German Environment Agency

11. July 2023

Global Governance of SRM – What (Not) To Do?

Workshop Report

1 Aim of the workshop

On 13 and 14 February 2023, the German Environment Agency (UBA) and the Copernicus Institute of Sustainable Development at Utrecht University jointly organized a "Workshop on Solar Radiation Modification", an online event focussing on questions surrounding the global governance of hypothetical solar geoengineering technologies. The immediate reason for the workshop were recent calls by some scientists to explore large-scale interventions in planetary systems, so-called "geoengineering", to counteract global heating. Geoengineering proposals range from technologies to remove carbon from the atmosphere (carbon dioxide removal, CDR) to solar radiation modification technologies (SRM). There are many technical uncertainties as well as geophysical and bioecological risks associated with both categories. SRM, in particular, is highly controversial, both in terms of its geophysical effects and in terms of ethics and governance. SRM raises intractable concerns around climate policy, justice, and governance. Such concerns were the focal point of this workshop, which brought together policymakers, civil society actors, practitioners, politicians, and scientists to discuss the role of SRM approaches in the existing global governance system. It also zoomed in on the governance dimensions of the potential deployment of solar geoengineering.

The aim of this workshop was thus to explore some of the following questions:

- Could solar geoengineering fit into an effective, equitable, and sustainable climate governance framework?
- What are the physical and political risks associated with research and deployment?
- Is there a risk of mitigation deterrence related to SRM research?

Moreover, given the controversial nature of these technologies, the workshop asked whether a 'non-use' agreement on solar geoengineering might be necessary, either for the foreseeable future or indefinitely. This issue of a non-use agreement raised further questions such as:

- Is an international non-use agreement needed?
- How could such a non-use agreement be designed?
- Should such an agreement include strict regulations and prohibitions on research and development of SRM technologies?
- If not through a non-use agreement, how could solar geoengineering be governed?

The event was held online via Zoom with a total of 70 registered participants. It was moderated by Dr. Jeroen Oomen from Utrecht University. Ideas were collected collaboratively using the online tool Miro.

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2.1 Reflections and outcomes

Participants agreed that should SRM ever be considered as a policy option, the resulting governance challenges would be complex and diverse. All stressed the need for a significantly accelerated and more ambitious reduction of greenhouse gas emissions. SRM cannot – and could never – be used as an alternative to mitigation. The workshop signalled that both scientific and political interest into technological approaches such as solar geoengineering as a potential or presumed failsafe is growing in some countries, notably the United States.

However, participants agreed that the increasing interest in solar geoengineering itself is also cause for concern. SRM introduces complex governance risks, such as the risk of mitigation deterrence, geopolitical tensions, and power distributions, as well as geophysical risks, like effects on hydrological cycles, temperature distributions, and reliability of solar geoengineering technologies. Governance concerns and geophysical risks will also interact in unpredictable ways. With regards to solar geoengineering research, major questions typically include: how to avoid mitigation deterrence? How to ensure inclusive governance practices around SRM research? Which types of SRM research are acceptable, which should be prohibited or restricted, and how should such decisions be taken, and at what level? For potential deployment of these technological, worries revolve around how to prevent deployment in the absence of a multilateral consensus and sufficient knowledge, how to ensure fair and democratic decision-making, geopolitical distributions of power, and institutional configurations.

Over the course of the two-day workshop, these worries featured prominently in the discussion. The diverse professional backgrounds of the participants, including researchers of various disciplines to policymakers and civil society representatives, provided a rich basis for discussion. From their respective vantage points, participants weighed the risks and concerns of SRM differently. In the report below, we outline the main topics that came up for debate, themed around major questions that arose during the two-day workshop.

