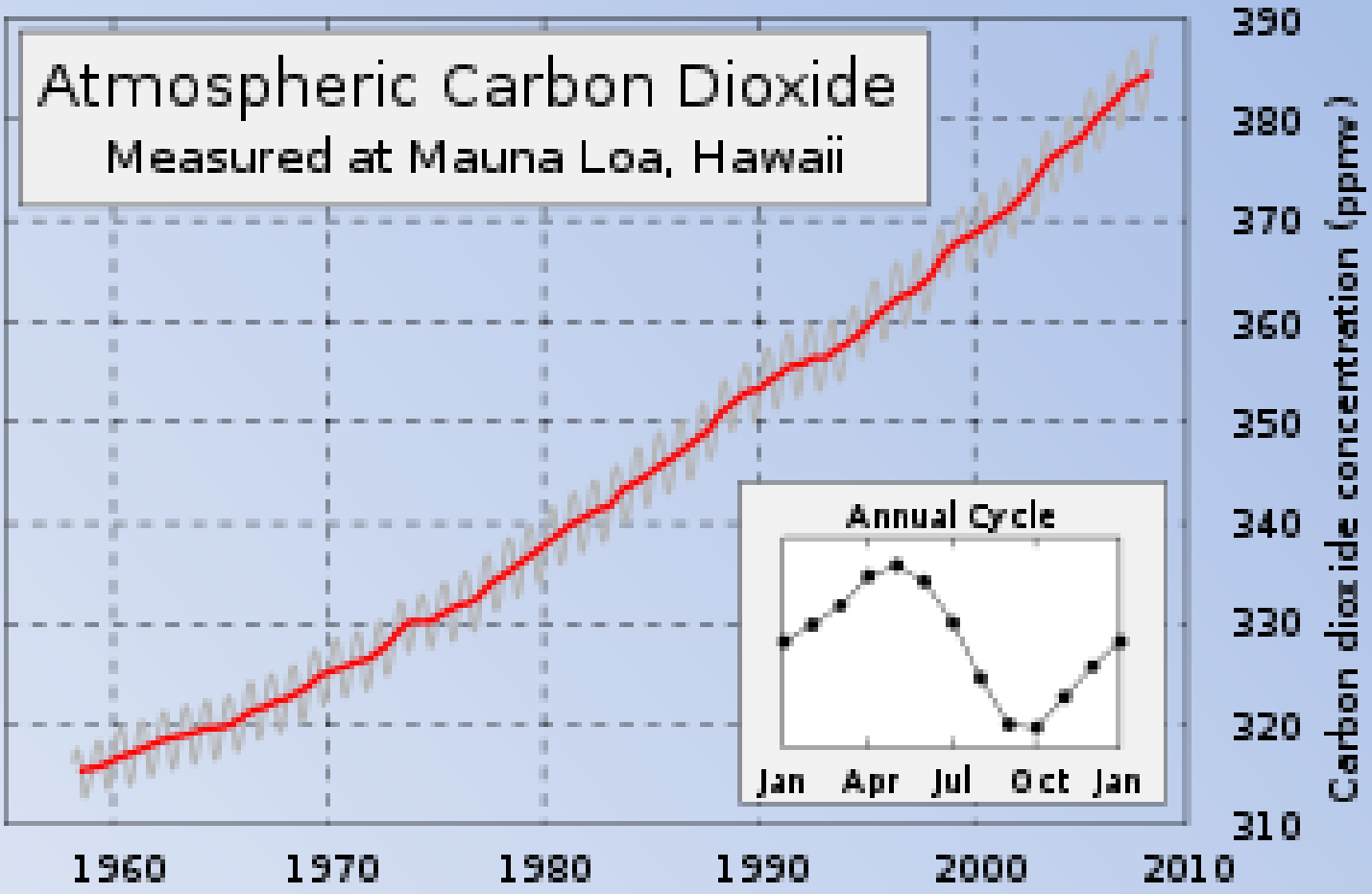
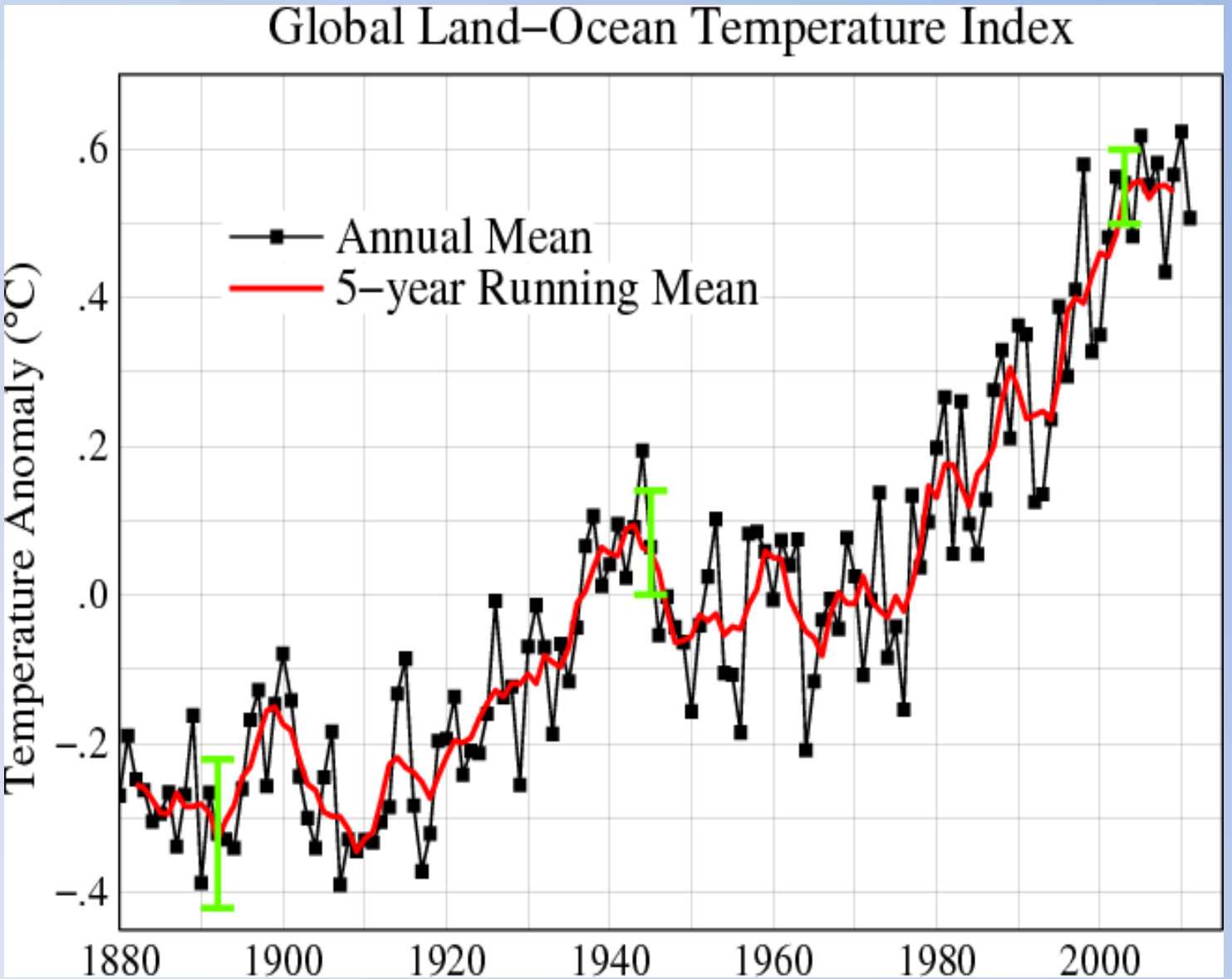
Hack the Planet: An overview of climate engineering approaches

