

An Inconvenient Truth



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A Really
~~*An*~~ *Inconvenient Truth*

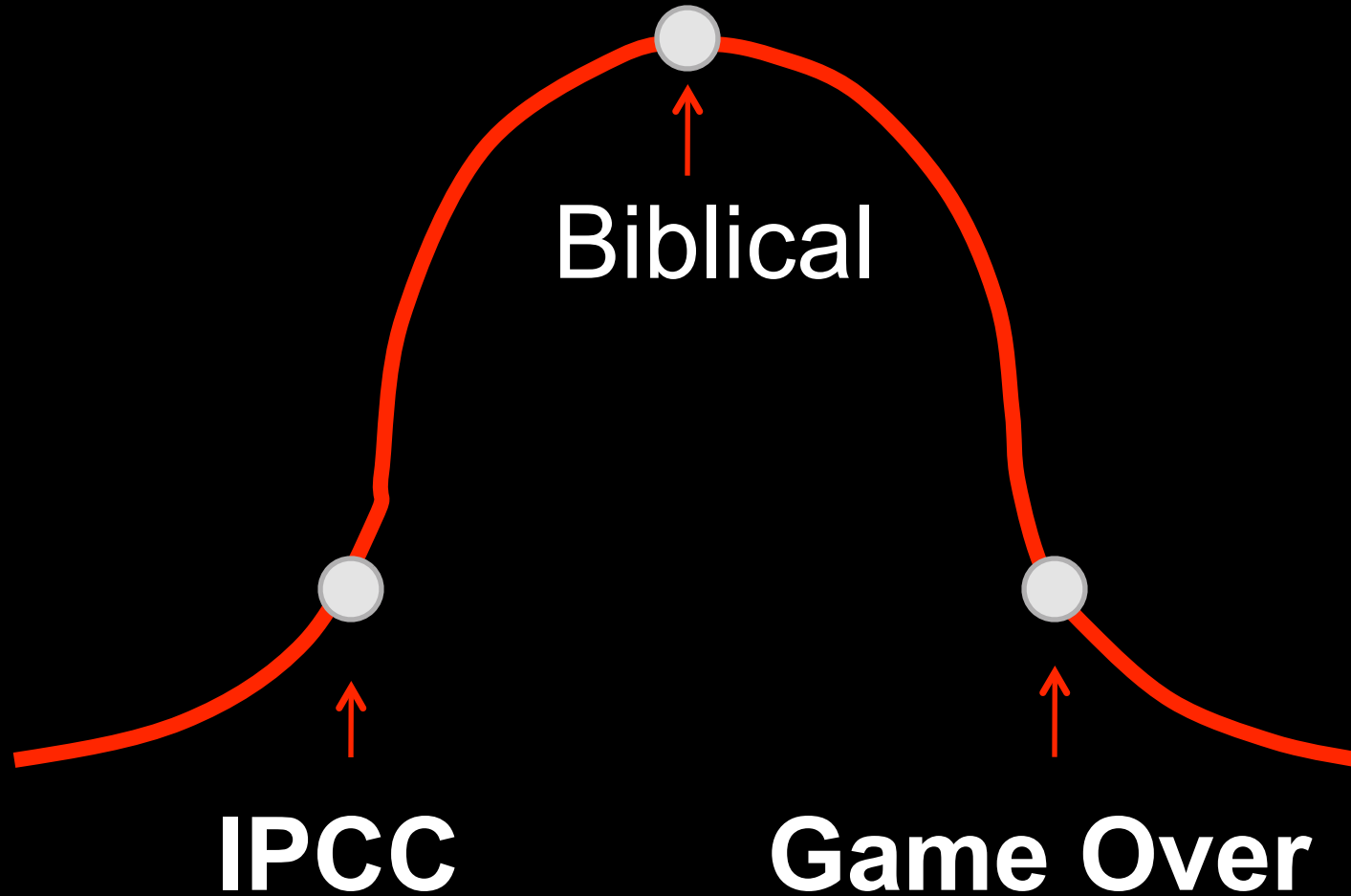


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UN IPCC

- Policy makers and the public rely on information from the United Nations Intergovernmental Panel on Climate Change
- The latest (2007) IPCC reports show that climate change will cause dire impacts on humanity
- But because of time constraints, political influence, and consensus requirements, the IPCC reports reflect a *best-case analysis* of climate change
- We will consider the *expected case*
 - And show that the IPCC models are too conservative