2.1.1 Research assessment and research development

At the workshop, some scientists emphasized the persistent uncertainties and the need for SRM research. Not only is there currently a paucity of knowledge, they insisted, but research is also needed for assessment purposes. However, given the widely existing unease about the potential geophysical and political effects of SRM, some argued for international restrictions of SRM research, similar to research restrictions on certain weapon systems or human cloning. In this line of thinking, SRM governance should limit the development of SRM technologies, without restricting research on climate science, stratospheric chemistry, or volcanology. One major concern voiced in the workshop was whether assessment of SRM approaches can be adequately distinguished from development. Several participants argued that such a distinction could not be made, let alone implemented in regulatory practice. Instead, they argued for a diversification of research perspectives on SRM, and an integration of critical social science perspectives in particular. Historically, SRM has been developed through the perspective of geophysical science, leading to a narrow technological focus. Expanding the discussion beyond such technical concerns would allow for a more balanced policy debate. Enriching climate models with social and cultural parameters could be a starting point for better research diversity, although this would run into serious epistemological issues. The issue was not resolved, although participants clearly expressed the need for stricter forms of research governance.

2.1.2 Can governments make informed decisions?

Disagreements about research governance fed into a discussion about options for national and international decision-making on SRM research. For instance, how could advisory boards and research funders make informed and wise decisions? How can existing processes of due and undue influence be made transparent? Undue influence from private and commercial parties on public opinion and policy is a major concern in climate politics; many participants expressed the need for greater clarity and transparency about how positions on SRM would be formed. Transparency and inclusiveness should also be imperative for scientific assessment reports to ensure objectivity. Some experts stressed that (authoritative) assessments that cover policy options and try to present them objectively are inevitably problematic, as they present paradigmatic and disciplinary convictions and elide disagreements. These discussions overlapped with those on research governance, as well as if and how to fund SRM research. Most participating scientists agreed that disclosure of research funding should become standard, obligatory practice. In that light, many participants saw private and commercial funding for SRM research as dangerous. At the same time, public funding for SRM research proved a divisive issue. For some, such funding provides an implicit government mandate for SRM development, risking the normalization of SRM. For others, public funding is the only way to safeguard public oversight over the research and development of these technologies.

2.1.3 Is solar geoengineering a security issue?

On the morning of the second day, questions of research governance made way for discussions about SRM as a security issue. Participants engaged with the (perceived) political risks of SRM and how governments might respond to SRM research (and potential deployment). Examples of such security concerns include, among others, the potential for SRM deployment to exacerbate existing social and economic inequalities, the possibility of unilateral deployment leading to geopolitical tensions, as well as conflict and distrust over the control over these technologies. In these fears, questions of predictability, attribution of effects, and scale of the effects also play a key role. In the workshop, the discussion centred on SRM as a geopolitical, security, and military issue. One speaker observed that security experts perceive SRM through the lens of national security and their previous experiences with safeguarding technologies. Their key fear is that SRM development might become an arms race between countries, even though some security experts argue that through transparency and trust-building this might be avoidable. SRM (development) research is also a concern, as it could always be used for military development. It would therefore need a prohibitive framework or a monitoring regime to avoid those risks. Across the workshop, significant disagreements arose about which security risks would be most salient; yet all participants agreed that SRM poses major security risks.

2.1.4 How can decision-making on SRM adopt a justice perspective?

One fundamental worry for many critics of SRM research is the question of justice. Could SRM ever be governed in a just way? And would it? Many participants, especially from civil society but also from academia, agreed that this seems unlikely. However, beyond restrictive governance, this also raised the question of how to safeguard justice concerns within the political and policy process. On this topic, discussions centred on inherent biases in SRM discourse and unequal distributions of power, funding, and expertise. Many participants criticized the dominance of the Global North, and especially of the United States, in the debate on SRM.

Several experts argued that a global regime for SRM, if ever contemplated, would need to involve all states in decision-making; a non-inclusive, major-power centred decision-making modus similar to the UN Security Council would not meet fundamental justice concerns. One expert

proposed that only states that have reduced their emissions sufficiently or have not contributed to historical emissions should decide on SRM. In this view, conversely, states that still emit too much carbon dioxide and hence add to the climate crisis should be barred from joining decisions on SRM.

