Title: An End to Reticence? Natural Scientists and the Politics of Global Change

Date: Feb 13, 2008 02:00 PM

URL: http://pirsa.org/08020001

Abstract: A convergence of climate, resource, technological, and economic stresses gravely threaten the future of humankind. Scientists have a special role in humankind\\\'s response, because only rigorous science can help us understand the complexities and potential consequences of these stresses. Diminishing the threat they pose will require profound social, institutional, and technological changes -- changes that will be opposed by powerful status-quo special interests. Do scientists have a responsibility to articulate the dangers of inaction to a broader event beyond simply publishing their findings in scholarly journals? Should they become more actively involved in the politics of global change?

An End to Reticence?

Natural Scientists and the Politics of Global Change

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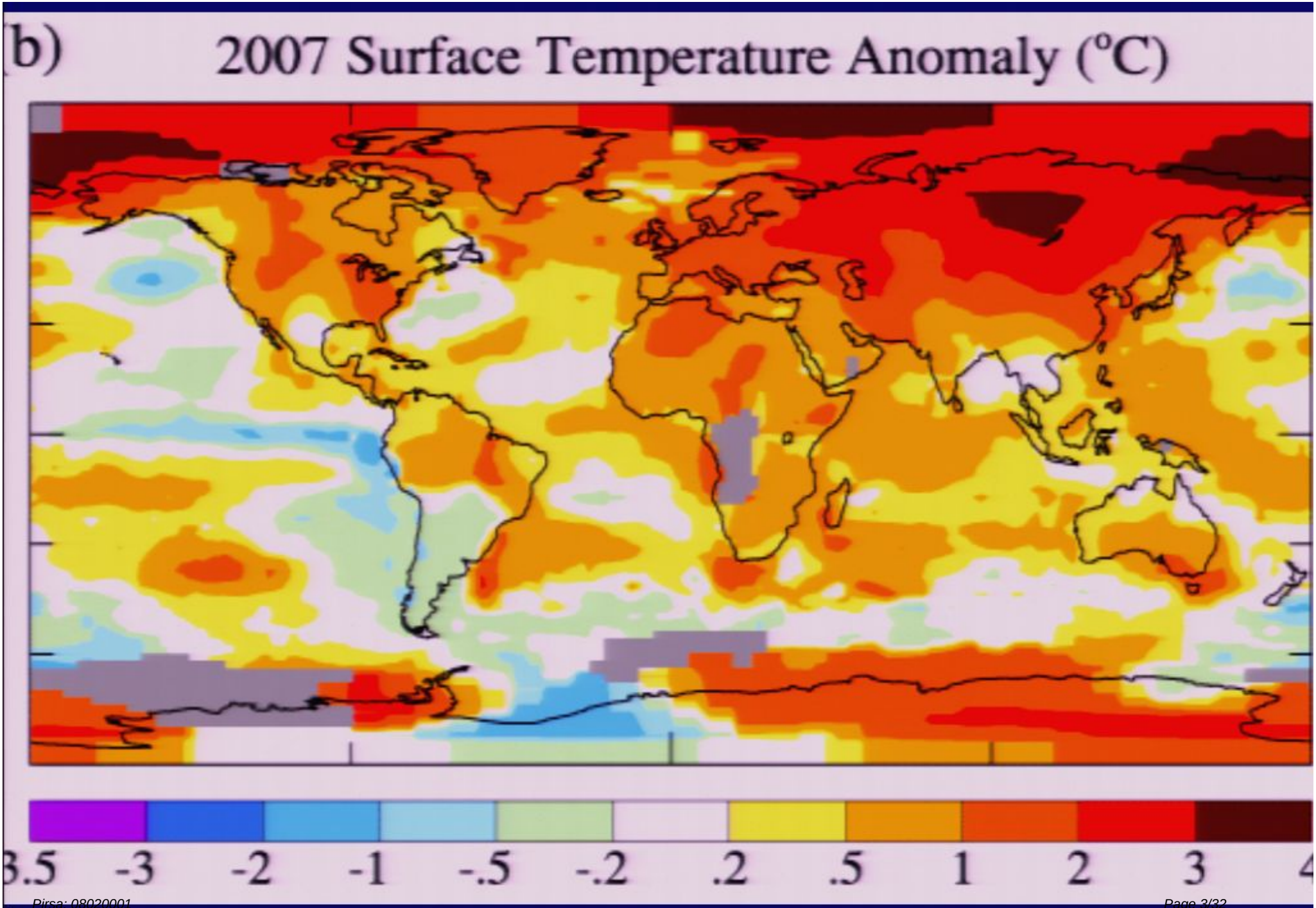
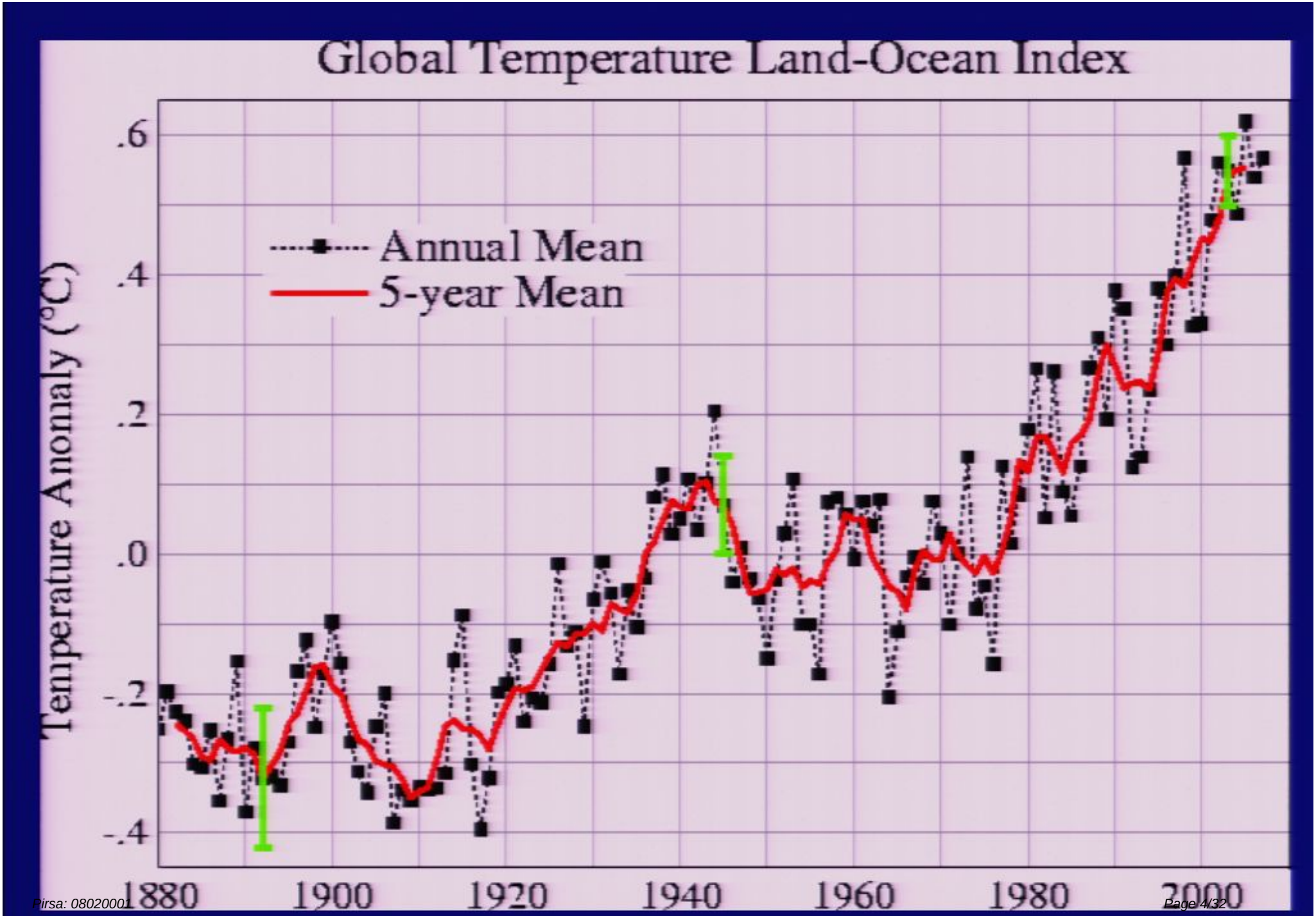
Trudeau Centre for Peace and Conflict Studies
University of Toronto