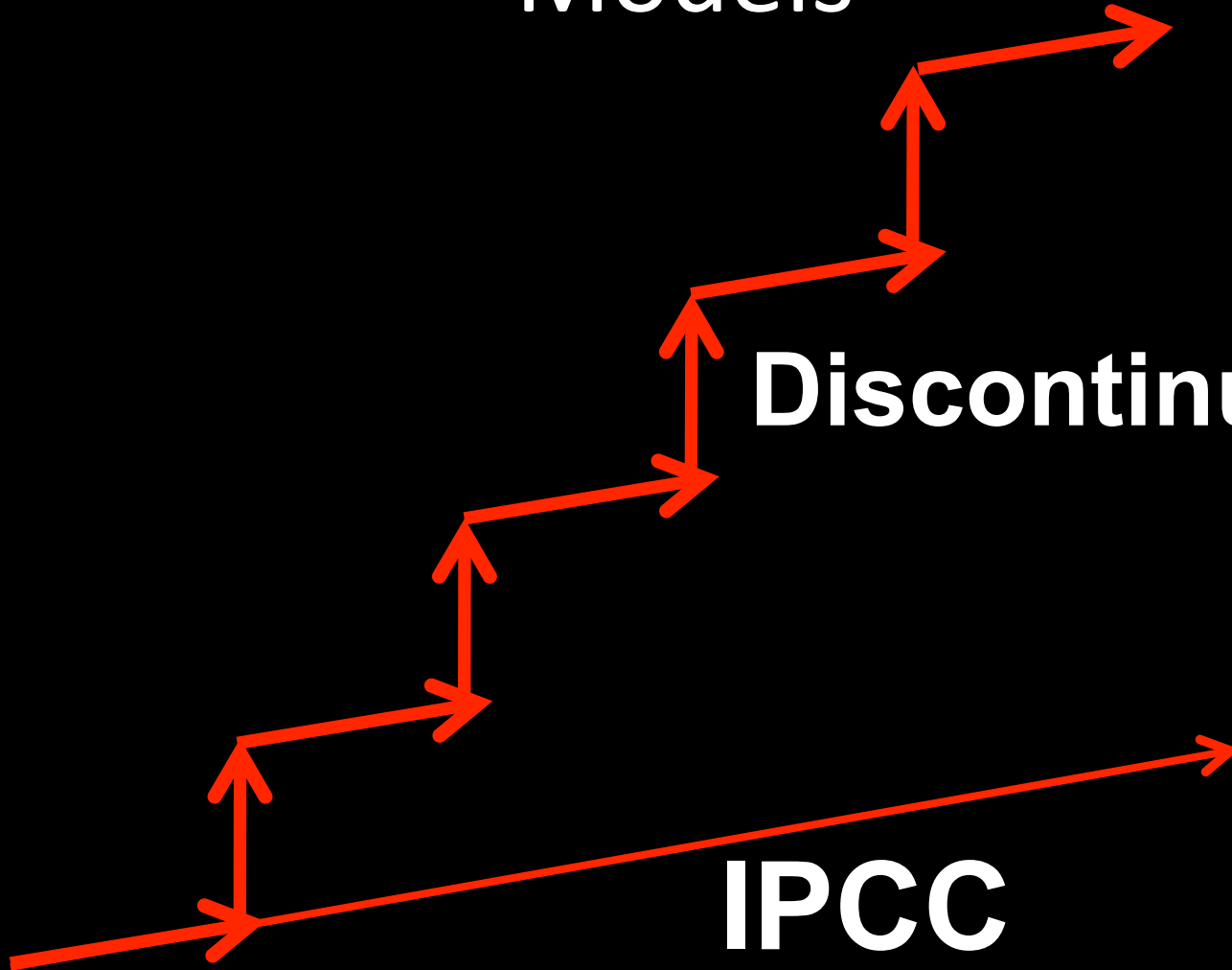
Bell Curve of Possible Outcomes



Models

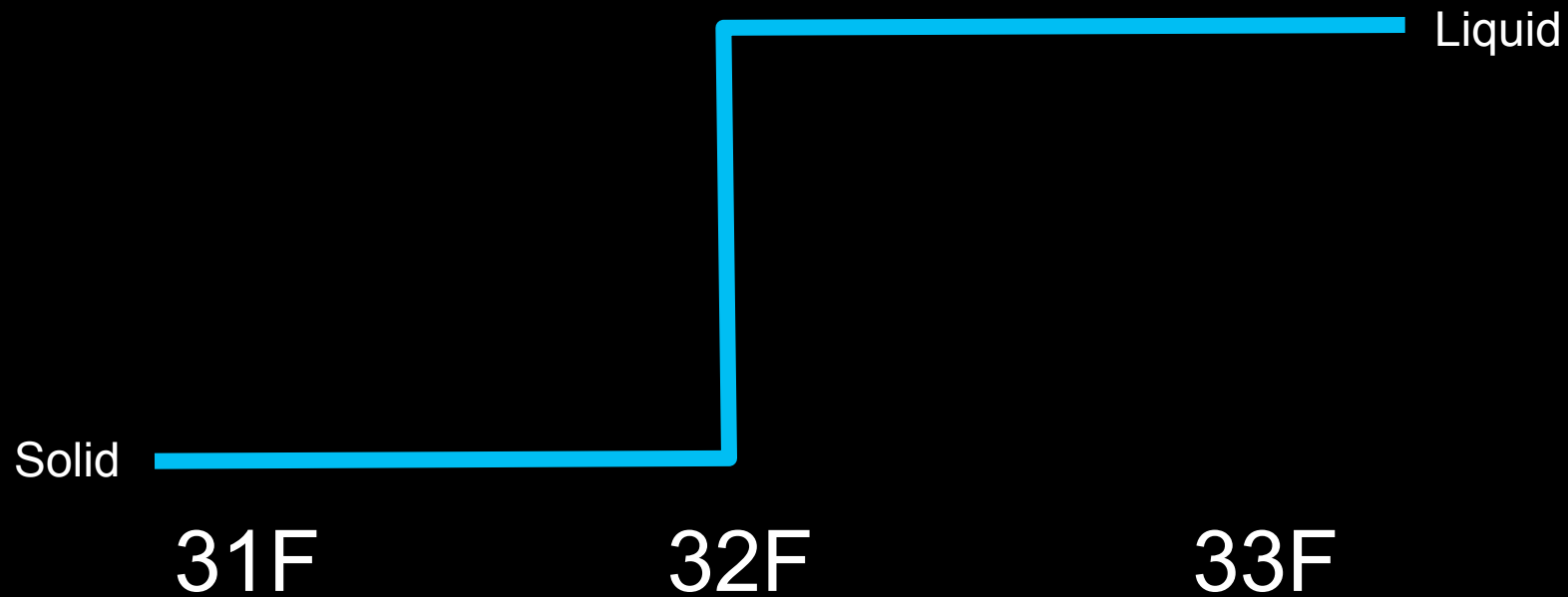
Discontinuous

IPCC

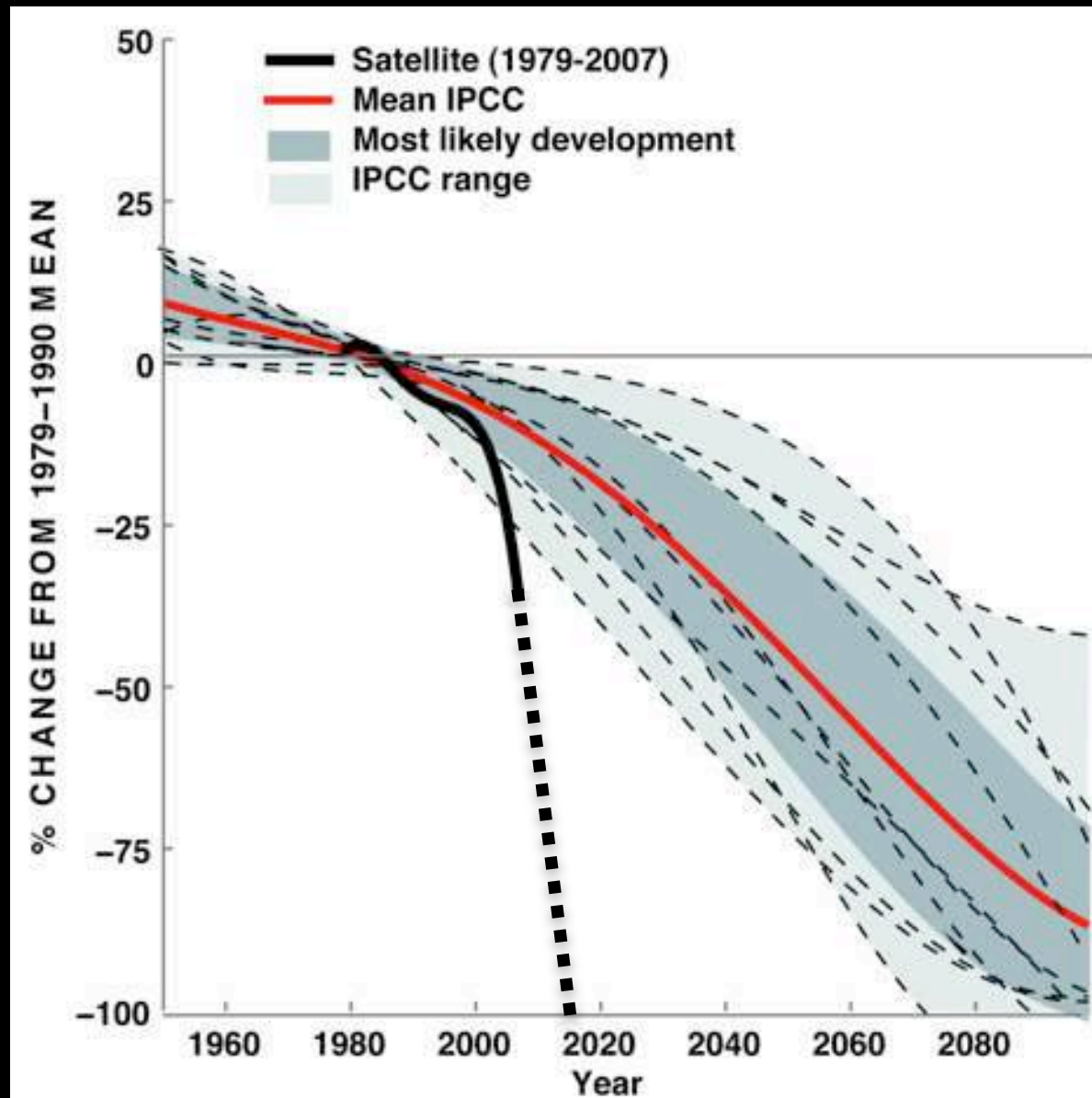


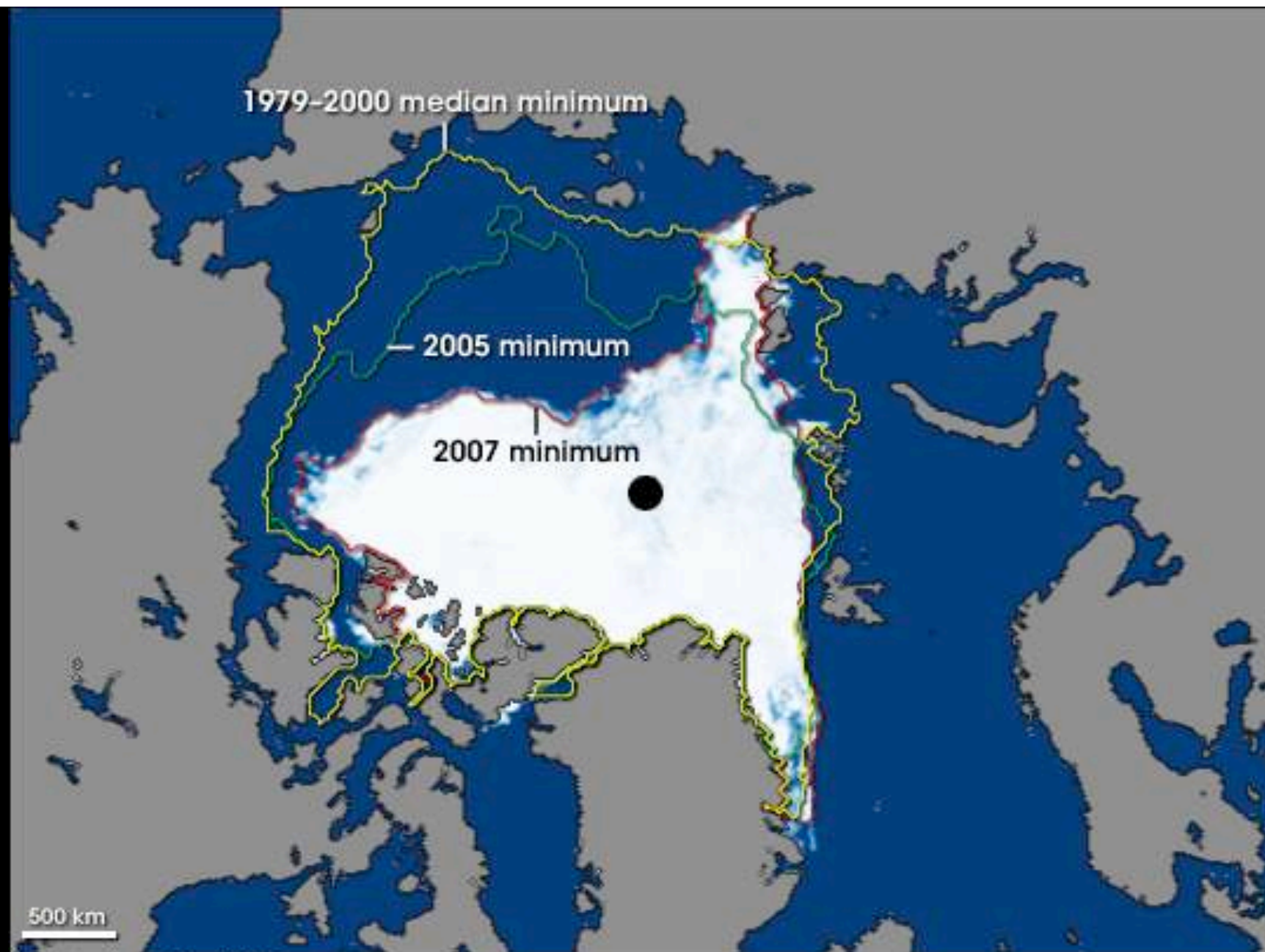
Discontinuities are common throughout nature

