Sani Pass, South Africa (VW Pics via ZUMA Wire)

How could SRM affect Southern Africa?

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Prepared by SRM360 and the African Climate Intervention Research Hub

Contents

With risks from climate change mounting, there is growing interest in emerging approaches to cool the planet, known as sunlight reflection methods (SRM) or solar geoengineering. What are these approaches, and what could they mean for Southern Africa?

About SRM360

SRM360 is a non-profit knowledge broker dedicated to informing people about sunlight reflection methods – or solar geoengineering – so they can contribute to critical decisions about its research, development, and governance.

About the African Climate Intervention Research Hub

The African Climate Intervention Research Hub (ACIRH) is a collaborative network of scientists and institutions working to strengthen Africa's capacity and leadership in climate intervention research.

Key messages

Increasing risks

Southern Africa is facing increasing threats from climate change. Emissions cuts, while essential to limiting long-term climate risks, cannot fully address the near- and medium-term risks climate change poses for the region.

Weighing risks against risks

If implemented, SRM has the potential to reduce many climate risks, but it would also introduce new risks. These should be carefully weighed against the impacts of climate change without SRM.

Engaging with the discussion

Increasing the involvement of African expertise and priorities is key to shaping a global SRM discussion that reflects the realities of those most affected by climate risks.

Women checking sunflower crop in Zambia (Science Photo Library via Reuters)

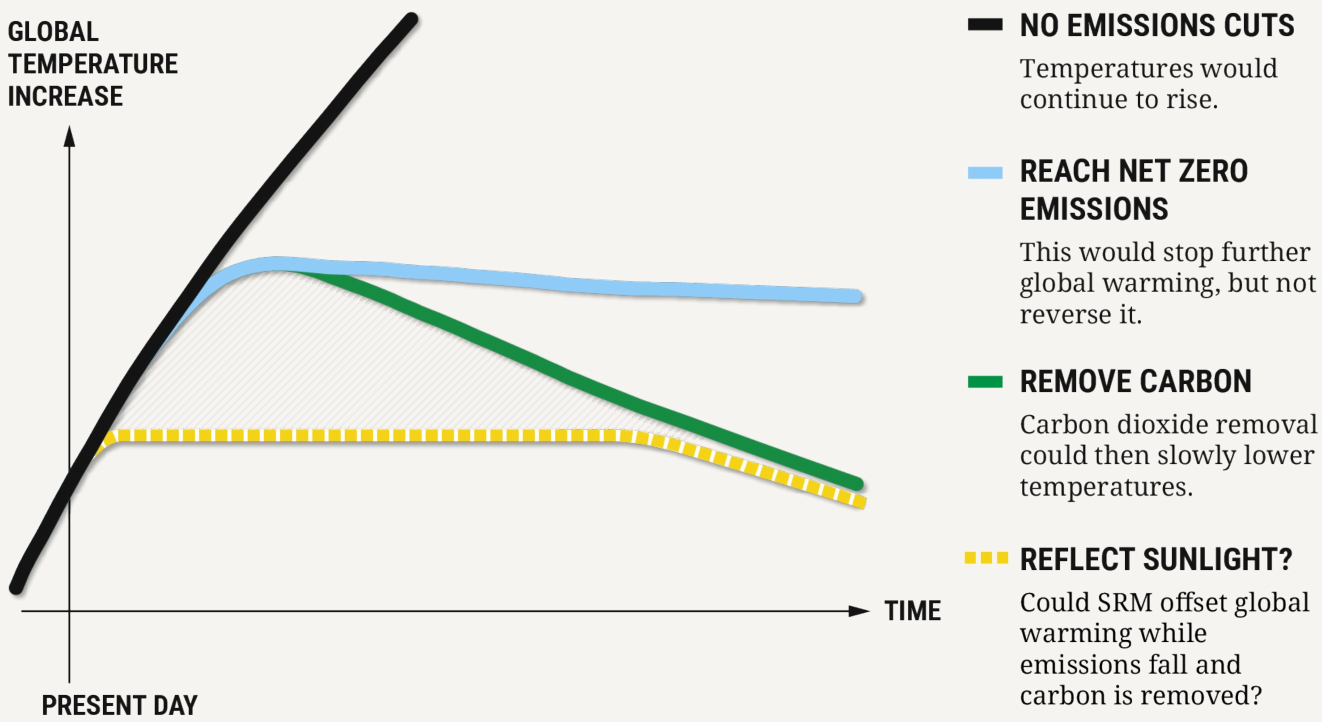
The climate context

The world is fast approaching 1.5°C of warming and is on track for about 2.8°C under current policies.[1] Threats from climate change are increasing globally, with weather becoming more extreme, sea levels rising, and tipping points approaching.