Perimeter Institute
February 13 2008


(b) 2007 Surface Temperature Anomaly (°C)
3.5 -3 -2 -1 -.5 -.2 .2 .5 1 2 3 4

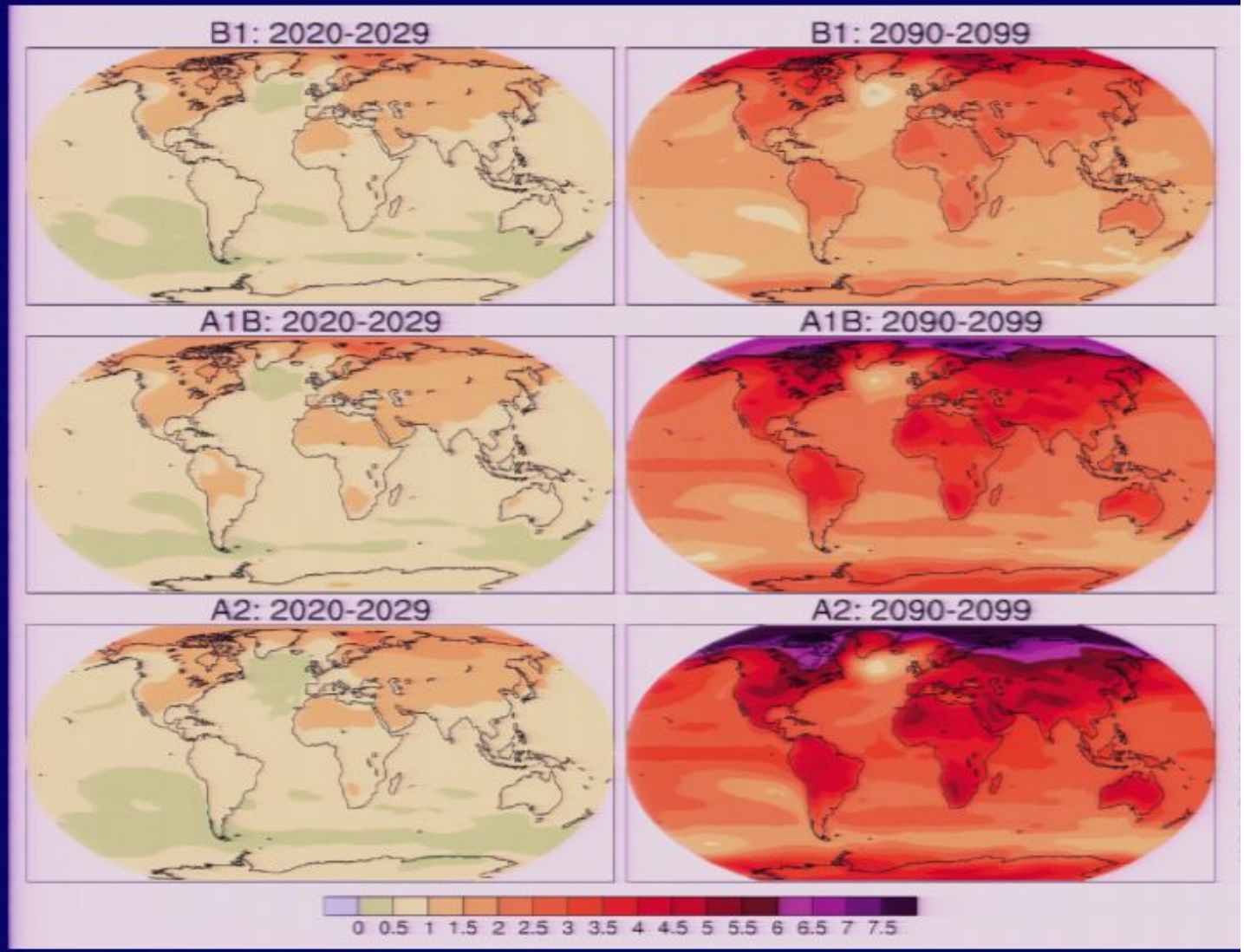

Global Temperature Land-Ocean Index
Annual Mean
5-year Mean
Temperature Anomaly (°C)
.6
.4
.2
.0
-.2
-.4
1880
1900
1920
1940
1960
1980
2000

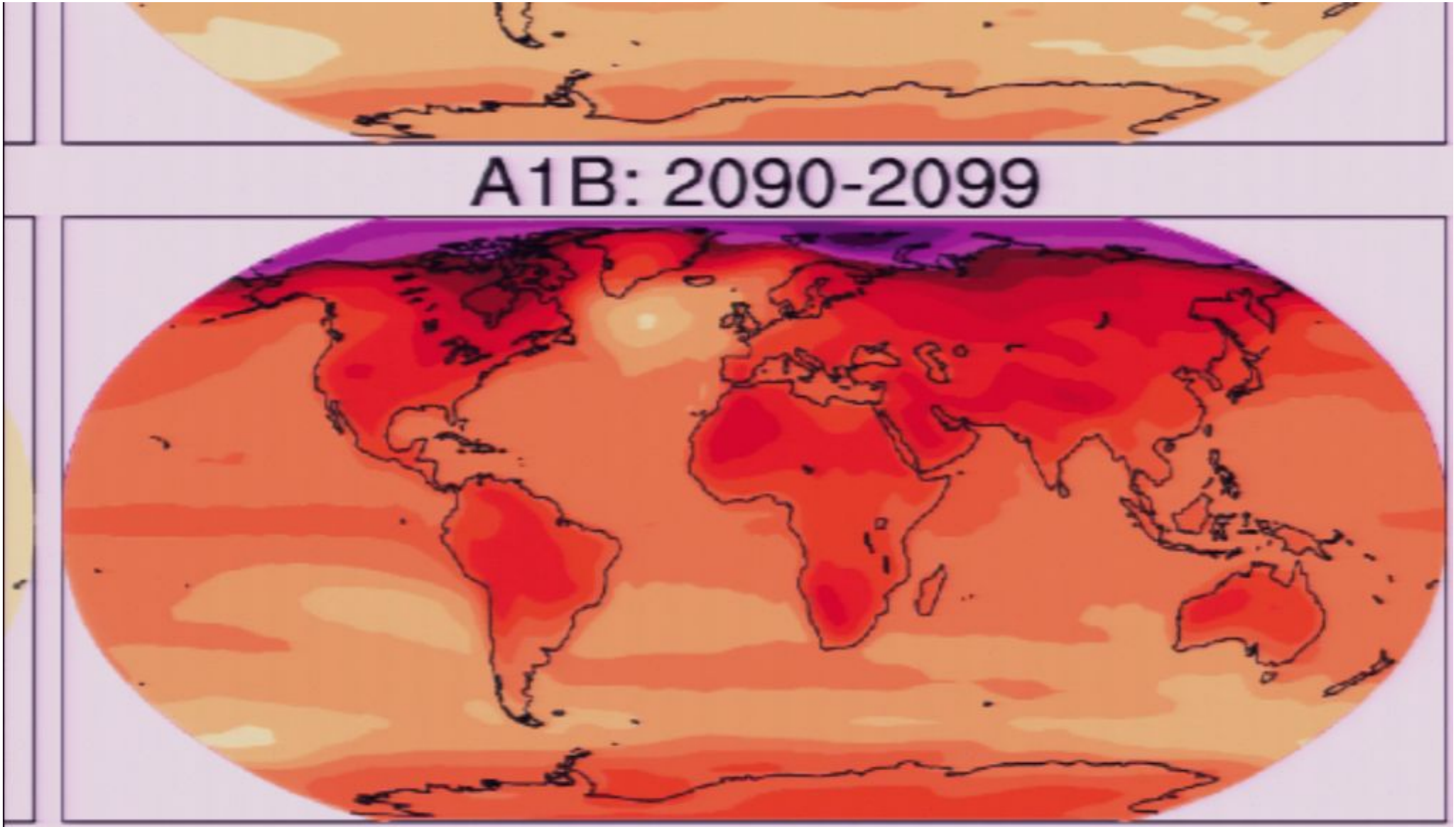
Projections of Future Changes in Climate

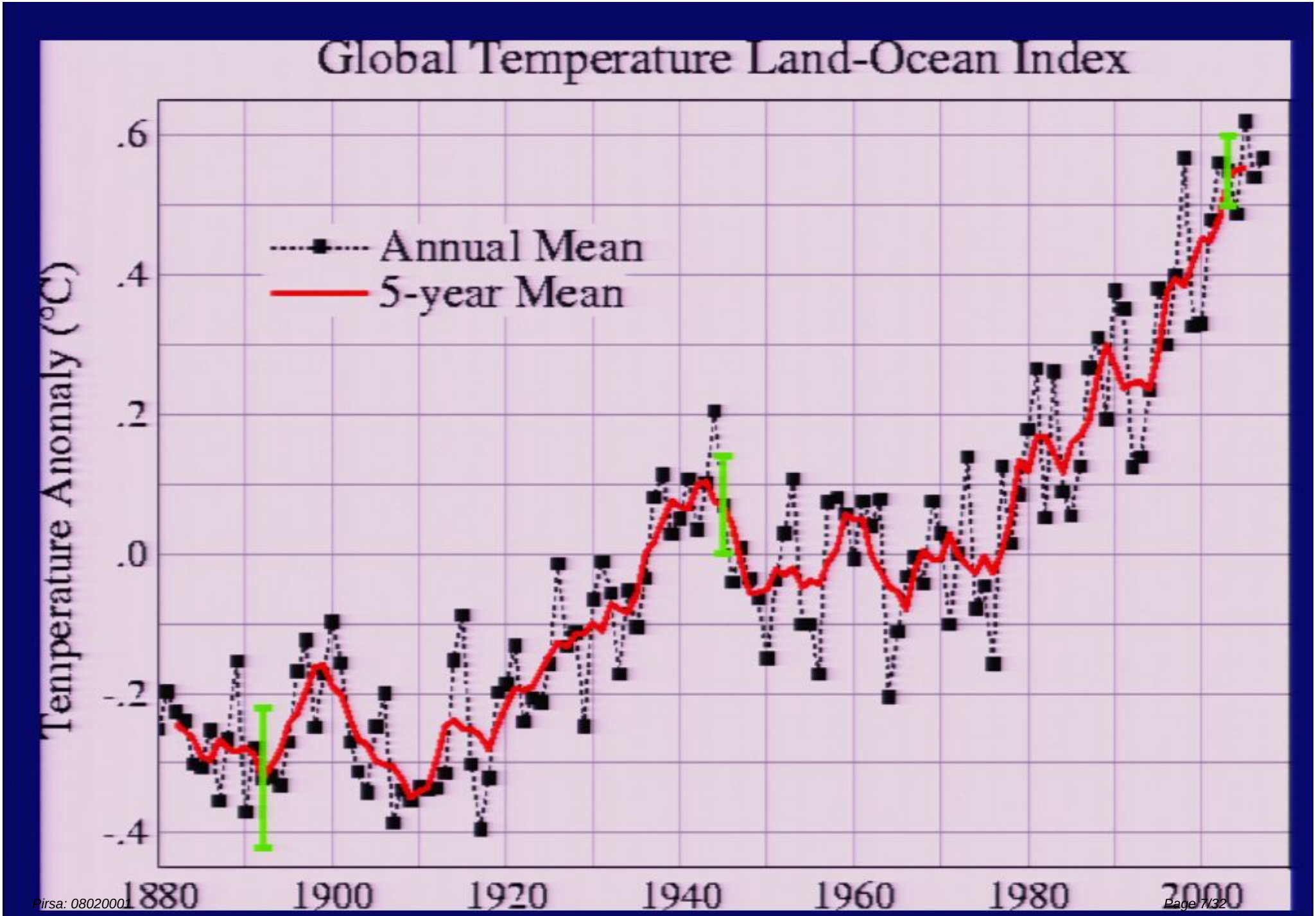
Projected warming in 21st century expected to be

