How could SRM affect India?

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Prepared by SRM360 and the Council on Energy, Environment and Water (CEEW)

Above: a mirage on a hot summer day in front of India Gate in New Delhi (Kabir Jhangiani via Reuters Connect)

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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. These approaches could reduce some climate risks, but they also carry new risks and raise pressing questions about how any use of them should be governed. What are these approaches, what could they mean for India, and how should decisions about them be made?

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 Council on Energy, Environment and Water

The Council on Energy, Environment and Water (CEEW) – a homegrown institution with headquarters in New Delhi – is among the world's leading climate think tanks. The Council uses data, integrated analysis, and strategic outreach to support public policy, transform markets, shape technology, and nudge behaviour. It addresses pressing regional and global challenges through an integrated and internationally focused approach.

Key messages

Surging temperatures

India is expected to face increasingly dangerous temperatures due to continued global warming and future reductions in air pollution.

Risks to be weighed

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.

Understanding and engagement

As a particularly climate-vulnerable region with growing analytical capacity on the topic, India will have important decisions to make regarding SRM research and governance. Improving understanding and engagement on the topic in India will be key.

Governance and cooperation

Because SRM would affect the whole world and its impacts would be uneven, decisions about it cannot be left to any single actor. Strong, inclusive international governance will be essential to manage the risks and protect the interests of climate-vulnerable countries.

Commuters in Kolkata cover their heads in the severe heat (Suprabhat Dutta)

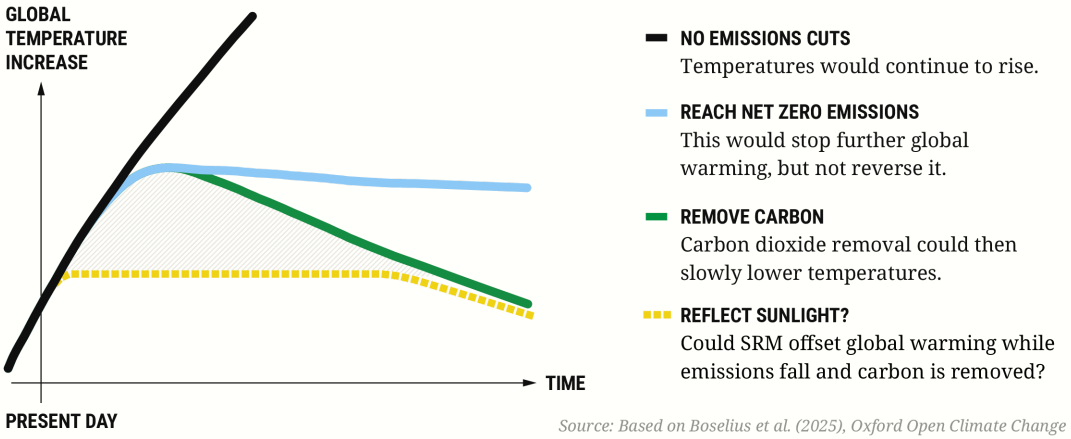
The climate context

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.

India has faced some of the most dangerous heatwaves in the world, with high temperatures combining with high humidity to produce lethal conditions.[2] This is expected to worsen with future global warming[3] and as the country works to cut air pollution, which kills over a million people per year[4] but also offsets some of the warming from climate change.[5] Increasingly extreme weather also threatens agriculture and food security.[6]

Strategies to tackle climate change

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



Source: Based on Boselius et al. (2025), Oxford Open Climate Change

The main strategy to address climate change is cutting carbon dioxide emissions; there cannot be a 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.[7]

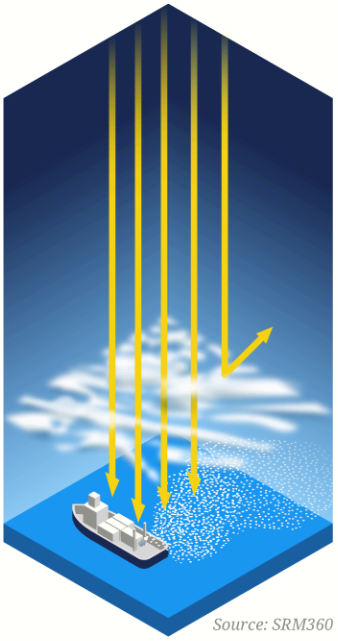
Reducing global temperatures once emissions are eliminated would require also removing hundreds of billions of tonnes of carbon dioxide from the atmosphere, which would be extremely costly and could take more than a century.[8]