One potential promise of SRM - that it would buy time for humanity to address climate change - was regarded as doubtful by participants. Fundamentally, some participants said, any notion of an international community deciding for or against the use of geoengineering always omits marginalized voices. A particular target for anger at the workshop was research that uses stakeholder participation only as window-dressing, in which local and indigenous communities are only approached to obtain their consent for field experiments.

Overall, participants emphasized the importance of integrating a justice perspective into the policy process. However, some policymakers warned from experience that fully integrating justice into policy processes may not be realistic. By extension, they warned, SRM decision-making and development will not be predominantly based on justice concerns. Some steps in a more equitable direction, however, might be taken by recognizing different forms of expertise and knowledge, and ensuring the co-production of knowledge. Nevertheless, critical questions remained regarding how justice could be pursued in an international coordination process on SRM.

2.1.5 How could institutional processes be reconciled with the issue structure of SRM?

Any potential governance of SRM would be difficult to reconcile with current institutional processes. Majority decisions at the international level, for example, cannot adequately address the global scope of a possible deployment, which would require the consent of all parties involved. The moral dilemma of burdening future generations with the necessary maintenance of the measures for centuries is not covered in current institutional processes either. Participants raised the following questions: How could a governance regime for SRM be built, if at all? Which existing regime could best deal with the challenges mentioned above? Amongst others, the UN Environment Assembly appeared as a potential forum for some, as did some alternative venues or a (restrictive) plurilateral agreement between a coalition of countries that would commit parties not to develop or deploy SRM technologies. More generally, participants criticized the often-vague wording of governance proposals on SRM, suggesting that they should address specific regimes and necessary adaptation to the problem structure of SRM as precisely as possible. How to do so remained an open question – one necessitating further discussion.

2.1.6 Can we avoid mitigation deterrence?

The issue of mitigation deterrence - the potential for SRM debates to reduce incentives for current emission reduction efforts - was a prominent theme throughout the workshop and found the most consensus. Solar geoengineering has come into view as a response to the lacklustre mitigation of greenhouse gas emissions; all participants agreed that mitigation deterrence is potentially the damaging immediate consequence of any increasing interest in SRM. At the same time, significant debate arose about how serious the risk of mitigation deterrence due to SRM research and development is. Many participants expressed concern that SRM could be used as a tool for climate delay, as an instrument to assuage public opinion, via redistributing mitigation efforts to radiative forcing instead of carbon levels, or through redirecting research funding away from mitigation efforts. For instance, public funds allocated for mitigation efforts might partially be repurposed for SRM research and development. Most social scientists and policymakers at the workshop argued that such dynamics are already in play. Others were less convinced, arguing that mitigation delay happens with or without SRM research – and that SRM research may not have much of an effect on such delay tactics. From

these disagreements, a brief discussion on linking SRM development to mitigation commitments followed. However, many felt that this approach posed serious risks, as solar geoengineering and mitigation are fundamentally different interventions. Overall, the participants acknowledged the utmost importance of considering mitigation deterrence in SRM discussions.

2.1.7 Debates on an international non-use agreement on SRM

Most participants agreed that current developments around SRM necessitate a non-use agreement. Almost all participants agreed that a moratorium on the ***use*** of SRM would be necessary for the foreseeable future. How such a moratorium would be constructed, however, remained an open and heated topic of discussion. In the workshop, two avenues appeared as possibilities. On the one hand, solar geoengineering could be addressed using existing governance mechanisms, such as UNEA, CBD, Montreal Protocol or the UNFCCC. Participants expressed their concern about the need for unanimity in those UN venues, however, as it may lead to a toothless agreement and may preclude politically contentious additions such as justice concerns. Moreover, many argued that the UNFCCC should focus on its core mandate, i.e. the reduction of greenhouse gas concentrations in the atmosphere. Adding SRM could weaken mitigation efforts. An alternative option would be a plurilateral agreement of a coalition of countries that would agree on an international non-use agreement on solar geoengineering, along the lines proposed by Biermann et al (2022). In such a coalition, politically aligned countries could agree on banning SRM use in their own territories and commit to opposing SRM in other multilateral venues.