greatest over land and at most high northern latitudes

and least over the Southern Ocean and parts of the North Atlantic Ocean




A1B: 2090-2099
A2: 2090-2099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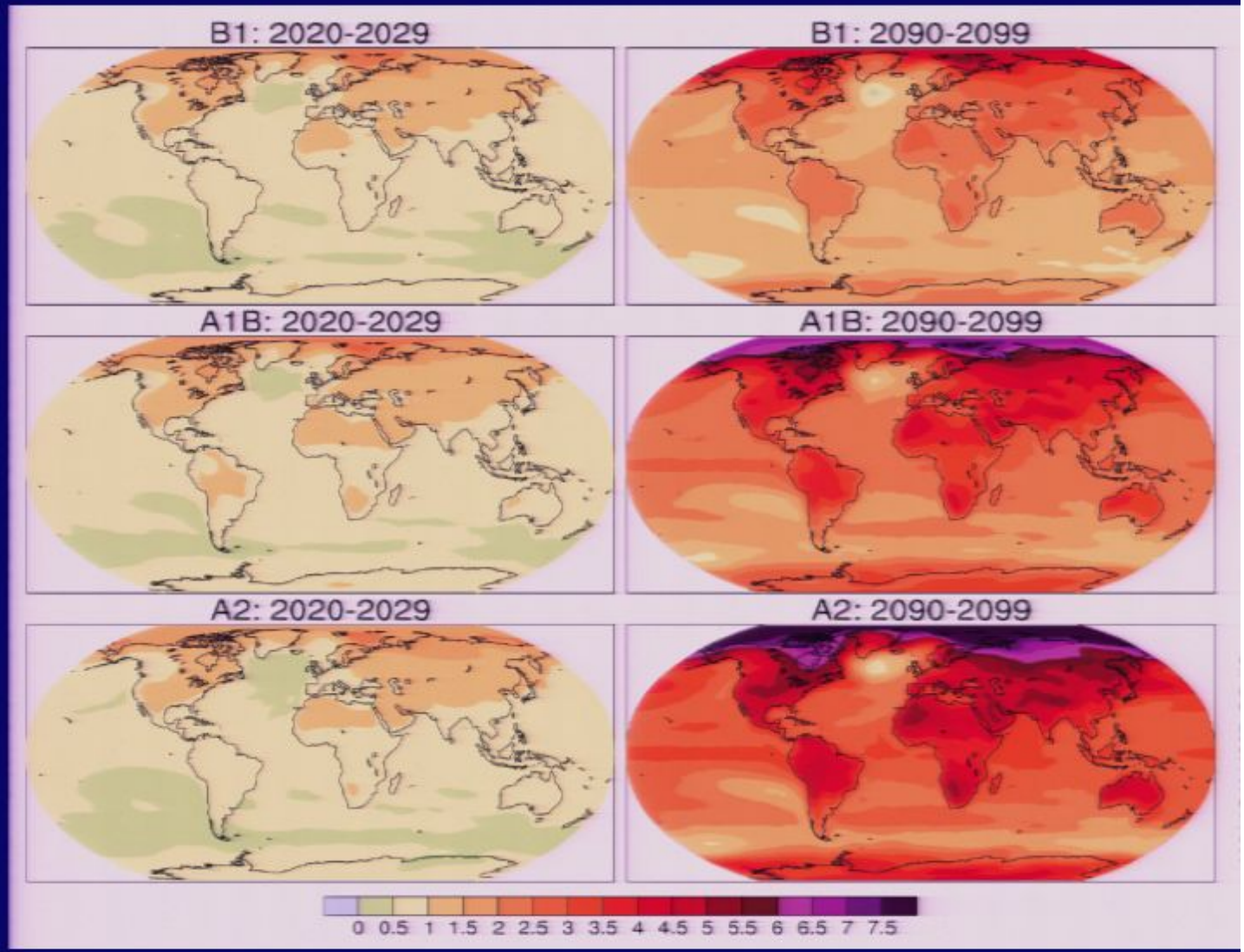

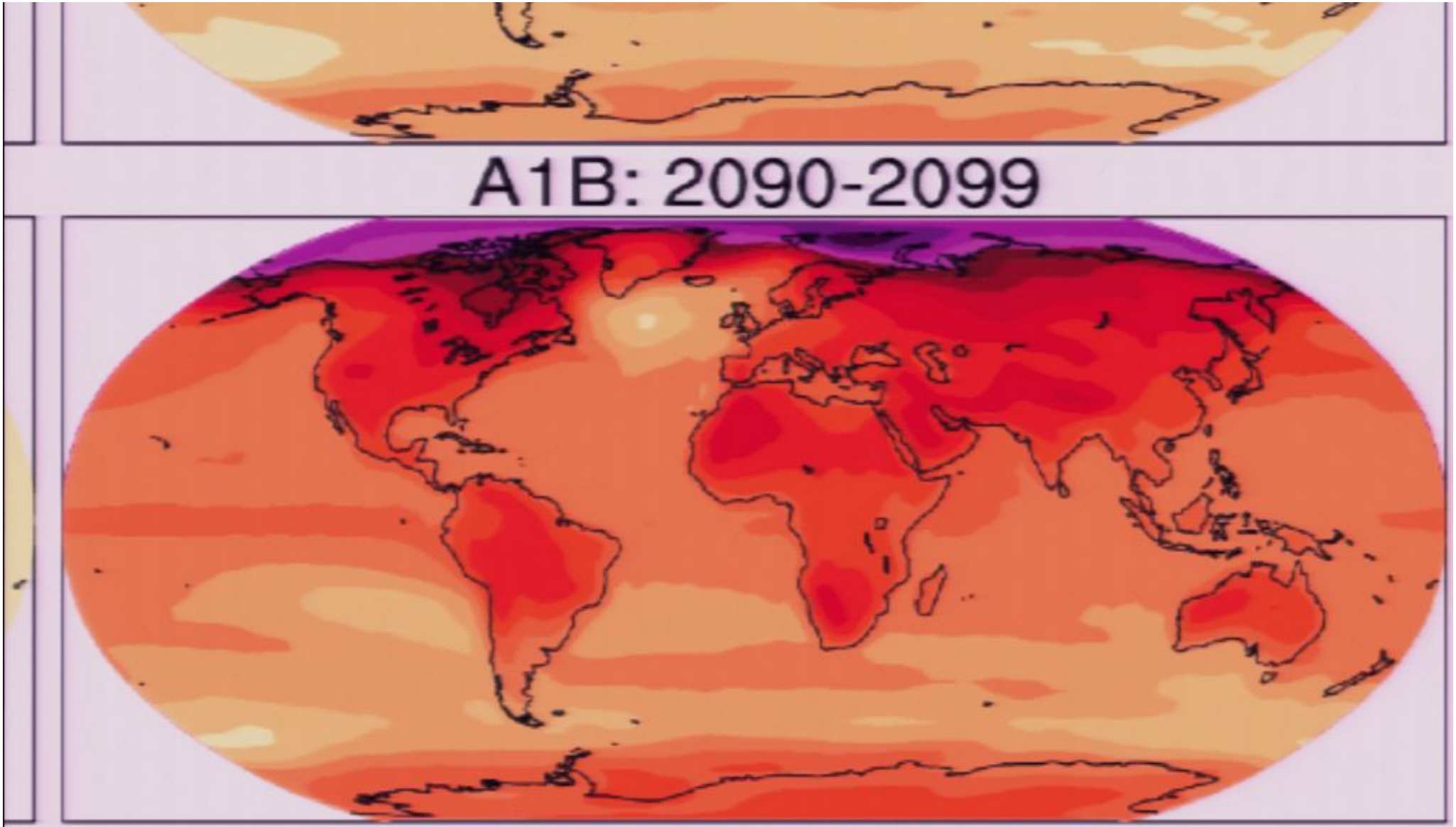
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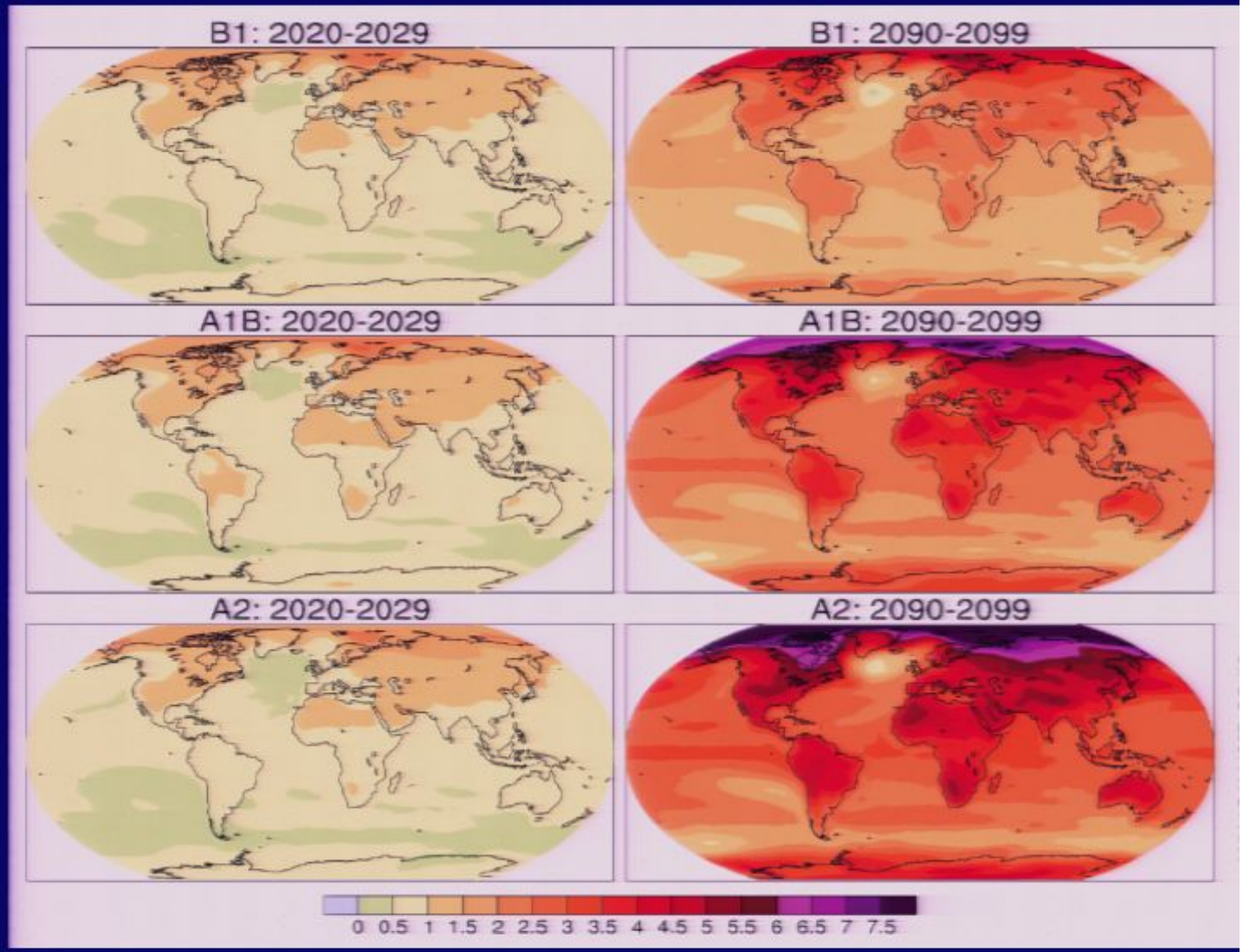

