

Briefing note on Solar Radiation Modification

Potential options for international governance

Key Messages

- An important new insight from the new Intergovernmental Panel on Climate Change's (IPCC) sixth assessment (AR6) was that even with the most rapid and deep efforts resulting in the lowest greenhouse gas emission scenarios, it is now more likely than not that warming will exceed 1.5°C.
- In addition to deep and rapid climate mitigation and adaptation, researchers are exploring an additional approach – known as solar radiation modification (SRM) – to temporarily limit global warming by enhancing the Earth's reflectivity.
- There are multiple potential risks – both known and unknown – as well as benefits in researching, developing or potentially deploying SRM to temporarily limit global warming. However, overshooting the Paris Agreement temperature goals also entails risks for both humanity and the ecosystems we depend on for survival.
- There is currently no dedicated, formal international framework or fora to guide and connect governance processes for SRM research, development, demonstration, or deployment, which poses risks, given, for example, that SRM would affect every country on the planet, but not necessarily equally.
- A range of potential options for international governance of SRM have been described in recent research as well as in assessments by the IPCC.

Context

- Our planet is getting hotter and human-induced climate change has already caused widespread adverse impacts and poses additional severe risks if global warming exceeds 1.5°C.¹
- Inadequate progress in reducing global greenhouse gases means that even with the deepest emissions reductions and removals scenarios assessed by the IPCC, it is now more likely than not that warming will exceed 1.5°C.² Almost half the people on the planet (and the ecosystems on which life depends) are already highly vulnerable to climate change³ and despite some progress with adaptation, many gaps exist⁴ and adaptation will reach limits with increased warming.⁵
- In addition to the primary focus on deep and rapid climate mitigation and adaptation, another approach – known as solar radiation modification (SRM) – is being explored to temporarily limit global warming (for example, if 1.5°C is exceeded), by enhancing the Earth's reflectivity.⁶ SRM is coming under increasing scientific and public scrutiny. Further research could help contribute to a better understanding of the relative risks – with or without SRM – in a rapidly warming world. Some governments and non-state actors are investing into SRM research.⁷
- However, there is currently no dedicated, comprehensive international framework or fora to inform, guide and connect governance processes for SRM research, development, demonstration, or deployment. This in itself poses serious risks given that SRM would affect every country on the planet, but not necessarily equally.⁸

Potential options for international governance

- Governance refers to the structures, processes, and actions through which private and public actors interact to address societal goals. This includes formal and informal institutions and the associated norms, rules, laws, and procedures for deciding, managing, implementing, and monitoring policies and measures at any geographic or political scale, from global to local.⁹
- While governance objectives range broadly, from prohibition to enabling research and potentially deployment, there is agreement that SRM governance should cover all interacting stages of research through to any potential deployment (or prohibition) with rules, institutions, and norms¹⁰ – but this does not necessarily imply that all aspects would be addressed in one existing or new institution.
- At this stage, learning, knowledge-sharing, and building understanding play crucial roles in governance processes and in relation to SRM, this has been highlighted in both international¹¹ and national¹² contexts and processes.
- Some scholars emphasise the importance of the precautionary approach: preventing research¹³ or deployment until specific criteria regarding scientific consensus, impact assessments and governance issues are met.¹⁴ Others have argued that because SRM may reduce some climate hazards, a precautionary approach might include SRM.¹⁵
- Co-evolution of governance and SRM research provides a chance for responsibly developing SRM approaches with broader public participation and political legitimacy. It could also help guard against potential risks and harms and ensure that SRM is considered only as a part of a broader portfolio of responses to climate change.¹⁶ Co-evolution alone, however, may not be sufficient to achieve these objectives.
- Given that the risks and potential benefits of the various SRM techniques being proposed differ substantially, a wide array of proposals for near-term anticipatory or adaptive governance exist, most based around the following principles¹⁷:
 - Guard against potential risks and harm;
 - Enable and guide appropriate research and development of scientific knowledge;
 - Legitimise any future research or policymaking through active and informed public and expert community engagement;
 - Ensure that SRM is considered only as a part of a broader, mitigation-centred portfolio of responses to climate change.
- Currently there is no targeted international law relating to SRM.¹⁸ However, a recent United Nations (UN) resolution welcomed legal guidance addressing activities aimed at intentional large-scale modification of the atmosphere (e.g. SRM).¹⁹ A number of multilateral agreements also contain provisions applicable to SRM, including the Convention on Biological Diversity, the UN Convention on the Law of the Sea, the Environmental Modification Convention, and the Vienna Convention on the Protection of the Ozone Layer and its Montreal Protocol.²⁰ None, however, is comprehensive, and no overall international guiding or connecting process exists. This lack of robust and formal SRM governance poses risks.²¹
- Scholars have identified options for an institutional home for SRM governance, ranging from consortia of states²² and formal integration into existing UN bodies like the United Nations Framework Convention on Climate Change (UNFCCC) or the Convention on Biological Diversity (CBD), to the creation of specific, but less formalised global fora or forms of club governance. Recent years have also seen the emergence of transnational non-state actors focusing on SRM governance, primarily expert networks and non-governmental organisations.²³ New institutions or constellations of existing institutions may be required and different governance functions may need to be situated in different institutions.²⁴