- H₂O



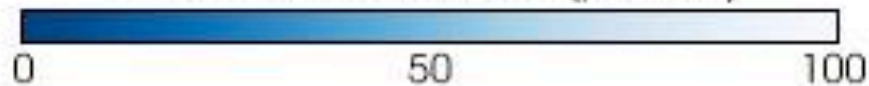
Actual Arctic Melt vs IPCC Models



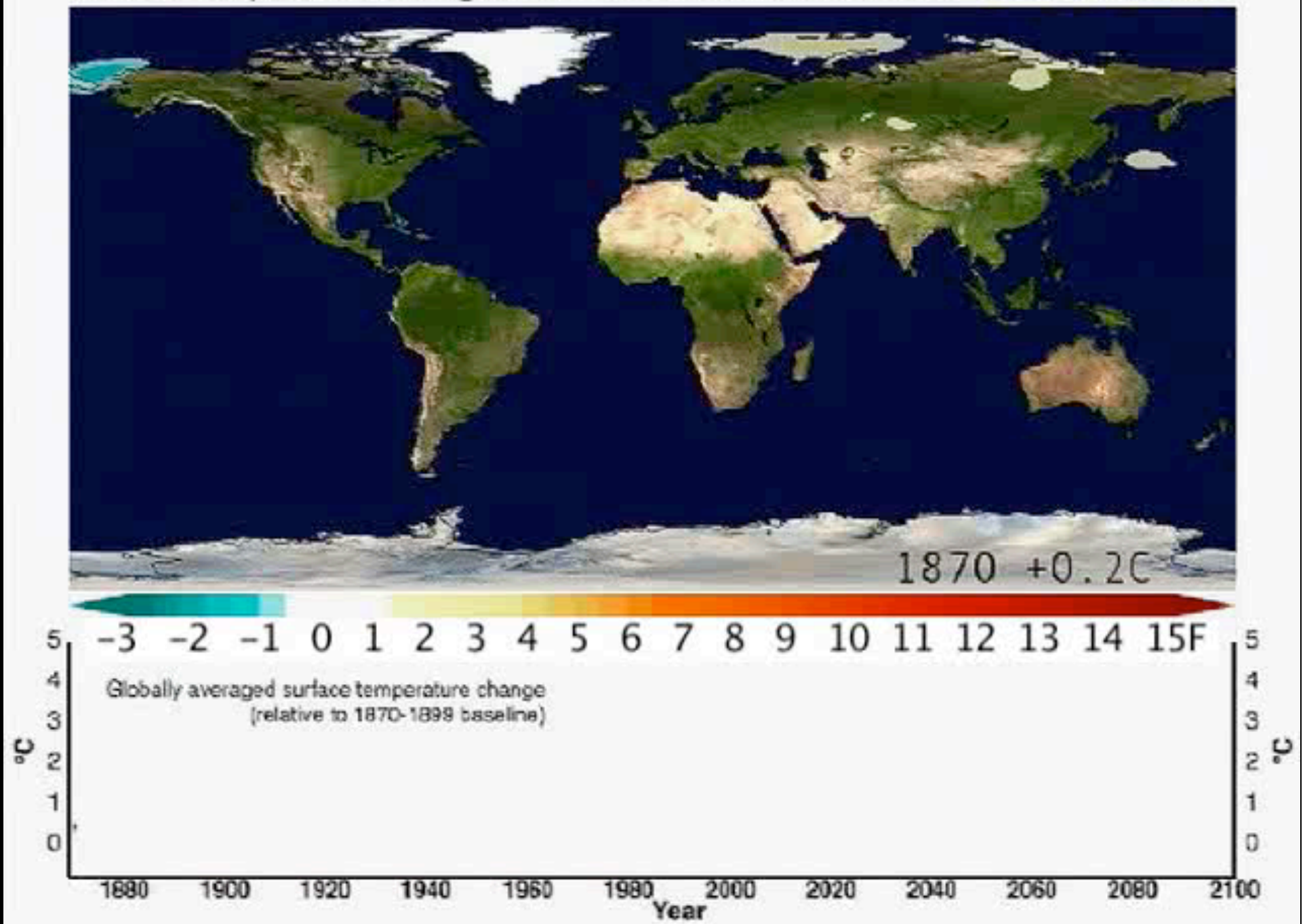


September 16, 2007

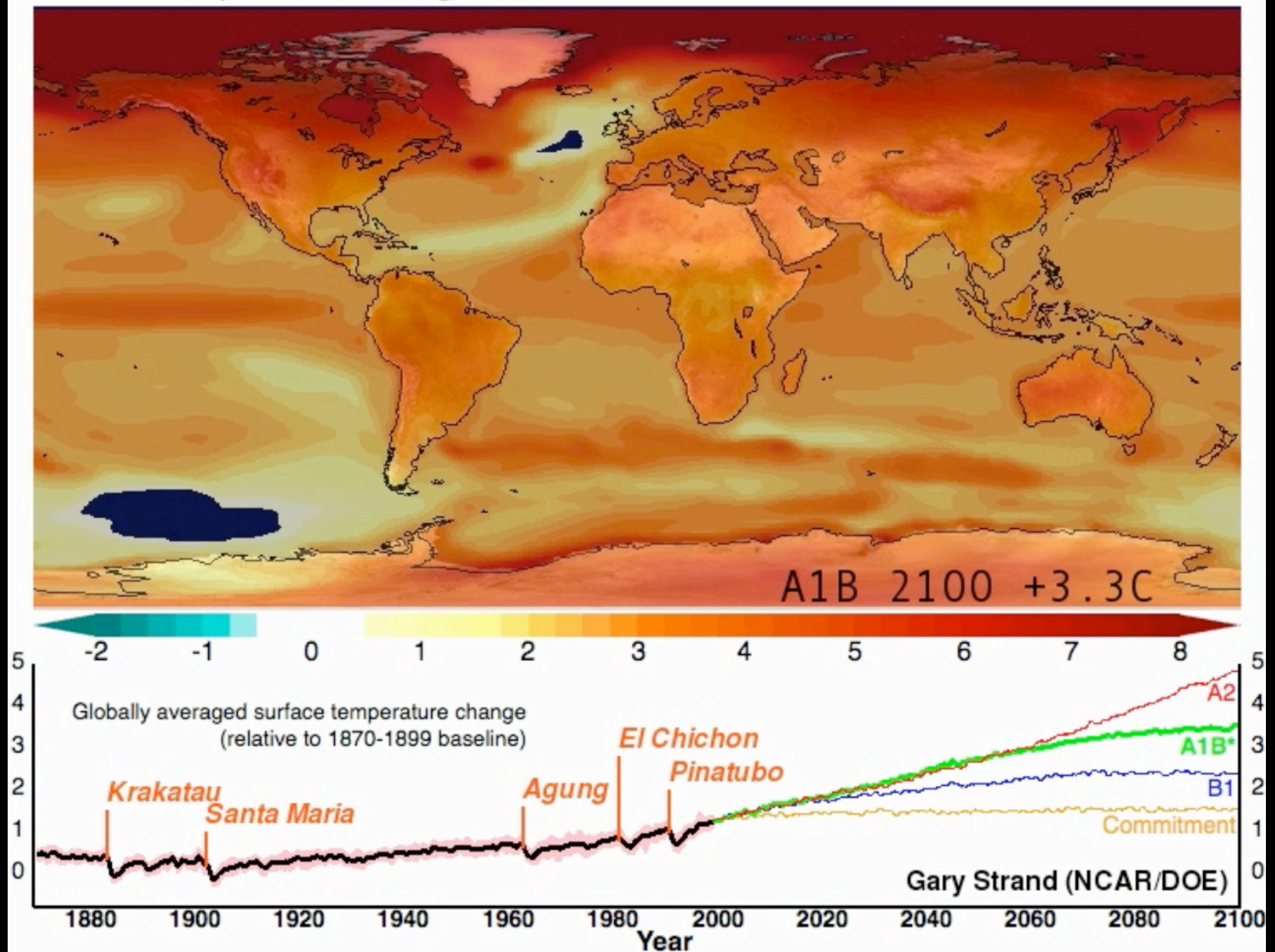
Sea Ice Concentration (percent)