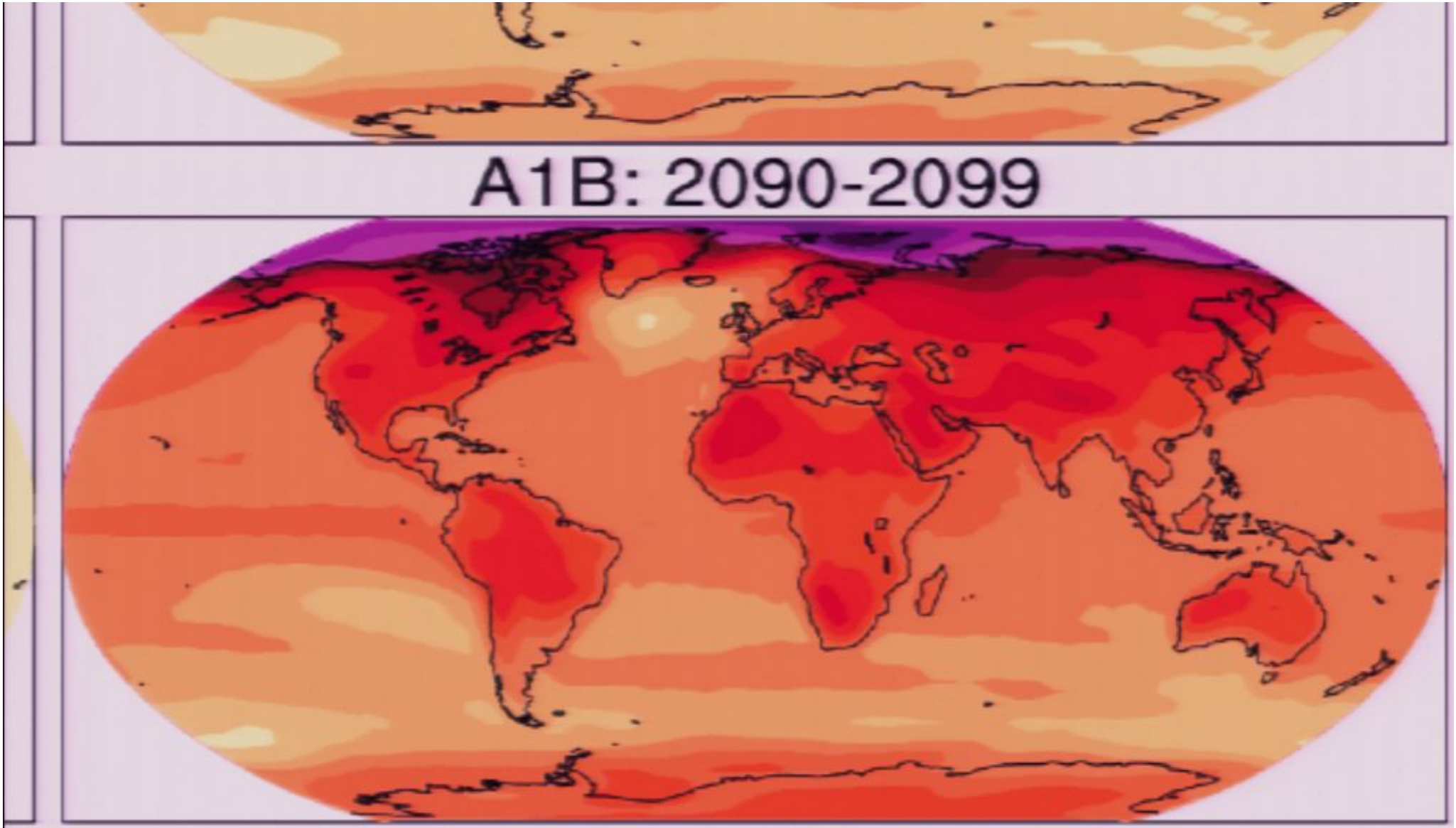
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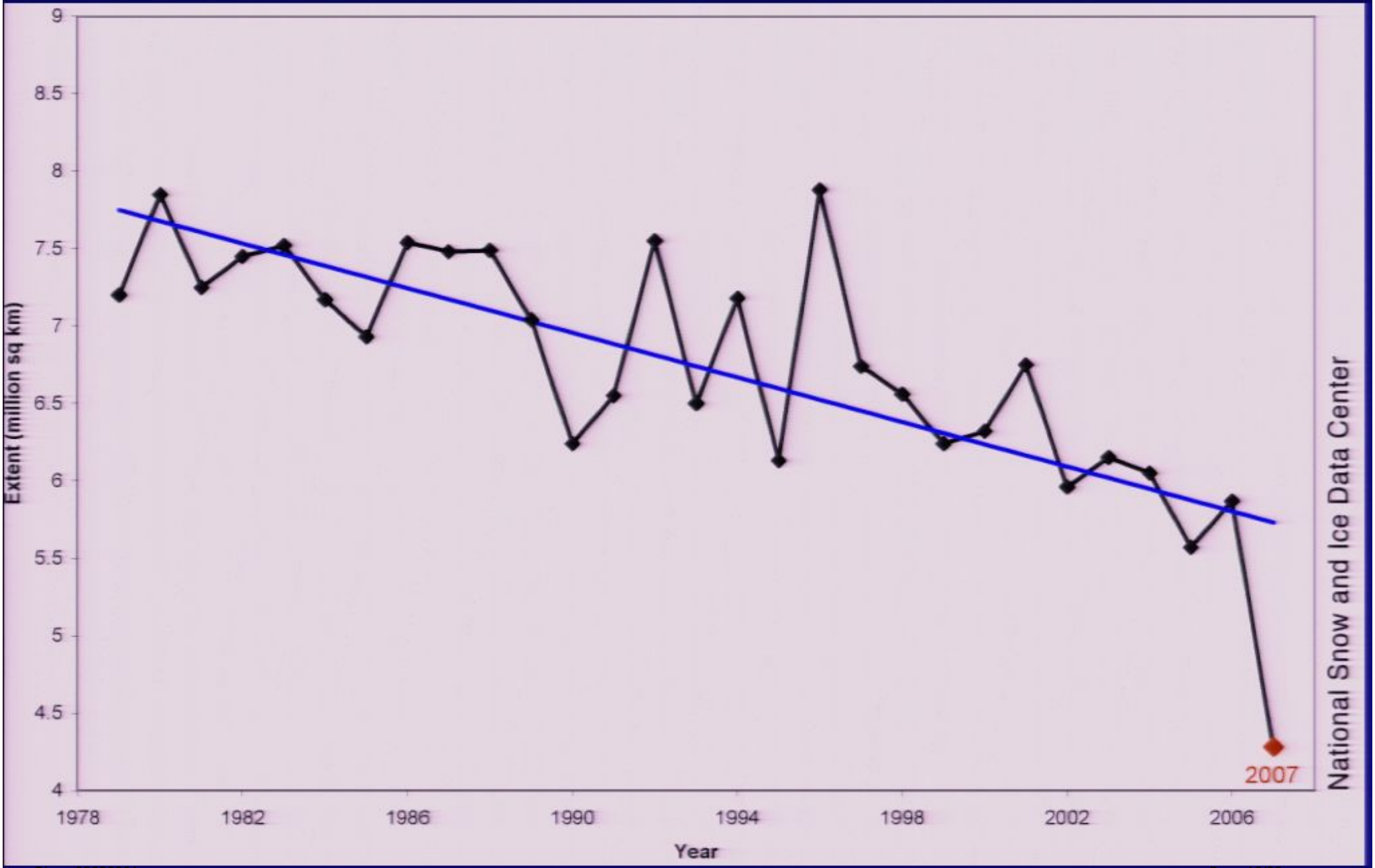
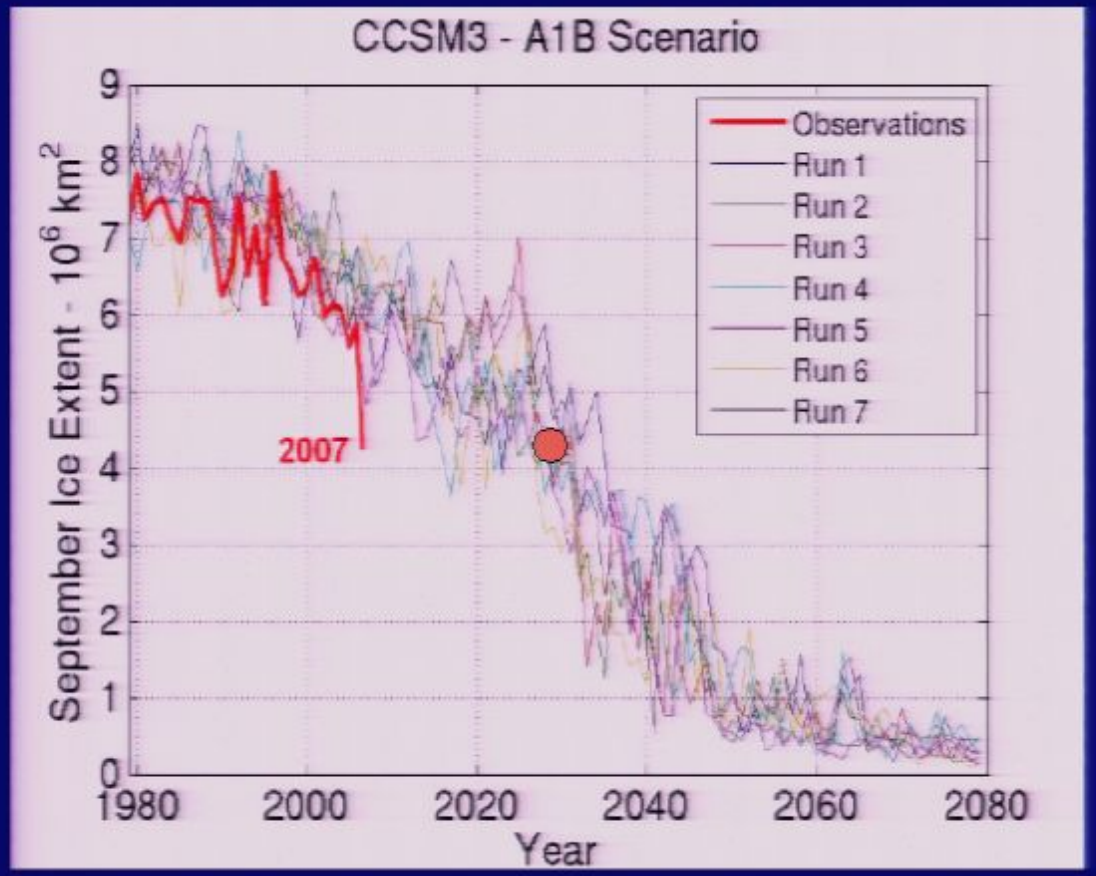
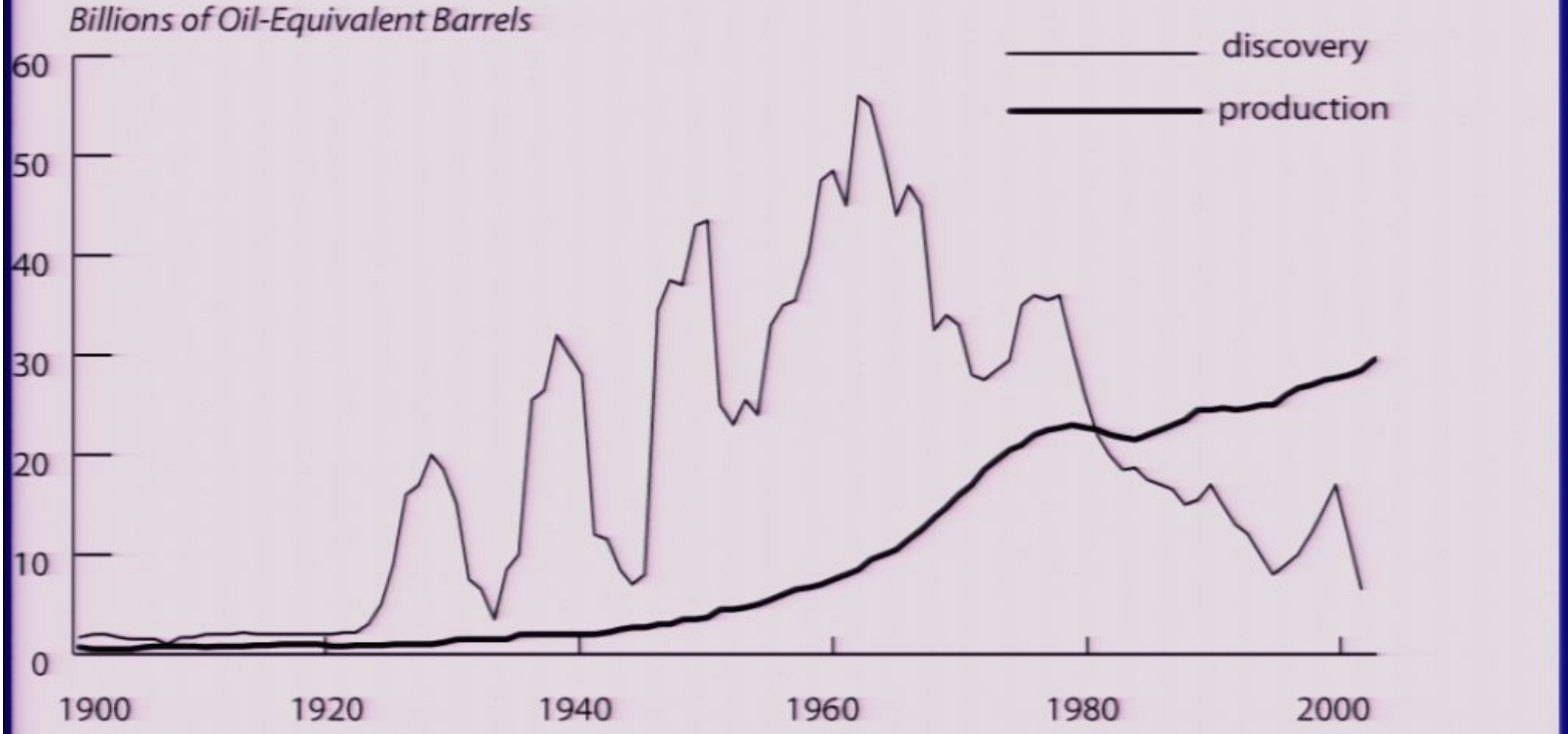