Notes and references

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- ¹ IPCC (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press. Available from: www.ipcc.ch/report/ar6/wg2/
- ² In the lowest (very low) emissions scenario, the IPCC assess that it is more likely than not (>50% chance) that global surface temperature would decline back to below 1.5°C toward the end of the 21st century, with a temporary overshoot of no more than 0.1°C above 1.5°C global warming. See: IPCC (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3–32. Available from: <https://www.ipcc.ch/report/ar6/wg1/> (SPM B.1.3)
- ³ IPCC (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press. Available from: www.ipcc.ch/report/ar6/wg2/ (SPM B.2)
- ⁴ IPCC (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press. Available from: www.ipcc.ch/report/ar6/wg2/ (SPM C.1) See also: UNEP Adaptation Gap Report (2021) <https://www.unep.org/resources/adaptation-gap-report-2021>
- ⁵ IPCC (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press. Available from: www.ipcc.ch/report/ar6/wg2/ (SPM C.3)
- ⁶ SRM refers to proposals to increase the reflection of shortwave radiation (sunlight) back to space to counteract anthropogenic warming and some of its harmful impacts. A number of SRM options have been proposed, including: Stratospheric Aerosol Injection (SAI), Marine Cloud Brightening (MCB), Ground-Based Albedo Modifications (GBAM), and Ocean Albedo Change (OAC). For more detail, see: IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available from: www.ipcc.ch/report/ar6/wg3/ (Chapter 14 Cross Working Group Box 4).
- ⁷ C2G (2022). Status of global activities relating to solar radiation modification and its governance. 17 May 2022. Carnegie Climate Governance Initiative (C2G). Carnegie Council for Ethics in International Affairs. New York. Available from: https://bit.ly/GlobalSRM_TB (Accessed on: 07 July 2022).
- ⁸ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available from: www.ipcc.ch/report/ar6/wg3/ (Chapter 14 Cross Working Group Box 4).
- ⁹ Governance refers to the structures, processes, and actions through which private and public actors interact to address societal goals. This includes formal and informal institutions and the associated norms, rules, laws and procedures for deciding, managing, implementing and monitoring policies and measures at any geographic or political scale, from global to local. See: IPCC (2022) WGIII Annex I: Glossary: https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_Annex-I.pdf
- ¹⁰ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA. Available from: www.ipcc.ch/report/ar6/wg3/ (Table 14.4)
- ¹¹ See for example, activities supported by Parties to the Convention on Biological Diversity (CBD) <https://www.cbd.int/climate/geoengineering/> (Accessed on: 01 August 2022).
- ¹² For examples of nationally funded research programmes and projects see: C2G (2022). Status of global activities relating to solar radiation modification and its governance. 17 May 2022. Carnegie Climate Governance Initiative (C2G). Carnegie Council for Ethics in International Affairs. New York. Available from: https://bit.ly/GlobalSRM_TB (Accessed on: 07 July 2022).
- ¹³ Biermann, F., Oomen, J., Gupta, A., Ali, S. H., Conca, K., Hajer, M. A., Kashwan, P., Kotzé, L. J., Leach, M., Messner, D., Okereke, C., Persson, Å., Potoc̆nik, J., Schlosberg, D., Scobie, M., and VanDeveer, S. D. (2022). Solar geoengineering: The case for an international non-use agreement. WIREs Climate Change, 13(3), e754. Available from: <https://doi.org/10.1002/wcc.754>

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- ¹⁴ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA. Available from: www.ipcc.ch/report/ar6/wg3/ (14.4.5.1)
- ¹⁵ National Academies of Sciences, Engineering, and Medicine (2021). Reflecting Sunlight: Recommendations for Solar Geoengineering Research and Research Governance. Washington, DC: The National Academies Press. Available from: <https://doi.org/10.17226/25762> (p103)
- ¹⁶ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available from: www.ipcc.ch/report/ar6/wg3/ (Chapter 14 Cross Working Group Box 4).
- ¹⁷ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA. Available from: www.ipcc.ch/report/ar6/wg3/ (14.4.5.1)
- ¹⁸ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA. Available from: www.ipcc.ch/report/ar6/wg3/ (14.4.5.1)
- ¹⁹ UN (2021). Protection of the atmosphere: resolution / adopted by the General Assembly. United Nations Resolution A/RES/76/112. Available from: <https://digitallibrary.un.org/record/3952214?ln=en> (Guideline 7)
- ²⁰ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA. Available from: www.ipcc.ch/report/ar6/wg3/ (14.4.5.1)
- ²¹ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available from: www.ipcc.ch/report/ar6/wg3/ (Chapter 14 Cross Working Group Box 4).
- ²² IPCC (2018). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press. Available from: <https://www.ipcc.ch/sr15/> (4.3.8.1)
- ²³ IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA. Available from: www.ipcc.ch/report/ar6/wg3/ (14.4.5.1)
- ²⁴ National Academies of Sciences, Engineering, and Medicine (2021). Reflecting Sunlight: Recommendations for Solar Geoengineering Research and Research Governance. Washington, DC: The National Academies Press. Available from: <https://doi.org/10.17226/25762>

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This content of this briefing note was prepared in good faith, based on the most recent high quality evidence sources available, and according to C2G's [mission and principles](#). Corrections welcomed. Please notify contact@c2g2.net of errata.

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