

Stratospheric Aerosol Injection (SAI)

Prelims - General issues on Environmental ecology, Bio-diversity and Climate Change.

Mains - General Studies-III (Conservation, environmental pollution and degradation, environmental impact assessment)

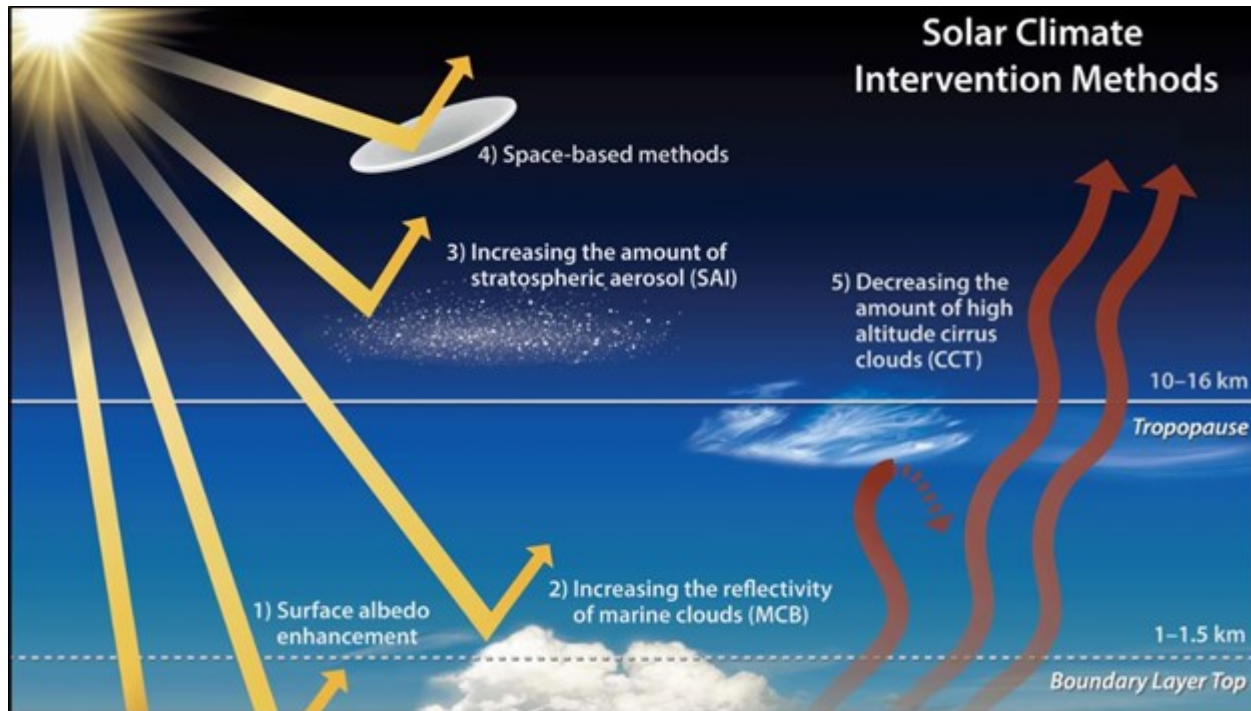
Why in news?

A recent study published in the journal Earth's Future has explored an innovative approach to SAI, specifically by investigating low-altitude aerosol delivery, aiming to reduce costs and potentially bring it closer to implementation despite opposition.

- **Stratospheric Aerosol Injection (SAI)** - It involves injecting aerosols (tiny particles) into Earth's stratosphere.
- These aerosols then reflect a portion of incoming sunlight back into space, thereby reducing the amount of solar radiation reaching the Earth's surface and leading to a cooling effect.
- **Low-Altitude SAI** - Traditionally, SAI envisioned injections at very high altitudes (above 20 km).
- However, the new study investigates the feasibility of spraying particles at lower heights (e.g., 13 km).

Advantages of Low-Altitude Injection

- **Technical Feasibility** - It is technically less challenging.
- **Aircraft Requirements** - It does not require specially designed high-altitude aircraft.
- **Accessibility and Cost-Effectiveness** - This makes the approach potentially more accessible and cost-effective, as existing aircraft (e.g., Boeing 777F) could be modified, though modifications like insulated double-walled pressurized tanks would still be necessary for safe aerosol transport.
- **Faster Implementation** - Designing and building specialized high-altitude aircraft takes nearly a decade and billions of dollars.
- Modifying existing aircraft is a faster and cheaper alternative.



Risks and Side Effects

- **Increased Aerosol Use** - Using three times the usual amount of aerosols (as suggested for 1°C cooling at lower altitudes) carries greater risks.
- **Direct Side Effects** - These include delayed recovery of the ozone layer and acid rain.
- **Uneven Cooling** - The cooling effect is projected to be more pronounced in Polar Regions than in the tropics, where warming is more severe.
- **Masking Climate Change** - A significant concern is that the cooling effect could mask the true extent of global warming, potentially leading to complacency among nations regarding the urgency of curtailing greenhouse gas emissions.
- **No Reversal of Climate Change** - It is crucial to understand that SAI would not reverse climate change; it would only provide a temporary cooling effect. It also would not address other ecological effects of climate change.
- **Social and Geopolitical Risks** - The global nature of SAI's effects presents immense challenges regarding governance, fairness, and democratic control. The lack of a clear international framework for its implementation and regulation is a major point of contention.
- **International Debate** - In 2021, the US National Academies of Sciences, Engineering, and Medicine recommended funding solar geoengineering research with a focus on transparency.
- However, in 2022, an international coalition of scholars called for a moratorium on solar geoengineering R&D, arguing that the technology is "ungovernable in a fair, democratic and effective manner."

Reference

[The Hindu | Stratospheric Aerosol Injection \(SAI\)](#)



SHANKAR
IAS PARLIAMENT
Information is Empowering