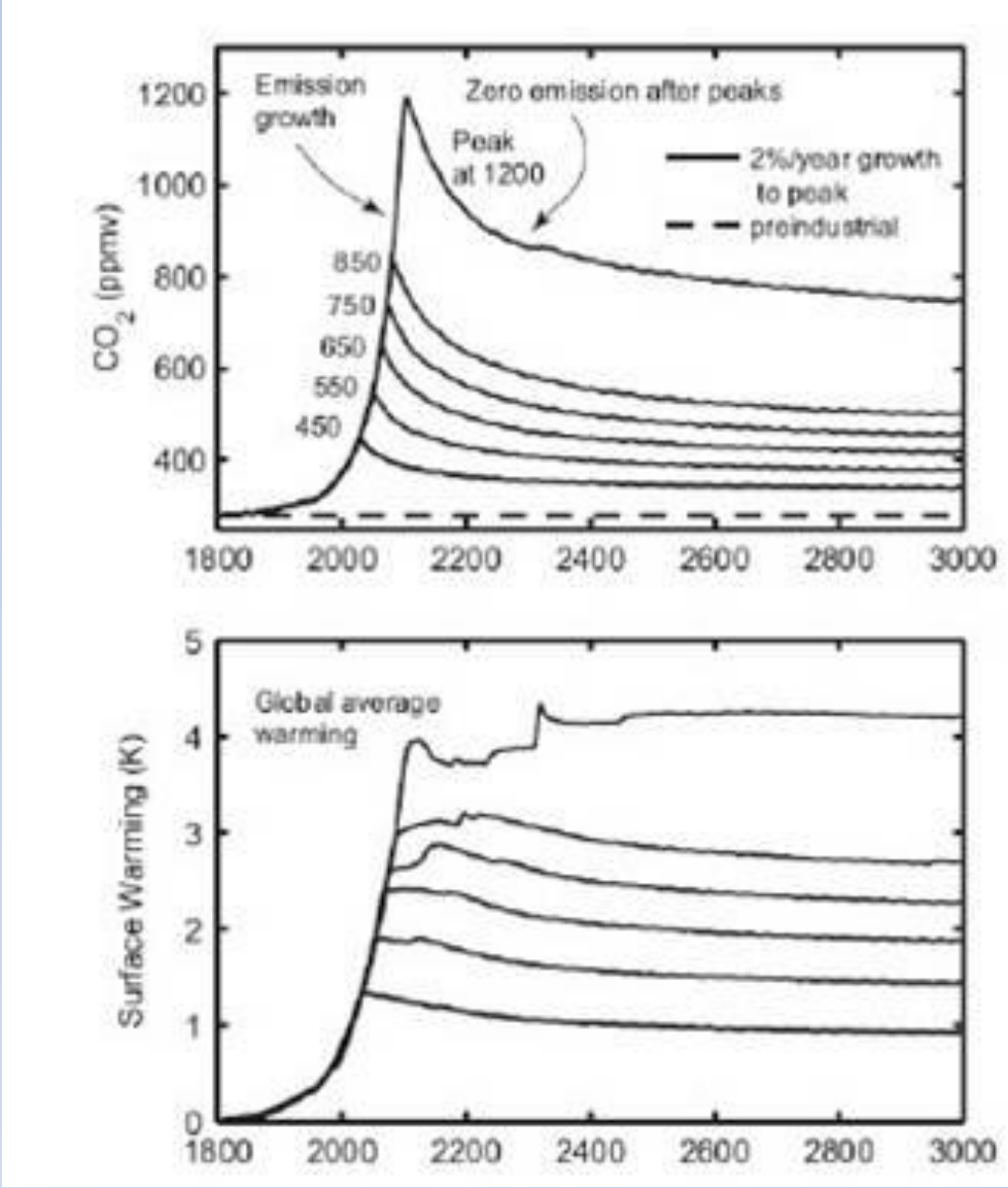
Eli Kintisch
Science magazine
MIT Knight Science Journalism Fellowship


Atmospheric Carbon Dioxide
Measured at Mauna Loa, Hawaii
Annual Cycle
Jan
Apr
Jul
Oct
Jan
1960
1970
1980
1990
2000
2010
310
320
330
340
350
360
370
380
390
Carbon dioxide concentration (ppmv)


Global Land–Ocean Temperature Index
Annual Mean
5–year Running Mean
Temperature Anomaly (°C)
.6
.4
.2
.0
–.2
–.4
1880
1900
1920
1940
1960
1980
2000