SRM may offer a way to cool the planet relatively quickly, 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 by increasing the amount of sunlight the Earth reflects back to space. If deployed 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)	**Marine cloud brightening (MCB)**
	A global intervention	A regional intervention
		
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.[9]	By a fleet of ships with specially designed sprayers delivering precisely sized sea-salt particles into low-lying ocean clouds.[10]
Would it work?	Researchers are confident that this would be technically feasible and capable of lowering global temperatures,[11] estimating a cost of tens of billions of dollars per year.[9]	Researchers are not currently confident that this would be technically feasible, as current sea-salt sprayers are far too inefficient.[11]
What are the drawbacks?	It would have several side effects, and some regions could see greater changes to rainfall compared to climate change alone.[12]	Its patchy, regional cooling effect could substantially shift rainfall patterns, and it may be less effective or counter-productive in some cases.[13]

How might SAI affect India?

India is home to several leading SRM experts, and researchers in the country are increasingly engaging with the topic.

This table outlines how some key risks for India 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 India are expected to become more intense, more frequent, and longer lasting, likely increasing heat-related deaths.[2]	The cooling effect of SAI could significantly reduce extreme heat in India.[14,15]
Monsoons	Global warming is expected to increase average and extreme monsoon rainfall in India.[16]	Some studies find that SAI would reduce monsoon rainfall in India relative to current levels.[17,18] However, the findings are uncertain, and other studies suggest that large-scale SAI could have only a limited impact on monsoon rainfall.[19,20]
Flooding	Flood risks in India are expected to increase as warmer temperatures increase the atmosphere's capacity to hold moisture.[21]	SAI could reduce flood risks in India by decreasing extreme rainfall, but it could also reduce water availability by lowering rainfall overall.[17]
Agriculture	While there may be some beneficial effects, the net impact of climate change on yields of major crops in India is expected to be negative and substantial.[6]	Studies suggest that SAI could have a positive impact on the yields of major crops in India by alleviating some climate-related stresses.[14,19]

Issues and challenges

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

Physical effects

- SAI could reduce the rainfall changes expected under climate change overall,[12] but it could worsen them in some places.[22] Deployed unevenly, SRM could produce substantial shifts in rainfall patterns.[23]
- SAI could delay the recovery of the ozone hole and add a little to air pollution, though these risks may be small compared to the benefits of reduced heat.[24]

Sociopolitical concerns

- There is a concern that advancing SRM would undermine efforts to cut emissions. This is known as mitigation displacement or moral hazard.[25]
- SRM deployment would have impacts across the world and countries might not cooperate to make decisions fairly or effectively.[26]
- The benefits and risks of SRM would be uneven, which could increase tensions between countries.[27] The attribution of SRM's impacts may also be contested, which could pose further geopolitical risks.[26,28]
- 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 for the planet.[29]

The need for governance

Given the high stakes involved, its vulnerability to climate change, and its growing analytical capacity on the topic, India has an important role to play in discussions on SRM.[30] Continued efforts to strengthen Indian expertise and engagement with SRM will be key for more informed decision-making on the topic.[30] Because SRM would affect the whole world and its risks and benefits would be spread unevenly, international governance is needed to ensure that any decisions are made fairly, transparently, and with the interests of climate-vulnerable countries in mind.[31] Without such coordination, decisions taken by one country or a small group could impose risks on others and heighten geopolitical tension.[31] Establishing governance early would help build trust, guard against unilateral action, and keep the door open to inclusive, evidence-based decisions. Engaging with international initiatives, such as the Solar Geoengineering Research Governance Platform,[32] is one way Indian experts can shape this field.

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, scan the QR code or visit SRM360.org/primer/india

Endnotes

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