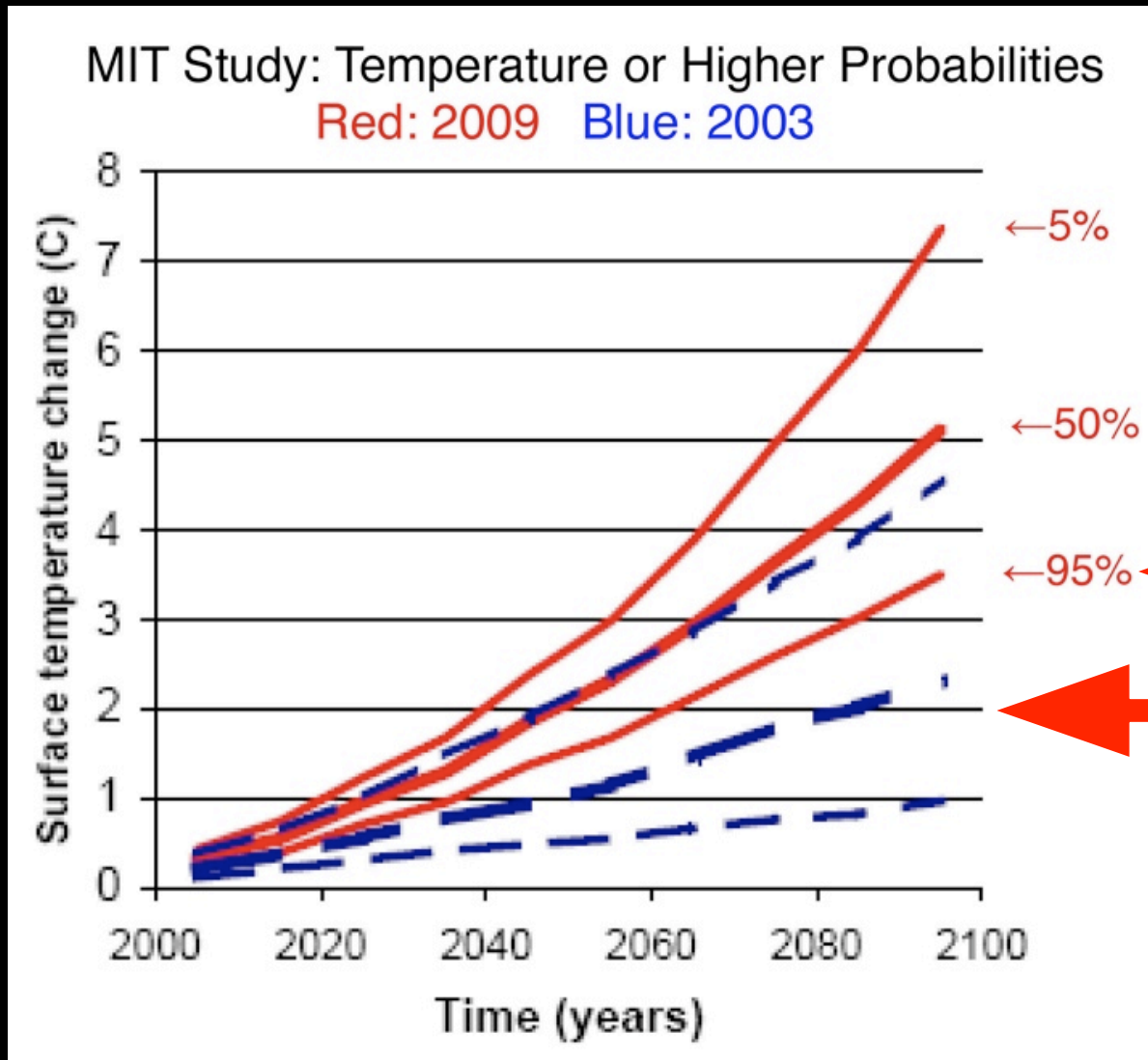
Surface temperature change relative to 1870-1899 baseline CCSM3 IPCC AR4