Again, the question of SRM *research* was much more polarized. To the majority of participants, governance engagements with SRM should focus on restricting it as much as possible. This includes severely limiting funding for SRM research and banning outdoor SRM experimentation. Typically, those concerns coincided with urgent concerns about global justice, mitigation deterrence, and the geopolitical risks of the development of SRM technologies. Yet other participants viewed SRM research as a necessity and argued that a multilateral agreement should not necessarily restrict research, but rather steer it towards more inclusive, democratic, and more geographically dispersed practices.

2.2 Conclusions

Solar geoengineering is historically and regionally situated. Whether or not to engage in large-scale research programs emerged as a question for value judgements and political decisions. Throughout the workshop, experts and participants zoomed in on the historical contingencies that made SRM into the research field that it is today, as well as the political decisions and developments that have pushed SRM towards the political and scientific mainstream. In addition to the myriad open technical, ecological, and geophysical questions, the question of who governs and directs the development of SRM as a research field remains a key concern. Presentations and discussions highlighted the different ways in which SRM has been perceived and received historically, both in political and scientific circles. How SRM is made sense of, negotiated, and governed differs depending on the contexts in which it arrives will influence its development for decades to come. Such dynamics ought to be clear and transparent throughout the governance process. Currently, they are not and – as most participants agreed – nor are they just.

3 Key Recommendations

Several key conclusions and recommendations emerged from the workshop, most of which were supported widely by participants:

- The decision-making and research processes around SRM ought to be transparent as possible, and should give a voice to communities beyond scientists and policymakers.
- Governments should develop policies, both internationally and nationally, on their respective position of whether to prohibit, to allow or even to support research and development of technologies for SRM. Governments need to develop clearer rules and regulations on how they address questions of SRM research, development, and research funding, with some participants calling for prohibitions of such funding and others being more supportive.
- The scientific debate on SRM ought to be diversified in multiple ways, such as:
    - A more fundamental demand on interdisciplinary research, in which social science can co-construct physical science research questions and model projections. No research funding ought to be made available without such more critical perspectives involved.
    - Scientific expertise ought to be expanded to include non-scientific perspectives, e.g., from civil society and indigenous communities.
    - Scientific expertise and assessment must not be restricted to SRM experts, but rather be placed in conversation with a much broader understanding of climate politics, climate science, and bioecological sciences.
    - The Global North bias in SRM discussions and research ought to be corrected. SRM governance research should be contextualized in climate justice discussions, by including more voices from the Global South and pluralizing forms of knowledge production and dissemination.
- Global justice concerns should be placed at the heart of the debate on SRM. Both bottom-up and top-down processes of decision-making should start from a justice perspective.
- Policymakers should be (made) aware of the difference between 'governing to restrict' SRM development and 'governing to enable' SRM development. A deliberate choice ought to be made. If not, the default will likely be implicit support for the development of SRM.
- Any policy needs to avoid mitigation deterrence through SRM development and SRM advocacy. This includes careful awareness at international negotiations and careful deliberation about national and international research frameworks.

A Addendum: Programme

The workshop comprised of plenary sessions and break-out groups. The addendum below describes each session concisely, introducing the speakers, their topics, and the major points they addressed in their contributions.

Monday, February 13, 2023

Opening by Dr. Susanne Dröge, Head of Department of Climate Protection and Energy at the German Environment Agency (UBA)

Dr. Susanne Dröge gave an opening presentation on the contested issue of SRM governance. Citing concerns about potential mitigation deterrence and unilateral application as well as intensifying interest in SRM research, she illustrated the polarized views on SRM.