Southern Africa has already suffered significant harm from climate change, despite its limited contribution to the problem. Risks are expected to continue increasing, with more extreme heat, worsened droughts, intensified cyclones, and reduced agricultural productivity.

Strategies to tackle climate change

This illustrative diagram explores the potential contributions of different climate strategies over the long term:



The main strategy to address climate change is cutting carbon dioxide emissions; there is no sustainable solution to climate change without emissions cuts. Reaching net zero emissions would stop further global warming, but would not reduce temperatures to safer levels.[2]

Reducing global temperatures once emissions are eliminated would require also removing hundreds of billions of tonnes of carbon dioxide from the atmosphere, which would be extremely costly and could take more than a century.[3]

SRM may offer a way to cool the planet while carbon dioxide is removed from the atmosphere, but it comes with trade-offs and challenges. Could it help as an additional measure to tackle climate change?

What is SRM?

SRM is a set of potential approaches to cool the planet relatively quickly by increasing the amount of sunlight the Earth reflects back to space. If implemented wisely, it could reduce many impacts of climate change, but it comes with new risks and challenges.

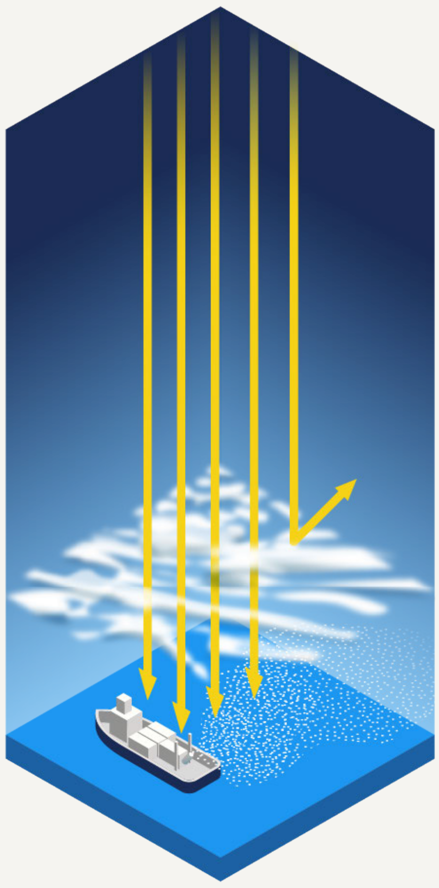
Two approaches have received particular attention.

Stratospheric aerosol injection (SAI)

A global intervention

Marine cloud brightening (MCB)

A regional intervention



	Stratospheric aerosol injection (SAI)	Marine cloud brightening (MCB)
What's the idea?	A global layer of tiny particles in the upper atmosphere to directly reflect a small fraction of sunlight before it heats the Earth.	More reflective ocean clouds to provide regional cooling, which could potentially be scaled up to a global level.
How could it be done?	By a fleet of specially designed high-flying planes releasing tiny reflective particles that would stay in the stratosphere for 1–2 years.[4]	By a fleet of ships with specially designed sprayers delivering precisely sized sea-salt particles into low-lying ocean clouds.[7]
Would it work?	Researchers are confident that this would be technically feasible and capable of lowering global temperatures,[5] at an estimated cost of tens of billions of dollars per year.[4]	Researchers are not currently confident this would be technically feasible as current sea-salt sprayers are far too inefficient.[5]
What are the drawbacks?	It would have several side effects, and some regions could see greater changes to rainfall compared to climate change alone.[6]	Its patchy, regional cooling effect could substantially shift rainfall patterns, and it may be less effective or counter-productive in some cases.[8]

How might SAI affect Southern Africa?

This table outlines how some key risks for Southern Africa could be affected by SAI compared to future climate change.

	What impacts would climate change have?	What impacts would SAI have?
Extreme heat	Heatwaves in the region are expected to become more intense, more frequent, and longer lasting, increasing risks for people, livestock, and crops.[9]	SAI could reduce extreme heat in Southern Africa, lowering exposure to heat-related risks.[10]
Water scarcity	Future climate change is expected to increase dry spells and drought risk in the region.[11]	Most studies suggest SAI would exacerbate drought risks in Southern Africa,[13,14] though others find it could reduce risks compared to future climate change.[15,16]
	“Day Zero” events, where city water supplies run dry – as nearly happened in Cape Town – are expected to become increasingly likely.[12]	One study suggests SAI could limit further increases in the risk of “Day Zero” level droughts in Cape Town.[12]
Cyclones	Cyclones in Southern Africa and the associated rainfall are expected to get more intense with future climate change, although the relationship is complex.[17]	Climate models do not all agree, but studies suggest SAI could reduce cyclone intensity across most of the region compared to future climate change.[18,19]
Agriculture	Stresses from climate change are expected to have major impacts on agricultural productivity in the region, increasing risks to food security.[20]	According to one study, the impacts of SAI on crop yields in the region would be mixed, with little overall difference compared to future climate change in the modelled scenario, though significant uncertainties remain.[21]