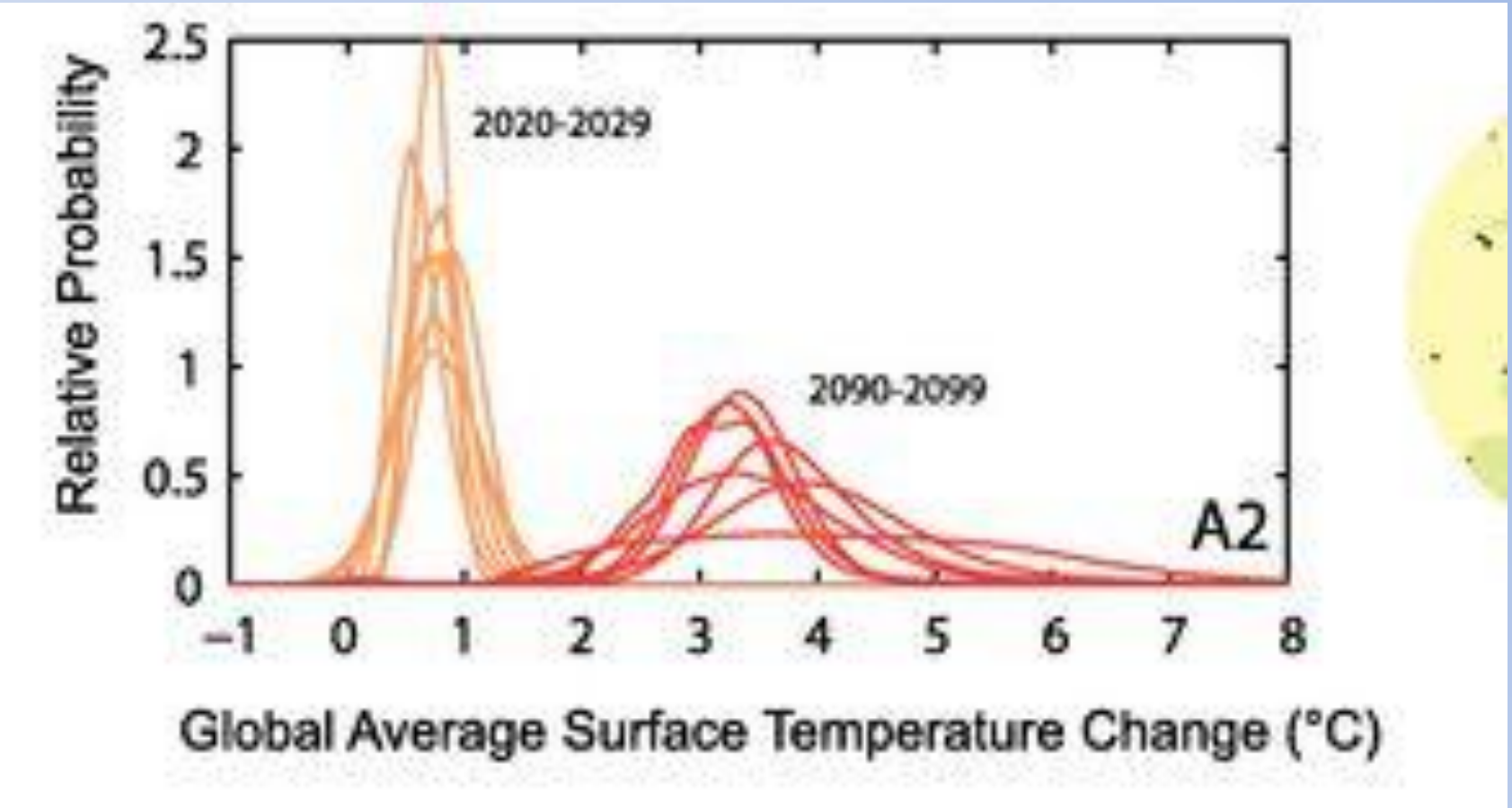
NASA, 2012

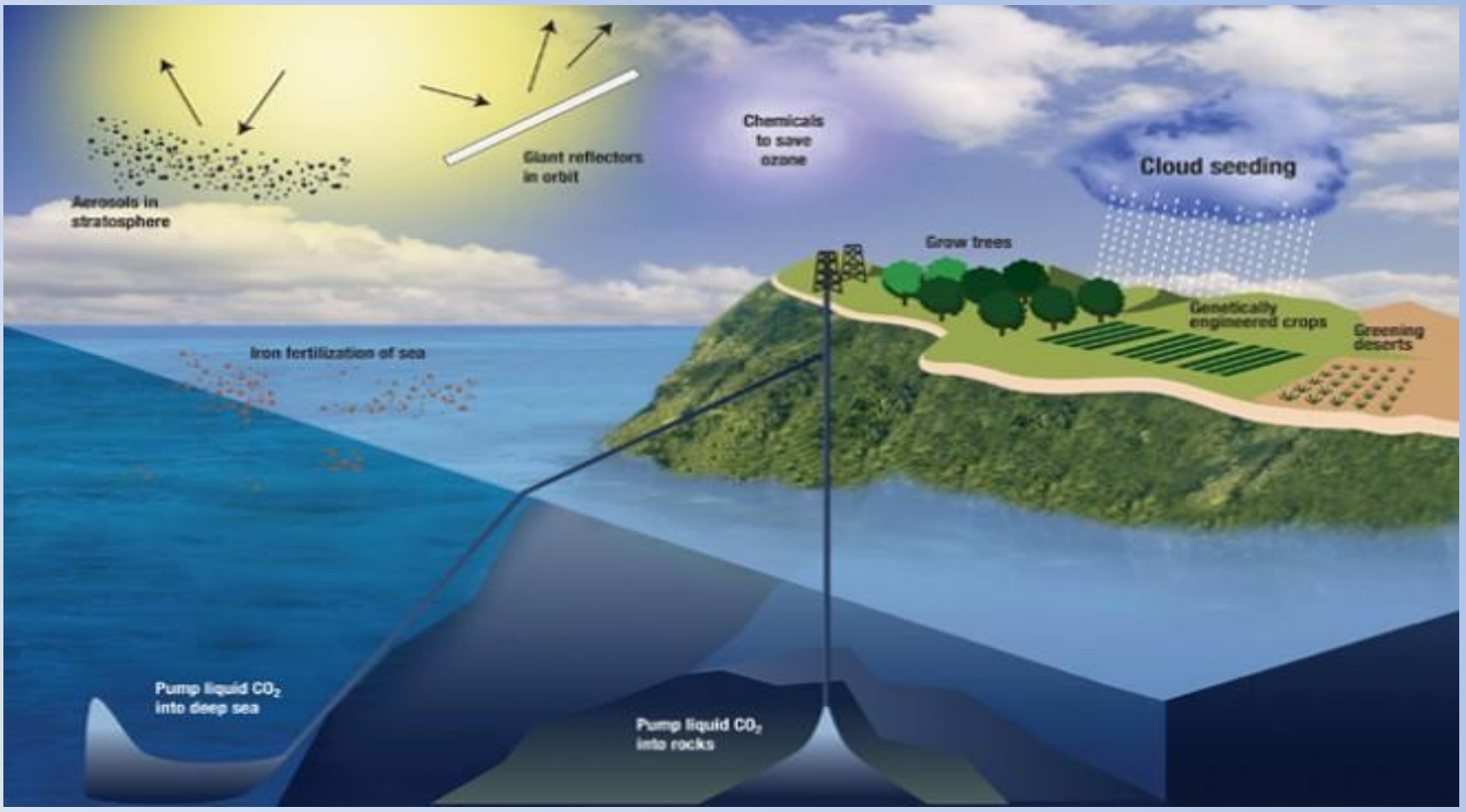
Even if we **ceased** carbon emissions **tomorrow**, it would take centuries for the planet to cool



Solomon et al (2009) Irreversible climate change due to carbon dioxide emissions, PNAS, 106, 1704–1709.

Recent work has focused on worst case scenarios





(credit Wired Magazine)

Geoengineering: **How**

- Two basic types:

  --Altering the Planet's Brightness

  BLOCKING THE SUN

  --Engineering Earth's Carbon cycle to remove CO2 from the atmosphere :

  GETTING THE CARBON OUT

  (A third: altering heat flows on earth: damming Bering Strait, for example…)