Session 1: SRM governance in light of climate politics

Presentations and Discussions

Prof. Dr. Frank Biermann introduced the current challenges of SRM in the context of climate governance. He pointed out the complexities of a possible international regulatory process on an application, including the difficulty of guaranteeing the consent of all affected parties under a majority law. Instead, he argued for an immediate non-use agreement on SRM as well as increased efforts for decarbonization.

In an historical overview, the emergence of SRM as a policy issue in the science-policy interface was presented by *Dr. Julia Schubert*. She demonstrated both the mutability of the concept and the dominance of the natural sciences in its formation. She showed that our conceptualization of geoengineering is highly relevant to its regulation and for a diversification of research agendas. This was followed by a discussion with the two speakers and Dr. Susanne Dröge.

Session 2: Key Policy Issues for SRM governance

Breakout Sessions

After short plenary pitches, participants could take part in one of three breakouts. Here, they were invited to interact with governance researchers who led discussions on key policy issues for SRM governance. *Dr. Duncan McLaren* discussed risk conceptions of SRM. In addition to physical risks of the technologies, the main topics were the potential collateral damage to mitigation efforts and the normalization of SRM through research, as well as the risk of not including marginalized actors.

Matthias Honegger led a discussion on the role of cooperative research and assessment as a basis for governance. Here, participants called for a more inclusive design of models that should not only reflect more actors and social contexts but also depict more diverse scenarios. It also highlighted the need for more transparency in research funding and for public engagement.

Dr. Julia Schubert led a discussion on the history of SRM and its implications for current debates. Discussions included the different impacts of natural and social sciences on policy, the effectiveness of science communication, and the potential for making deliberate course corrections rather than following pathways laid out by previous framings of SRM.

Tuesday, 14 February, 2023

Session 3: Existing Governance Mechanisms and Their Implications

Presentations and Panel Discussion

The second day started with a series of presentations on existing governance mechanisms relating to SRM and their implications.

Dr. Dana Ruddigkeit (UBA) opened the session taking stock of SRM governance in practice and the next steps needed to move the process forward. She differentiated between a need for regulation of information exchange, of research and of application. She spoke about the pros and cons of a multi-institutional governance architecture and regulatory requirements for research design and funding, amongst others. Lastly, she mentioned CBD Dec. X/33 on geoengineering as a useful starting point for a governance framework, discussing the possibility of regulating SRM through a new treaty, entrusting it to a new international organization, or seeking a UN declaration as a first step.

Dr. Dhanasree Jayaram spoke about appropriate ways to incorporate justice concerns into the policy process. Regarding distributive justice, she encouraged asking who would benefit or suffer from potential technologies. Procedural justice refers to the involvement of diverse stakeholders in decision-making processes, transparency, and research funding. However, justice also involves recognizing the global hierarchies and socioeconomic conditions that have caused inequality in the SRM discourse to date.

Prof Dr. Aarti Gupta gave a presentation on global SRM governance challenges. She spoke about the political context of global injustice, in which possible decisions on SRM would be situated. She argued that 'buying time' for a sustainable transformation through SRM has no historical precedent. Such claims should be questioned politically, with a keen eye on potential winners and losers. Prof. Gupta criticized the often vague formulation of governance proposals, which often address central moral and political dilemmas only peripherally. In Gupta's view, these concerns should take centre stage.

Dr. Olaf Corry spoke about the security policy relevance of SRM and its reception by security experts. He noted a "security silence" in the debate on SRM to date, and posited the disruptive potential of SRM, potential geopolitical distrust, and the risk of disinformation as common concerns among security experts. The specific securitization of SRM, he said, depends on the country, but overall shows that climate intervention is unlikely to remain in a climate box.

These four presentations were followed by a discussion with the audience.