9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
Extent (million sq km)
1978
1982
1986
1990
1994
1998
2002
2006
Year
2007
National Snow and Ice Data Center

The 2007 loss of Arctic ocean ice indicates that the ice/albedo feedback has been underestimated.



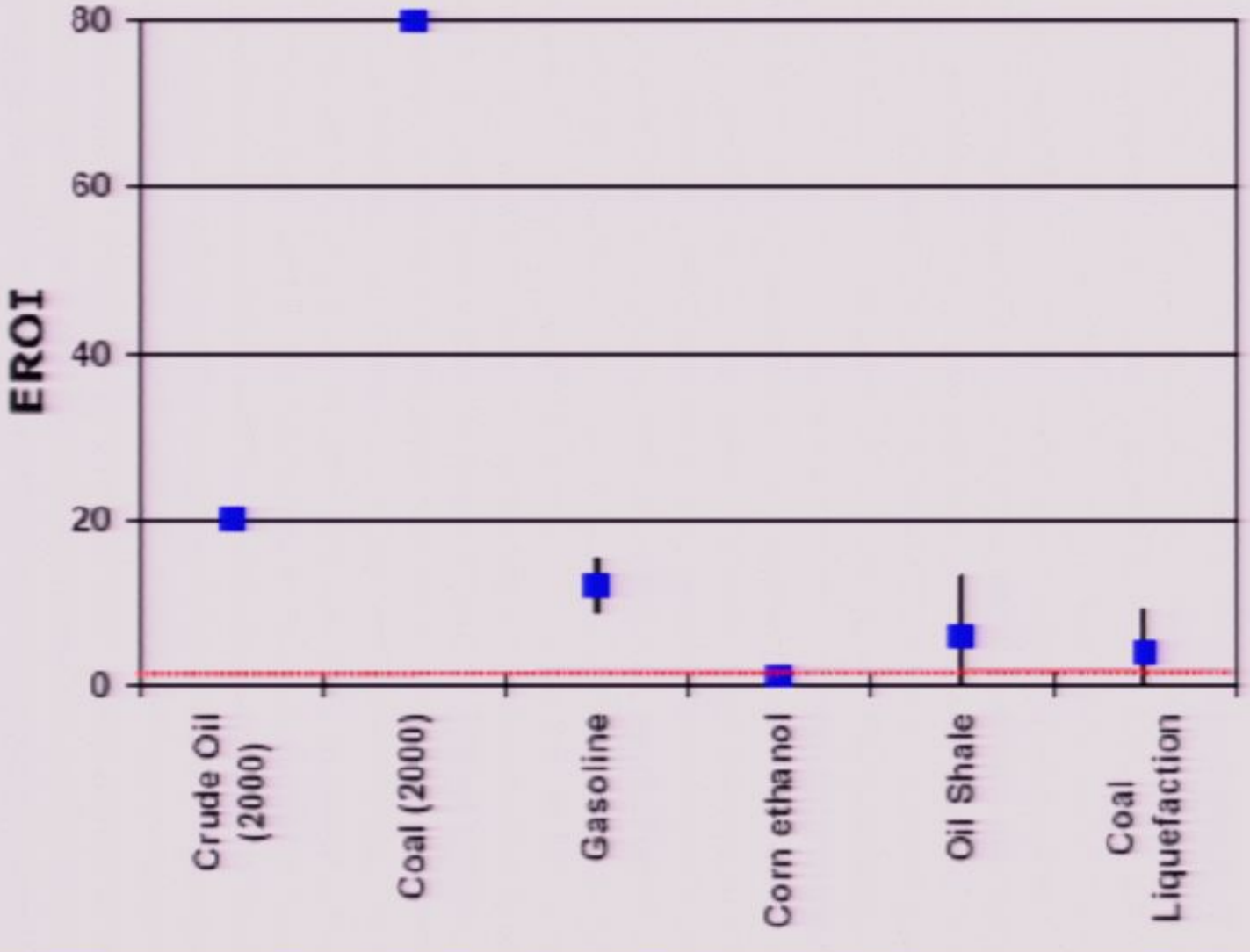
Observed 2007 sea ice cover retreat not replicated in models until ~2027

