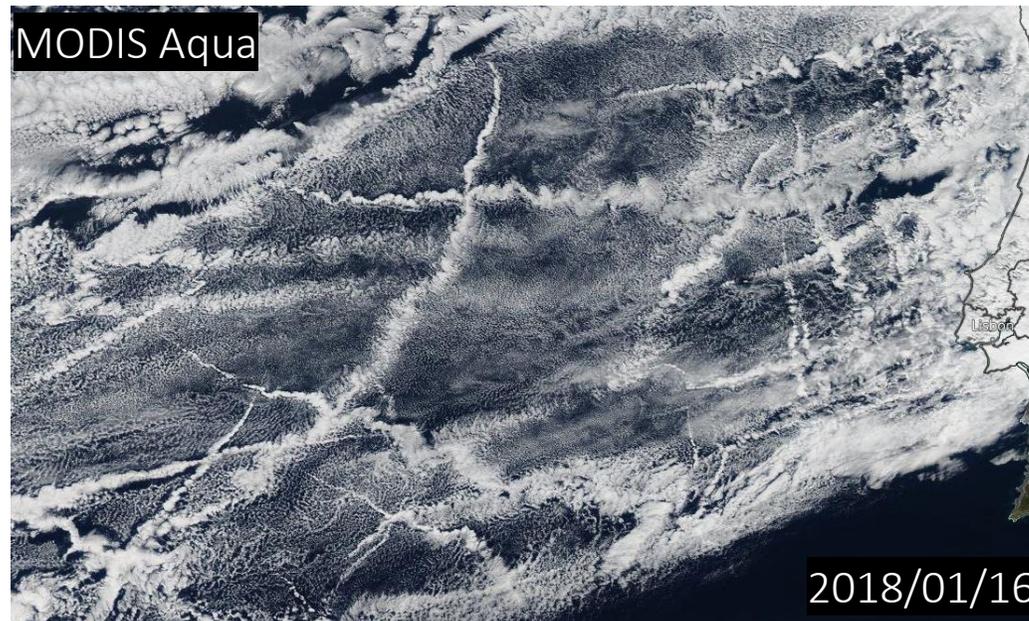


The DOE/NOAA Marine Cloud Brightening Workshop

Co-organizers: Graham Feingold, Virendra P. Ghate, Lynn M. Russell

Program Managers: Shaima Nasiri (DOE); Gregory Frost and Victoria Breeze (NOAA)

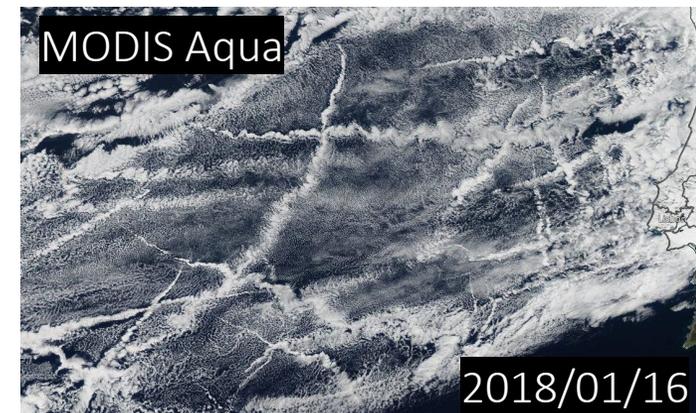


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Fan Yang, Jianhao Zhang, and Xue Zheng

What is Marine Cloud Brightening (MCB)?

- MCB is a form of Climate Intervention, the goal of which is to increase the reflectance of shallow, liquid clouds, thereby cooling the planet, and offsetting some of the worst effects of greenhouse gas warming
- MCB is based on the physics of aerosol-cloud interactions, a subject that our community has worked on for decades



Motivation for the Workshop

- The planet is warming at an alarming rate
- Humans and Ecosystems are under duress
- Increasing discussion and calls for a Climate Intervention Program
- It is incumbent on us to provide the best information possible so that wise decisions can be made

Format

- Virtual Workshop jointly hosted by DOE/ASR and NOAA/Earth's Radiation Budget
- 3 days April 11 – 13
- ~30 attendees (by invitation)
- White papers submitted prior to workshop
- Discussions/breakouts focused on *current knowledge, challenges, path forward*

Desired Outcome

- Review of critical issues, assessing knowledge/knowledge gaps, and suggesting *a research roadmap for MCB research focused on physical science questions*
- We did not discuss societal, governance, ethical dimensions

A Roadmap for MCB Research

Discussed research topics that must be resolved for a viable MCB program

 OPINION

To assess marine cloud brightening's technical feasibility, we need to know what to study—and when to stop

