibly covertly—in a manner that risks conflict if other nations blame them for a weather disaster they believe was caused by geoengineering.
Large-scale geoengineering could be internationally disruptive because of its potential to substantially affect the Earth’s biosphere, which would change global weather patterns and provide climate benefits to some regions at the expense of others. Depending on the scale and location of deployment, it could change weather systems in the United States.

Researchers in several countries, including Australia, China, India, Russia, the United Kingdom and the United States, as well as several EU members, are exploring geoengineering techniques. We assess that the lack of any country level dialogue or governance body to set regulations and enforce transparency over research increases the possibility that state or nonstate actors will independently develop or deploy the technology— possibly covertly—in a manner that risks conflict if other nations blame them for a weather disaster they believe was caused by geoengineering.”

EU Commission, Communication on Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change, 2021:
“The impacts of climate change have knock-on effects across borders and continents. Even local climate impacts have regional or global repercussions, and such transboundary climate risk can reach Europe. For instance, the disruption of port infrastructure could hamper or even close down trade routes, both for commodities and goods, with potential cascading effects across international supply chains.”

UN Climate Security Mechanism, Progress report, 2021:
“The Climate Security Mechanism (CSM) is a joint initiative by the United Nations Department of Political and Peacebuilding Affairs (DPPA), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). It was established in 2018 with the objective of strengthening the capacity of the United Nations system to analyze and more systematically address the adverse impacts of climate change on peace and security. The CSM works with partners around the world to enhance a gender-sensitive understanding of the issue and to support capacity building efforts in United Nations entities and regional and subregional organizations for the prevention and management of climate-related security risks.”

Council of the EU, Council conclusions on Climate Diplomacy, 2020:
“The European Union is acutely aware that climate change multiplies threats to international stability and security in particular affecting those in most fragile and vulnerable situations, reinforcing environmental pressures and disaster risk, contributing to the loss of livelihoods and forcing the displacement of people. ...

The Council continues to encourage the UN Security Council (UNSC) and the United Nations system to create a comprehensive information basis for the UNSC on climate-related security risks, to fully integrate short and long-term climate and environmental risk factors in the assessment and management of threats to peace and security, at country, regional and international levels, and to draw on the expertise of the whole UN system in order to find operational responses to these risks and strengthen UN missions on the ground."

EU External Action Service, Climate Change and Defence Roadmap, 2020:
"Climate change increases global instability. This will likely increase the number of crisis situations to which the EU might need to respond while at the same time the armed forces will be asked more frequently to assist civilian authorities in response to flooding or forest fires, both at home and abroad.
Future capabilities will need to adapt to this changing operational environment (e.g. extreme heat or higher sea levels). At the same time, the armed forces need to invest in greener technologies throughout their capability inventory and infrastructure."

International Military Council on Climate and Security, The World climate and security report, 2020:
"Integrate climate into armed forces risk assessment, early warning, surveillance, and operational preparations to include adaptation measures to climate-proof military infrastructure.Early warning and surveillance framework should also have the capacity to anticipate risks from emergent climate-manipulating technologies such as geoengineering."

UN Development Program, Climate Security Nexus and Prevention of Violent Extremism, 2020:
"Climate change can contribute to food and water insecurity, but also increase competition for essential resources, impair livelihoods and coping strategies to have disruptive effects on the life opportunities of young people. It can drive forced displacement and rural-urban migration as well as alter transhumance patterns, potentially fuelling social tensions between different communities and exacerbating the drivers of conflict and fragility. Investment in adaptation and resilience can offset some of these impacts, but not all.

These indirect impacts on governance and social systems are an important consideration when examining the intersectional risks posed by climate change and violent extremism."

Council of the EU, Conclusions on Security and Defence in the context of the EU Global Strategy, 2019:
"Underlines the importance environmental issues and climate change have for security and defence, as outlined in the Council conclusions on Climate Diplomacy of February

2019. The Council also welcomes the increased climate sensitivity of EU actions on conflict prevention and sustainable security and emphasises the need for adequate risk assessment and risk management strategies. [...] considering the impact of climate change within the assessment of global threats and challenges."