Issues and challenges

While SRM might reduce many climate impacts, it raises several concerns, including side effects and governance challenges.

Physical effects

A man carrying a bucket during a drought in Cape Town, South Africa (Reuters)

- SAI could reduce the rainfall changes expected under climate change overall, but the effects on Southern Africa would be mixed. Some studies suggest longer dry spells and less heavy rainfall over parts of the region, which could deepen water stress in already dry areas.[13,14] If implemented unevenly, SRM could produce substantial shifts in rainfall patterns.
- SAI could delay the recovery of the ozone hole and affect air quality. Estimates of the resulting health effects vary, from net harm[22] to effects that are small relative to the health benefits of reduced heat.[23]

Sociopolitical concerns

- There is a concern that advancing SRM would undermine efforts to cut emissions. This is known as mitigation displacement or moral hazard.[24]
- SRM implementation would have impacts across the world and countries might not cooperate to make decisions fairly or effectively.[25]
- The benefits and risks of SRM would be uneven, which could increase tensions between countries.[26] The attribution of SRM's impacts may also be contested, posing further geopolitical risks.[25]
- Large-scale SRM would need to be reliably maintained, as an abrupt and long-lasting stop would cause a "termination shock" – a rapid increase in temperature with devastating effects on the planet. [27]

Considering these concerns and the potential impacts of climate change in the region, many African scientists advocate for more research and engagement on SRM, particularly as it pertains to Africa.[28] Evidence produced through African-led research can help inform policy positions across Africa.

Appendix

Additional reading

Learn more about SRM in SRM360's introductory guide at SRM360.org/guide/why-consider-srm

For the online version of this primer, visit: SRM360.org/primer/southern-africa

Endnotes

1. UNEP. (2025). Emissions Gap Report 2025. https://www.unep.org/resources/emissions-gap-report-2025

2. Palazzo Corner S, Siegert M, Ceppi P, et al. (2023). The zero emissions commitment and climate stabilization. Frontiers in Science. 1:1170744. https://doi.org/10.3389/fsci.2023.1170744

3. IPCC. (2022). Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Shukla PR, Skea J, Slade R, et al. (eds.)]. Cambridge University Press. https://doi.org/10.1017/9781009157926.001

4. Smith W. (2020). The cost of stratospheric aerosol injection through 2100. Environmental Research Letters. 15(11):114004. https://doi.org/10.1088/1748-9326/aba7e7

5. Parson EA, Keith DW. (2024). Solar geoengineering: History, methods, governance, prospects. Annual Review of Environment and Resources. 49. https://doi.org/10.1146/annurev-environ-112321-081911

6. Irvine PJ, Keith DW. (2020). Halving warming with stratospheric aerosol geoengineering moderates policy-relevant climate hazards. Environmental Research Letters. 15(4):044011. https://doi.org/10.1088/1748-9326/ab76de

7. Salter S, Sortino G, Latham J. (2008) Sea-going hardware for the cloud albedo method of reversing global warming. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 366(1882):3989-4006. https://doi.org/10.1098/rsta.2008.0136

8. Wan JS, Chen CC, Tilmes S, et al. (2024). Diminished efficacy of regional marine cloud brightening in a warmer world. Nature Climate Change. 14(8):808-14. https://doi.org/10.1038/s41558-024-02046-7

9. Engelbrecht FA, Steinkopf J, Padavatan J, Midgley GF. (2024). Projections of future climate change in Southern Africa and the potential for regional tipping points. In Sustainability of southern African ecosystems under global change: Science for management and policy interventions (pp. 169-190). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-10948-5_7

10. Oloniyo OA, Abiodun BJ, Makinde AI, et al. (2026). African heat stress risk under stratospheric aerosol injection: insights from ARISE-SAI-1.5 simulations. Environmental Research: Climate https://doi.org/10.1088/2752-5295/ae71ff

11. Abiodun BJ, Odoulami RC, Sawadogo W, et al. (2021). Potential impacts of stratospheric aerosol injection on drought risk managements over major river basins in Africa. Climatic Change. 169:31. https://doi.org/10.1007/s10584-021-03268-w