Michael S. Diamond^{a,b,1} , Andrew Gettelman^c, Matthew D. Lebsock^d, Allison McComiskey^e,
Lynn M. Russell^f , Robert Wood^g , and Graham Feingold^b

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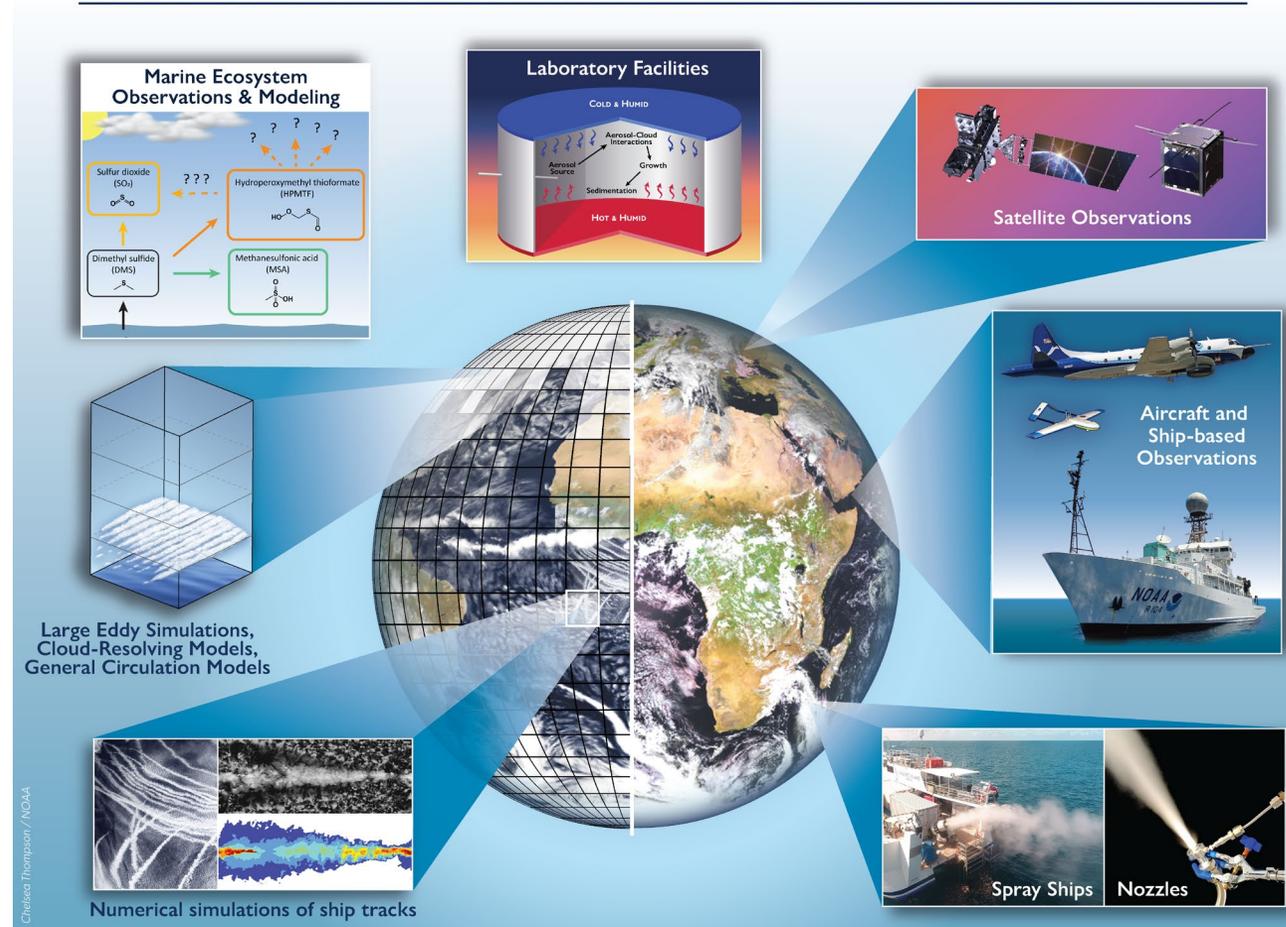
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Integrated system of observations, lab facilities, and modeling at a range of scales

