Human Rights Council Advisory Committee

Questionnaire on the impact of new technologies for climate protection on the enjoyment of human rights [1]

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Core questions (for all stakeholders)

1. Which new technologies for climate protection (NTCP) are of particular importance when it comes to impact on human rights? List three most relevant and explain your choice.

This submission focuses on stratospheric aerosol injection (SAI): injecting particles into the atmosphere to reflect sunlight, cooling the Earth. Note that there are other methods for reflecting sunlight, for instance cloud seeding. **But SAI warrants specific focus because of its uniquely high magnitude of potential benefits and risks.** SAI could directly affect temperature, and other Earth systems, at a global level.

Indeed, **SAI is one of the most feasible ways in which global warming could be limited within our lifetimes.** SAI was recently costed at roughly US$18 billion per year per Celsius of cooling[1] and developing the aviation payload system is not expected to be highly difficult[2]. If (optimistically) implemented carefully and cooperatively over a long period of time, SAI can alleviate the many human rights risks of climate change.

However, SAI's global reach presents global and potentially severe risks. SAI could cause unknown ripple effects across ecological systems[3], destabilize international and domestic politics[4], and worsen other global catastrophes. **At worst, SAI's interactions with other global catastrophes could create risks worse than climate change itself[5].** Further, the relatively centralized nature of SAI may further exacerbate existing inequalities in global decision-making, and rights to meaningful informed participation and self-determination.

This is at the heart of SAI's risk trade-offs with climate change. Answers to forthcoming questions further explore the SAI risks and the climate-SAI comparison.

2. What kind of NTCP may contribute to human rights promotion and protection? Please, explain how.

Under optimistic conditions, **SAI may alleviate climate risks and thus the human rights implications of climate change**. More 'designed' and optimal deployments, like more limited injections[6] in specific latitudes[7] or seasons[8], could reduce SAI's ecosystem risks while alleviating climate risks.

[1] The term *new technologies for climate protection* for the purpose of this questionnaire broadly refers to techniques of deliberate intervention in the Earth's natural system in order to prevent further climate change or reverse it. The two main kinds are (1) Solar Radiation Management SRM (i.e. stratospheric aerosols) and (2) Carbon Dioxide Removal CDR. CDR solutions can be nature-based (forestation, soil carbon sequestration, biochar, etc.) or technological (enhanced weathering, bioenergy with carbon capture and storage, direct air capture and storage, etc.).

This would require high levels of international cooperation and coordination over the entirety of deployment. SAI deployment would be decades, potentially over a century long (depending on how quickly the world can shift to renewable energy and stabilize greenhouse gas concentrations at a safe level).

However, international politics, society, and culture are not known for stability. Especially over decadal and potentially century long timeframes. Election swings, societal changes, and broader geopolitics are volatile. **There is no guarantee that SAI would be used cooperatively and carefully over a long period of time**. Even optimized SAI deployments are not a panacea. Ideally optimized SAI (and what this would look like) could still be a source of social and political controversy.

3. What are the key human rights challenges and risks arising from NTCP and from which in particular? Do NTCP create unique and unprecedented challenges or risks, or are there earlier precedents that help us understand the issue area?

We live in a world of politicization, poor coordination, and misinformation, headed towards roughly 3 degrees of global warming. In such a world, SAI is more likely to be used in an uncoordinated fashion and masking more levels of warming. **Less coordinated SAI presents more risks, especially in the worst cases.**

Thicker and more uncoordinated SAI would produce more ecosystem side effects. The frequent ecosystem effect cited is affecting rainfall and drought patterns[9–11]. **There are also ripple effects across ecosystems that may be unforeseen.** For instance, changing temperature distributions can change animal distributions, changing vectors of diseases like malaria[12]. The exact nature of the ecosystem effects is highly uncertain, especially because climate change is already pushing Earth systems into novel difficult to predict states, which SAI would further interact with. All that is clear is that more, quicker, and more uncoordinated SAI would pose more ecosystem impacts[3]. SAI's ecosystem impacts could be preferable to the impacts of climate change (noting the caveats that this will be highly contested, unevenly distributed across different countries, and depends on the exact use of SAI and extent of climate change). Nonetheless, outlining potential ecosystem interactions is critical to understanding SAI's risk profile.