EU External Action Service, EU Statement before the United Nations Security Council, "Addressing the impacts of climate-related disasters on international peace and security" 2019:
"Climate change acts as a threat multiplier for conflicts over access to increasingly scarce resources and for instability and international and internal displacement. [...] Assessing climate and environmental risks and their potential impact on socio-economic stability should be done in all countries but has to become a priority especially in the most fragile situations."

EU External Action Service, A Global Strategy for the European Union's Foreign and Security Policy, 2016:
"Yet today terrorism, hybrid threats, economic volatility, climate change and energy insecurity endanger our people and territory. … Climate change and environmental degradation exacerbate potential conflict, in light of their impact on desertification, land degradation, and water and food scarcity. We will therefore redouble our efforts on prevention, monitoring root causes such as human rights violations, inequality, resource stress, and climate change – which is a threat multiplier that catalyses water and food scarcity, pandemics and displacement."

European Union Institute for Security Studies EUISS, Report on Space security for Europe, 2016:
"This can include reinforcing the use of space assets for addressing global challenges (such as environment protection, climate change, sustainable development, and disaster response) while at the same time building space economic diplomacy to promote the European industrial base. International space cooperation can thus become a diplomatic tool that serves both as a market opener for the promotion of European solutions abroad and as a door opener to deeper cooperation on space security issues."

UN Environment Program, Livelihood Security Climate Change, Migration and Conflict in the Sahel, 2011:
"Changes in the [Sahel's] regional climate are impacting issues linked to the availability of natural resources essential to livelihoods in the region, as well as food insecurity. Along with important social, economic and political factors, this can lead to migration, conflict or a combination of the two."

UN General Assembly, "Invites Major United Nations Organs to Intensify Efforts in Addressing Security Implications of Climate Change", 2009:

“Deeply concerned about the possible security implications of climate change, the General Assembly today invited the major organs of the United Nations, including the Security Council, to intensify their efforts to address the challenge, as appropriate and within their respective mandates.”

UN Security Council, "Security councils hols first-ever debate on impact of climate change on peace, security", 2007:

“Security council holds first-ever debate on impact of climate change on peace, security, hearing over 50 speakers. Secretary-General Ban Ki-moon said that projected climate changes could not only have serious environmental, social and economic implications, but implications for peace and security (...) outlined several “alarming, though not alarmist” scenarios, including limited or threatened access to energy increasing the risk of conflict, a scarcity of food and water transforming peaceful competition into violence and floods and droughts sparking massive human migrations, polarizing societies and weakening the ability of countries to resolve conflicts peacefully.”

Annex 2: Existing international treaties and UN Resolutions relevant to SRM (based on UNEP, 2023)

Convention / Treaty	Year	Potential relevance
Conventions and Protocols		
Liability Convention (of the Outer Space Treaty)	**1972**	The Liability Convention of the outer space treaty provides that a launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space. The Convention also provides for procedures for the settlement of claims for damages.
ENMOD Convention	**1977**	The ENMOD convention prohibits hostile action to modify the environment as a means of warfare. And it encourages the exchange of scientific and technological information on the use of environmental modification techniques for peaceful purposes. "States Parties in a position to do so shall contribute, alone or together with other States or international organizations, to international economic and scientific co-operation in the preservation, improvement and peaceful utilization of the environment, with due consideration for the needs of the developing areas of the world."
Vienna Convention / Montreal Protocol	**1985**	Parties to the Vienna Convention and Montreal Protocol agree to adopt measures to reduce or prevent human activities that have or are likely to have adverse effects resulting from modification of the ozone layer. The governance model may offer insight into regulating SAI deployment, though the applicability is limited insofar that many of the substances that could be used for SAI are naturally occurring or otherwise commonly used and only when injected in the stratosphere would they hold adverse effects.
Convention on Environmental Impact Assessment in a Transboundary Context (UNECE)	**1991**	The UN Convention on Environmental Impact Assessment in a Transboundary Context (under the UN Economic Commission for Europe 1991) calls for parties to undertake environmental impact assessment, potentially including for SRM activities.
UNFCCC Article 3.3	**1992**	"The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost."