Surface temperature change relative to 1870-1899 baseline CCSM3 IPCC AR4



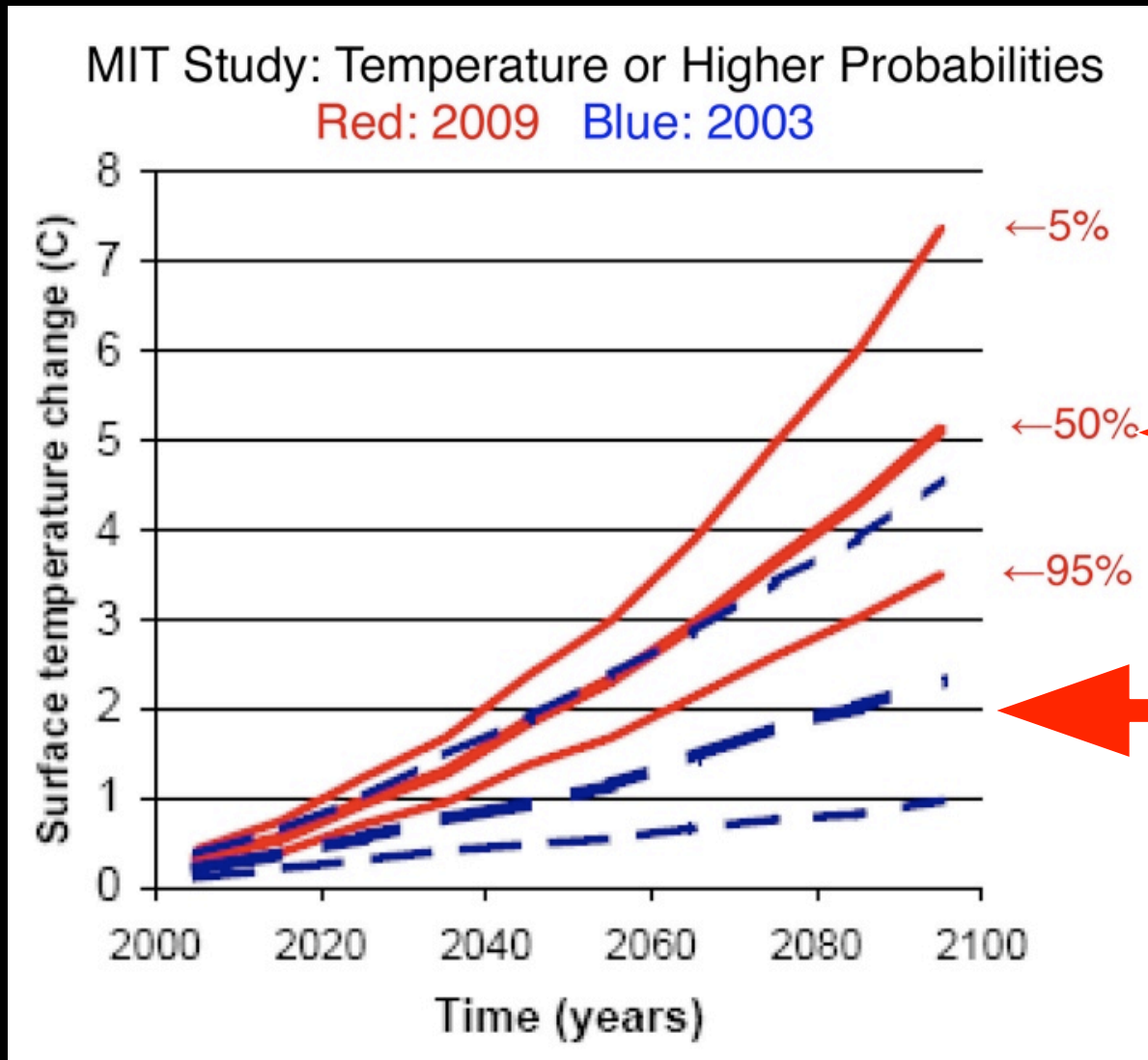
MIT Temperature Study



2009 MIT Study:
95% chance that
“Business-as-usual”
temperature
increase will *exceed*
3.5°C (6.3°F) in 2095



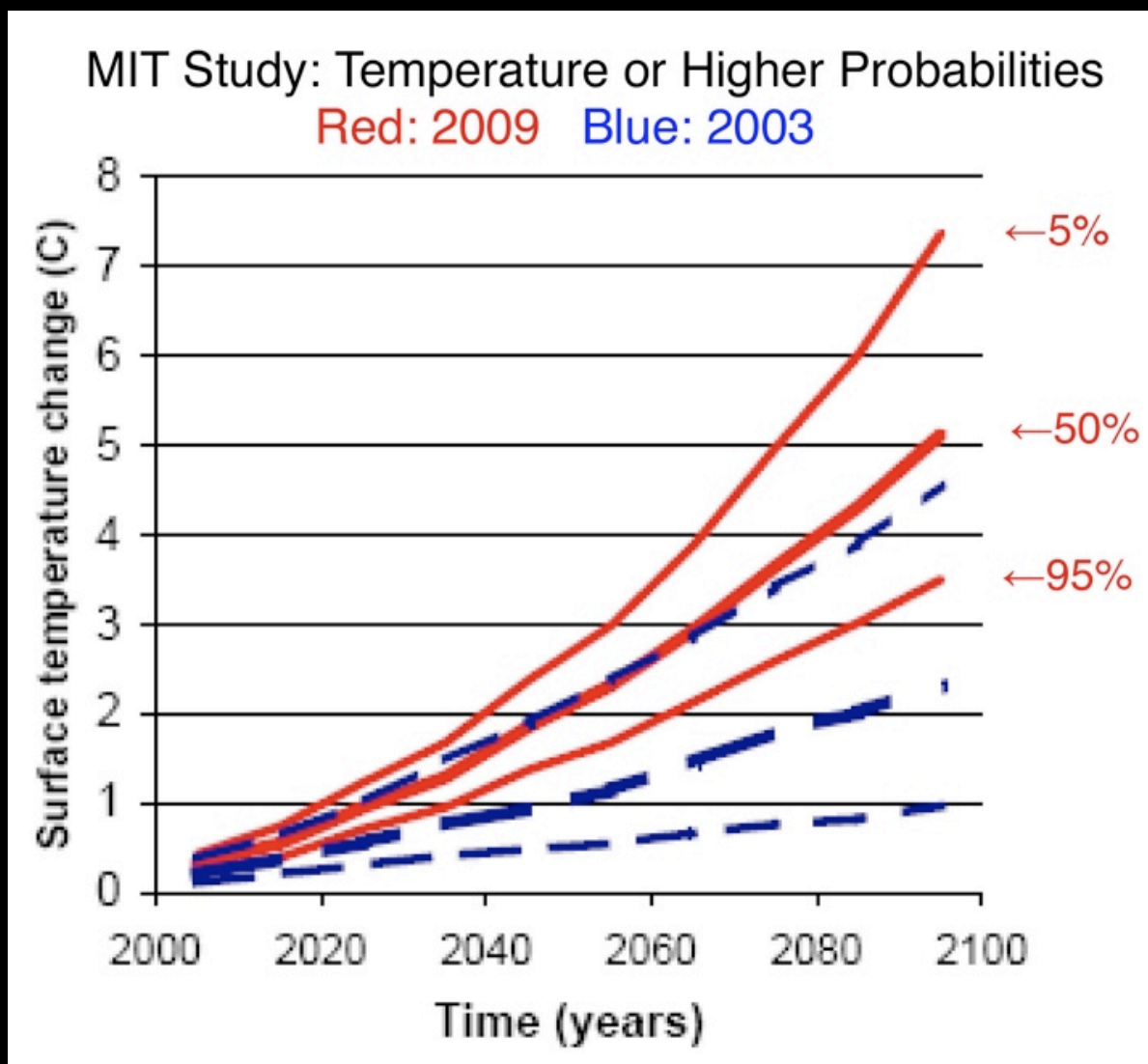
MIT Temperature Study



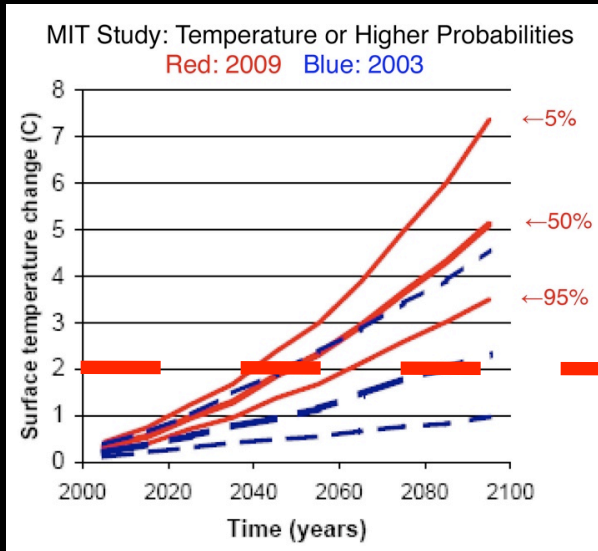
and a **50% chance** that temperature will exceed 5°C (9°F)!



MIT Temperature Study



Temperature Impact Analogy

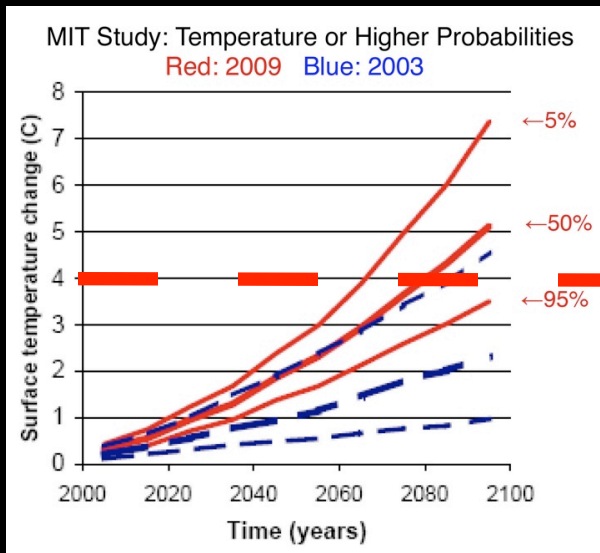


+2°C

20 mph



Temperature Impact Analogy

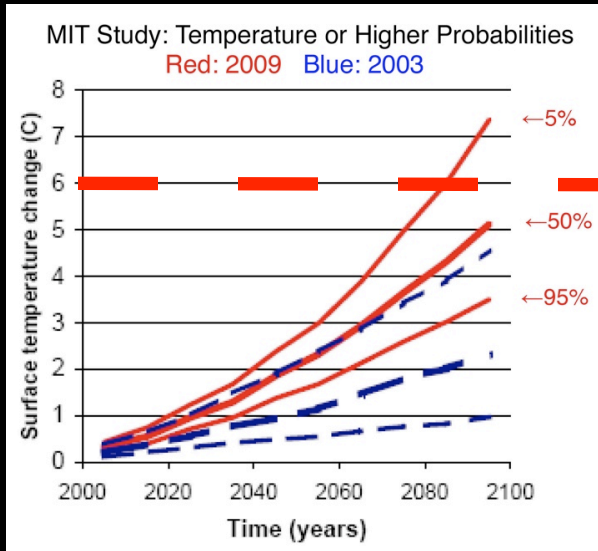


+4°C

40 mph



Temperature Impact Analogy



+6°C

60 mph





Greenland Ice

- Now losing ~300 Gigatons of ice every year ($\sim 300 \text{ km}^3$)
- Rate of loss is accelerating
- If all of Greenland collapses:
 - Oceans rise 20+ feet
- If all ice sheets collapse:
 - Oceans rise 280 feet
- IPCC Models do not consider ice sheet collapse
 - IPCC: ~2 foot rise by 2100
 - Jim Hansen, NASA Climate Scientist: “Certain” it will be 6+ feet