Global oil discovery peaked in the early 1960s

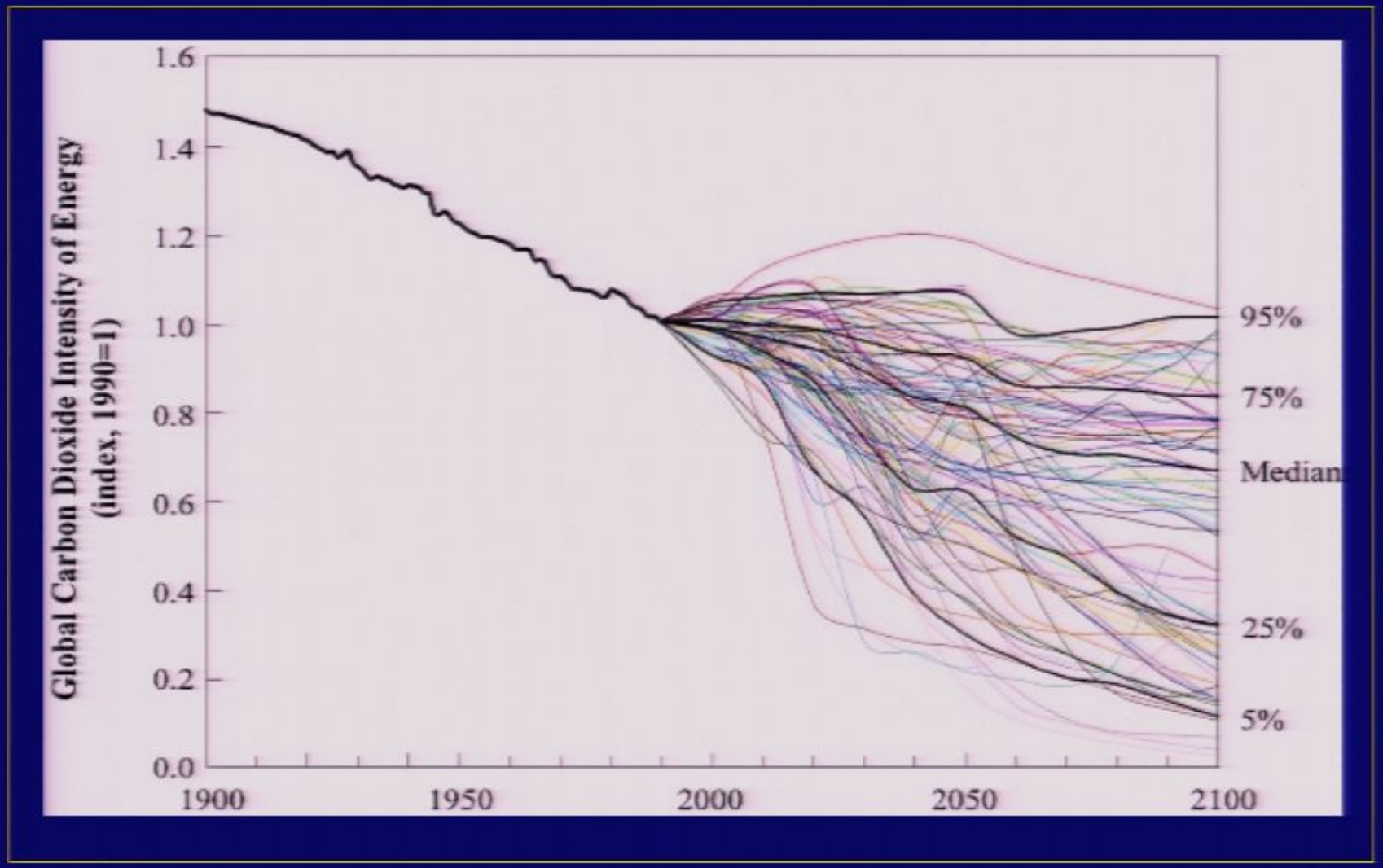


Source: Harry Longwell, "The Future of the Oil and Gas Industry: Past Approaches, New Challenges," World Energy 5 3 (2002): 100-4, and Colin Campbell, personal correspondence.

EROI for Fuel Systems



Will the Decarbonization Trend Continue?



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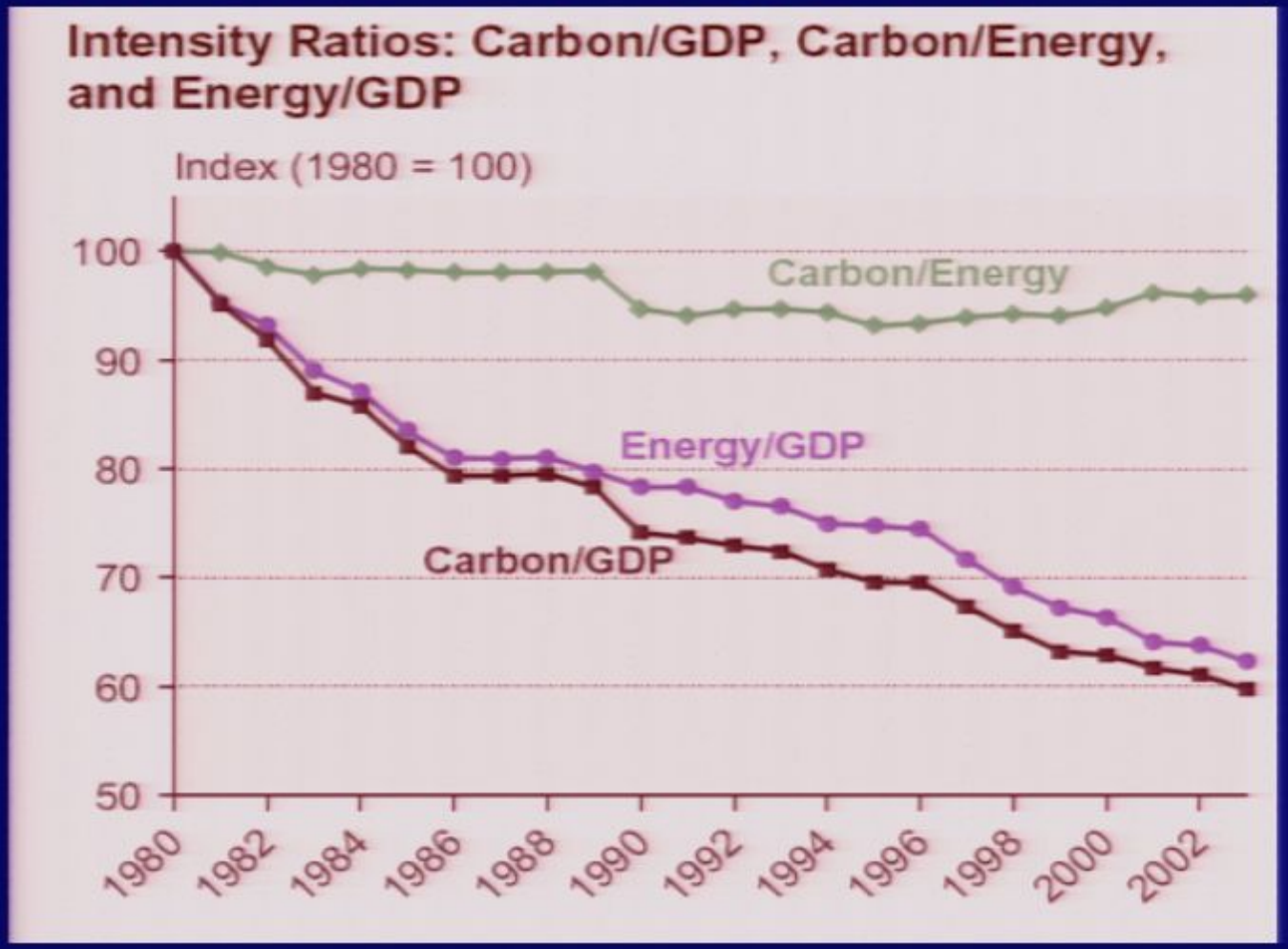
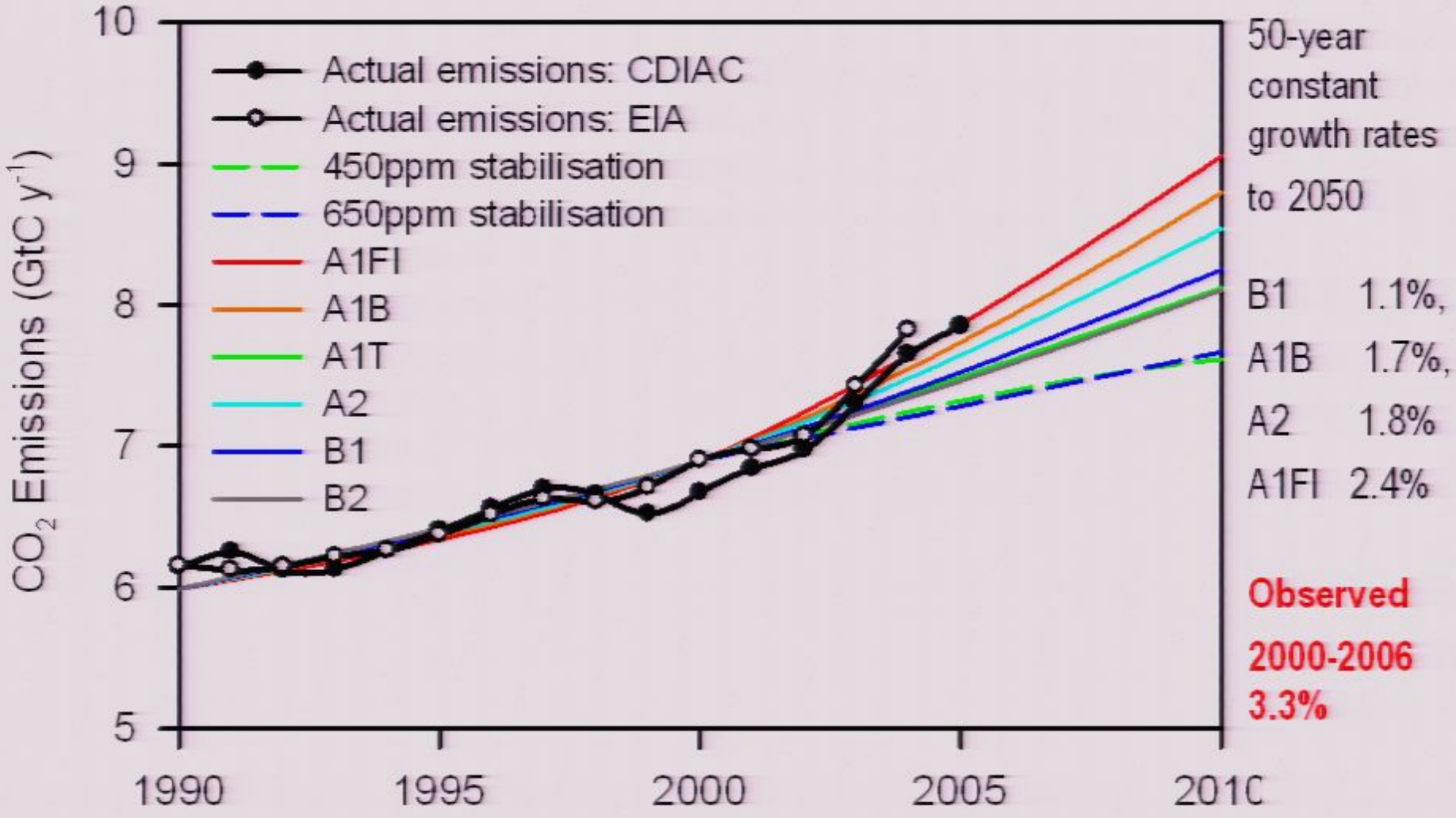