The worst-case risks are substantially more severe. If another catastrophe like economic collapse or nuclear deployment knocked out SAI masking multiple degrees of warming for a long enough time, and underlying greenhouse gas concentrations were still high, the Earth would slingshot back to warming in a matter of decades. This is known as 'Termination Shock'. We have experienced roughly 1.1 degrees of warming since 1850, multiple degrees of warming in a matter of decades would be worse than worst case climate change. Termination risk has been downplayed given the relatively small likelihood of other catastrophes and the possibility of redeploying SAI before a warming shock would occur[13].

Unlikely severe risks should not be dismissed. Influential historical events tend to be those which seem unlikely and are extreme. The millennium so far has seen the 9/11 attacks, Global Financial Crisis, and COVID-19. Unlikely impactful events should not be underestimated, especially regarding a high impact and high-risk technology like SAI.

In addition, one should caution against optimism regarding emergency responses. COVID-19 saw political leadership that spread misinformation (Donald Trump, USA), attempted a herd immunity response (Boris Johnson, UK), and bungled vaccine policy (Scott Morrison, Australia). This joins a legacy of mixed success in emergency responses[14–16]. **Trusting in clear and rational SAI policy, especially when stacked with other catastrophes occurring, would be imprudent (especially without changes in underlying institutions).**

4. What specific human rights may be affected by the use of NTCP? Please, explain how. Who are the rights-holders that potentially would be the most affected by the use of NTCP? Are they also the most affected by climate change? How could they and the society at large be engaged in the decision-making process?

See answers to Core Questions 2 and 3 on SAI benefits and risks. **Negative SAI side effects could affect rights to food, water, and health, among others.**

There are also procedural issues with SAI. SAI would affect the entire world, and if enacted by a relatively small number of actors, **could compromise rights to self-determination and meaningful informed participation**. In addition to the initial barrier of whether to deploy SAI in the first place, there are complex decisions of how the specific deployment should take place. SAI deployment is not just about reducing to a desired temperature[17]. There are other objectives to balance against, like the reduction of different ecosystem impacts. These highly complex and subjective issues seem highly difficult to resolve, not least in a fully participatory manner (especially considering the historical difficulties and failures of international climate negotiations[18]).

5. Is the existing international and your national human rights framework adequate to safeguarding human rights of those affected by the use of NTCP? Why or why not? If not, what principles may be identified in order to address the gaps? List them according to priority.

Existing frameworks are insufficient. Apart from informal norms of research[19], specific ethics policies of universities, and recent calls to by senior researchers to halt SAI field testing[20], there is no existing formalized governance of SAI research and deployment. **Some existing governance structures may be tangentially related to SAI[21], but there is nothing SAI specific.**

Previous efforts to develop SAI governance have been met with political resistance. Considering SAI research governance under the UN Environment Assembly[22] was stopped by the US and Saudi Arabia, who preferred keeping SAI in the realm of the Intergovernmental Panel on Climate Change[23].

6. Given that NTCP may present potential risks for the enjoyment of human rights, to what extent do human rights legal obligations require the States to pursue other climate protection policies presenting less risks of harm, including mitigation and adaptation measures?

Mitigation and adaptation should be the overriding focus of climate policy. On paper, SAI is no replacement for mitigation. But vested interests and politics could mean that SAI is used as a justification for delaying rapid renewable transitions[24,25]. Connecting SAI and mitigation delay is difficult to causally analyze[26], and indeed there are other clear drivers of mitigation delay that warrant focus instead of SAI (for instance, fossil fuel lobbying or climate politicization). Regardless, potential mitigation delay should not be dismissed in SAI governance.