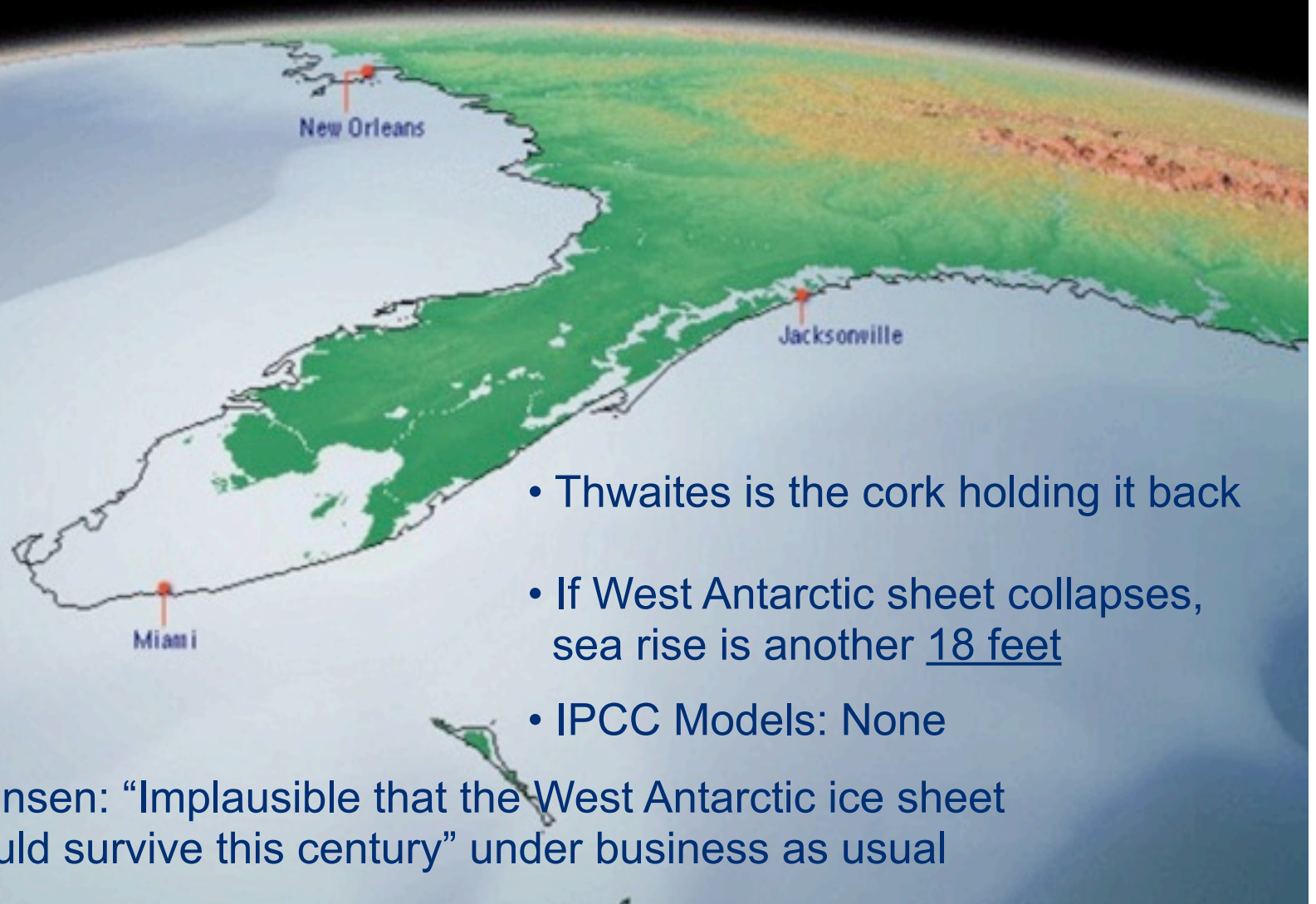
Source: NASA



Pine Island & Thwaites Glaciers Antarctica

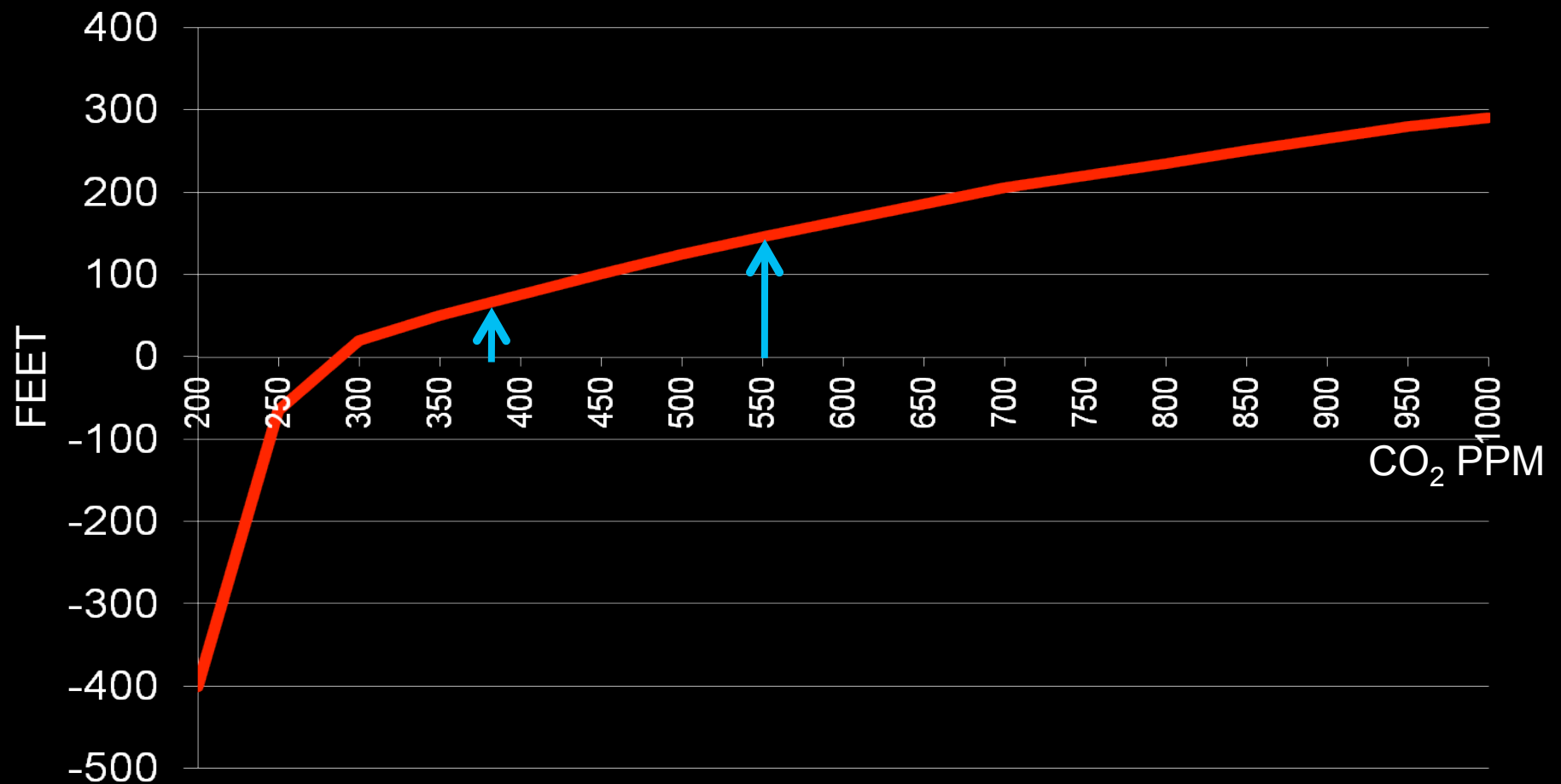
- In place for 20 million years
- Now melting & thinning at record pace
 - 1995: 70M acre feet/year
 - 2006: 220M acre feet/year
- If they collapse: Sea rises 6 feet and speeds collapse of West Antarctic Ice Sheet
- NASA: Weak underbelly in recent radar images
- British Antarctic Survey:
 - “Thwaites in danger of imminent collapse”
- No collapse models exist in IPCC, so just model slow melt over time

West Antarctic Ice Sheet



Oceans Will Rise

Based on Actual Historical Data – Not Models





Permafrost

- Stores methane in Siberia and other Arctic regions
- Melting now and already releasing 50M tons per year
 - Equivalent to 1B Tons of CO₂
 - Accelerating since avg. temp 32°F now
 - Entire region on verge of collapse
- Contains more equivalent CO₂ than the entire atmosphere!
- This is a near-term tipping point
 - Will overwhelm human actions to reduce CO₂ emissions



A Global Time Bomb

- Methane Clathrates (frozen) at ocean floor
- Massive amounts
- Will be released if ocean temperatures rise
- This happened in the past, including 55M years ago
 - Global temp rose 5 to 9C.
 - Mass extinctions
- IPCC Models: Not included



Other Dangers: *All Already Happening*

- Reduction of ocean's ability to absorb CO₂
- Collapse of forests / increased wild fires
- Spread of deserts
- Mega-droughts
- Mass extinctions
- More extreme weather
- Reduction in global food production





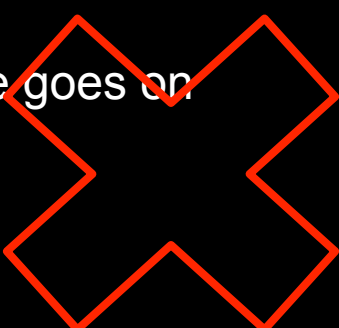
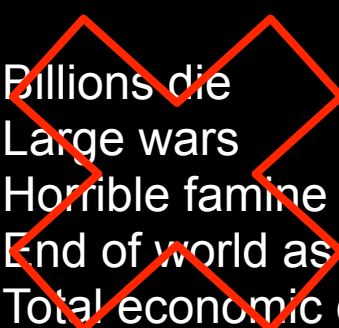


Potential Impacts

- Wars over resources
- Abandonment of many major cities
- Massive shortages of food and water
- Collapse of economies
- Runaway greenhouse effect: Venus Syndrome

Choices

To Act or Not to Act: 4 Outcomes

	<u>No Climate Change</u>	<u>Yes Climate Change</u>
<u>We Act</u>	 <ul style="list-style-type: none">➤ Waste Money➤ Invent new technology➤ Reduce reliance on oil	 <ul style="list-style-type: none">➤ Spend Money➤ Save 1B Lives➤ Invent new technology➤ Reduce reliance on oil
<u>We Do NOT Act</u>	 <ul style="list-style-type: none">➤ Life goes on	 <ul style="list-style-type: none">➤ Billions die➤ Large wars➤ Horrible famine and drought➤ End of world as we know it➤ Total economic collapse

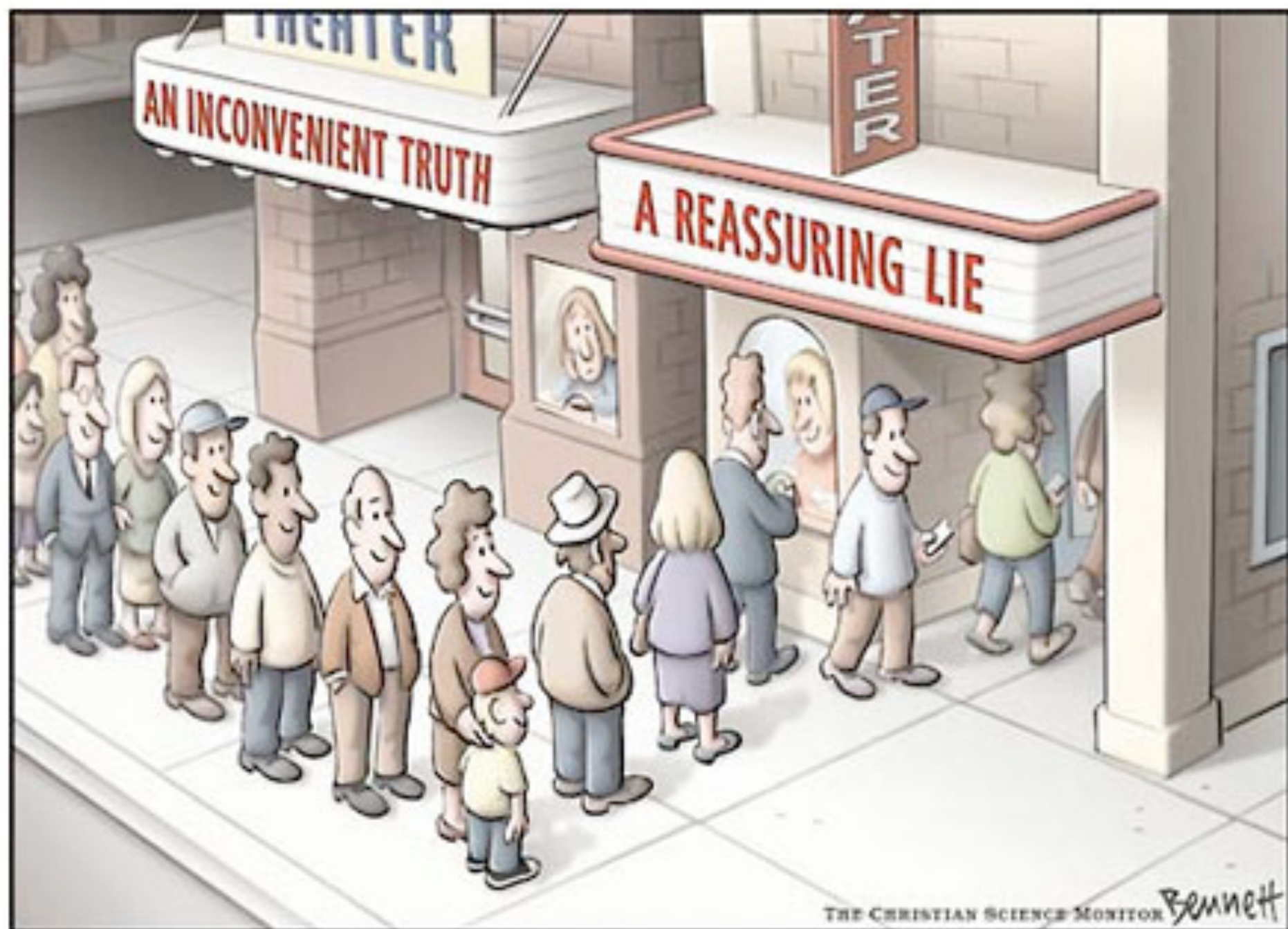
Why Don't We Act?