CO2 concentrations, Jubany Station, Antarctica

Year	ppm	Δ	
1994	356.75		
1995	358.18	1.43	
1996	360.33	2.15	
1997	361.81	1.48	
1998	363.95	2.14	1.64
1999	365.65	1.70	
2000	366.69	1.04	
2001	368.22	1.53	
2002	370.47	2.25	
2003	372.19	1.72	
2004	374.87	2.68	2.10
2005	376.73	1.86	
2006	378.74	2.01	

Trajectory of Global Fossil Fuel Emissions



Raupach et al. 2007, PNAS

The Dirt on Coal

Coal provides >25 percent of world's primary energy

It provides 40 percent of world's electricity

Coal extraction grew at ~5 percent per year between 2000 and 2005 (corresponding to a doubling time of 14 years)

Ninety percent is consumed in country of origin

Coal produces nearly 40 percent of world's greenhouse gas emissions, mainly CO_2

The Future of Coal (MIT, 2007)

"Today, and independent of whatever carbon constraints may be chosen, the priority objective with respect to coal should be the successful large-scale demonstration of the technical, economic, and environmental performance of the technologies that make up all of the major components of a large-scale integrated CCS system – capture, transportation and storage.

Such demonstrations are a prerequisite for broad deployment at the gigatonne scale in response to adoption of future carbon mitigation policy . . . ."

Scale Constraints

Sequestering one gigatonne of carbon per year requires injection of about 50 million barrels per day of supercritical CO2 from about six hundred 1000 MW of coal plants.

The Challenge: Very soon, humankind must cap—and then ramp down—global carbon emissions

We have very little "room to warm":

Estimated maximum "safe" warming: 2°C

Warming to date: 0.8°C

Warming in pipeline, even if emissions cease: 0.6°C

Room to warm: 0.6°C

So we have very little "room to emit":

Estimated carbon concentration that is likely to produce at least 2°C warming: ~450 ppm

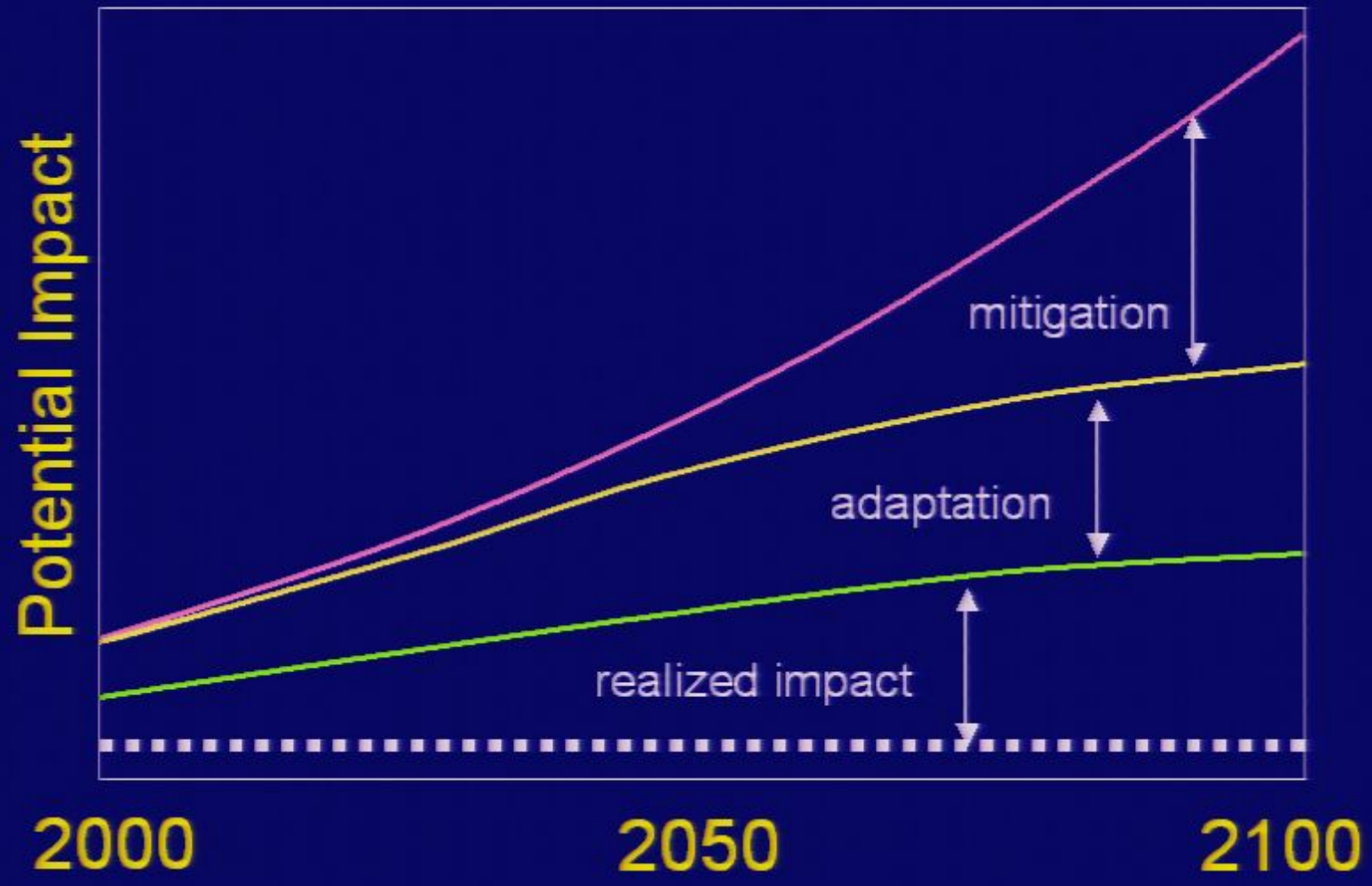
Current concentration: ~380 ppm

Room to emit: ~ 70 ppm

Incremental annual increase: ~2 ppm and rising

Years to 450 ppm: ~ 30

Impact, Mitigation, and Adaptation



Chris Milly (USGS/NOAA-GFDL, 2007)

Hansen's "John Mercer Effect"

"In 1978, when global warming was beginning to get attention from government agencies, Mercer suggested that global warming could lead to disastrous disintegration of the West Antarctic ice sheet. Although it was not obvious who was right on the science, I noticed that researchers who suggested that his paper was alarmist were regarded as more authoritative.