Further, effective SAI deployment would depend on effective mitigation and carbon dioxide removal. While there is certainly uncertainty over the specific nature of SAI risks, it is relatively clear that minimizing the time of SAI deployment is desirable. Conversely, SAI as a permanent climate-bandaid is clearly undesirable. **Minimizing the time of a potential SAI deployment is only possible by transitioning to renewable energy and stabilizing greenhouse gas concentrations to a safe level as fast as possible.**

7. As opposed to focusing on selected few technologies, do you think a holistic and inclusive approach will help reduce any gaps in the existing system for addressing human rights challenges from NTCP?

See answer to Core Question 6 on the importance of mitigation and carbon dioxide removal.

8. What should be the responsibilities of key stakeholders (UN agencies, states, NHRIs, civil society, technical community and academia, private sector) in mitigating the risks of NTCP to human rights and/or fostering its protection?

Governance and human rights responsibilities can be split into the short and long term.

Shorter term responsibilities center around issues of SAI research. There are many open questions that need to be addressed. For the purposes of this submission, I provide an initial canvas of three issues to consider.

First, who does the research? SAI research is heavily driven by researchers in wealthy institutions in the global north[27,28]. Non-representative research that is the basis of SAI governance could compromise representation in later SAI decisions. **Second, should patents be allowed on SAI technology?** Patents could create a vested interest in deployment[29]. There is also whether some patents for more general aviation technologies could also be counted as an 'SAI' patent. **Third, could research constitute a 'Slippery Slope' to deployment?** The Slippery Slope concept has been dismissed by some as incorrect and outdated given existing resistance to SAI[30]. But SAI is an especially high-risk technology with a low barrier to entry. Dismissing Slippery Slope concerns at such an early stage would be premature. Further, the Slippery Slope is also often cited[31] without clarifying its exact causal nature[32]. Slippery Slope concerns should not be dismissed when discussing research governance.

Longer term responsibilities center around issues of SAI deployment. Again, there are many critical open questions to address. **First, should SAI even be deployed? Second, how should deployment occur?** (See answers to Core Questions 2 and 3)

Specific questions for the technical community and academic institutions

1. How would you differentiate between "new" and "old" technologies for climate protection?

The difference between 'new' and 'old' technologies is blurred. SAI itself would not necessarily require major technological innovations[2]. Attempts to modify climate systems have a surprisingly long history. Operation Popeye for instance was an initiative by the US military in the Vietnam War to seed clouds to extend the Monsoon Season and disrupt Vietnamese supply lines[33]. **The difference is that the purpose of technological use has changed. The goal is now explicit, direct, and global scale modification with Earth systems.**

2. Which NTCP do you find most important for the global efforts to combat climate change and why?

See answer to Core Question 1 on the magnitude and importance of SAI.

3. What will be the impact of NTCP on the enjoyment of human rights in the short-term and the long-term?

See answer to Core Question 8 on short- and long-term governance of SAI.

4. How should the impact of the use of NTCP be assessed and attributed given scientific uncertainty? What is the role for the precautionary approach?

Development of climate and ecosystem monitoring capabilities should accompany SAI research (particularly if field testing occurs) and development. **International climate monitoring capabilities are insufficient to understand the complexity of climate impacts[34].** Understanding SAI impacts lends further importance to the development of climate monitoring capabilities. But this just at the international level. Development in regional monitoring is necessary to understand more granular ecosystem impacts.

However, even the most optimistic improvements in monitoring will not change two critical issues. First, **unknown unknowns are part of complex Earth systems**, especially as climate change pushes them towards novel system states which are harder to predict. Second, ***understandings* of attribution are not limited to what the 'science' may say[35].** Perceived attributions can be based off incorrect SAI assumptions or misinformation[5], and may be a source of social or geopolitical tension.

5. Will the current international human rights framework and standards as well as national policies be effective in addressing human rights challenges from NTCP? If not, how can they be improved?

See answer to Core Question 5 on the lack of existing SAI governance.

6. Do you think that policy efforts to address human rights challenges in NTCP will promote their use or deter it? How to strike a balance between the need to employ technology with the goal of reaching net zero CO2 emissions and the need to protect human rights?

See answer to Core Question 6 for more on the importance of mitigation and greenhouse gas removal.

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