Failure of the "Risk Thermostat"

We respond strongest to threats that are:	Climate Change is:
Visible	Invisible
With historical precedent	Unprecedented
Immediate	Drawn out
With simple causality	With complex causality
Caused by another "tribe"	Caused by all of us
Have direct personal impacts	Unpredictable & indirect impacts

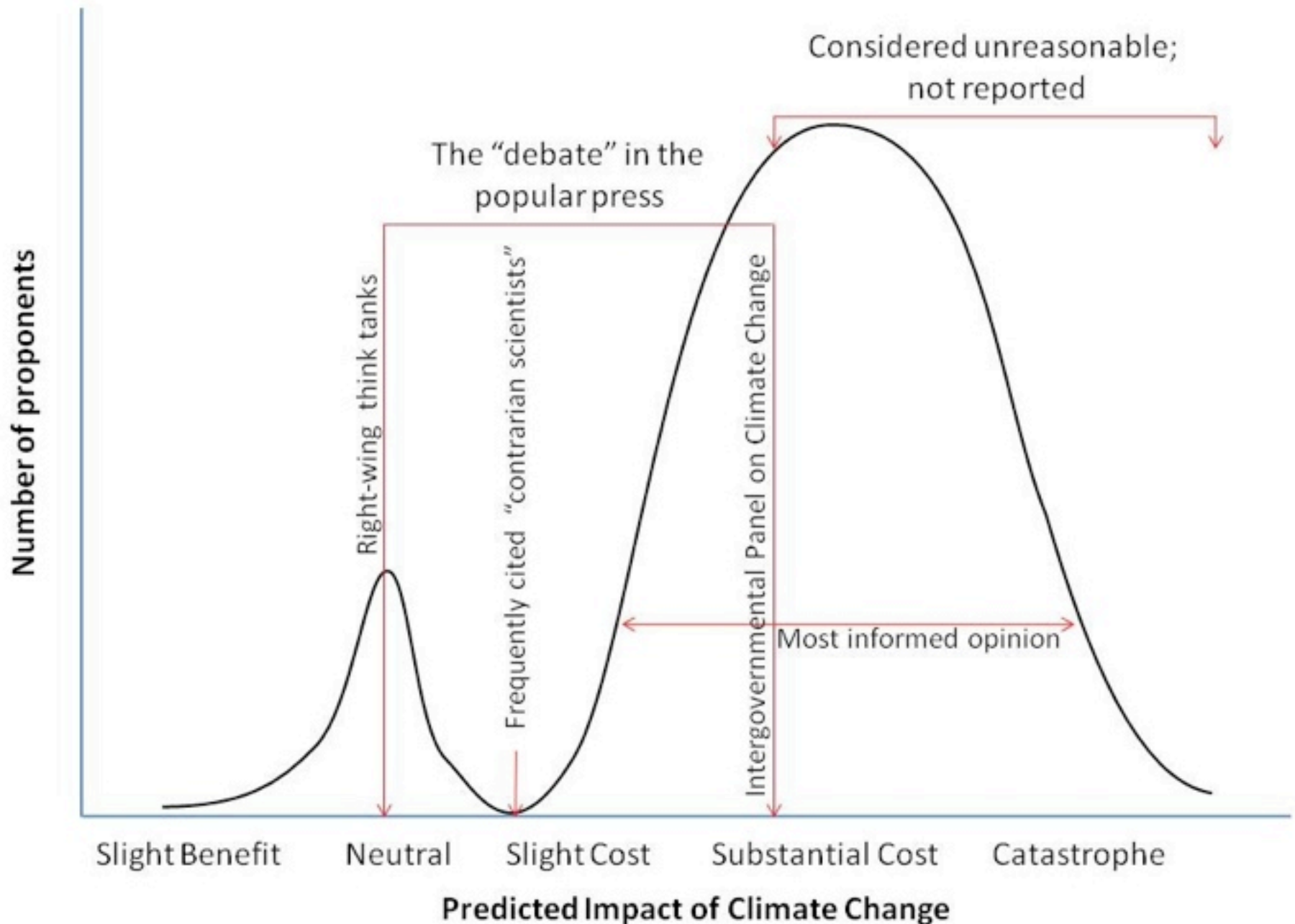
Denial Strategies

Displaced commitment	"I protect the environment in other ways"
Condemn the accuser	"You have no right to challenge me"
Denial of responsibility	"I am not the main cause of this problem"
Rejection of blame	"I have done nothing wrong"
Ignorance	"I didn't know"
Powerlessness	"I can't make any difference"
Fabricated constraints	"There are too many impediments"
After the flood	"Society is corrupt"
Comfort	"It's too hard for me to change my behavior"



THE CHRISTIAN SCIENCE MONITOR *Bennett*

Distribution of professional opinion on anthropogenic climate change



What to Do?

What Can You Do?

- Ask your children for forgiveness
- Buy a fuel-efficient car
- Eat less beef
- Change your light bulbs, wear a sweater, etc.
- Talk to your family, friends, and colleagues
- Get your company to “Go Green”
- ***Talk to your elected leaders***

What Can Countries Do?

- Implement a Cap & Trade system or tax for CO₂
- Mandatory energy efficiency standards
- ***Ban new coal-fired power plants***
- ***Quickly Phase out existing coal-fired plants***
- Eliminate subsidies for fossil fuels
- Give subsidies & incentives for clean energy
- Increase energy/climate research spending 100x

What Can Countries Do? (Cont.)

- Phase out beef
- Prepare for extreme weather, drought, global instability, agriculture impacts, sea level rise
- Research geo-engineering remedies
- Develop 3rd and 4th generation nuclear plants
- Support global family planning
- Support & sign an aggressive treaty in Mexico City in 2010 (Copenhagen follow-on)

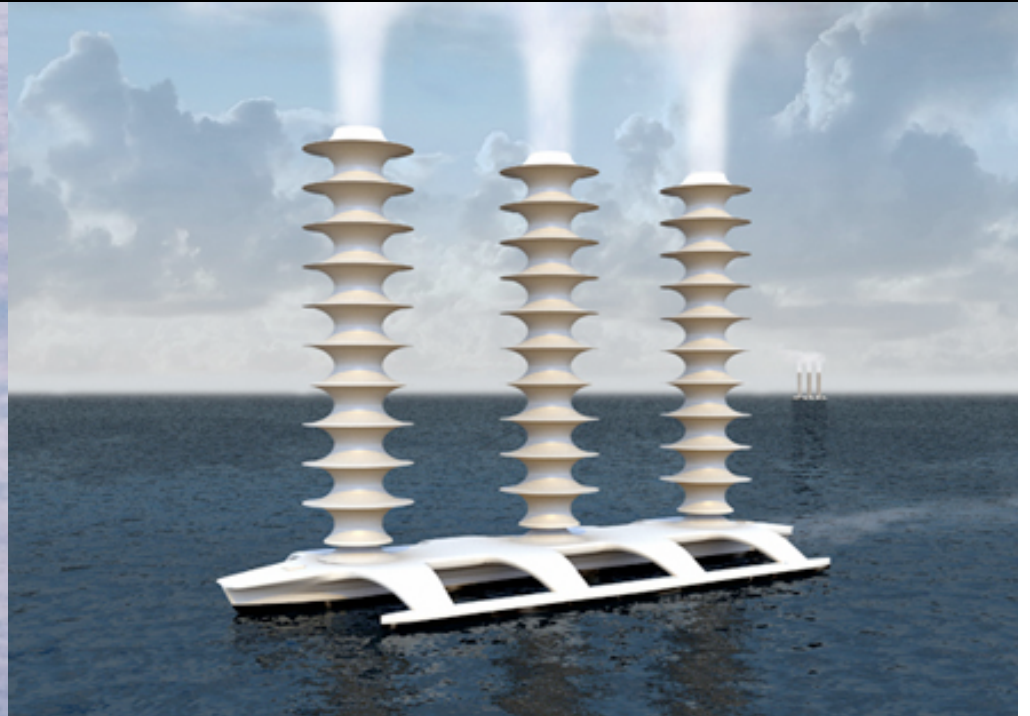
Geo-Engineering

- Intentional planet-wide changes meant to mitigate impacts of global warming
- Probably our only hope because, at this point, reducing emissions alone won't be enough
 - But we still need to dramatically reduce emissions!
- Like chemotherapy, many geo-engineering solutions have bad side-effects