Session 4: Perspectives on the future of SRM policy I

Input Session

The fourth session sought to provide space for different stakeholders in the SRM debate to share their perspectives. Four speakers presented their views from academic, diplomatic, and civil society angles, showcasing the range of different ideas about where SRM governance should lead.

Janos Pasztor was connected via a video message in which he emphasized the need for a broad societal conversation about SRM that takes in ethical, cultural, and other considerations besides the weighing of quantifiable risks. In the near-term, governments should focus on knowledge and capacity building, guided by the UN General Assembly in the SDGs and overshoot context.

Various actors from the UN Environment Assembly, the IPCC to UNESCO as well as non-state actors could later shape the process of building a comprehensive governance framework that offers clear regulations about decision-making on research and potential deployment.

Lili Fuhr gave a statement on the importance of broadening notions of expertise, contestation, and governance processes. She identified a growing civil society consensus against SRM and, considering this, called for increased efforts to prevent the normalization of geoengineering as a policy option, including in UN Human Rights Council reports or through changes to the Paris Agreement.

Dr. Ina Möller's presentation focused on institutional fit between the problem structure of SRM and its adaptation to international contexts of science and policy. She demonstrated a misfit of the complex issue structure of SRM and the institutional context in which it is currently situated. Both the problem definition and the institutional context may therefore undergo adjustments. She emphasized the importance of long-term perspectives on the impact of potential regulation on the institutional landscape, as well as the possibility that regulation could emerge from unexpected areas such as an ISO process.

Dr. Sean Low, lastly, spoke on social opposition against SRM experiments. In his presentation, he emphasized public engagement as a relative concept of which different actors make different demands. He also criticized that in the past, projects have often sought only to obtain the consent of affected stakeholders instead of focusing on meaningful exchange.

Session 5: Perspectives on the future of SRM Policy II

Working Sessions

Following up on the previous inputs, session 5 consisted of three in-depth parallel working sessions in which the participating academics, civil society actors and policymakers were able to exchange about the future of SRM policy.

Dr. Ina Möller and *Dr. Jeroen Oomen* led a session on how to avoid self-normalizing SRM research. Discussions highlighted the precautionary principle as the north star for research governance. Pleas were made for a broader array of expertise that includes indigenous and local non-scientific knowledge. The possible forums and models for a decision-making process were also discussed, including UNFCCC and CBD.

Dr. Duncan McLaren and *Dr. Dana Ruddigkeit* moderated a discussion on mitigation deterrence through SRM and whether and how it could be avoided. Participants emphasized the importance of identifying actors who might have an interest in SRM or to delay mitigation, as well as the importance analysing the behaviour of rogue actors. In turn, many argued for strong incentives for mitigation, while simultaneously asserting that a strict ban on unilateral interventions might help combat mitigation deterrence.

Dr. Sean Low, together with a range of civil society representatives, discussed how marginalized voices can be made to matter in SRM governance. The civil society experts present wanted to report from their wealth of experience on the ground.

Given the uneven distribution of participants between the three groups, the working sessions were shortened, after which civil society actors presented their views in the plenary discussion. They made the case for facing the unjust structures that underlie climate change and that also the SRM debate honestly. Importantly, they pointed out hierarchies of expertise, within universities and between disciplines, but also at the global level. Against this background, participants debated how existing alternative forms of knowledge can be integrated into policy forums in a more impactful way.

Session 6: Closing Discussion

The working sessions were followed by the closing discussion in session 6. Here, questions and concerns collected during the two days were discussed at length. *Dr. Jeroen Oomen* reflected on the relationship between SRM and climate governance at large, drawing on the discussion topics of the two days. Together with UBA, he closed the two-day Governance Workshop.

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Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
buergerservice@uba.de
Internet: www.umweltbundesamt.de
/umweltbundesamt.de
/umweltbundesamt

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Copernicus Institute for Sustainable Development, University of Utrecht
Prof. Dr. Frank Biermann
Dr. Jeroen Oomen
Milena Niesen