MARINE CLOUD BRIGHTENING

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Abstract

The idea behind the marine cloud brightening (MCB) geoengineering technique is that seeding marine stratocumulus clouds with copious quantities of roughly monodisperse sub-micrometre seawater particles could significantly enhance the cloud droplet number concentration thus increasing the cloud albedo and longevity – thereby producing a cooling, which computations suggest could be adequate to balance the warming associated with a doubling of atmospheric carbon dioxide.

We review herein recent research on a number of critical issues associated with MCB: (1) general circulation model (GCM) studies, which are our primary tools to evaluate globally the effectiveness of marine cloud brightening and to assess its climate impacts on rainfall amounts and distribution, as well as on polar sea-ice cover and thickness: (2) high resolution modeling of the effects of seeding on marine stratocumulus, which are required to understand the complex array of interacting cloud processes involved in brightening: (3) microphysical modelling sensitivity studies examining the influence of seeding amount, seed-particle salt-mass, air-mass characteristics, updraught speed and other parameters on cloud-albedo change: (4) sea-water spray production by controlled electrohydrodynamic instability, and by microfabrication lithography: (5) computational fluid dynamics studies of possible large-scale periodicities in Flettner rotors: and (6) the planning of a three-stage limited-area field research experiment, which has the objective of developing our fundamental knowledge of marine stratocumulus clouds, testing the technology developed for the MCB geoengineering application, and ultimately, if deemed justifiable, field-testing the idea quantitatively, on a limited (perhaps 100km) spatial scale.

KEYWORDS: cloud brightening: albedo: GCM and high resolution modeling: cloud seeding: spray technology: field experiment

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