Geo-Engineering Examples

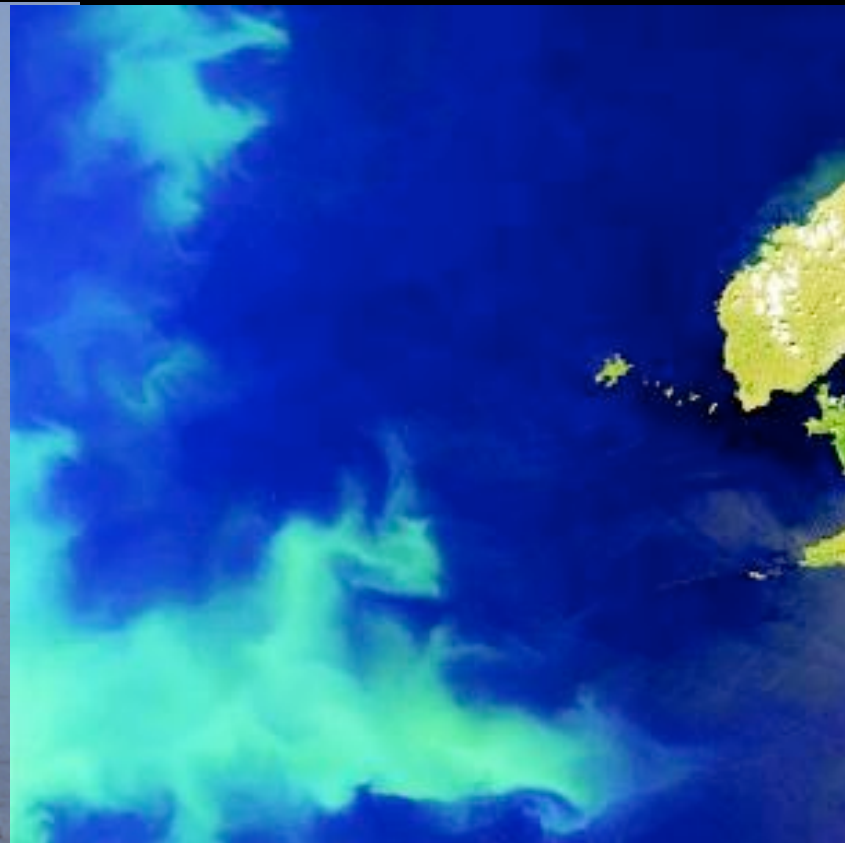
Block Sunlight

- Put smoke in the upper atmosphere or use ships to create low-level clouds
 - Stop the permafrost and Greenland from melting



Put Iron in the Ocean

- Grows algae, which eat CO_2 then die and sink to bottom



Turn Plants into Biochar

- Turns into solid carbon instead of CO₂
- Put back on ground... helps plants grow

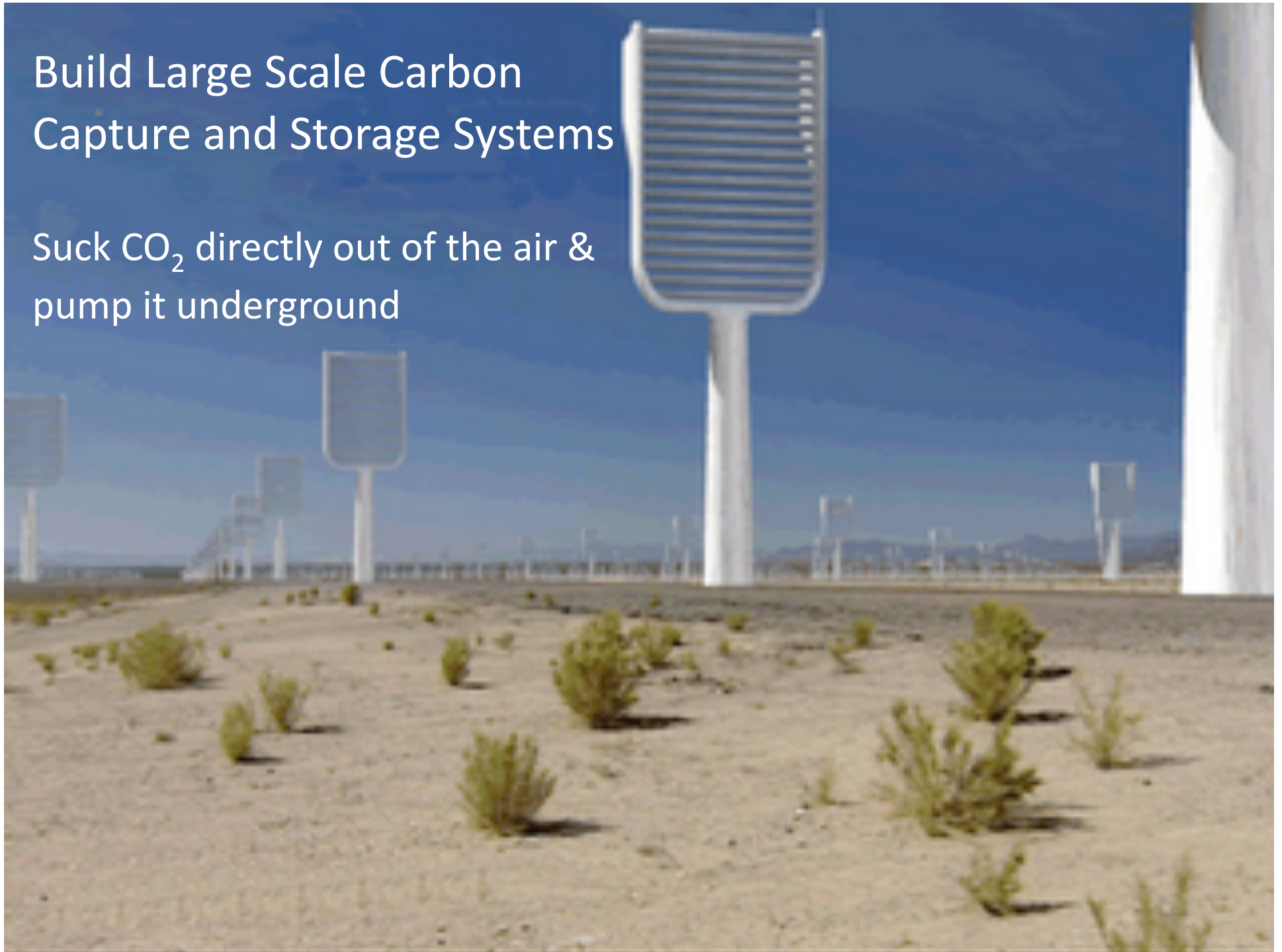


Reforest the Planet



Build Large Scale Carbon Capture and Storage Systems

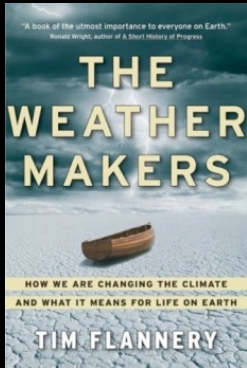
Suck CO₂ directly out of the air &
pump it underground



Some Good News

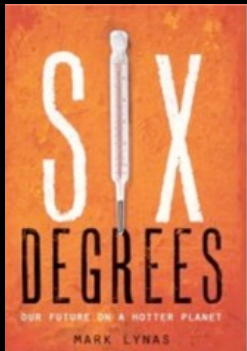
- We can still avoid the worst effects of climate change
 - But must act now
 - Need to phase out coal plants in 10 to 20 years and keep tar sands and oil shale in the ground
 - Move back to 350 ppm (from 387 now)
- Transitioning to a low-carbon world is the biggest economic opportunity ever!

Further Reading

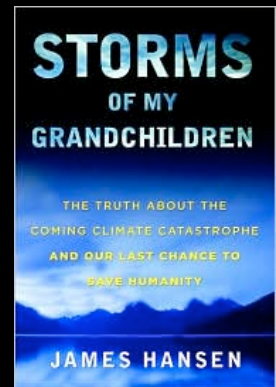


The Weather Makers by Tim Flannery

With Speed and Violence by Fred Pearce



Six Degrees by Mark Lynas



*Storms of Our Grandchildren:
The Truth About the Coming Climate Catastrophe and
Our Last Chance to Save Humanity*
by James Hansen (coming Dec. 8)

For More Information

Please visit:

www.ClimatePlace.org

Q & A

“They go on in strange paradox, decided only to be undecided, resolved to be irresolute, adamant for drift, solid for fluidity, all-powerful to be impotent... Owing to past neglect, in the face of the plainest warnings, we have entered upon a period of danger. The era of procrastination, of half measures, of soothing and baffling expedience of delays, is coming to its close. In its place we are entering a period of consequences.... We cannot avoid this period, we are in it now...”

- Winston Churchill, November 12, 1936