"It seems to me that scientists downplaying the dangers of climate change fare better when it comes to getting funding. Drawing attention to the dangers of global warming may or may not have helped increase funding for the relevant scientific areas, but it surely did not help individuals like Mercer who stuck their heads out."

New Scientist, 25 July 2007

Hansen's "John Mercer Effect"

"I can vouch for that from my own experience. After I published a paper in 1981 that described the likely effects of fossil fuel use, the US Department of Energy reversed a decision to fund my group's research, specifically criticizing aspects of that paper.

"I believe there is pressure on scientists to be conservative. Caveats are essential to science. They are born in skepticism, and skepticism is at the heart of the scientific method and discovery. However, in a case such as ice sheet instability and sea level rise, excessive caution also holds dangers. 'Scientific reticence' can hinder communication with the public about the dangers of global warming. We may rue reticence if it means no action is taken until it is too late to prevent future disasters."


How about you spend LESS time studying how MY generation destroyed the environment and MORE time figuring out a magical solution?
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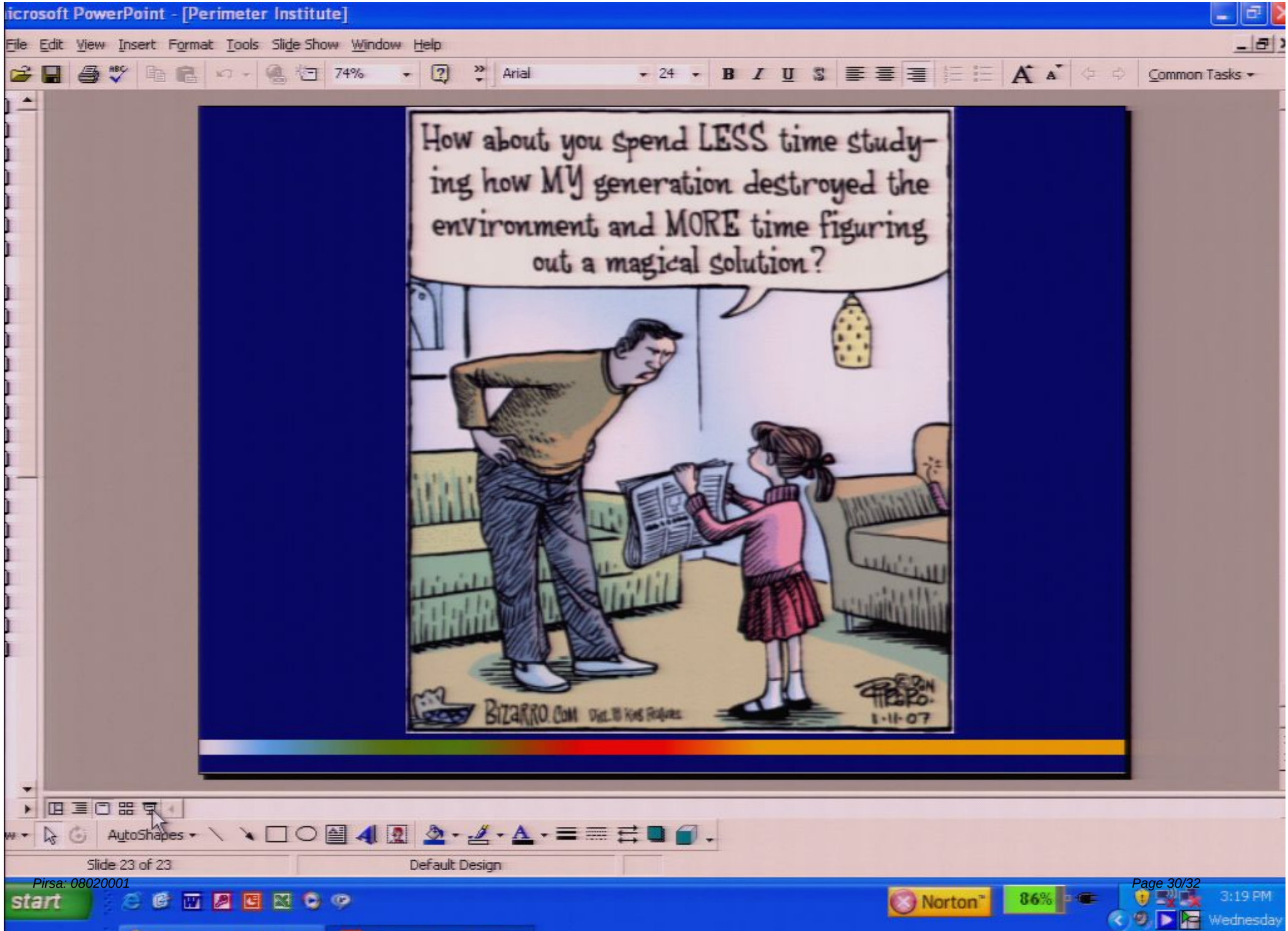
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Common Tasks
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Common Tasks

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Will the Decarbonization Trend Continue?

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Will the Decarbonization Trend Continue?

12

CO2 concentrations, Jubany Station, Antarctica

13

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15

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17

The Challenge: Very soon, humankind must stop—and then ramp down—global carbon emissions

We have very little "room to warm":

Estimated maximum "safe" warming: 2°C

Warming to date: 0.8°C

Warming in pipeline, even if emissions cease: 0.8°C

Room to warm: 0.4°C

18

19

Impact, Mitigation, and Adaptation

Potential Impact

mitigation

adaptation

residual impact

2000

2050

2100

20

Hansen's "John Mercer Effect"

21

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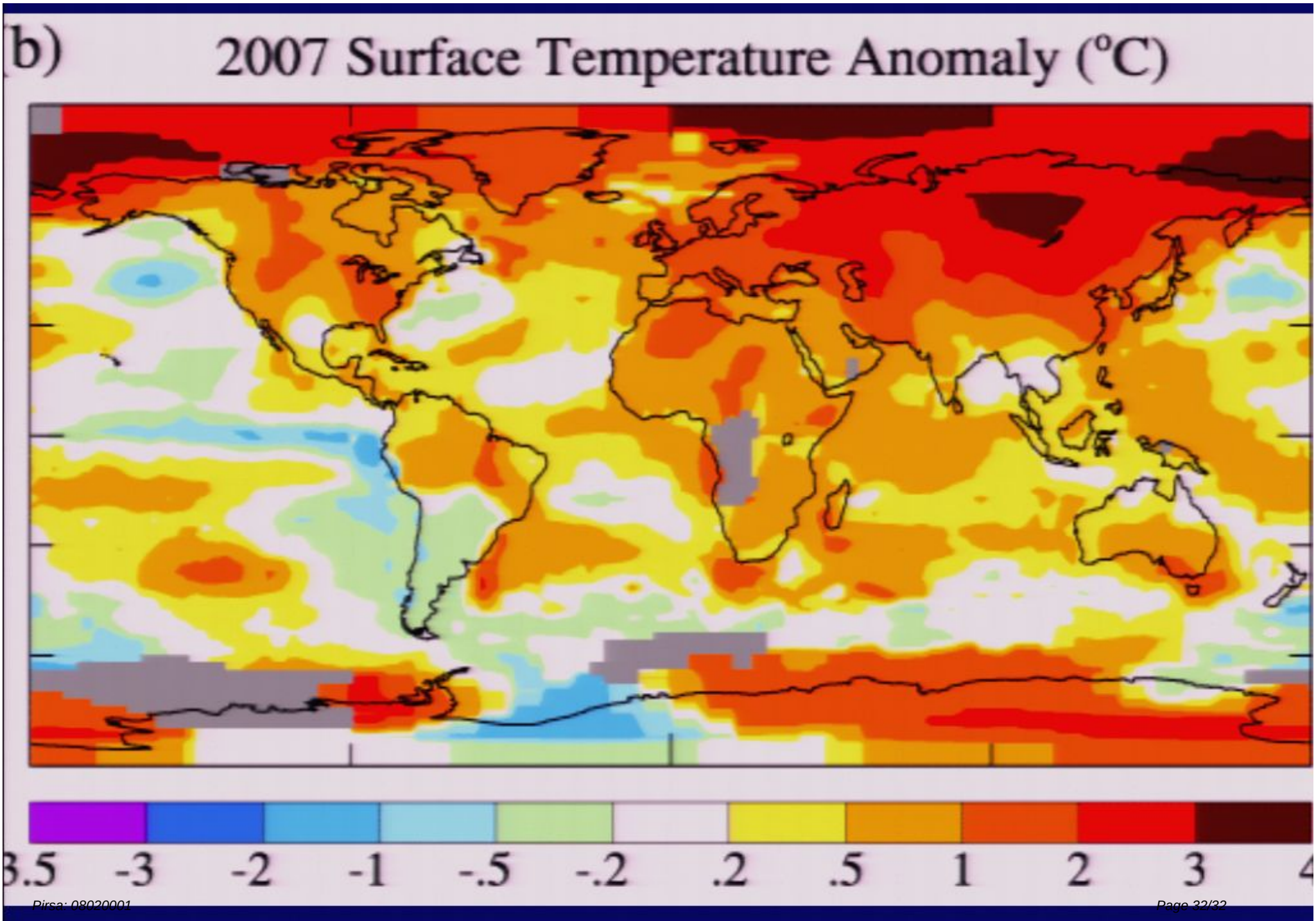
(b)
2007 Surface Temperature Anomaly (°C)
-3.5
-3
-2
-1
-.5
-.2
.2
.5
1
2
3
4