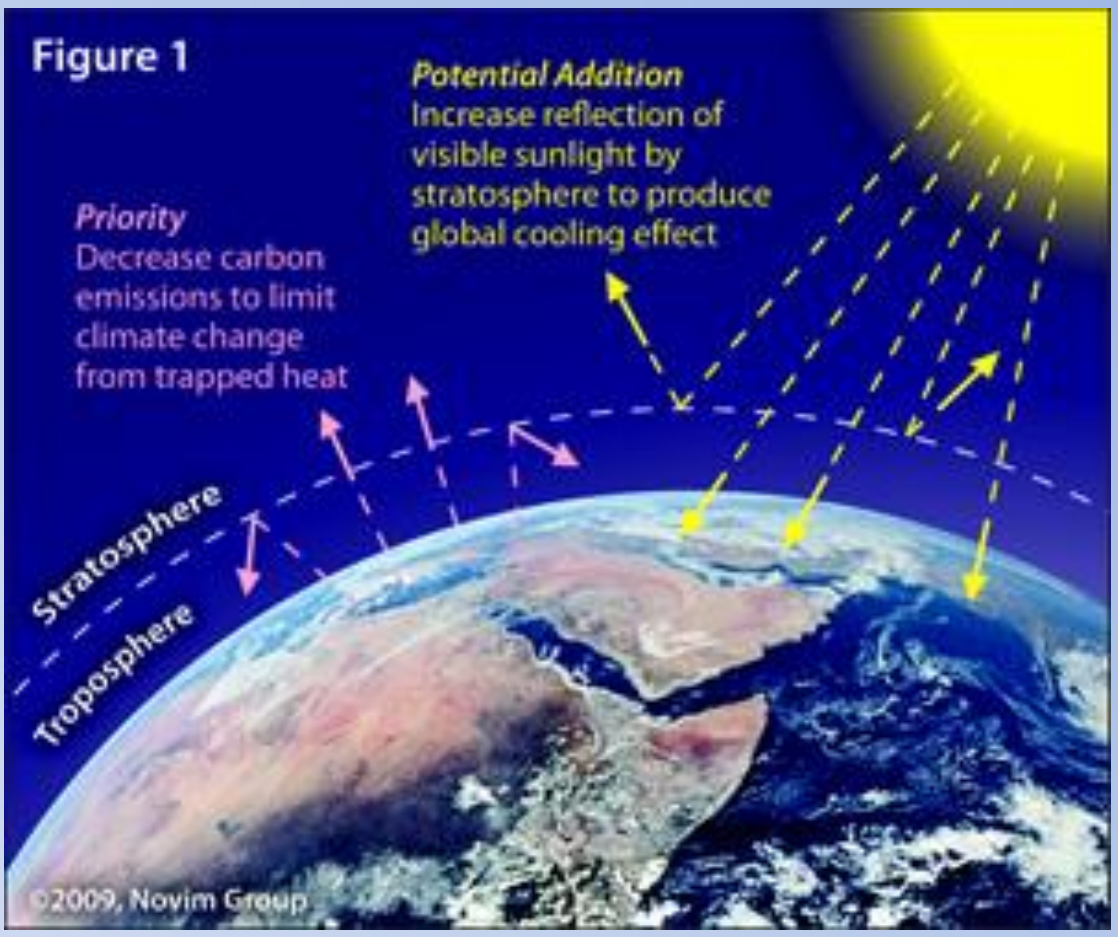


FIGURE 1: CLIMATE STRATEGY CONTEXT CIRCLE

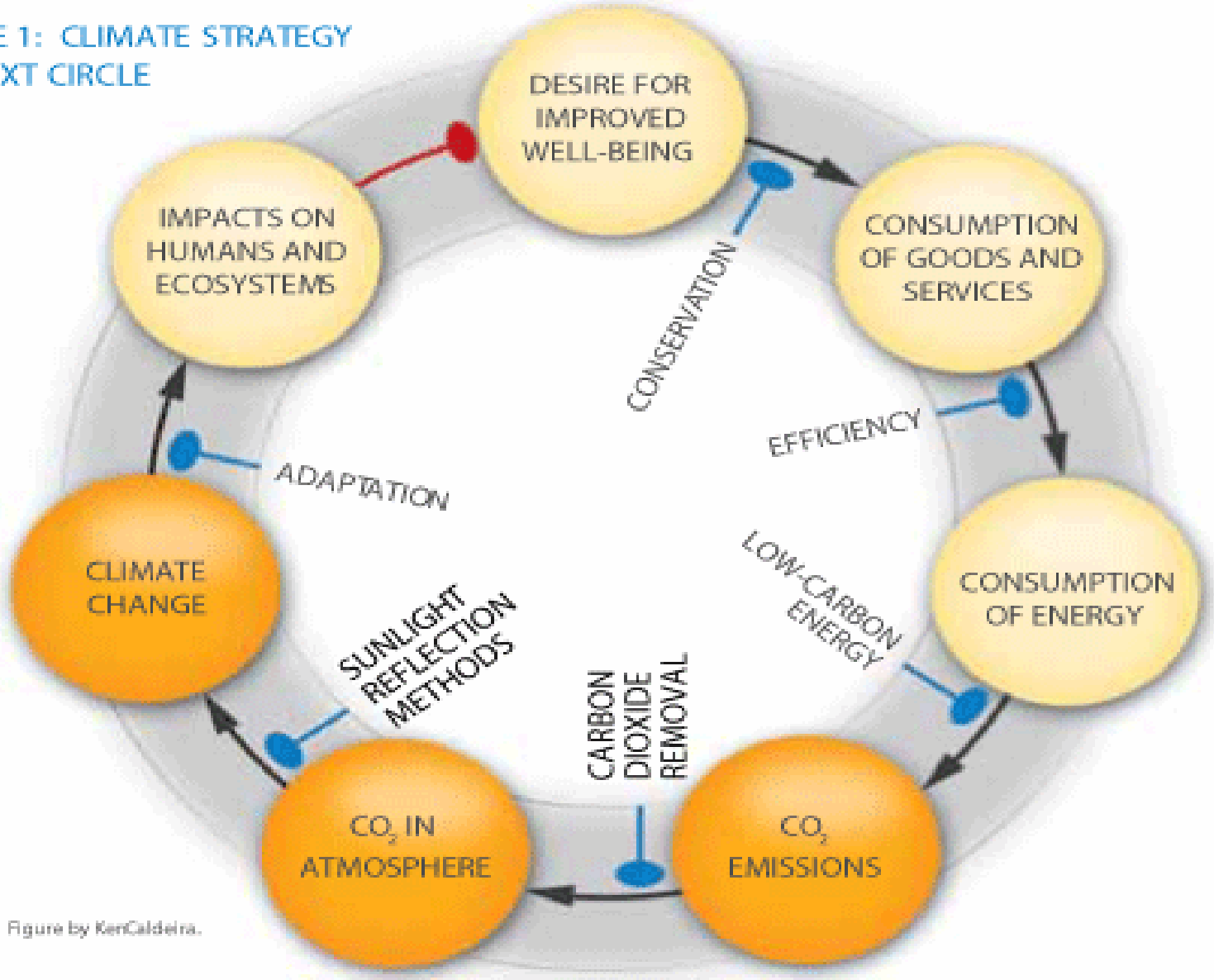


Figure by KenCaldeira.

An idea with historical roots

1908: Swedish physicist Svante Arrhenius: humanity should pursue a "virtuous" course to continue to burn fossil fuels staved off a future ice age.

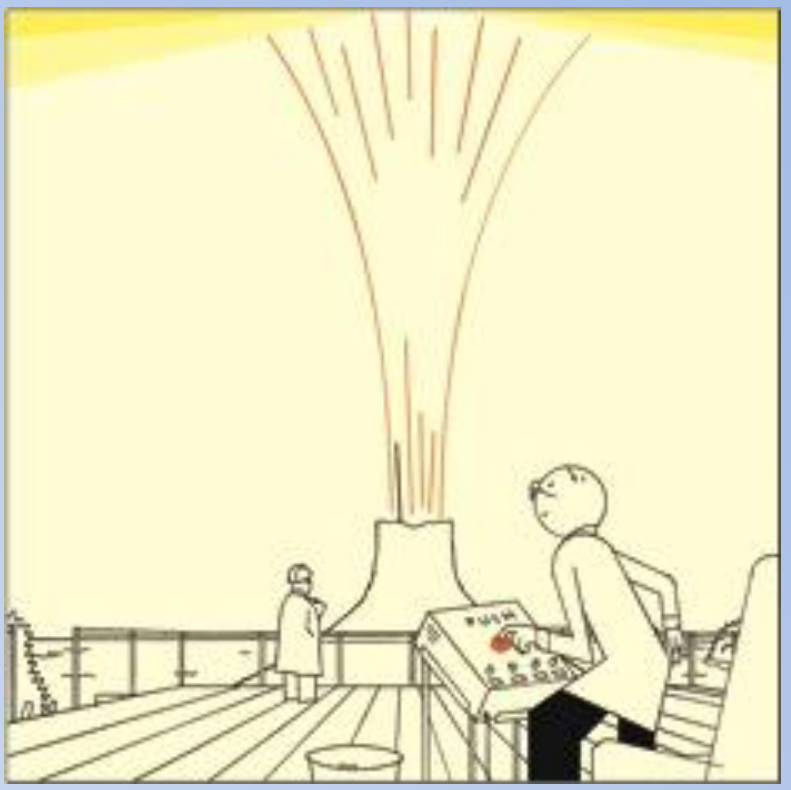
1960 Soviet propaganda by Rusin: "If we want to improve our planet and make it more suitable for life, we must alter its climate."

2002 Edward Teller: "Active management" of the atmosphere likely the "most overall practical approach" to maintaining "reasonable" temperatures.

