

# **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).
- $\bullet$  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)