12. Odoulami RC, New M, Wolski P, et al. (2020). Stratospheric Aerosol Geoengineering could lower future risk of 'Day Zero' level droughts in Cape Town. Environmental Research Letters. 15(12):124007. https://doi.org/10.1088/1748-9326/abbf13

13. Kumi N, Mensah C, Quagraine KA, et al. (2025). Africa's regional and local climate response to stratospheric aerosol injection characteristics. Frontiers in Climate. 7:1599405. https://doi.org/10.3389/fclim.2025.1599405

14. Quagraine KA, Tye MR, Quagraine KT, et al. (2025). Assessing the impact of stratospheric aerosol injection on precipitation extremes in Africa using the ARISE-SAI-1.5 dataset. Environmental Research: Climate. 4:035006. https://doi.org/10.1088/2752-5295/adee3c

15. Fu W, Yue X, Tian C, et al. (2025). Unequal socioeconomic exposure to drought extremes induced by stratospheric aerosol injection. Atmospheric Chemistry and Physics. 25(20):13103-21. https://doi.org/10.5194/acp-25-13103-2025

16. Liu Z, Lang X, Jiang D. (2024). Stratospheric aerosol injection geoengineering would mitigate greenhouse gas-induced drying and affect global drought patterns. Journal of Geophysical Research: Atmospheres. 129(3):e2023JD039988. https://doi.org/10.1029/2023JD039988

17. Joshua MD, Kasei RA, Wamukoya G. (2025). Assessing the contribution of climate change on tropical cyclones related to loss and damage in southern Africa: a case study of tropical cyclones in southern Malawi. Frontiers in Water. 7:1622293. https://doi.org/10.3389/frwa.2025.1622293

18. Gabriel Martins Ribeiro J, Reboita MS, Machado Crespo N, Moore J. (2025). Impacts of stratospheric aerosol injection on precipitation and winds associated with extratropical cyclones in the Southern Hemisphere. Environmental Research: Climate. 4(4):045021. https://doi.org/10.1088/2752-5295/ae228b

19. Reboita MS, Gabriel Martins Ribeiro J, Machado Crespo N, et al. (2024). Response of the Southern Hemisphere extratropical cyclone climatology to climate intervention with stratospheric aerosol injection. Environmental Research: Climate. 3(3):035006. https://doi.org/10.1088/2752-5295/ad519e

20. Nhemachena C, Nhamo L, Matchaya G, et al. (2020). Climate change impacts on water and agriculture sectors in Southern Africa: Threats and opportunities for sustainable development. Water. 12(10):2673. https://doi.org/10.3390/w12102673

21. Ayedun RF, Abiodun BJ, Xia L. (2026). Potential impacts of stratospheric aerosol injection on crop yields and related economic outcomes in Africa. Environmental Research: Climate. 5(2):025009. https:// https://doi.org/10.1088/2752-5295/ae4921

22. Eastham SD, Weisenstein DK, Keith DW, Barrett SR. (2018). Quantifying the impact of sulfate geoengineering on mortality from air quality and UV-B exposure. Atmospheric environment. 187:424-34. https://doi.org/10.1016/j.atmosenv.2018.05.047

23. Harding A, Vecchi GA, Yang W, Keith DW. (2024). Impact of solar geoengineering on temperature-attributable mortality. Proceedings of the National Academy of Sciences. 121(52):e2401801121. https://doi.org/10.1073/pnas.2401801121

24. Irvine P, Felgenhauer T, Turner M. (2024). Mitigation Displacement: Could SRM Undermine Emissions Cuts? SRM360.org https://srm360.org/article/mitigation-displacement-could-srm-undermine-emissions-cuts/

25. Corry O, McLaren D, Kornbech N. (2024). Scientific models versus power politics: How security expertise reframes solar geoengineering. Review of International Studies. 1-20. https://doi.org/10.1017/S0260210524000482

26. Morrissey W. (2024). Avoiding atmospheric anarchy: Geoengineering as a source of interstate tension. Environment and Security. 2(2):291-315. https://doi.org/10.1177/27538796231221597

27. Parker A, Irvine PJ. (2018). The risk of termination shock from solar geoengineering. Earth's Future. 6(3):456-67. https://doi.org/10.1002/2017EF000735

28. Klutse NAB, Abiodun B. (2025). SRM Research in Africa Is Not Neo-Colonial Experimentation. SRM360.org. https://srm360.org/perspective/srm-research-africa-not-neo-colonial-experimentation/