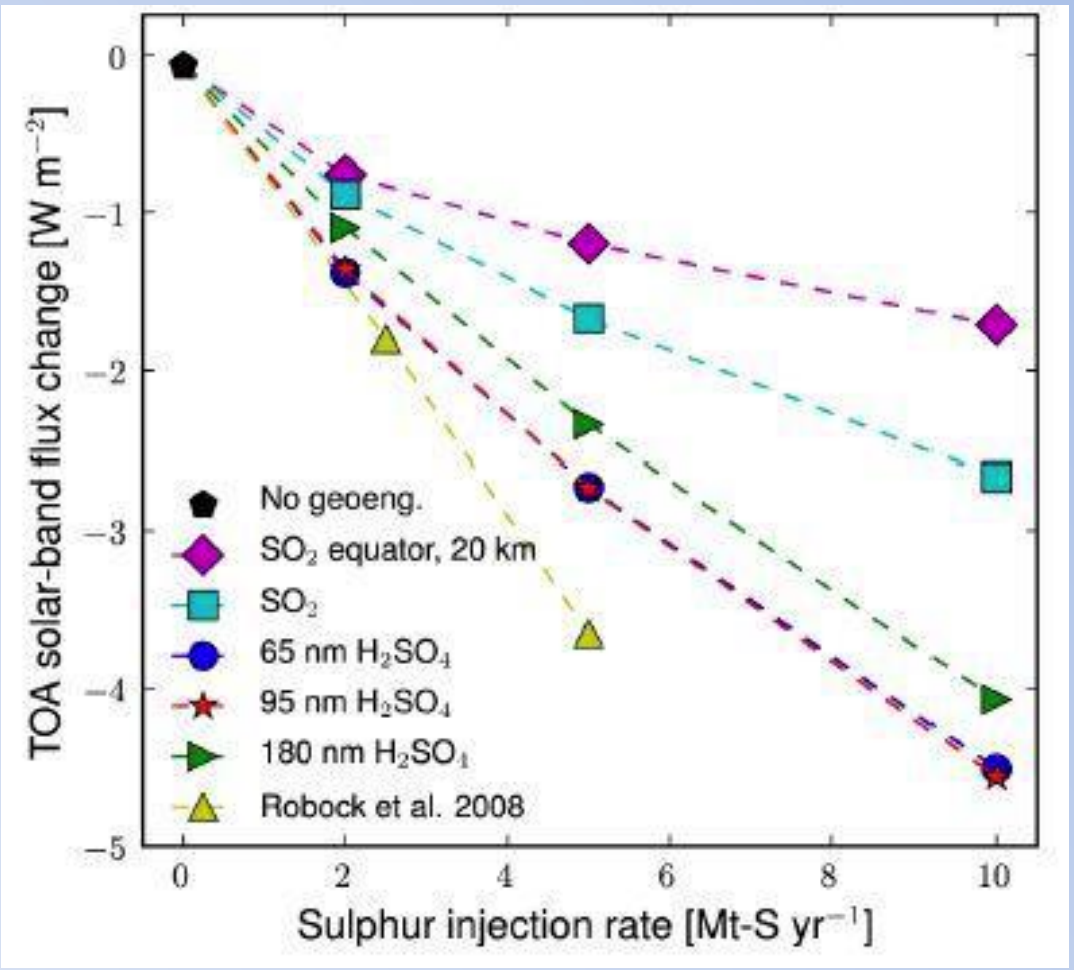
Geoenginering: **How**

Blocking Sunlight:

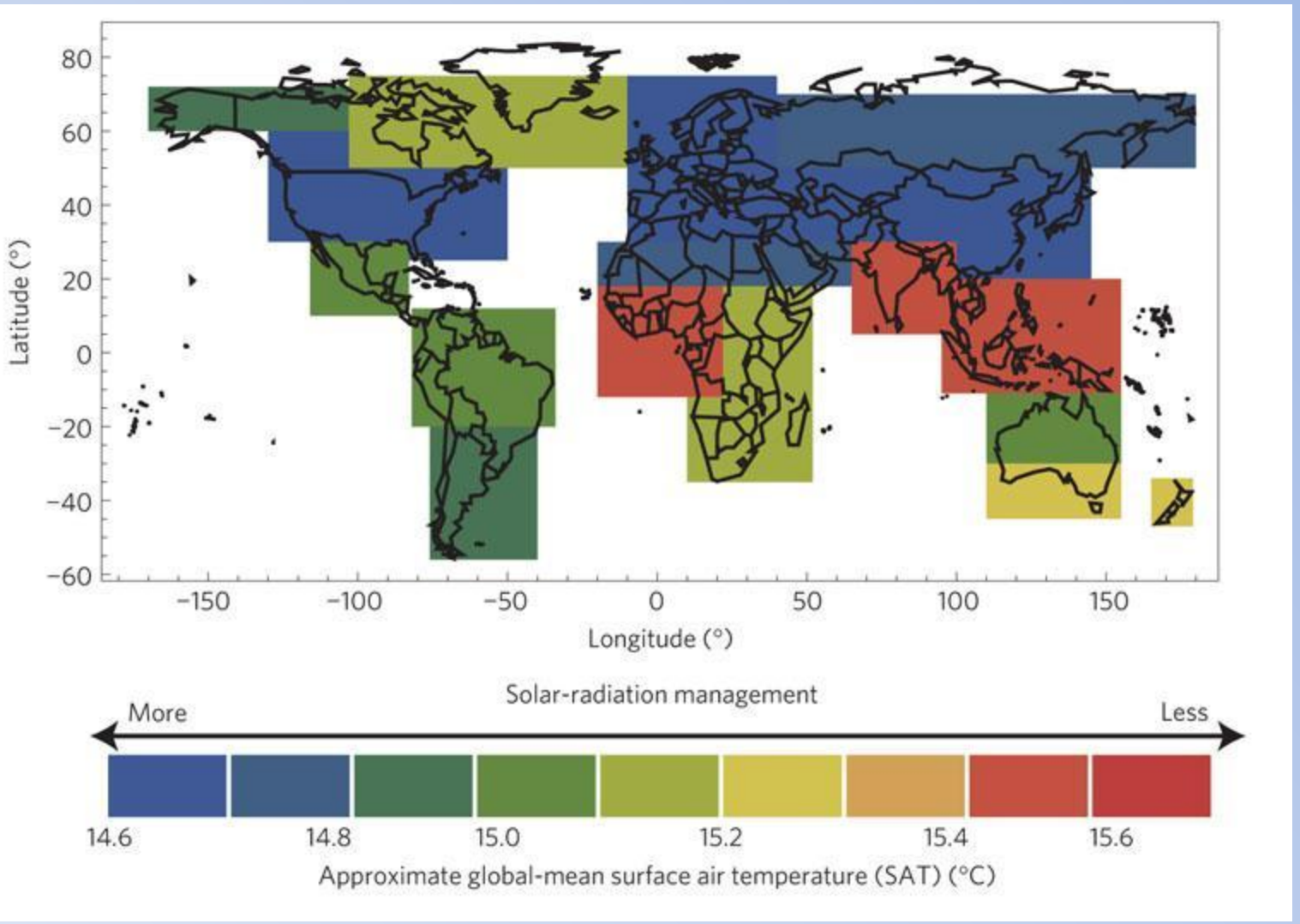
The Pinatubo Option



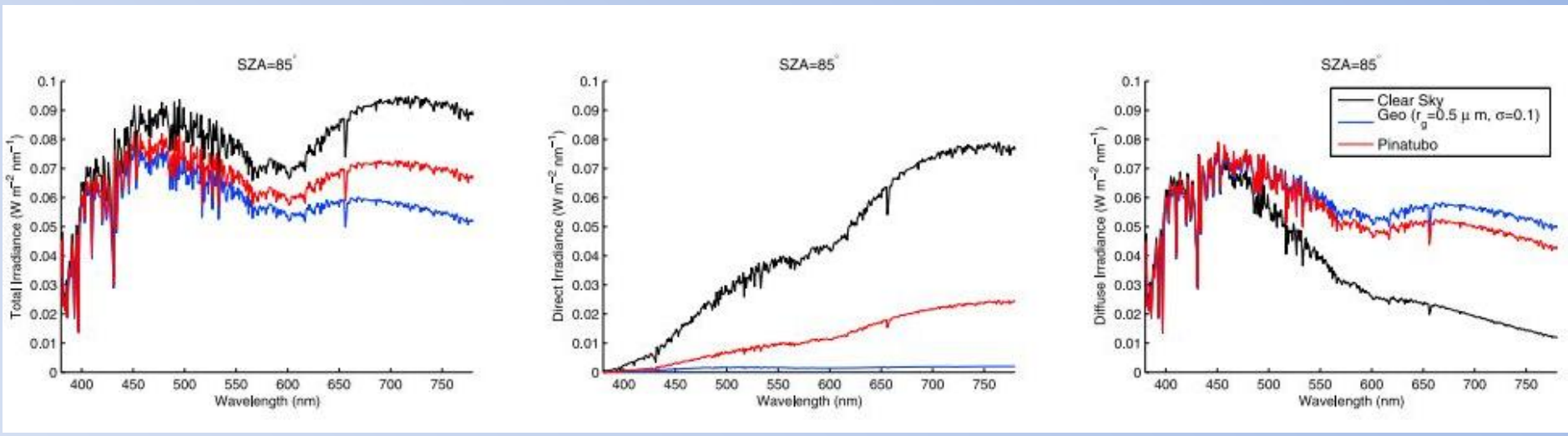
After Mt. Pinatubo put 20 million tons of sulfur dioxide into the atmosphere in 1991, Global Temperatures dropped by 1 degree F