INTEGRATED VIEW OF MARINE CLOUD BRIGHTENING RESEARCH



Workshop Report Timeline

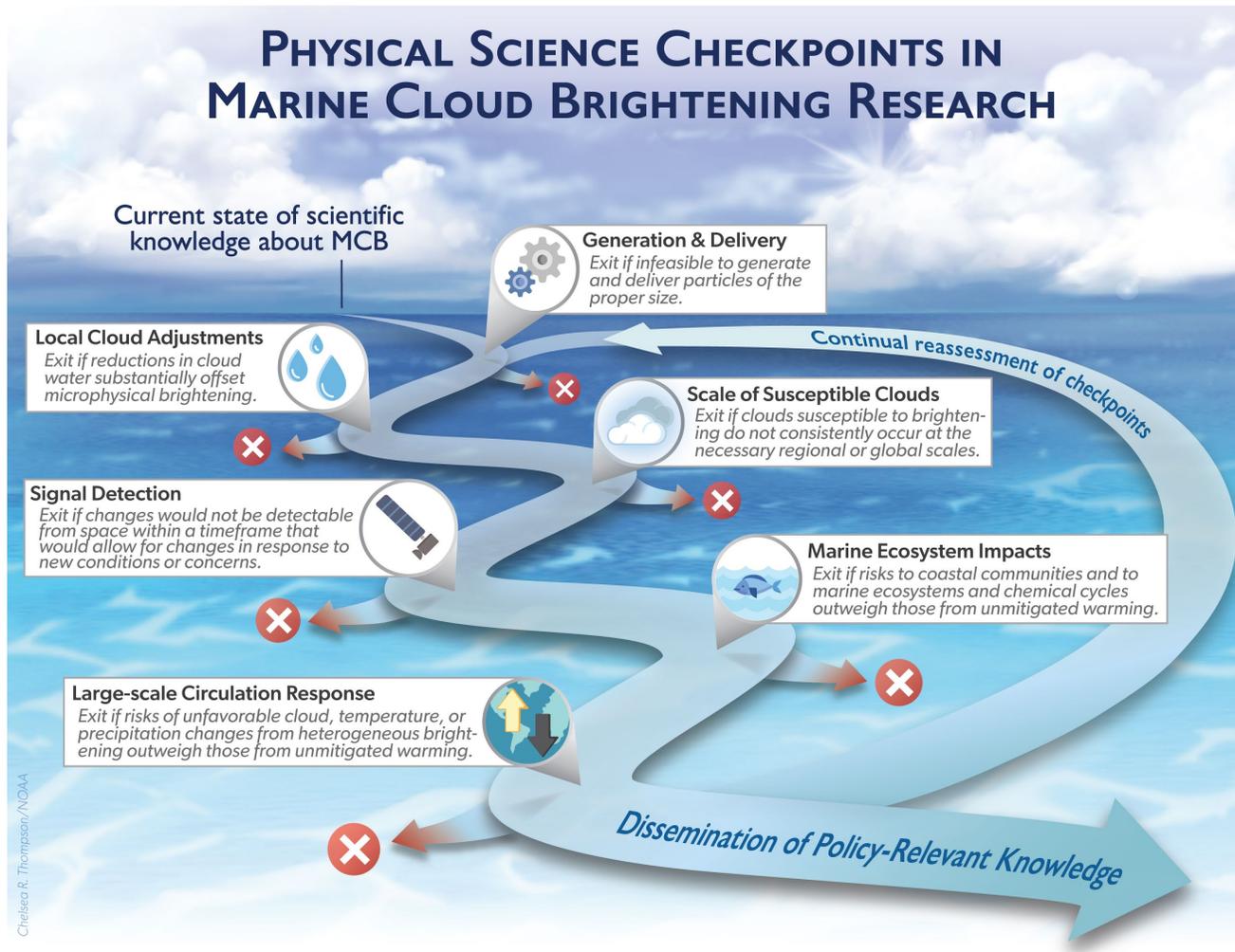
- Report has been approved by the DOE and NOAA program managers and all the coauthors
- Currently going through typesetting
- Anticipated to be available on the DOE website in 2 to 3 weeks

Thanks to DOE and NOAA Program Managers and their support teams for making this possible!

- Tracey Vieser
- Andrew Fowler (Gather.Town)
- Chelsea Thompson (graphics)

A Roadmap for MCB Research

Six checkpoints that must be passed for an MCB research effort to be viable



Generation & Delivery
Exit if infeasible to generate and deliver particles of the proper size.

Local Cloud Adjustments
Exit if reductions in cloud water substantially offset microphysical brightening.

Scale of Susceptible Clouds
Exit if clouds susceptible to brightening do not consistently occur at the necessary regional or global scales.

Signal Detection
Exit if changes would not be detectable from space within a timeframe that would allow for changes in response to new conditions or concerns.

Marine Ecosystem Impacts
Exit if risks to coastal communities and to marine ecosystems and chemical cycles outweigh those from unmitigated warming.

Large-scale Circulation Response
Exit if risks of unfavorable cloud, temperature, or precipitation changes from heterogeneous brightening outweigh those from unmitigated warming.