



## Mains Practice Question

**Q.** What is Marine Cloud Brightening? Discuss its potential benefits and risks in the context of mitigating climate change. (250 words)

20 May, 2024 GS Paper 1 Geography

### Approach

- Introduce by defining Marine Cloud Brightening
- Delve into potential benefits of MCB
- Highlight significant risks associated with it
- Conclude positively.

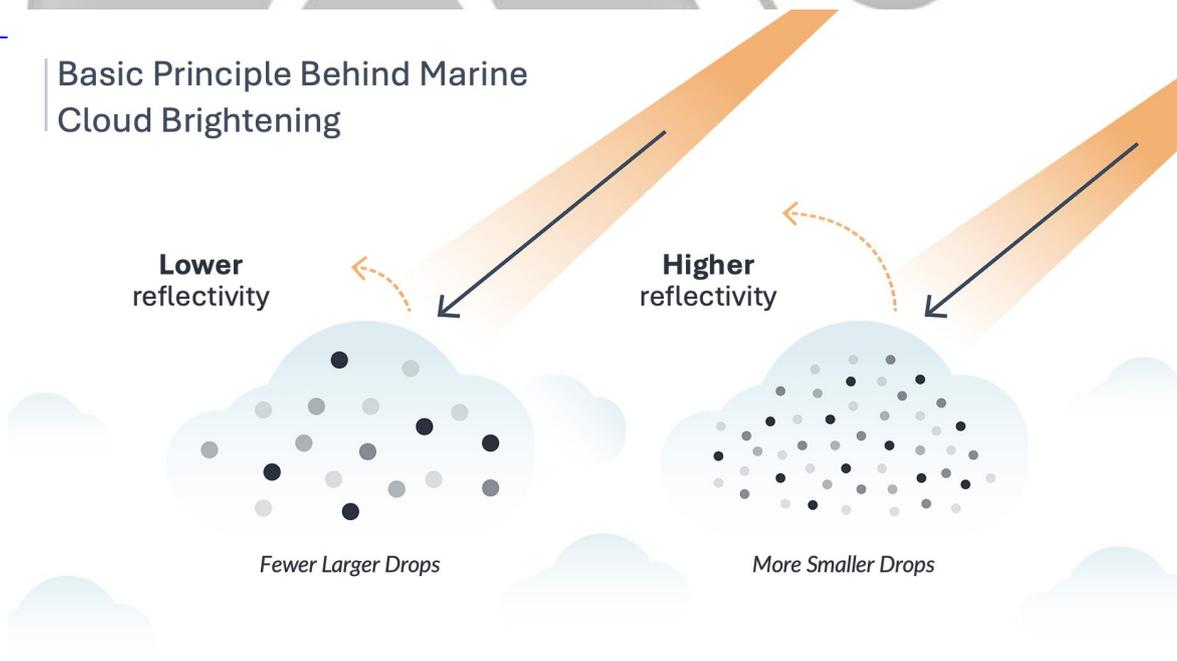
### Introduction

**Marine Cloud Brightening (MCB)** is a proposed geoengineering technique that aims to mitigate the effects of climate change by increasing the reflectivity of **low-level marine clouds**, thereby reflecting more incoming sunlight back into space and **reducing the amount of solar radiation** absorbed by the Earth's surface.

- The process involves spraying a fine mist of **seawater particles** into the atmosphere, which act as **cloud condensation nuclei** and promote the formation of brighter, more reflective clouds.
- These clouds have a higher albedo (reflectivity) and can reflect more incoming sunlight, potentially cooling the Earth's surface.

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### Basic Principle Behind Marine Cloud Brightening



## Body

### Potential Benefits:

- **Cooling Effect:** MCB has the potential to **reduce global temperatures** by reflecting more sunlight back into space, potentially mitigating the effects of climate change caused by greenhouse gas emissions.
  - MCB could lessen extreme ocean heat, potentially safeguarding marine ecosystems like **coral reefs** facing bleaching threats.
- **Buying Time for Emissions Cuts:** MCB could provide a buffer while we transition to cleaner energy sources.
  - This **buying time** could allow for deeper cuts in emissions and avoid reaching catastrophic tipping points, like the **irreversible melting of polar ice caps**.
- **Localized Impact:** Unlike other geoengineering techniques that aim to achieve global cooling, MCB can be **targeted to specific regions**, allowing for more localized climate interventions.
  - For example, MCB could be deployed in areas particularly vulnerable to rising sea levels or extreme heat events.
- **Reversibility:** The effects of MCB are **relatively short-lived**, and if stopped, the Earth's climate would return to its previous state within a few years, making it a **potentially reversible technique**.
- **Cost-effectiveness:** Compared to other geoengineering techniques, MCB is considered relatively inexpensive and technologically feasible.

### Potential Risks:

- **Unintended Consequences:** Like any large-scale intervention in the Earth's climate system, MCB carries the risk of unintended consequences that are difficult to predict, such as **changes in precipitation patterns, ocean circulation, and ecosystem disruptions**.
- **Limited Scope:** MCB might not be effective in all regions. Cloud types and atmospheric conditions can significantly impact its effectiveness.
  - Deploying **MCB in the tropics**, where clouds are already quite reflective, would likely have minimal impact on global warming.
- **Spatial Variability:** The cooling effects of MCB may **not be evenly distributed**, leading to regional disparities and potential conflicts over resource allocation and deployment.
- **Moral Hazard:** The perceived effectiveness of MCB could potentially **reduce the urgency to address the root causes of climate change**, such as reducing greenhouse gas emissions.
- **International Governance:** Deploying MCB unilaterally could **trigger international disputes**. Effective international agreements would be necessary for responsible implementation.

## Conclusion

While MCB holds promise as a potential climate change mitigation strategy, its deployment on a large scale would require careful consideration of the risks, as well as robust governance frameworks and international cooperation to ensure **responsible implementation and monitoring**.