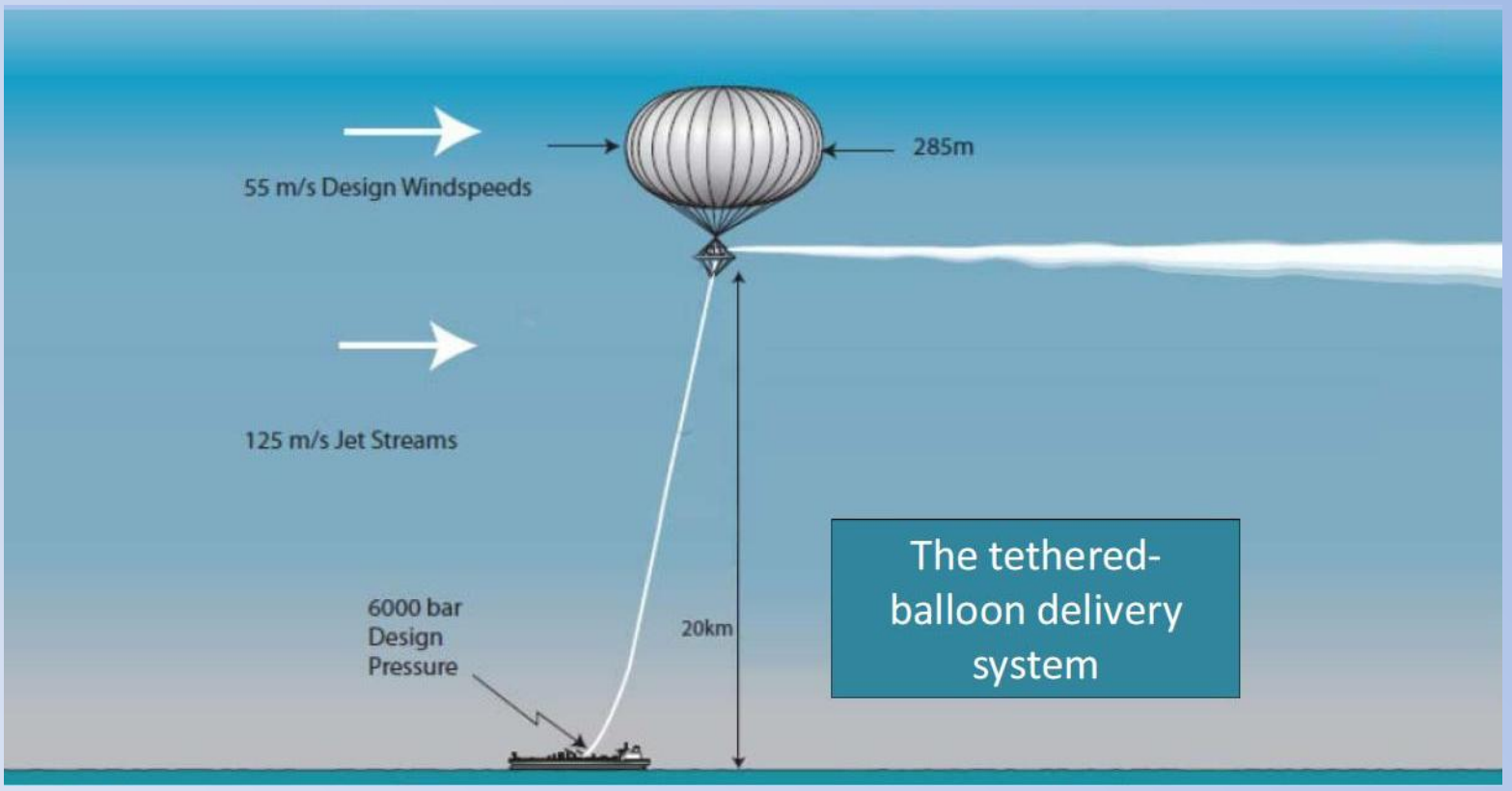
(McClellan et al 2012)



Ricke et al 2010



"A 2% reduction in total irradiance, approximately enough to offset anthropogenic warming for a doubling of CO2 concentrations, brightens the sky (increase in diffuse light) by 3 to 5 times" (Kravitz 2012)

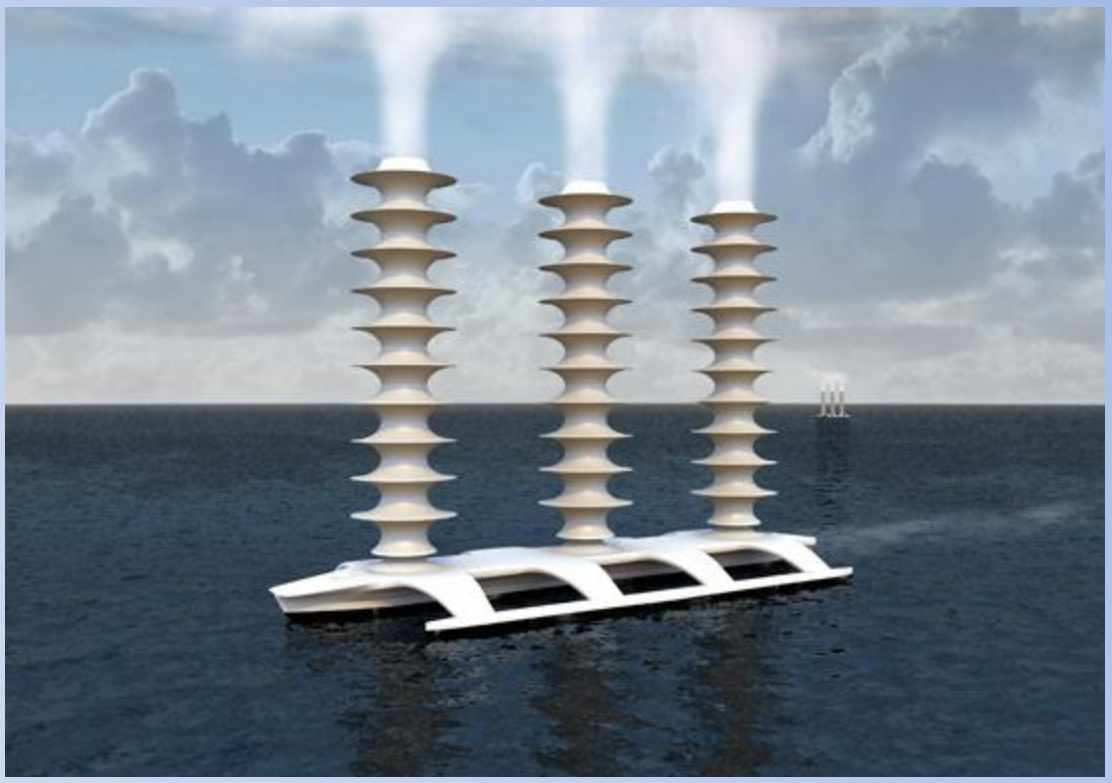


PROPOSED SPICE EXPERIMENT

Blocking Sunlight:

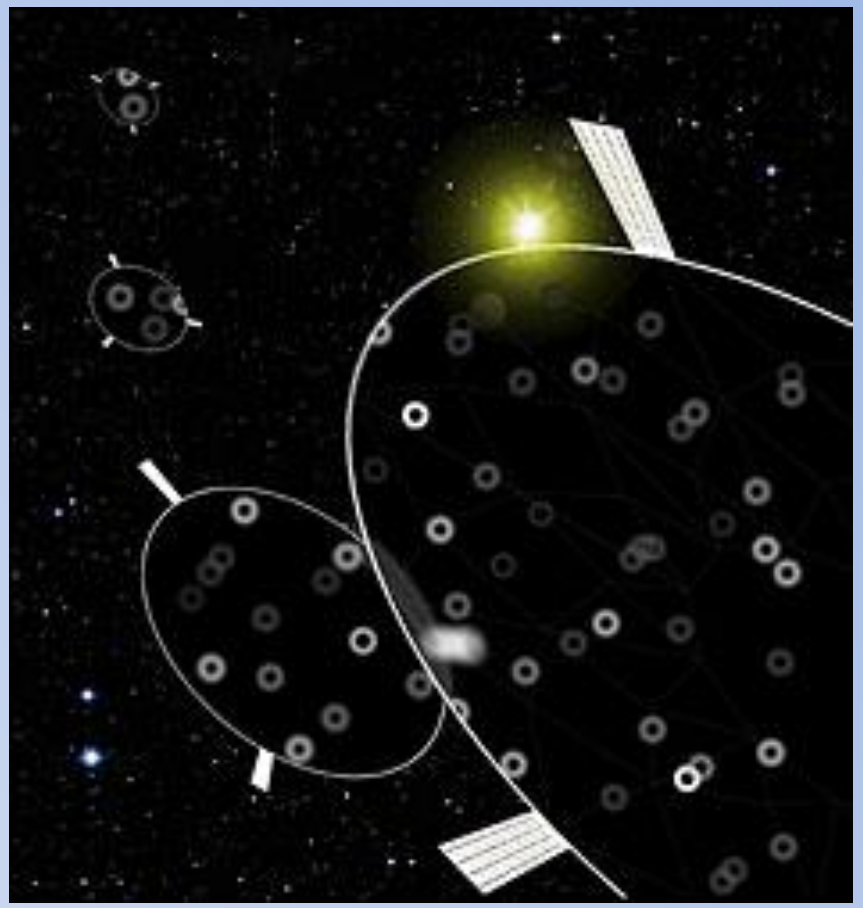
Brightening clouds at sea

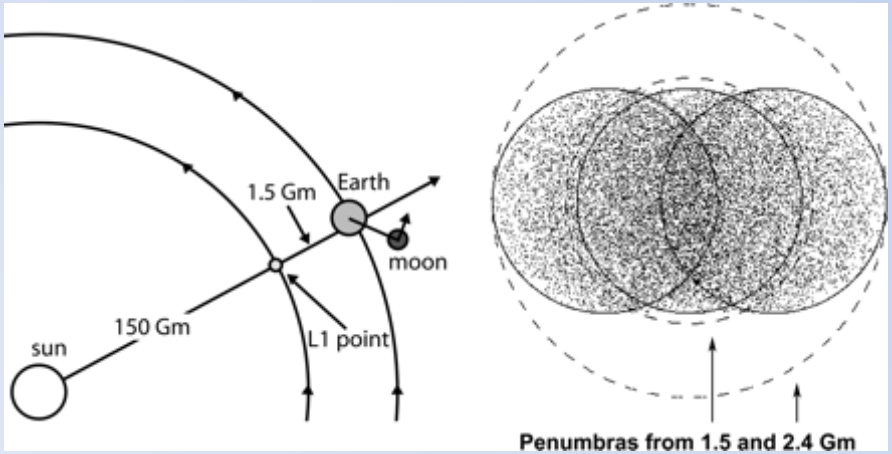
Idea: make existing natural low clouds over the ocean brighter by increasing the number of drops in the clouds.

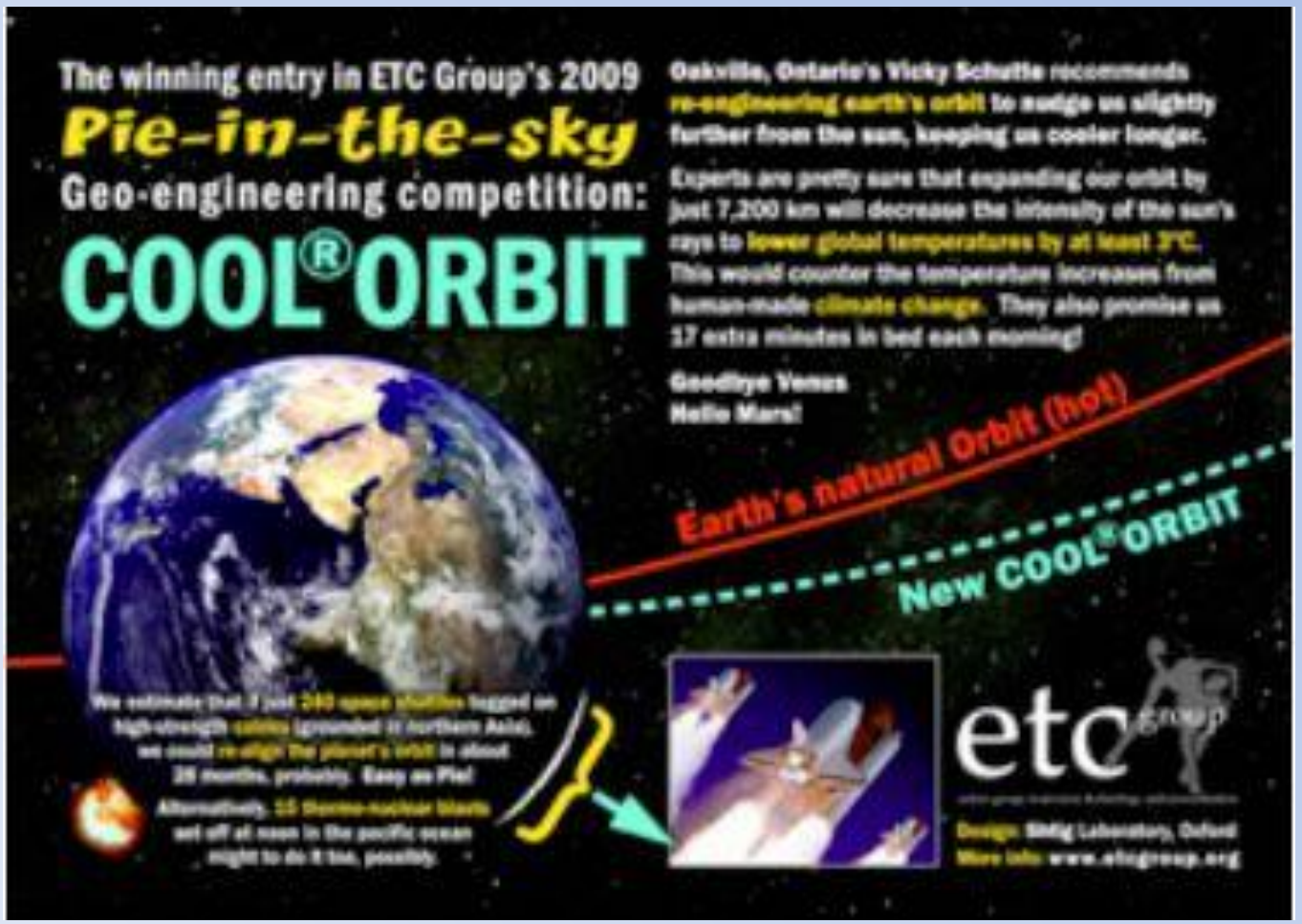


Blocking Sunlight:

•A 100,000 km cloud
•comprised of 16 trillion manhole-cover sized discs,
•~3 million miles from earth,
•blocking 2% of the sun's rays.
$1 -$5 trillion depending on launch technology.