UN Resolutions, draft resolutions, multilateral agreements, and COP decisions		
CBD – Decision X/33	**2010**	"Ensure […] in the absence of science-based, global, transparent and effective control and regulatory mechanisms for geo-engineering […] that no climate- related geoengineering activities that may affect biodiversity take place, until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts, except for small scale scientific research studies that would be conducted in a controlled setting[…]"
UNEP/CBD/ SBSTTA/16/INF/ 28	**2012**	Addresses the impact of Climate-related Geoengineering on Biological Diversity. Note by the Executive Secretary – Chapter 4: Potential impacts on biodiversity of generic SRM that causes uniform dimming.
London Protocol Amendment on Marine Geoengineering	**2013**	The London Protocol amendment on marine geoengineering seeks to establish a stable, legally-binding framework for the regulation of marine geoengineering, while also allowing for regulatory flexibility and adaptability to respond to new scientific and technological proposals that may adversely affect the marine environment in the future based on a precautionary approach. 'Marine geoengineering' is defined in the amendment as a deliberate intervention in the marine environment to manipulate natural processes, including to counteract anthropogenic climate change and its impacts, and that have the potential to result in deleterious effects, especially where those effects may be widespread, long-lasting or severe. The governance model regarding permitting of research is seen by some as a possible model for regulating SAI research (under a suitable convention), though it is unclear if it is effective at ensuring the pursuit of research of high value as permitting agencies may be incentivized to err excessively on the side of prevention.
Draft resolutions on "Geoengineering" at UNEA-4 and on Solar Radiation Modification at UNEA-6	**2019, 2024**	UNEA-4 considered a proposal for a UNEP-led report on the risks and potential of climate engineering, which did not find consensus. UNEA-6 considered a proposal, which initially suggested that UNEP would convene a group of experts to produce a detailed assessment report and a later revised version suggested asking UNEP to facilitate information sharing, neither of which found consensus though Parties seemed to agree that having a range of options for information sharing would be desirable heading into UNEA-7 in 2025.
The Montreal Protocol Decision XXXI/2: Area of focus for 2022 Scientific Assessment	**2021**	Potential areas of focus for the 2022 quadrennial reports of the Scientific Assessment Panel, the Environmental Effects Assessment Panel and the Technology and Economic Assessment Panel: "…An assessment of information and research related to solar radiation management and its potential effect on the stratospheric ozone layer".

Panel		
Security Council SC/14732 (Draft resolution)	**2021**	The Security Council in a contentious meeting, rejected a draft resolution that would have integrated climate-related security risk as a central component of United Nations conflict prevention strategies aiming to help counter the risk of conflict relapse.
General Assembly Resolution A/76/473, para. 12	**2021**	76/112. Protection of the atmosphere – Resolution adopted by the General Assembly on 9 December 2021 [on the report of the Sixth Committee (A/76/473, para. 12)]. Guideline 7 - Intentional large-scale modification of the atmosphere Activities aimed at intentional large-scale modification of the atmosphere should only be conducted with prudence and caution, and subject to any applicable rules of international law, including those relating to environmental impact assessment.
Human Rights Council A/HRC/RES/48 /14, para.	**2022**	48/14. Mandate of the Special Rapporteur on the promotion and protection of human rights in the context of climate change [Resolution adopted by the Human Rights Council on 8 October 2021] Paragraph 6 – Requests the Advisory Committee of the Human Rights Council to conduct a study and to prepare a report, in close cooperation with the Special Rapporteur, on the impact of new technologies for climate protection on the enjoyment of human rights, and to submit the report to the Council at its fifty-fourth session.