Solution: pull earth with 16 Space Shuttles into an orbit 7200 km wider

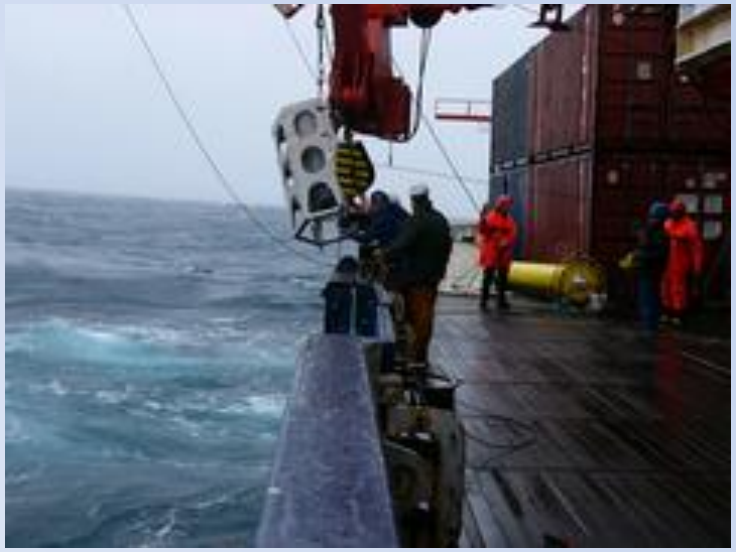
The Global Dustbuster: Air Capture

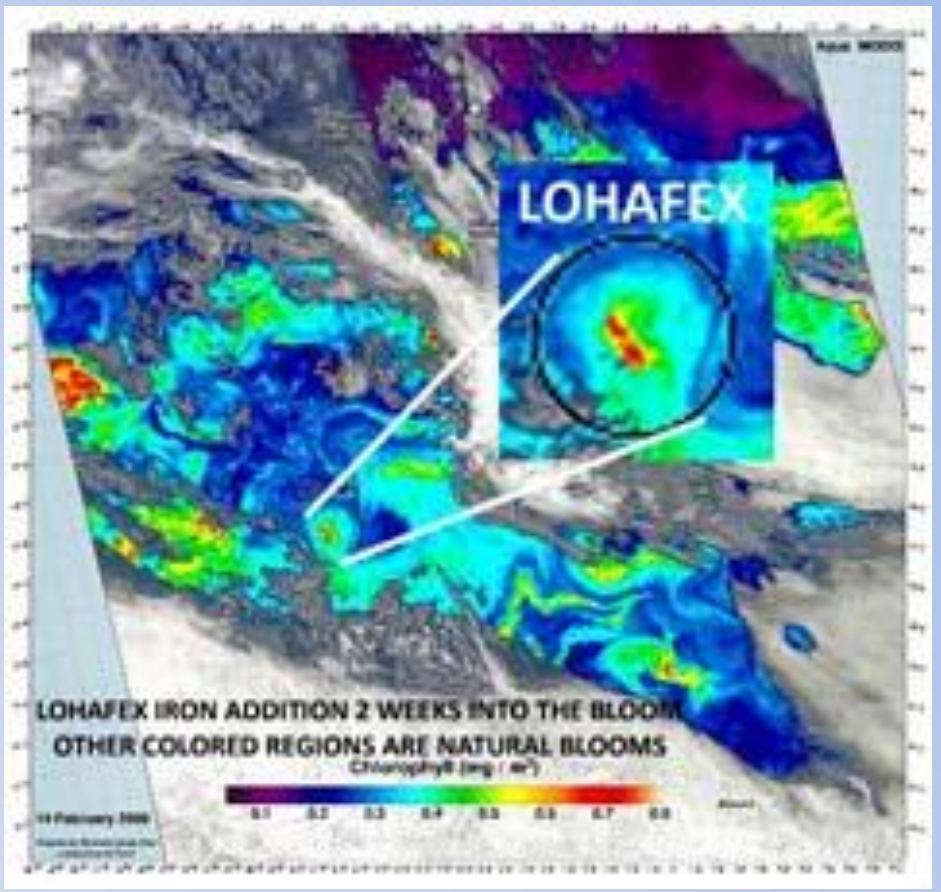
Contactor Tower:
Keith (David), 2008

Illustration by Carbon Engineering, Calgary

GETTING THE CARBON OUT

Growing Algae





Oxford Principles

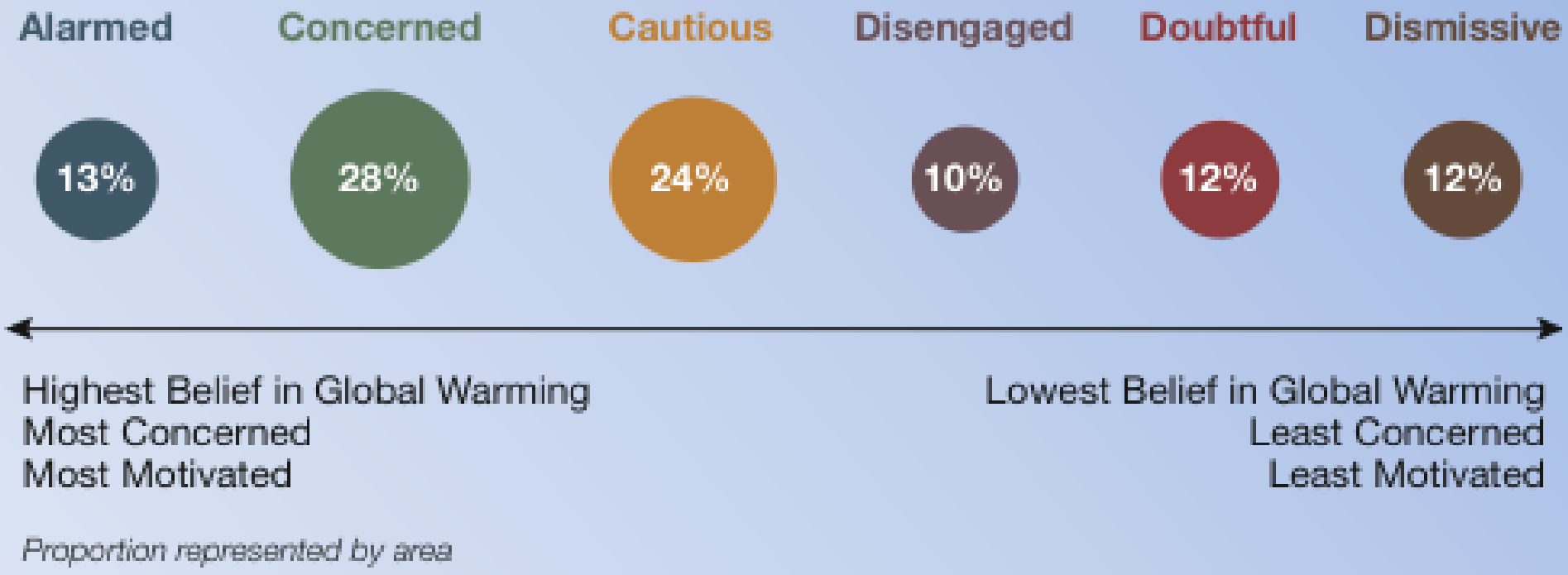
- SRM as a public good
- Public involvement in SRM research, including field trials
- Research plans be transparent and shared publically
- Independent assessment of impacts of research
- Deployment decisions only after robust global governance is established

Climate Engineering Policy Developments

- European Union
- UK Royal society
- Germany
- UK

- And US…

Motivation: Reach a broader audience



Yale & George Mason, June 2010


YouTube
eli kintisch
Brov
The Audition - Global Warming PSA
DCKillJoy
Subscribe
47 videos
0:57 / 1:38
3D
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Proposed art: **Here After Now**, by Sam Jury

Bay in Flux project

- Scientists, Artists, designers, journalists working together to design iPad applications
- Exploring how Narragansett Bay is changing with climate change

Thanks!

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